



# NATIONAL EMERGENCY MEDICAL SERVICES EDUCATION STANDARDS

## Paramedic Instructional Guidelines



# Preparatory EMS Systems

## Paramedic Education Standard

Integrates comprehensive knowledge of EMS systems, safety/well being of the paramedic, and medical/legal and ethical issues, which is intended to improve the health of EMS personnel, patients, and the community.

## Paramedic-Level Instructional Guideline

The Paramedic Instructional Guidelines in this section include all the topics and material at the AEMT level PLUS the following material:

- I. History of EMS
  - A. EMS Prior to World War I
    - 1. 1485 – Siege of Malaga, first recorded use of ambulance by military, no medical care provided
    - 2. 1800s – Napoleon designated vehicle and attendant to head to battle field
      - a. 1860 – first recorded use of medic and ambulance use in the United States
      - b. 1865 – first civilian ambulance, Commercial Hospital of Cincinnati, Ohio
      - c. 1869 – First ambulance service, Bellevue Hospital in New York, NY
      - d. 1899 – Michael Reese Hospital in Chicago operates automobile ambulance
  - B. EMS Between World War I and II
    - 1. 1900s – Hospitals place interns on ambulances, first real attempt at quality scene and transport care
    - 2. 1926 – Phoenix Fire Department enters EMS
    - 3. 1928 – First rescue squad launched in Roanoke, VA. Squad implemented by Julien Stanley Wise and named Roanoke Life Saving Crew
    - 4. 1940s
      - a. Many hospital-based ambulance services shut down due to lack of manpower resulting from WWI
      - b. City governments turn service over to police and fire departments
      - c. No laws on minimum training
      - d. Ambulance attendance became a form of punishment in many fire depts.
  - C. Post-World War II
    - 1. 1950s
      - a. 1951 – Helicopters used during Korean War

- b. 1956 – Mouth-to-mouth resuscitation developed by Dr. Elan and Dr. Safar
  - c. 1959 – First portable defibrillator developed at Johns Hopkins Hospital
- 2. 1960s
  - a. 1960 – LAFD puts medical personnel on every engine, ladder, and rescue company
  - b. 1965 – “Accidental Death & Disability: The Neglected Disease of Modern Society ” or The White Paper
    - i. Lack of uniform laws and standards
    - ii. Ambulances and equipment of poor quality
    - iii. Communication lacking between EMS and hospital
    - iv. Training of personnel lacking
    - v. Hospitals used part time staff in ED
    - vi. More people died in auto accidents than in Vietnam War
  - c. 1966
    - i. EMS Guidelines – Highway Safety Act, Standard 11
    - ii. Delivery of pre-hospital care using ambulances by Dr. Frank Pantridge in Belfast, Ireland
  - d. 1967 -- AAOS creates “Emergency Care and Transportation of the Sick and Injured.” First textbook for EMS personnel
  - e. 1968
    - i. Task Force of the Committee of EMS drafts basic training standards, results in “Training of Ambulance Personnel and Others Responsible for Emergency Care of the Sick and Injured at the Scene and During Transport” by Dunlop and Associates.
    - ii. American Telephone and Telegraph reserves 9-1-1 for emergency use
  - f. 1969
    - i. Dr. Eugene Nagel launches Nation’s first Paramedic program in Miami.
    - ii. The Committee on Ambulance Design Criteria published “Medical Requirements for Ambulance Design and Equipment.”
- 3. 1970s
  - a. 1970
    - i. Use of Helicopters in EMS explored
    - ii. National Registry of Emergency Medical Technicians established
  - b. 1971 -- The Committee on Injuries of the AAOS hosts national workshop on training for EMTs
  - c. 1972
    - i. Department of Health, Education and Welfare directed by President Nixon to develop new ways to organize EMS

- ii. Departments of Defense and Transportation form helicopter evacuation service
    - iii. TV show “Emergency!” begins 8-year run
  - d. 1973
    - i. EMS Systems Act of 1973 passed
    - ii. Star of Life developed by DOT
    - iii. St. Anthony’s Hospital in Denver starts Nation’s first civilian aeromedical transport service
  - e. 1974-1979
    - i. 1974
      - a) Department of Health, Education and Welfare published guidelines for developing and implementing EMS Systems
      - b) Federal report discloses that less than half of ambulance personnel completed DOT 81-hour course
    - ii. 1975
      - a) American Medical Association recognizes Emergency Medicine as specialty
      - b) University of Pittsburgh and Nancy Caroline, M.D. awarded contract for first EMT-Paramedic National Standard Curriculum
      - c) National Association of EMTs is formed
  - f. 1980s
    - i. 1983 - The EMS for Children Act passed
    - ii. 1985 – National Association of EMS Physicians formed
  - g. 1990s
    - i. 1990 – The Trauma Care System Planning and Development Act is passed
    - ii. 1991 – The Commission on Accreditation of Ambulance Services sets standards and benchmarks for ambulances services

## II. EMS Systems

### A. Components of the EMS System

- 1. Manpower --levels of EMS licensure
- 2. Education/training
  - a. National EMS Education Agenda for the Future: A Systems Approach
    - i. National EMS Scope of Practice Model
    - ii. National EMS Education Standards
    - iii. National EMS Education Program Accreditation
    - iv. National EMS Certification
- 3. Communications
- 4. Transportation
- 5. Facilities

6. Critical care units
7. Use of public safety agencies
8. Consumer participation
9. Accessibility of Care
10. Transfer of patients
  - a. Integration with other professionals and continuity of care
    - i. Medical personnel
    - ii. Law enforcement
    - iii. Emergency management
    - iv. Home healthcare providers
    - v. Other responders
11. Standardized medical record-keeping
12. Patients information and education
  - a. Patient education
    - i. Pre-incident
    - ii. Post-incident
  - b. Public education
    - i. Role modeling
    - ii. Community involvement
    - iii. Leader activities
    - iv. Community activities
    - v. Prevention activities
13. Independent review and evaluation
14. Disaster linkage
15. Mutual aid agreements
- B. Chain of survival
  1. Bystander care
  2. Dispatch
  3. Response
  4. Prehospital care
  5. Transportation
  6. Emergency department care
  7. Definitive care
  8. Rehabilitation
- C. Service Types
  1. Fire-based
  2. Third service
  3. Private (for profit and nonprofit)
  4. Hospital-based
  5. Hybrid/other
- D. Trauma Systems
- E. Medical Direction
  1. Role of the EMS physician in providing medical direction
    - a. Education and training of personnel
    - b. Participation in personnel selection process
    - c. Participation in equipment selection

- d. Development of clinical protocols
- e. Participate in quality improvement and problem resolution
- f. Provides direct input into patient care
- g. Interface between EMS providers and other health care agencies
- h. Advocacy within the medical community
- i. Serve as the “medical conscience” of the EMS system (Advocate for quality patient care)
- 2. Types of medical direction
  - a. On-line/direct
  - b. Off-line/indirect
- 3. Benefits of medical direction
  - a. On-line
  - b. Off-line
    - i. Prospective
    - ii. Retrospective

### III. Roles/Responsibilities/Professionalism of EMS Personnel

- A. Roles and Responsibilities
- B. Leadership/Affective Characteristics
  - 1. Attributes of professional
    - a. Integrity
    - b. Empathy
    - c. Self-motivation
    - d. Appearance and personal hygiene
  - 2. Confidence in skills and ability
  - 3. Communication
    - a. Verbal
    - b. Written
  - 4. Time management
  - 5. Teamwork and diplomacy
  - 6. Respect for patients, coworkers and other health care professionals
  - 7. Patient advocacy
  - 8. Careful delivery of service
- C. Administration
  - 1. Record keeping and reporting
  - 2. Special project coordination and implementation
  - 3. Station duties
  - 4. Interagency relationships/partnerships
- D. Credentialing
  - 1. Licensure
  - 2. Certification
  - 3. National registration
  - 4. Reciprocity
    - a. Maintenance of certification and licensure
      - i. Personal responsibility
      - ii. Continuing education

- iii. Skill competency verification
  - iv. Criminal implications
  - v. Fees
- E. Less Traditional Roles
  - 1. Expanded scope of practice
  - 2. Paramedics in Other Settings
    - a. Emergency departments
    - b. Clinics
    - c. Health departments
    - d. Physicians office
    - e. Interfacility transport
    - f. Critical care transport
    - g. Neonatal transport
    - h. High-risk obstetric transport
- F. Operational Responsibilities
  - 1. Preparation
  - 2. Response
  - 3. Scene assessment
  - 4. Patient assessment
  - 5. Management
    - a. Following protocols
    - b. Interacting with medical direction physician, as needed
  - 6. Appropriate disposition
    - a. Disposition issues
      - i. ED transport
      - ii. Alternative destinations
      - iii. Ground
      - iv. Air
      - v. Selection of the proper receiving facility
      - vi. Requires knowledge of the receiving facilities
      - vii. Hospital designation/categorization
      - viii. Based on hospital resource capabilities
      - ix. Clinical capabilities and specialty availability
      - x. Transfer agreements
      - xi. Payers and insurance systems
    - b. Non-Transport
      - i. Against medical advice
      - ii. No assistance needed
      - iii. Transfer to other EMS
      - iv. Medical examiner investigations
  - 7. Transfer of care
  - 8. Documentation
  - 9. Returning to service
- G. Education
  - 1. Education principles & practices
    - a. National EMS Scope of Practice Model
    - b. National EMS Education Standards

2. Paramedic education/accreditation
    - a. National EMS Program Accreditation
    - b. State accreditation
  3. Patient education
    - a. Pre-incident
    - b. Post-incident
  4. Public education
    - a. Role modeling
    - b. Community involvement
    - c. Leader activities
    - d. Community activities
    - e. Prevention activities
  5. Episodic/non-acute care activities
    - a. Patient home assistance
    - b. Social assistance
    - c. Home health care assistance
- H. Professionalism
1. Profession
  2. Specialized body of knowledge or expertise
    - a. Self-regulating
    - b. Maintains standards
  3. Professionals
    - a. Education
    - b. Follow standards of conduct and performance
    - c. Adhere to code of ethics
  4. Health care professional
    - a. Conforms to the standards of health care professions
    - b. Provides quality patient care
    - c. Instills pride in the profession
    - d. Strives for high standards
    - e. Earns respect of others
    - f. High societal expectations while on and off duty
    - g. EMS personnel occupy positions of public trust
    - h. Unprofessional conduct
    - i. Commitment to excellence
    - j. Image and behavior
      - a. Paramedics represent a variety of people
        - i. Self
        - ii. EMS agency
        - iii. State/county/ district EMS offices
        - iv. Peers
- I. Affective characteristics
1. Integrity
  2. Empathy
  3. Self-motivation
  4. Appearance and hygiene



5. Self-confidence
6. Time management
7. Communication
  - a. Verbal
  - b. Written
8. Teamwork and diplomacy
9. Respect for patients, coworkers and other healthcare professionals
10. Patient advocacy
11. Careful delivery of service

#### IV. Quality Improvement

- A. System for continually evaluating and improving care
- B. Continuous quality improvement (CQI)
- C. Dynamic process

#### V. Patient Safety

- A. Significant-one of the most urgent health care challenges
- B. Incidence-IoM report “To Err is Human” up to 98,000 patients die due to medical errors
- C. High risk activities
  1. Hand off
  2. Communication issues
  3. medication issues
  4. airway issues
  5. dropping patients
  6. ambulance crashes
  7. spinal immobilization
- D. How errors happen
  1. skills-based failure
  2. rules-based failure
  3. knowledge-based failure
- E. Preventing Errors
  1. Environmental
    - a. Clear protocols
    - b. Light
    - c. Minimal interruptions
    - d. Organization and packaging of drugs
  2. Individual
    - a. Reflection in action
    - b. Constantly question assumptions
    - c. Reflection bias
    - d. Use decision aids
    - e. Ask for help

# Preparatory Research

## Paramedic Education Standard

Integrates comprehensive knowledge of EMS systems, safety/well being of the paramedic, and medical/legal and ethical issues, which are intended to improve the health of EMS personnel, patients, and the community.

## Paramedic-Level Instructional Guideline

The Paramedic Instructional Guidelines in this section include all the topics and material at the AEMT level, PLUS the following material:

- I. Research Principles to Interpret Literature and Advocate Evidence-Based Practice
  - A. Introduction to Research
    - 1. Overview of research methodology
    - 2. Peer reviewed versus other publications
    - 3. Critically reviewing research articles
    - 4. Conceptual framework
    - 5. Limitations of research
  - B. Importance of Research in EMS
    - 1. Outcomes-based research
    - 2. New procedures, medications, and treatments
    - 3. Quality assurance
    - 4. Improved patient outcomes
    - 5. Professionalism
    - 6. Evidence-based medicine
  - C. Types of Research
    - 1. Quantitative
      - a. Experimental
      - b. Non-experimental
      - c. Survey research
    - 2. Qualitative
      - a. Characteristics
      - b. Data collection methods
      - c. Types of qualitative research
      - d. Data analysis
        - i. Summarizing
        - ii. Interpreting
  - D. Ethical Considerations in Research
    - 1. Human research subject protection
      - a. Uncoerced and voluntary participation
      - b. Subjects must be fully informed of the risks and benefits

- c. Subjects must consent to participation
    - d. Subjects have the right to withdraw at anytime
  - 2. Role of the Institutional Review Board (IRB)
  - 3. Conflicts of interest
  - 4. Accurate data reporting
  - 5. Office of Human Research Protections
  - 6. Food and Drug Administration
- E. Literature Review
  - 1. Role in research
  - 2. Reference sources
    - a. Peer reviewed literature
    - b. Government sources
    - c. Online literature search engines
- F. Statistics
  - 1. Descriptive statistics
  - 2. Inferential statistics
  - 3. Sampling
    - a. Population
    - b. Parameter
    - c. Sample
    - d. Polling
    - e. Sampling error
  - 4. Statistical significance
- G. Relating Research to EMS
  - 1. National EMS Research Agenda
  - 2. Developing researchers
  - 3. Higher education institutions
  - 4. Research domains
    - a. Clinical
    - b. Systems
    - c. Education
  - 5. Evidence-based research
    - a. Research into practice
  - 6. Clinical studies
    - a. Improvement in patient outcomes
  - 7. Educational studies
  - 8. Collaborative efforts
  - 9. Funding
    - a. Public funding
    - b. Corporate support
    - c. Foundation support
    - d. Federal Government
  - 10. Advancement of profession
  - 11. Research consortia

12. Patient databases/data collection
    - a. Hospitals
    - b. EMS agencies
    - c. Linking data
  13. Joining with hospitals
  14. Regulatory issues
    - a. Waiver of informed consent in emergency circumstances
    - b. Health Insurance Portability and Accountability Act
    - c. National assurance program
  15. Establishing a research agenda/adherence to research agenda
- H. Evidence-based decision making
1. Traditional medical practice is based on
    - a. Medical knowledge
    - b. Intuition
    - c. Judgment
  2. High-quality patient care should focus on procedures proven useful in improving patient outcomes
  3. The challenge for EMS is the relative lack of prehospital research.
  4. Evidence-based decision making technique
    - a. Formulate a question about appropriate treatments
    - b. Search medical literature for related research
    - c. Appraise evidence for validity and reliability
    - d. If evidence supports a change in practice, adopt the new therapy allowing for unique patient needs.

# Preparatory Workforce Safety and Wellness

## Paramedic Education Standard

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## Paramedic-Level Instructional Guideline

The Paramedic Instructional Guidelines in this section include all the topics and material at the AEMT level, PLUS the following material:

- I. Provider Safety and Well-Being
- II. Standard safety precautions
  - A. Handwashing
  - B. Adherence to standard precautions/OSHA regulations
  - C. Safe operation of EMS/patient care equipment
  - D. Environmental control
  - E. Occupational health and bloodborne pathogens
    - 1. Immunizations
    - 2. Sharps
- III. Personal Protective Equipment
- IV. Stress Management
  - A. Types of stress reactions
    - 1. Acute stress reaction
    - 2. Delayed stress reaction
    - 3. Cumulative stress reaction
  - B. Stress management
    - 1. Change in lifestyle
    - 2. Balance in life
    - 3. Recognize response to family and friends
    - 4. Change in work environment
    - 5. Seek professional assistance
  - C. Dealing with death and dying
    - A. Stages of death and dying
      - 1. Denial
      - 2. Anger
      - 3. Bargaining

4. Depression
  5. Acceptance
- V. Prevention of Work-Related Injuries
- A. Vehicle restraint systems
  - B. Safe lifting techniques
  - C. Adequate sleep
  - D. Physical fitness and nutrition
  - E. Hazard awareness
  - F. Adherence to standard precautions/OSHA regulations
  - G. Disease transmission prevention -- communicable versus blood borne
- VI. Lifting and moving patients
- A. Lifting techniques
    1. Safety precautions
    2. Guidelines for lifting
  - B. Safe lifting of cots and stretchers.
  - C. Power lift or squat lift position
  - D. Power grip
  - E. Back in locked-in position
  - F. Carrying
    1. Precautions for carrying
    2. Guidelines for carrying
    3. Correct carrying procedure
    4. One-handed carrying technique
    5. Correct carrying procedure on stairs
  - G. Reaching
    1. Guidelines for reaching
    2. Application of reaching techniques
    3. Correct reaching for log rolls
  - H. Pushing and pulling guidelines
    1. Emergency move
      - a. Indications
        - i. Fire or danger of fire
        - ii. Explosives or other hazardous materials
        - iii. Other hazards at the scene
        - iv. To gain access to other patients in a vehicle who need life-saving care
        - v. Patient's location or position, e.g., a cardiac arrest patient sitting in a chair or lying on a bed
      - b. Technique
    2. Urgent Move
    3. Indications
      - a. Altered mental status
      - b. Inadequate breathing
      - c. Shock (hypoperfusion)
      - d. Technique

4. Non-urgent moves
    - a. Indication
      - i. Direct ground lift (no suspected spine injury)
      - ii. Extremity lift (no suspected extremity or back injuries)
  5. Transfer of supine patient from bed to stretcher
    - a. Direct carry
    - b. Draw sheet method
- I. Equipment
1. Stretchers/cots
    - a. Types
      - i. Wheeled stretcher
      - ii. Portable stretcher
      - iii. Stair chair
      - iv. Bariatric stretcher
    - b. Standard
  2. Tracked systems
    - a. Backboards
      - i. Long
      - ii. Short
        - a) Traditional wooden device
        - b) Vest type device
          - i) Scoop or orthopedic stretcher
          - ii) Flexible stretcher
    - b. Bariatric stretcher
      - i. Pneumatic or electronic stretchers
      - ii. Neonatal Isolettes
    - c. Maintenance - follow manufacturer's directions for inspection, cleaning, repair and upkeep
    - d. Patient positioning
      - i. Unresponsive patient without suspected spine injury
      - ii. A patient with chest pain or discomfort or difficulty breathing
      - iii. A patient with suspected spine injury
      - iv. Pregnant patient with hypotension
      - v. A patient who is nauseated or vomiting
    - e. Bariatric patients
      - i. Patient size
      - ii. Specialized equipment
        - a) Stretchers
        - b) Ambulances
          - i) Ramps
          - ii) Winches
        - c) Personnel considerations

VII. Disease Transmission

VIII. Wellness Principles

- A. Physical Wellbeing
  - 1. Physical fitness
    - a. Cardiovascular endurance
    - b. Muscle strength
    - c. Muscle flexibility
  - 2. Sleep
  - 3. Disease prevention
  - 4. Injury prevention
- B. Mental Wellbeing
  - 1. Alcohol and drug issues
  - 2. Smoking cessation
  - 3. Stress Management
  - 4. Relationship issues



# Preparatory Documentation

## Paramedic Education Standard

Integrates comprehensive knowledge of EMS systems, safety/well being of the paramedic, and medical/legal and ethical issues, which are intended to improve the health of EMS personnel, patients, and the community.

## Paramedic-Level Instructional Guideline

The Paramedic Instructional Guidelines in this section include all the topics and material at the AEMT level PLUS the following material:

- I. Principles of medical documentation and report writing
  - A. Minimum Data Set
    - 1. Patient information gathered by the paramedic
    - 2. Administrative information/Response information
  - B. Prehospital Care Report
    - 1. Functions
    - 2. Uses
      - a. Types
      - b. Sections
    - 3. Special Considerations
      - a. Confidentiality
      - b. Distribution
      - c. Health Information Portability and Accountability Act of 1996
  - C. Falsification Issues
    - 1. Willful falsification -- consequences
    - 2. Errors
      - a. during documentation
      - b. after submission
      - c. electronic
  - D. Documentation of Patient Refusal
    - 1. Establishing competence
    - 2. Documenting competence
    - 3. Documenting partial, incomplete, or refused care
    - 4. Documentation of the complete, incomplete or refused assessment
  - E. Special Situations/Reports/Incident Reporting
    - 1. Multiple casualty incidents (MCI)
    - 2. Special reports
      - a. interagency
      - b. Legal reporting
      - c. exposure

- d. injury
    - e. Interfacility transfer
- F. Reason for Transfer
- G. Treatment Prior to Arrival
- H. Full Assessment
- I. Treatment Provided Enroute
  - 1. Scheduled
  - 2. Unanticipated
- J. Condition on Arrival
  - 1. Reading a patient record
  - 2. Narrative styles
    - a. Body systems documentation
    - b. Body parts documentation
    - c. Documenting the clinical impression/working diagnosis
    - d. Documenting treatment and response
    - e. Documenting transfer of patient care

# Preparatory EMS System Communication

## Paramedic Education Standard

Integrates comprehensive knowledge of EMS systems, safety/well being of the paramedic, and medical/legal and ethical issues, which are intended to improve the health of EMS personnel, patients, and the community.

## Paramedic-Level Instructional Guideline

The Paramedic Instructional Guidelines in this section include all the topics and material at the AEMT level PLUS the following material:

- I. EMS Communication System
  - A. System Components
    - 1. Base station
    - 2. Mobile radios (transmitter/receivers)
      - a. Vehicular mounted device
      - b. Mobile transmitters usually transmit at lower power than base stations (typically 20-50 watts)
      - c. Typical transmission range is 10-15 miles over average terrain
    - 3. Portable radios (transmitter/receivers)
      - a. Handheld device
      - b. Typically have power output of 1-5 watts, limiting their range
    - 4. Repeater/base station
    - 5. Digital radio equipment
    - 6. Cellular telephones
  - B. Radio Communications
    - 1. Radio frequencies
    - 2. Response to the scene
      - a. The dispatcher needs to be notified that the call was received
      - b. Dispatch needs to know that the unit is en route
    - 3. Arrival at the scene – dispatcher must be notified
    - 4. Depart the scene
      - a. Dispatcher must be notified
      - b. Prolonged on scene times with absence of communications
    - 5. Arrival at the receiving facility or rendezvous point -- dispatcher must be notified
    - 6. Arrival for service after patient transfer -- dispatcher must be notified

- II. Communicating with other health care professionals
  - A. Communication With Medical Control
    - 1. Medical control is at the receiving facility. Medical control is at a separate site
    - 2. Paramedics may need to contact medical control for consultation and to get orders for administration of medications
    - 3. Paramedics must be accurate
    - 4. After receiving an order for a medication or procedure—repeat the order back word for word
    - 5. Orders that are unclear or appear to be inappropriate should be questioned or clarified for the paramedic
  - B. Communication With Receiving Facilities
    - 1. Patient reporting concepts
    - 2. Arrival at the hospital
    - 3. Leaving the hospital for the station
  - C. System Maintenance
    - 1. Radio checks
    - 2. Planning for failures
  - D. Phone/Wireless Communications
- III. Team communication and dynamics
  - A. Source
    - 1. Medium
    - 2. Common symbols
    - 3. Clear format
      - a. Written
      - b. Verbal
      - c. Other symbols
  - B. Encoding
  - C. Message
  - D. Decoding
  - E. Receiver
  - F. Feedback

# Preparatory Therapeutic Communication

## Paramedic Education Standard

Integrates comprehensive knowledge of EMS systems, safety/well being of the paramedic, and medical/legal and ethical issues, which are intended to improve the health of EMS personnel, patients, and the community.

## Paramedic-Level Instructional Guideline

The Paramedic Instructional Guidelines in this section include all the topics and material at the AEMT level PLUS the following material:

- I. Principles of communicating with patients in a manner that achieves a positive relationship
  - A. Interpersonal Communication
    - 1. The paramedic should self-introduce at the start of any conversation
    - 2. Make and keep eye contact
    - 3. When practical, position yourself at a level lower than the patient or on the same level
    - 4. Be honest with the patient
    - 5. Use language the patient can understand and avoid medical jargon
    - 6. Be aware of your own body language
    - 7. Speak calmly, clearly, slowly and distinctly
    - 8. Use the patient's proper name, either first or last, depending on the circumstances
    - 9. If a patient has difficulty hearing, speak clearly with lips visible
    - 10. Allow the patient enough time to answer a question before asking the next one
    - 11. Act and speak in a calm, confident manner
  - B. Factors That Affect Communication
    - 1. Communication with hearing impaired, non-English speaking populations and use of interpreters—be positioned to address any of these special situations
    - 2. Internal factors for effective communication
      - a. Accepting others as people
      - b. Empathy
      - c. Be a good listener
      - d. Introduction
        - i. Self
        - ii. Partners/team
        - iii. Patient introduction

3. External factors for effective communication
    - a. Privacy
    - b. Interruptions
    - c. Physical environment
      - i. Lighting
      - ii. Noises and out side interference
      - iii. Distracting equipment
      - iv. Distance
      - v. Equal seating - eye level
    - d. Dress
  4. Note-taking
- C. Interviewing Techniques
1. Types of questions used in interviewing
    - a. Open-ended questions
    - b. Closed or direct questions
    - c. One question at a time
    - d. Choose language the patient understands
  2. Types of responses
    - a. Facilitation
    - b. Silence
    - c. Reflection
    - d. Empathy
    - e. Clarification
    - f. Confrontation
    - g. Interpretation
    - h. Explanation
    - i. Summary
  3. Traps of interviewing
    - a. Providing false assurance or reassurance
    - b. Giving advice
    - c. Authority
    - d. Using avoidance language
    - e. Distancing
    - f. Professional jargon
    - g. Leading or biased questions
    - h. Talking too much
    - i. Interrupting
    - j. Using “why” questions
  4. Nonverbal skills
    - a. Physical appearance
      - i. Interviewer
      - ii. Patient
    - b. Posture and gestures
      - i. Interviewer
      - ii. Patient
      - iii. Gestures

- iv. Facial expressions
  - v. Eye contact
  - vi. Voice
  - vii. Touch
- 5. Developing patient rapport
  - a. Put the patient and yourself at ease
- 6. Strategies to ascertain information
  - a. Patients generally communicate in three ways
  - b. Obtaining information on complaints
    - i. Resistance
    - ii. Shifting focus
    - iii. Defense mechanisms
    - iv. Distraction
- 7. Methods to assess mental status during the interview
  - a. Observation
  - b. Conversation
    - i. Orientation
    - ii. Speech
    - iii. Thinking
    - iv. Attention
    - v. Concentration
    - vi. Comprehension
    - vii. Remote, recent, and immediate memory
    - viii. Affect
    - ix. Autonomic responses
    - x. Facial movements
    - xi. Reactive movements
    - xii. Grooming movements
- 8. Exploration is a method to review the patient's internal experiences
  - a. Mood
  - b. Energy level
  - c. Content of thinking
- D. Dealing With Difficult Patients
  - 1. Patients unmotivated to talk
    - a. Most patients are more than willing to talk
    - b. Difficult interviews
    - c. Techniques to use
      - i. Start the interview in the normal manner
      - ii. Attempt to use open-ended questions
      - iii. Provide positive feedback
      - iv. Make sure the patient understands the questions
      - v. Continue to ask questions
    - d. Interviewing a hostile patient
    - e. Hearing impaired patients
    - f. Patients under the influence of street drugs or alcohol
    - g. Sexually aggressive patient

- E. Adjusting Communication Strategies
1. Age
    - a. Infants
    - b. Preschoolers
    - c. School-age children
      - i. Use parent and caregiver
      - ii. Clear explanations
      - iii. Be honest
    - d. Adolescents
    - e. Adults
    - f. Geriatrics
      - i. Potential for visual deficit
      - ii. Potential for auditory deficit
      - iii. Obtain glasses and hearing aid
  2. Stage of development
  3. Patients with special needs
  4. Differing cultures
    - a. Enormous diversity in populations of all cultures
    - b. Diversity (a term once used primarily to describe "racial awareness") now refers to differences of any kind: race, class, religion, gender, sexual preference, personal habitat, and physical ability
    - c. Good health care depends on sensitivity toward these differences
    - d. Experiences of health and illness vary widely because of different beliefs, behaviors, and past experiences, and may conflict with the paramedic's learned medical practice
    - e. By revealing awareness of cultural issues, the paramedic will convey interest, concern, and respect
    - f. When dealing with patients from different cultures, remember the following key points:
      - i. Individual is the "foreground"—the culture is the "background"
      - ii. Different generations and individuals within the same family may have different sets of beliefs
      - iii. Not all people identify with their ethnic cultural background
      - iv. All people share common problems or situations
      - v. Respect the integrity of cultural beliefs
      - vi. Realize that people may not share your explanations of the causes of their ill health, but may accept conventional treatments
      - vii. You do not have to agree with every aspect of another's culture, nor does the person have to accept everything about yours for effective and culturally sensitive health care to occur



- viii. Recognize your personal cultural assumptions, prejudices, and belief systems and do not let them interfere with patient care
- ix. Introduce yourself and the way in which you want to be called
- x. Both the paramedic and the patient will bring cultural stereotypes to a professional relationship.
- xi. Ethnocentrism
- xii. Cultural imposition
- xiii. Space
  - a) Intimate zone
  - b) Personal distance
  - c) Social distance
  - d) Public distance
- xiv. Cultural issues
  - a) Variety of space
  - b) Accept the sick role in different ways
  - c) Nonverbal communication may be perceived differently
  - d) Asian, Native Americans, Indochinese, and Arabs may consider direct eye contact impolite or aggressive
  - e) Touch
  - f) Language barrier
- xv. Special considerations
  - a) Regardless of the patient's cultural background, educational status, occupation, or ability to speak English, most patients will be anxious during an emergency event
  - b) Attempt to communicate in English first to determine whether the patient understands or speaks some English words or phrases
  - c) Bystanders, coworkers, or family members may be available to provide assistance
  - d) If the patient does not speak or understand English, attempt to communicate with signs or gestures
  - e) Notify the receiving hospital as soon as possible to arrange for an interpreter
  - f) If time permits, all assessment procedures should be performed slowly and with the patient's permission
  - g) Be aware that "private space" is culturally defined
  - h) Pointing to the area of the body to be examined before touching the patient is best
- g. Respect the patient's need for modesty and privacy at the scene and during transport

# Preparatory Medical/Legal and Ethics

## Paramedic Education Standard

Integrates comprehensive knowledge of EMS systems, safety/well being of the paramedic, and medical/legal and ethical issues, which are intended to improve the health of EMS personnel, patients, and the community.

## Paramedic-Level Instructional Guideline

The Paramedic Instructional Guidelines in this section include all the topics and material at the AEMT level, PLUS the following material:

- I. Consent/Refusal of Care
  - A. Consent to Care
    - 1. Nature of illness
    - 2. Treatment recommendations
    - 3. Risks and refusals
    - 4. Alternatives
  - B. Types of Consent
    - 1. Expressed consent – non-verbal
    - 2. Informed consent -- research
    - 3. Implied consent (emergency doctrine) and incapacitation
      - a. Physical
      - b. Mental
    - 4. Involuntary consent
      - a. Mental Health
      - b. Incarceration
    - 5. Minors
      - a. Parental permission and In Loco Parentis emergency doctrines
      - b. Emancipation
        - i. Married
        - ii. Armed Services
        - iii. Independence – court decree
    - 6. Medical Restraint and Use of Force Doctrine
      - a. Reasonable prevention of harm
        - i. Suicide
        - ii. Homicide
      - b. Nonpunitive
    - 7. Legal complications related to consent
      - a. Abandonment
      - b. False imprisonment

- c. Assault
      - d. Battery
    - C. Refusal of Care and/or Transportation
      - 1. Patient must be alert and oriented to person, place, and time
      - 2. Patient must be informed of the risks of refusing care (e.g., death)
      - 3. Patient must be informed if problems return/persist they should call EMS or see a physician
      - 4. Against medical advice
        - a. Due diligence
          - i. Standard of care
          - ii. Medical control
        - b. Documentation
- II. Confidentiality
  - A. Obligation to Protect Patient Information
  - B. HIPAA
  - C. Responsibility Arising From Physician – Patient Relationship
    - 1. Assessment findings
    - 2. Treatments rendered
  - D. Privileged Communications
    - 1. Need to know
      - a. Healthcare providers
    - 2. Education
    - 3. Legally mandated
      - a. Child abuse reported
      - b. Subpoena
    - 4. Third-party billing
    - 5. Release of medical information
  - E. Breach of Confidentiality
    - 1. Libel
    - 2. Slander
- III. Advanced Directives
  - A. Patient Self-Determination Act
    - 1. Do not resuscitate (DNR)
    - 2. Living wills
    - 3. Durable power of attorney
- IV. Tort and Criminal Actions
  - A. Basic Legal Concepts
    - 1. Judiciary system
      - a. Origins of jurisprudence – common law
      - b. Source of constitutional law
        - i. Legislative
          - a) Statutes
          - b) Regulations

- ii. Administrative
      - a) Regulatory policy
  - c. The legal process
    - i. Role of courts
      - a) Court of original jurisdiction – trial by judge or jury
      - b) Appeals and precedents
  - d. Elements of a Civil Lawsuit
    - i. Actionable Cause
    - ii. Complaint
    - iii. Investigation – discovery
      - a) Dispositions
      - b) Interrogatives
    - iv. Trial
      - a) Decision
      - b) Settlement
    - v. Appeal
  - e. Slander
  - f. Libel
- B. Criminality
  - 1. Breaches of conduct
    - a. Assault
    - b. Battery
    - c. Kidnapping
  - 2. Mandatory reporting requirements
    - a. Abuse and assault
      - i. Child abuse -- neglect
      - ii. Elder abuse
      - iii. Domestic Violence
    - b. Criminality
      - i. Sexual assault
      - ii. Penetrating Trauma
        - a) Gunshot
        - b) Stab wounds
    - c. Communicable diseases
      - i. Reportable
      - ii. Animal Bites
- C. Civil Tort
  - 1. Concept of negligence
    - a. *Res ipsa loquitur*
    - b. Negligence per se
  - 2. Elements of negligence
    - a. Duty to act
      - i. Contractual
      - ii. Duty undertaken
    - b. Breach of duty
      - i. Standard of care

- ii. Commission
      - a) Malfeasance
      - b) Misfeasance
    - iii. Omission-- nonfeasance
    - iv. False imprisonment
    - v. Wrongful death
    - vi. Abandonment
  - c. Proximate causation
  - d. Damages to plaintiff
    - i. Physical -- e.g. lost earnings
    - ii. Psychological – e.g., pain and suffering
    - iii. Punitive
  - e. Defenses
    - i. Good samaritan
    - ii. Governmental immunity
    - iii. Statute of limitations
    - iv. Contributory negligence
  - f. Protection from liability
    - i. Professionalism
    - ii. Standard of care
    - iii. Liability insurance

## V. Statutory Responsibilities

- A. Medical Practice Act
  - 1. Physician responsibilities – competency assurance
    - a. Mandatory training
    - b. Skill competency
    - c. Run review
  - 2. Liability of the paramedic medical director
    - a. On-line – direct supervision
    - b. Off-line – protocols with standing orders under indirect supervision
  - 3. Borrowed Servant Doctrine – liability for actions of EMTs supervised by the paramedic
- B. Medical Direction
- C. Duty to Act
  - 1. Good samaritan
  - 2. Abandonment

## VI. Mandatory Reporting

- A. Legally Compelled to Notify Authorities
  - 1. Abuse
  - 2. Neglect
- B. Arises From Special Relationship With Patient
- C. Legal Liability for Failure to Report

- VII. Health Care Regulation
  - A. Scope of Practice
  - B. Licensure
    - 1. Occupational regulation
    - 2. Practicing without a license
  - C. Certification
    - 1. Non-governmental
  - D. Credentialing
    - 1. Jurisdiction-specific
    - 2. Medical control
- VIII. Patient Rights/Advocacy
  - A. Patient Rights
    - 1. Non-judgmental care
      - a. Civil rights -- discrimination
      - b. Human rights
    - 2. Confidentiality
      - a. Elements of confidential information
        - i. Patient history
        - ii. Assessment findings
        - iii. Treatment rendered
      - b. Release of information, requiring written permission
        - i. Patient
        - ii. Legal guardian
        - iii. Legal substitution
      - c. Limited release of information without permission
        - i. Need to know --Other healthcare providers
        - ii. Legal mandate -- Subpoena
        - iii. Third-party billing -- HIPAA
      - d. Improper release of information
        - i. Invasion of privacy—ridicule, notoriety or embarrassment
        - ii. Defamation from libel or slander
  - B. Patient Advocacy
    - 1. EMTALA Regulations
    - 2. Shared Decision - making
- IX. End of Life Issues
  - A. Limited Resuscitation
    - 1. Health Care Proxy
    - 2. Medical Orders for Life Sustaining Treatments (MOLST)
  - B. Withholding Resuscitation and “Obvious Death” Criteria
  - C. Termination of Resuscitation
  - D. Organ donation

- X. Ethical Principles/Moral Obligations
  - A. Morals and Concepts of Right and Wrongs
  - B. Ethics
    - 1. Branch of philosophy
    - 2. Study of morality
  - C. Applied Ethics and Use of Ethical Values
  - D. Ethical Conflicts
    - 1. Futility of care: cardiac arrest in the wilderness
    - 2. Allocation of limited resources (Medical Rationing) such as use of triage
    - 3. Professional misconduct such as patient abuse
    - 4. Economic triage such as patient-dumping
- XI. Ethical Tests and Decision Making
  - A. Do No Harm
  - B. In Good Faith
  - C. Patient's Best Interest
- XII. Employment Law
  - A. American With Disabilities Act
  - B. Title VII – Civil Rights Act
  - C. Amendments to Title VII
  - D. Family Medical Leave Act
  - E. Occupational Safety and Health Act
  - F. Ryan White Act

# Anatomy and Physiology

## Paramedic Education Standard

Integrates a complex depth and comprehensive breadth of knowledge of the anatomy and physiology of all human systems.

## Paramedic-Level Instructional Guideline

The Paramedic Instructional Guidelines in this section include all the topics and material at the AEMT level, PLUS the following material:

- I. Anatomical Terms
  - A. Anatomy
  - B. Physiology
  - C. Pathophysiology
  - D. Homeostasis
  - E. Specific body parts and areas
    - 1. Axillary
    - 2. Brachial
    - 3. Buccal
    - 4. Cardiac
    - 5. Cervical
    - 6. Cranial
    - 7. Cutaneous
    - 8. Deltoid
    - 9. Femoral
    - 10. Gastric
    - 11. Gluteal
    - 12. Hepatic
    - 13. Inguinal
    - 14. Lumbar
    - 15. Mammary
    - 16. Nasal
    - 17. Occipital
    - 18. Orbital
    - 19. Parietal
    - 20. Patellar
    - 21. Pectoral
    - 22. Perineal
    - 23. Plantar
    - 24. Popliteal
    - 25. Pulmonary



- 26. Renal
- 27. Sacral
- 28. Temporal
- 29. Umbilical
- 30. Volar

II. Planes and sections of the body

- A. Frontal (coronal) Plane
- B. Sagittal Plane
- C. Midsagittal Plane
- D. Transverse Plane
- E. Cross-Section
- F. Longitudinal Section

III. Anatomical Topography

- A. Abdominal Quadrants and Regions
  - 1. Abdominal quadrants
    - a. Right upper quadrant (RUQ)
    - b. Left upper quadrant (LUQ)
    - c. Right lower quadrant (RLQ)
    - d. Left lower quadrant (LLQ)
  - 2. Abdominal regions
    - a. Right hypochondriac
    - b. Epigastric
    - c. Left hypochondriac
    - d. Right lumbar
    - e. Umbilical
    - f. Left lumbar
    - g. Right iliac
    - h. Hypogastric
    - i. Left iliac

IV. Organ Systems

- A. Skeletal
- B. Muscular
- C. Respiratory
- D. Circulatory
- E. Nervous
- F. Integumentary
- G. Digestive
- H. Endocrine
- I. Renal
- J. Reproductive
- K. Lymphatic System and Immune System

- V. Anatomic Cavities
  - A. Dorsal
    - 1. Cranial cavity
    - 2. Spinal cavity
  - B. Ventral
    - 1. Thoracic cavity
    - 2. Abdominal cavity
    - 3. Pelvic cavity
- VI. Organization
  - A. Atomic Level
    - 1. Matter,
    - 2. Element
    - 3. Atom
    - 4. Proton
    - 5. Neutron
    - 6. Electron
    - 7. Bonding
      - a. Ionic
      - b. Covalent
      - c. Hydrogen bonds
    - 8. Chemical reactions
      - a. Synthesis
      - b. Decomposition
  - B. Chemical Level
    - 1. Carbohydrates
      - a. Monosaccharides
      - b. Disaccharides
      - c. Oligosaccharides
      - d. Polysaccharides
      - e. Starches
      - f. Glycogen
      - g. Cellulose
      - h. Fiber
    - 2. Lipids
      - a. True fats
      - b. Triglycerides
      - c. Phospholipids
      - d. Steroids
    - 3. Proteins
      - a. Amino acids
      - b. Peptide bonds
      - c. Polypeptide
    - 4. Enzymes -- Active Site Theory
    - 5. Nucleic acids
      - a. DNA

- b. RNA
  - c. ATP
- 6. Trace Elements

## VII. Cell Structure and Function

- A. Cell Theory
- B. Cellular Anatomy and Physiology
  - 1. Cell membrane
  - 2. Cytoplasm
  - 3. Nucleus and chromosomes
  - 4. Organelles
    - a. Mitochondria
    - b. Lysosomes
    - c. Golgi apparatus
    - d. Ribosomes
    - e. Endoplasmic reticulum
- C. Cellular Respiration
  - 1. Aerobic
  - 2. Anaerobic
- D. Cellular Environment
  - 1. Water compartments
    - a. Intracellular (ICF)
    - b. Extracellular (ECF)
      - i. plasma
      - ii. lymph
      - iii. interstitial fluid
      - iv. specialized fluids
        - a) synovial
        - b) cerebrospinal
        - c) aqueous humor
  - 2. Isotonic
  - 3. Hypotonic
  - 4. Hypertonic
  - 5. Acid and base
    - a. pH scale
      - i. Base
      - ii. Acid
    - b. Normal pH ranges of body fluids
    - c. Buffer system
- E. Cellular Transport Mechanisms
  - 1. Diffusion
  - 2. Osmosis
  - 3. Facilitated diffusion
  - 4. Active transport
  - 5. Filtration
  - 6. Phagocytosis
  - 7. Pinocytosis

- F. Cell Division
  - 1. Mitosis
  - 2. Meiosis
    - a. Genetic code
    - b. Protein synthesis
    - c. Differentiation
    - d. DNA fingerprinting
  - 3. Mutations
- VIII. Tissue Level of Organization and Membranes
  - A. Epithelial tissue
    - 1. Simple squamous
    - 2. Stratified squamous
    - 3. Transitional
    - 4. Simple cuboidal
    - 5. Simple columnar
    - 6. Ciliated
  - B. Connective tissue
    - 1. Blood
    - 2. Areolar
    - 3. Adipose
    - 4. Fibrous
    - 5. Elastic
    - 6. Bone
    - 7. Cartilage
  - C. Muscle tissue
    - 1. Smooth
    - 2. Skeletal
    - 3. Cardiac
  - D. Neural tissue
  - E. Membranes
    - 1. Pleura
    - 2. Pericardial
    - 3. Peritoneum-mesentery
    - 4. Specialized connective tissue
      - a. Superficial fascia
      - b. Periosteum
      - c. Perichondrium
      - d. Synovial
      - e. Deep fascia
      - f. Meninges
      - g. Fibrous pericardium
- IX. Skeletal System
  - A. Functions
  - B. Classification of bones

1. Long bones
  - a. Diaphysis
  - b. Epiphysis
  - c. Marrow canal
  - d. Yellow bone marrow
2. Short bones
3. Flat bones
4. Irregular bones
5. Joint surfaces
  - a. Articular cartilage
  - b. Periosteum
- C. Embryonic skeleton maturation
  1. Bone matrix
  2. Osteoblasts
  3. Ossification – the production of bone matrix
  4. Fontanelles
  5. Epiphyseal discs
  6. Osteoclasts
  7. Marrow canal
- D. Bone growth and maintenance
  1. Heredity
  2. Nutrition
  3. Hormones
  4. Exercise – stress
- E. Hormones involved in bone growth and maintenance
  1. Growth Hormone
  2. Thyroxine
  3. Insulin
  4. Parathyroid hormone
  5. Calcitonin
  6. Estrogen
  7. Testosterone
- F. Major subdivision of the skeleton
  1. Axial skeleton
  2. Appendicular skeleton
- G. Components
  1. Skull
    - a. Cranial bones
      - i. frontal
      - ii. temporal
      - iii. occipital
      - iv. sphenoid
      - v. ethmoid
    - b. Sutures
    - c. Facial bones
      - i. manible

- ii. condyloid joint
    - iii. maxillae
  - d. Paranasal sinuses and ciliated epithelium
  - e. Mastoid sinuses
  - f. Auditory bones
- 2. Vertebral column
  - a. Vertebrae
  - b. Cervical vertebrae
    - i. atlas
    - ii. pivot joint
    - iii. axis
  - c. Thoracic vertebrae
  - d. Lumbar vertebrae
  - e. Sacrum
  - f. Sacroiliac joints
  - g. Coccyx
- 3. Vertebral canal
  - a. Discs
  - b. Symphysis joints
- 4. Rib cage
  - a. 12 pairs of ribs
  - b. Sternum
  - c. Manubrium
  - d. Body
  - e. Xiphoid process
  - f. True ribs
  - g. False ribs
  - h. Floating ribs
- 5. Shoulder and Arm
  - a. Scapula
  - b. Clavicle
  - c. Humerus
  - d. Radius
  - e. Ulna
  - f. Carpals
  - g. Metacarpals
  - h. Phalanges
- 6. Hip and Leg
  - a. Hip bones
  - b. Ilium
  - c. Ischium
  - d. Pubis
  - e. Pubic bones
  - f. Pubic symphysis
  - g. Acetabulum
  - h. Femur

- i. Patella
    - j. Tibia
    - k. Fibula
    - l. Tarsala
    - m. Calcaneus
    - n. Talus
    - o. Metatarsals
    - p. Phalanges
  - H. Classification of Joints
    - 1. Synathrosis (immovable)
    - 2. Amphiarthrosis (slightly movable)
    - 3. Diarthrosis (freely movable)
  - I. Types of Joints
    - 1. Gliding joints
    - 2. Hinge joints
    - 3. Pivot joints
    - 4. Ball and socket joints
    - 5. Saddle joints
    - 6. Symphysis
  - J. Synovial Joints
    - 1. Articular cartilage
    - 2. Joint capsule
    - 3. Synovial membrane
    - 4. Synovial fluid
    - 5. Bursae
- X. Muscular System
  - A. Gross Anatomy
    - 1. Muscle fibers
    - 2. Tendons
    - 3. Fascia
    - 4. Periosteum
    - 5. Origin
    - 6. Insertion
  - B. Microscopic Anatomy
    - 1. Myofibrils
    - 2. Myosin
    - 3. Actin
    - 4. Titin
    - 5. Troponin
    - 6. Tropomyosin
    - 7. Sarcoplasmic reticulum
  - C. Actions of Muscles
    - 1. Flexion
    - 2. Extension
    - 3. Adduction

4. Abduction
  5. Pronation
  6. Supination
  7. Dorsiflexion
  8. Plantar flexion
  9. Rotation
- D. Contraction of a Skeletal Muscle Fiber
1. Nerve Impulse
    - a. Polarization
    - b. Depolarization
    - c. Repolarization
    - d. Action potential
  2. Neuromuscular junction and functions
    - a. Axon terminal
    - b. Synapse
  3. Structure of the sarcomere
  4. Sliding filament theory of muscle contraction and function
    - a. Acetylcholine
    - b. Calcium ions
    - c. Myosin and actin
    - d. Troponin and tropomyosin
    - e. Cholinesterase
  5. Energy sources for muscle contraction
    - a. ATP
    - b. Creatinine phosphate
    - c. Creatinine
    - d. Glycogen
    - e. Glucose
  6. Hemoglobin, myoglobin, oxygen debt, lactic acid, and recovery oxygen uptake
  7. Aerobic and anaerobic endurance and the relationship to muscle movement
- E. Major Muscles of the Body
1. Antagonistic
  2. Synergistic

## XI. Respiratory System

- A. General Function of the Respiratory System
1. Upper respiratory tract
  2. Lower respiratory tract
- B. Structure and Functions of the Nasal Cavities and Pharynx
1. Nasal cavities
    - a. Nose
    - b. Nasal cavities
    - c. Nasal septum
    - d. Nasal mucosa



- e. Olfactory receptors
    - f. Paranasal sinuses
  - 2. Pharynx
    - a. Nasopharynx
    - b. Soft palate
    - c. Oropharynx
    - d. Laryngopharynx
- C. Structure and Function of the Larynx and the Speaking Mechanism
  - 1. Voice box
  - 2. Thyroid cartilage
  - 3. Epiglottis
  - 4. Vocal cords
  - 5. Glottis
- D. Structure and Functions of the Trachea and Bronchial Tree
  - 1. Trachea
  - 2. Primary bronchi
  - 3. Bronchial tree
  - 4. Right and left main-stem bronchi
  - 5. Bronchioles
- E. Lungs
  - 1. Location and function
  - 2. Pleural membranes
    - a. Parietal pleura
    - b. Visceral pleura
    - c. serous fluid
  - 3. Hilus
- F. Structure and Function of the Alveoli and Pulmonary Capillaries
  - 1. Surfactant
- G. Mechanism of Breathing
  - 1. Mechanical ventilation
    - a. Mechanism of inhalation
      - i. inspiration
      - ii. phrenic nerve
      - iii. intercostal nerves
      - iv. respiration
      - v. ventilation/perfusion disturbance
      - vi. diaphragm
      - vii. external intercostal muscles
      - viii. internal intercostal muscles
      - ix. pressures
    - b. Changes in air pressure that occur within the thoracic cavity during respiration
      - i. atmospheric
      - ii. intrapleural
      - iii. intrapulmonic
    - c. Role of the visceral and parietal pleura in respiration
    - d. Mechanics of exhalation

- H. Explain the Diffusion of Gases in External and Internal Respiration
  - I. Discuss Pulmonary Volumes
    - 1. Tidal volume
    - 2. Minute respiratory volume (MRV)
    - 3. Inspiratory reserve volume
    - 4. Expiratory reserve volume
    - 5. Vital capacity
    - 6. Residual air volume
  - J. Physiological Dead Space and Lung Compliance
  - K. Oxygen and Carbon Dioxide Transport in the Blood
  - L. Nervous and Chemical Mechanisms That Regulate Respiration
  - M. Respiration Affect on pH of Certain Body Fluids
  - N. Respiration and Acid-Base Balance
    - 1. Respiratory acidosis and alkalosis
    - 2. Metabolic acidosis and alkalosis
- XII. Circulatory
- A. Blood
    - 1. Composition and function of blood
    - 2. Composition and function of blood plasma
      - a. Amount
      - b. Color
      - c. pH
      - d. Viscosity
      - e. Plasma
        - i. plasma proteins
        - ii. prothrombin
        - iii. fibrinogen
        - iv. albumin
        - v. globulins
    - 3. Primary hemopoietic tissue
    - 4. Function of red blood cells
    - 5. Nutrients necessary for red blood cell production
    - 6. Function of the following
      - a. Stem cells
      - b. Hemocytoblasts
      - c. Normoblasts
      - d. Reticulocyte
    - 7. Red blood cell production in hypoxic state
    - 8. Red blood cell and hemoglobin destruction
    - 9. ABO group and Rh factor blood types
    - 10. Types and function of white blood cells (leukocytes)
      - a. Neutrophils
      - b. eosinophils
      - c. basophils
      - d. lymphocytes
      - e. monocytes

11. Platelets role in hemostasis
    - a. Vascular spasm
    - b. Platelet plugs
    - c. Chemical clotting
  12. Three stages of chemical blood clotting
  13. Normal values in a complete blood count
- B. The Heart
1. Location and features of the heart
    - a. Mediastinum
    - b. Pericardial membranes
    - c. Fibrous pericardium
    - d. Parietal pericardium
    - e. Epicardium
  2. Chambers of the heart
    - a. Myocardium
    - b. Endocardium
    - c. Right and left atria
    - d. Right and left ventricles
  3. Valves of the heart and their function
    - a. Tricuspid valve
    - b. Bicuspid valve (mitral valve)
    - c. Aortic valve
    - d. Pulmonary semilunar valve
  4. Cardiac cycle
  5. Creation of heart sounds
    - a. Papillary muscles
    - b. Chordae tendinae
  6. Coronary arteries
    - a. Coronary circulation
  7. Major blood vessels
  8. Cardiac conduction pathway and its relationship to a normal electrocardiogram
    - a. Pacemaker cells
    - b. Conduction cells
  9. Stroke volume, cardiac output, and Starlings law of the heart
  10. Nervous system regulation of the function of the heart
- C. Blood Vessels and Circulation
1. Structure and function of the blood vessels, arteries, veins and capillaries
  2. Arterial and venous anastomosis
  3. Structure of capillaries
  4. Exchange of gases that occurs at the capillary level
  5. Mechanism that regulate blood flow through arteries, capillaries, and veins
  6. Pathway and purpose of the pulmonary circulation
  7. Pathway of the systemic circulation
  8. Pathway and purpose of the hepatic portal circulation
  9. Fetal circulation

10. Branches of the Aorta and their distributions
11. Major systemic arteries and the parts of the body they nourish
12. Major systemic veins and the parts of the body they drain of blood
13. Hemodynamics
  - a. Blood pressure
    - i. venous return
    - ii. pulse pressure
    - iii. peripheral resistance
  - b. Factors that maintain systemic blood pressure
    - i. heart rate and force of contraction
    - ii. vessel elasticity
    - iii. blood viscosity
    - iv. hormones
    - v. peripheral resistance
  - c. Osmosis
  - d. Diffusion
  - e. Facilitated diffusion
  - f. Active Transport
  - g. Hydrostatic pressure
  - h. Oncotic pressure
14. Regulation of blood pressure by the heart and kidneys
15. Medulla and autonomic nervous system regulation of the diameter of the blood vessels
16. Coordination of the cardiac, vasomotor, and respiratory centers to control blood flow through the tissues

### XIII. Nervous System

- A. Basic Components
  1. Neuron
    - a. Axon
    - b. Dendrites
    - c. Myelin sheath
    - d. Neurolemma
    - e. Microglia
    - f. Astrocytes
    - g. Schwann cells
    - h. Neuroglia
  2. Type of neurons
    - a. Sensory
    - b. Motor
    - c. Interneurons
  3. Nerves and Tracts
    - a. Sensory nerves
    - b. Motor nerves
    - c. Mixed nerve
    - d. Nerve tract (white matter)

4. Nerve Impulse
  - a. Membrane potential and the conduction of an action potential
    - i. polarization
    - ii. depolarization
    - iii. impulse transmission
    - iv. salutatory conduction
  - b. Impulse transmission at synapses
- B. Central Nervous System
  1. Function of the spinal cord
  2. Spinal nerves and function
  3. Spinal cord reflexes
    - a. Stretch reflexes
    - b. Reflex arc
    - c. Flexor reflexes
  4. Parts of the brain
    - a. Ventricles
    - b. Medulla
    - c. Pons midbrain
    - d. Cerebellum
    - e. Hypothalamus
    - f. Thalamus
    - g. Cerebrum
    - h. Frontal lobes
    - i. Parietal lobes
    - j. Temporal lobes
    - k. Occipital lobes
    - l. Basal ganglia
    - m. Corpus callosum
  5. Meninges location and function
  6. Function of the blood-brain barrier
  7. Location and functions of the cerebrospinal fluid
- C. Peripheral Nervous System
  1. Cranial nerves and function
    - a. Olfactory nerves
    - b. Optic nerves
    - c. Oculomotor nerves
    - d. Trochlear nerves
    - e. Trigeminal nerves
    - f. Abducens nerves
    - g. Facial nerves
    - h. Vestibulocochlear nerves
    - i. Glossopharyngeal nerves
    - j. Vagus nerves
    - k. Accessory nerves
    - l. Hypoglossal nerves

2. Distribution pattern of spinal nerves
  3. Sensory and motor pathways
    - a. Sensory pathways
      - i. posterior column pathway
      - ii. spinothalamic pathway
      - iii. spinocerebellar pathway
    - b. Motor pathways
      - i. pyramidal system
      - ii. extrapyramidal system
  4. Sympathetic division of the autonomic nervous system
  5. Parasympathetic division of the autonomic nervous system
  6. Effects of the sympathetic and parasympathetic divisions of the ANS on various organs of the body
    - a. Eyes
    - b. Skin
    - c. Cardiovascular system
    - d. Adrenal glands
    - e. Respiratory system
    - f. Digestive system
    - g. Skeletal muscles
    - h. Urinary system
    - i. Reproductive system
- D. Sensory Function
1. General purposes of sensations
  2. General sense and the special senses
    - a. General senses
      - i. pain
      - ii. temperature
      - iii. touch, pressure, position
      - iv. chemical detection
    - b. Special senses
      - i. smell
      - ii. taste
      - iii. vision
      - iv. hearing
      - v. balance
  3. Parts of the sensory pathway and the general functions of each
    - a. Receptors
    - b. Sensory neurons
    - c. Sensory tracts
    - d. Sensory areas
  4. Characteristics of sensations
    - a. Projection
      - i. phantom pain
    - b. Intensity
    - c. Contrast

- d. Adaptation
- e. After-image
- 5. Characteristics of cutaneous senses
  - a. Free nerve endings
  - b. Encapsulated nerve endings
  - c. Neuropathy
- 6. Referred pain
- 7. Importance of proprioception or muscle sense
- 8. Pathways for the sense of taste
  - a. Taste buds
  - b. Chemoreceptors
  - c. Transmission via the facial and glossopharyngeal nerves
- 9. Pathways for the sense of Smell
  - a. Olfaction chemoreceptors
  - b. Olfactory cranial nerves
- 10. Sensation of hunger and thirst
  - a. Visceral sensations
  - b. Hypothalamas receptors
  - c. Water to salt proportion
- 11. Components of the eye and function
  - a. Vision receptors
  - b. Refracting system
  - c. Eyelids
  - d. Lacrimal apparatus
  - e. Conjunctiva
    - i. conjunctivitis
  - f. Lacrimal glands
    - i. tears
    - ii. lysozome enzyme
  - g. Lacrimal sac
  - h. Nasolacrimal duct
  - i. Eyeball
    - i. orbit
    - ii. extrinsic muscles
    - iii. layers of the eyeball
      - a) sclera
      - b) cornea
      - c) choroid layer
      - d) ciliary body
      - e) suspensory ligaments
      - f) iris
      - g) pupil
      - h) lens
      - i) cataracts
      - j) rods

- k) macula area
    - l) macula lutea
    - m) fovea
    - n) ganglion neurons
    - o) optic disc
  - iv. cavities
    - a) posterior cavity – vitreous humor
    - b) anterior cavity
      - i) aqueous humor -- glaucoma
      - ii) canal of Schlemm
  - v. physiology of vision
    - a) refraction
      - i) nearsightedness – myopia
      - ii) farsightedness – hyperopia & presbyopia
      - iii) astigmatism
      - iv) strabismus
      - v) amblyopia
    - b) rods and rhodopsin
    - c) cones and color blindness
    - d) optic nerve
    - e) optic chiasma
    - f) occipital lobes of cerebral cortex
      - i) binocular vision
- j. Components and function of the ear
  - i. outer ear
    - a) auricle – pinna
    - b) ear canal
  - ii. middle ear
    - a) eardrum – tympanic membrane
    - b) malleus
    - c) incus
    - d) stapes
    - e) oval window
    - f) eustachian tube
  - iii. inner ear
    - a) bony labyrinth
    - b) membranous labyrinth
    - c) perilymph
    - d) endolymph
    - e) cochlea
      - i) medial canal
      - ii) organ of Corti
      - iii) round window
      - iv) utricle and saccule
        - (a) otoliths
      - v) Semicircular canals



- f) process of hearing, vibration transmission and nerve impulse generation
    - i) deafness
        - (a) conduction deafness
        - (b) nerve deafness
        - (c) central deafness
      - g) physiology of equilibrium
  - iv. proprioception
  - v. arterial pressoreceptors and chemoreceptors

#### XIV. Integumentary System

- A. General Functions of the Integumentary System
- B. Layers and Functions of the Skin
  - 1. Epidermis
  - 2. Dermis
  - 3. Subcutaneous tissue
- C. Additional Skin Structures:
  - 1. Stratum corneum
  - 2. Stratum germinativum
  - 3. Melanocytes
  - 4. Melanin
- D. Cutaneous Senses
- E. Other Structures and Function
  - 1. Hair
  - 2. Nails
  - 3. Sebaceous glands
  - 4. Ceruminous glands
  - 5. Eccrine sweat glands
- F. Dermal Arterioles Response to Heat, Cold and Stress
- G. Structure and Function of Subcutaneous Tissue
- H. Skin Response to Injury and Repair Process
- I. Effects of the Aging Process on the Skin

#### XV. Digestive System

- A. General Function of the Digestive System and the Major Divisions
  - 1. Alimentary tube
  - 2. Accessory organs
- B. Accessory Organs of Digestion
- C. Mechanical and Chemical Digestion
- D. Structure and Function of the Teeth and Tongue
- E. Function of Saliva
- F. Location and Function of the Pharynx and Esophagus
- G. Mechanical and Chemical Breakdown of Food in the Mouth
- H. Mechanics of Swallowing
- I. Location, Structure, and Function of the Stomach, Small intestine, Liver, Gallbladder, and Pancreas

- J. Four Layers of the Alimentary Canal
  - 1. Mucosa
  - 2. Submucosa
  - 3. External muscle layer
  - 4. Serosa
- K. Absorption in the Large and Small Intestine
- L. Function of the Normal Flora in the Colon
- M. Peristalsis and Chyme

## XVI. Endocrine System

- A. Function of the Endocrine System
- B. Endocrine and Exocrine Glands
- C. Endocrine Glands and the Hormones Secreted
  - 1. Prostaglandin
  - 2. Target organs
  - 3. Target tissue
- D. Chemistry of Hormones
  - 1. Amines
  - 2. Proteins
  - 3. Steroids
- E. Regulation of Hormone Secretion
  - 1. Positive and negative feedback mechanisms
- F. Pituitary Gland
  - 1. Posterior pituitary gland
    - a. Antidiuretic hormone (ADH)
    - b. Osmoreceptors
    - c. Oxytocin
- G. Anterior Pituitary Gland
  - 1. Growth Hormone (GH)
  - 2. Thyroid-stimulating hormone (TSH)
  - 3. Adrenocorticotrophic Hormone (ACTH)
  - 4. Prolactin
  - 5. Follicle-stimulating hormone (FSH)
  - 6. Luteinizing hormone (LH)
- H. Thyroid Gland
  - 1. Thyroxine (T4)
    - a. goiter
    - b. cretinism
    - c. myxedema
    - d. Graves' disease
  - 2. Triiodothyronine (T3)
  - 3. Calcitonin
- I. Parathyroid hormone (PTH) and calcitonin
- J. Pancreas
  - 1. Islets of Langerhans
    - a. Alpha cells

- b. Beta cells
    - c. Delta cells
  - 2. Insulin
    - a. Diabetes mellitus
    - b. Hyperglycemia
    - c. Hypoglycemia
  - 3. Glucagon
  - 4. Somatostatin
- K. Relationship Between Insulin and Glucagon
- L. Prostaglandins
- M. Adrenal Glands
  - 1. Adrenal medulla
    - a. epinephrine
    - b. norepinephrine
  - 2. Adrenal Cortex
    - a. Mineralocorticoids
      - i. aldosterone
      - ii. rennin-angiotensin mechanism
    - b. Glucocorticoids
      - i. cortisol
        - a) gluconeogenesis
        - b) anti-inflammatory effects -- histamine
    - c. Sex hormones
      - i. estrogen
      - ii. progesterone
      - iii. inhibin
      - iv. testosterone
    - d. Diseases of the adrenal cortex
      - i. Addison's disease
      - ii. Cushing's syndrome
- N. How Protein Hormones and Steroid Hormones Exert Their Effects
- O. Coordinated Physiological Responses Controlled by Hormones
- P. Hormones That Are Especially Important to Normal Growth and Development

## XVII. Renal System

- A. Location and General Function of Each Organ in the Urinary System
- B. Components of a Nephron and the Associated Blood Vessels
- C. Process of Urine Formation
  - 1. Glomerular filtration,
  - 2. Tubular reabsorption
  - 3. Tubular secretion
  - 4. Kidney blood flow
- D. Kidneys Function in Maintaining Normal Blood Volume and Pressure
- E. Kidneys Maintenance of Normal Blood pH and Electrolyte Balance
- F. Hormones That Affect Kidney Function
  - 1. Aldosterone

2. Atrial natriuretic peptide (ANP)
3. Antidiuretic hormone (ADH)
4. Parathyroid hormone (PTH)
- G. Urination Reflex and Voluntary Control
- H. Characteristics of Normal Urine
  1. Amount
  2. Color
  3. Specific gravity
  4. pH
  5. constituents
  6. nitrogenous wastes
- I. Water Compartments
- J. Water Movement Between the Compartments
- K. Water Entry and Exit in the Body
- L. Water and Electrolyte Distribution in the Body
- M. Basic Concepts Involved in the Control of Fluid and Electrolyte Regulation
- N. Buffering Systems That Balance the pH of the Intracellular and Extracellular Fluids

## XVIII. Reproductive System

- A. Define the Following:
  1. Diploid
  2. Haploid
  3. Gametes
  4. Endometrium
  5. Genetic disease
  6. Homologous chromosomes
  7. Autosomes
  8. Sex chromosomes
  9. Genes
  10. Alleles
  11. Genotype
  12. Phenotype
  13. Homomzygous
  14. Heterozygous
- B. Spermatogenesis and Oogenesis
- C. Hormones Necessary for the Formation of Gametes
- D. Essential and Accessory Reproductive Organs of the Male and Female
- E. Structures That Constitute External Genitals in Both Sexes
- F. Parts of the Sperm Cell
- G. Life Cycle of an Oocyte
- H. Menstrual Cycle in Terms of Changes in Hormone Levels and the Condition of the Endometrium
- I. Major Developmental Changes During Gestation
- J. Function and Structure of the Placenta and Umbilical Cord
- K. Fetal Circulation/Respiration

- L. Average Gestation Period
  - M. Stages of Labor
  - N. Physiologic Changes in Infant After Birth
- XIX. Lymphatic and Immune System
- A. Major Components and Functions of the Lymphatic System
  - B. Formation of Lymph Fluid
  - C. Lymph Vessels and Return to the Blood
  - D. Location and Function of Lymph Nodes and the Spleen
  - E. Lymphocytes
  - F. Immunity
    - 1. Antigens
    - 2. antibodies
  - G. Innate Immunity
    - 1. Defensive cells
      - a. Natural killer cells (NK cells)
      - b. Basophils
      - c. Mast cells
      - d. Phagocytes
      - e. Langerhans cells
    - 2. Chemical defenses
      - a. Interferons
      - b. Complement
      - c. Inflammation
      - d. Fever
  - H. Adaptive Immunity
    - 1. Cell-mediated
    - 2. Antibody mediated
  - I. Thymus
    - 1. Stem cells
    - 2. T lymphocytes – T cells
  - J. Humoral immunity and Cell Mediated Immunity
  - K. Development and Function of B Cells and T Cells
  - L. Acquired Immunity and Genetic Immunity
  - M. Vaccinations
  - N. Classifications of Microorganisms
  - O. Distribution of and Benefits of Normal Flora
  - P. Infectious Disease
    - 1. Methods by which infectious diseases are spread
- XX. Nutrition, Metabolism and Body Temperature
- A. Normal Range of Body Temperature
  - B. Homeostatic Mechanisms That Maintain a Constant Body Temperature
  - C. Metabolism, Catabolism, Anabolism, Basal Metabolic Rate, Kilo-Calories

- D. Methods Heat is Generated and Lost in the Body
  - 1. Thyroxine
  - 2. Sympathetic stimulation
  - 3. Respiration
  - 4. Skeletal muscles
  - 5. Liver
  - 6. Food
- E. Fever
  - 1. Cause
  - 2. Advantages
  - 3. Disadvantages
- F. Hypothalamus Function as the Thermostat in the Body
- G. Cell Respiration
  - 1. Byproducts
  - 2. Disposal of byproducts
- H. Cellular Metabolism
  - 1. Metabolic roles of fats, glucose, and proteins
  - 2. Synthesis uses for glucose, amino acids and fats
  - 3. Metabolic rate and kilocalories
  - 4. Factors that affect metabolic rate
- I. Functions of Vitamins, Minerals, and Other Important Nutrients
  - 1. Basic food groups
  - 2. Minerals, vitamins and water
  - 3. Significance of caloric value of foods

# Medical Terminology

## Medical Terminology

### **Paramedic Education Standard**

Integrates comprehensive anatomical and medical terminology and abbreviations into the written and oral communication with colleagues and other health care professionals.

### **Paramedic-Level Instructional Guideline**

The Paramedic Instructional Guidelines in this section include all the topics and material at the AEMT level, PLUS the following material:

- I. Medical Terminology
  - A. Importance
  - B. Basic Rules and Elements
  - C. Word Roots, Prefixes, and Suffixes
  - D. Literal Meanings From Medical Terms Based on Word Construction
  - E. Define Common Abbreviations and Interpret Common Symbols
  - F. Body Structure
  - G. Body Systems

# Pathophysiology

# Pathophysiology

## Paramedic Education Standard

Integrates comprehensive knowledge of pathophysiology of major human systems.

## Paramedic-Level Instructional Guideline

The Paramedic Instructional Guidelines in this section include all the topics and material at the AEMT level, PLUS the following material:

- I. Introduction
    - A. Correlation of Pathophysiology With Disease Process
      - 1. Cells appear similar to multicellular “social” organism
      - 2. Cells communicate electrochemically
      - 3. Coordination of specific bodily functions
        - a. Endocrine
        - b. Exocrine
        - c. Other coordinating receptors
          - i. chemoreceptors
          - ii. baroreceptors
          - iii. adrenergic
          - iv. others
- II. Basic Cellular Review
  - A. Major Classes of Cells
  - B. Chief Cellular Functions
    - 1. Differentiation or maturation
    - 2. Perform one function or act in concert with other cells to perform a more complex task
  - C. Cellular Components
    - 1. Structure and function
    - 2. Three main components
  - D. Tissue Types
    - 1. Epithelial tissue
    - 2. Connective tissue
    - 3. Muscle tissue
    - 4. Nervous tissue
- III. Alterations in Cells and Tissues
  - A. Cellular Adaptation
    - 1. Atrophy
    - 2. Hypertrophy



3. Hyperplasia
4. Dysplasia
5. Metaplasia
- B. Cellular Injury
  1. Hypoxic injury
    - a. Most common
    - b. May result from
      - i. Decreased amounts of oxygen
      - ii. Loss of hemoglobin or hemoglobin function
      - iii. Decreased number of red blood cells
      - iv. Respiratory or cardiovascular system disease
      - v. Loss of cytochromes
  2. Chemical injury from agents such as:
    - a. Poisons
    - b. Lead
    - c. Carbon monoxide
    - d. Ethanol
    - e. Pharmacological
  3. Infectious injury
    - a. Virulence or pathogenicity of microorganisms via
      - i. Invading and destroying cells
      - ii. Producing toxins
      - iii. Producing hypersensitivity reactions
    - b. Bacteria
      - i. Survival and growth
      - ii. Bacteria produce enzymes or toxins
        - a) Toxins
          - i) Exotoxins
          - ii) Endotoxins
        - b) Fever is caused pyrogens
        - c) Inflammation
        - d) Hypersensitivity
        - e) Bacteremia or Septicemia
    - c. Viruses
      - i. Among the most common afflictions
      - ii. Intracellular parasites
      - iii. Protein coat (capsid)
      - iv. Viruses do not produce exotoxins or endotoxins
  4. Immunologic and inflammatory injury
    - a. Cellular membranes
    - b. Rapid leakage of potassium out of the cell and an influx of water
  5. Injurious genetic factors
  6. Injurious nutritional imbalances
  7. injurious physical agents

- C. Manifestation of Cellular Injury
  - 1. Cellular manifestations
  - 2. Systemic manifestations
- D. Cellular Death/Necrosis

#### IV. The Cellular Environment

- A. Distribution of Body Fluids
  - 1. Intracellular fluid (ICF)
  - 2. Extracellular fluid (ECF)
    - a. Interstitial fluid
    - b. Intravascular fluid
    - c. Other
  - 3. Total body water (TBW)
- B. Aging and Distribution of Body Fluids
  - 1. birth
  - 2. Infancy
  - 3. Childhood
  - 4. Adulthood
  - 5. Elderly
- C. Water Movement Between ICF and ECF
  - 1. Osmotic forces
  - 2. Role of sodium and potassium
- D. Water Movement Between Plasma and Interstitial Fluid
  - 1. Osmotic forces within capillary bed
  - 2. Starling's hypothesis
  - 3. Role of capillary and membrane permeability
- E. Alterations in Water Movement – Edema
  - 1. Pathophysiology
    - a. Increased capillary permeability
    - b. Decreased oncotic pressure
    - c. Increased capillary hydrostatic pressure
    - d. Hydrostatic pressure
    - e. Lymphatic vessel obstruction
  - 2. Clinical manifestations
    - a. Local
    - b. Generalized
  - 3. Evaluation and treatment
- F. Water Balance and the Role of Electrolytes
  - 1. Water balance
    - a. Role of antidiuretic hormone (ADH)
    - b. Receptors
      - i. osmoreceptors
      - ii. volume sensitive receptors
      - iii. baroreceptors
  - 2. Sodium and chloride balance
    - a. Role and function of sodium as a cation

- b. Role and function of chloride as an anion
  - c. Hormone regulation by aldosterone and natriuretic hormone
  - d. Role of renin-angiotensin system
- 3. Alterations in sodium, chloride, and water balance
  - a. Isotonic alterations
    - i. isotonic volume depletions
    - ii. isotonic volume excesses
  - b. Hypertonic alterations
    - i. hypernatremia
    - ii. water deficit
    - iii. hyperchloremia
  - c. Hypotonic alterations
    - i. hyponatremia
    - ii. water excess
    - iii. hyponatremia
- 4. Alterations in potassium, calcium, phosphate, and magnesium balance
  - a. Potassium
    - i. hypokalemia
    - ii. hyperkalemia
  - b. Calcium and phosphate
    - i. hypocalcemia
    - ii. hypercalcemia
    - iii. hypophosphatemia
    - iv. hyperphosphatemia
  - c. Magnesium
    - i. hypomagnesemia
    - ii. hypermagnesemia
- G. Acid-base balances
  - 1. Hydrogen ion and pH
  - 2. Buffer systems
    - a. Carbonic acid-bicarbonate buffering
    - b. Protein buffering
    - c. Renal buffering
    - d. Other buffers
  - 3. Acid-based imbalances
    - a. Metabolic acidosis
      - i. pathophysiology
      - ii. clinical presentation
      - iii. evaluation and treatment
    - b. Metabolic alkalosis (rare)
      - i. pathophysiology
      - ii. clinical presentation
      - iii. evaluation and treatment
    - c. Respiratory acidosis
      - i. pathophysiology
      - ii. clinical presentation
      - iii. evaluation and treatment

- d. Respiratory alkalosis
  - i. pathophysiology
  - ii. clinical presentation
  - iii. evaluation and treatment

## V. Genetics and Familial Diseases

### A. Factors Causing Disease

- 1. Genetic
- 2. Environmental
  - a. Microorganisms and immunologic exposures
  - b. Personal habits and life-style
  - c. Chemical substances
  - d. Physical environment
  - e. Psychosocial environment
- 3. Age and gender
  - a. Accumulative affects of both genetic and environmental factors
  - b. Life-style, anatomic, or hormonal differences

### B. Analyzing Disease Risk

- 1. Disease rates
  - a. Incidence rate
  - b. Prevalence rate
  - c. Mortality rate
- 2. Risk factor analysis
  - a. Causal risk factors
  - b. Noncausal risk factors

### C. Combined Effects and Interaction Among Risk Factors

- 1. Familial disease tendency
- 2. Aging and age-related disorders

### D. Common Familial Disease and Associated Risk Factors

- 1. Immunologic disorders
  - a. Allergies
  - b. Asthma
  - c. Rheumatic fever
- 2. Cancer
  - a. Breast cancer
  - b. Colorectal cancer
  - c. Lung cancer
- 3. Endocrine disorders
  - a. Diabetes mellitus
    - i. insulin-dependent diabetes mellitus
    - ii. non-insulin dependent diabetes mellitus
- 4. Hematologic disorders
  - a. Drug-induced hemolytic anemia
  - b. Hemophilia
  - c. Hemochromatosis

5. Cardiovascular disorders
  - a. Long QT syndrome (autosomal dominant disorder)
  - b. Cardiac myopathies
  - c. Mitral valve prolapse
  - d. Coronary heart disease
    - i. family history and CHD risk
    - ii. genetic factors and predisposition
  - e. Hypertension and stroke
6. Renal disorders
  - a. Gout (uric acid accumulation)
  - b. Kidney stones
7. Gastrointestinal disorders
  - a. Malabsorption disorders
    - i. lactose intolerance
    - ii. ulcerative colitis
    - iii. Crohn's disease
  - b. Peptic ulcers
  - c. Gallstones
  - d. Obesity
    - i. associated disease processes
    - ii. causal risk factors
8. Neuromuscular disorders
  - a. Huntington Disease
  - b. Muscular Dystrophy
  - c. Multiple Sclerosis
  - d. Alzheimer Disease
9. Pshychiatric disorders
  - a. Schizophrenia
  - b. Manic-depressive

## VI. Hypoperfusion

- A. Pathogenesis
  1. Decreased cardiac output
  2. Compensatory mechanisms
    - a. Catecholamine release
      - i. epinephrine and norepinephrine
      - ii. increase in systemic vascular resistance
    - b. Role of aldosterone, renin-angiotenis, and ADH
      - i. adequate or increased blood volume
      - ii. vasoconstriction increases systemic blood pressure
    - c. Shift of interstitial fluid
    - d. Splenic discharge
  3. Increased preload, stroke volume, and heart rate
    - a. Increased myocardial oxygen demand
    - b. Systemic and pulmonary edema
      - i. dyspnea

- ii. dusky skin color
    - iii. low blood pressure
    - iv. oliguria
    - v. impaired mentation
  - c. Decreased cardiac output and ejection fraction
    - i. decreased blood pressure
    - ii. decreased tissue perfusion
    - iii. impaired cellular metabolism
- B. Types of Shock
  - 1. Cardiogenic shock
    - a. Defined
    - b. Pathophysiology
    - c. Evaluation and treatment
  - 2. Hypovolemic shock
    - a. Defined
    - b. Pathophysiology
    - c. Evaluation and treatment
  - 3. Neurogenic shock
    - a. Defined
    - b. Pathophysiology
    - c. Evaluation and treatment
  - 4. Anaphylactic shock
    - a. Defined
    - b. Pathophysiology
    - c. Evaluation and treatment
  - 5. Septic shock
    - a. Defined
    - b. Pathophysiology
    - c. Evaluation and treatment
- C. Multiple Organ Dysfunction Syndrome (MODS)
  - 1. Defined
    - a. Progressive failure of two or more organ systems
    - b. Occurs after severe illness or injury
    - c. New diagnosis first described in 1975
    - d. Mortality rate of 60%-90%
    - e. Major cause of death following septic, traumatic, and burn injuries
  - 2. Pathophysiology
    - a. Injury or endotoxin release
    - b. Vascular endothelial damage, neuroendocrine response, and release of inflammatory mediators
    - c. Activation of complement, coagulation, and kallikrein/kinin systems
    - d. Massive systemic immune/inflammatory and coagulation responses
    - e. Vascular changes
      - i. vasodilation

- ii. increase in capillary permeability
      - iii. selective vasoconstriction
      - iv. microvascular thrombi
    - f. Maldistribution of systemic and organ blood flow
    - g. Hypermetabolism
    - h. Oxygen supply/demand imbalance
    - i. Tissue hypoxia
      - i. tissue hypoperfusion
      - ii. exhaustion of fuel supply (i.e., atp, glucose, etc)
      - iii. metabolic failure
      - iv. lysosome breakdown
      - v. anaerobic metabolism
      - vi. acidosis and impaired cellular function
    - j. Organ dysfunction
      - i. decreased cardiac function and myocardial depression
      - ii. renal failure
      - iii. failure of smooth muscle of vascular system
        - a) release of capillary sphincters
        - b) vasodilation
  - 3. Clinical presentation—24 hours after initial resuscitation
    - a. Low-grade fever
    - b. Tachycardia
    - c. Dyspnea and adult respiratory distress syndrome (ARDS)
    - d. Altered mental status
    - e. Hyperdynamic state
    - f. Hypermetabolic states
    - g. Renal and liver failure (14-21 days)
    - h. Gastrointestinal and immune collapse (14-21 days)
    - i. Cardiovascular collapse and death (21-28 days)
- D. Cellular metabolism impairment
- 1. Oxygen impairment
    - a. Anaerobic metabolism
    - b. Increased lactate
    - c. Metabolic acidosis
    - d. Decreased oxygen affinity for hemoglobin
    - e. Decreased ATP
    - f. Changes in cellular electrolytes
    - g. Cellular edema
    - h. Release of lysosomal enzymes
  - 2. Impaired glucose use
    - a. Increase serum glucose
    - b. Catecholamines, cortisol, growth hormone release
    - c. Increased gluconeogenesis, gluconeolysis, and lipolysis

## VII. Self-Defense Mechanisms

- A. Introduction—lines of defense
  - 1. Anatomic barriers
  - 2. Inflammatory response
  - 3. Immune response
- B. Characteristics of the immune response
  - 1. Natural versus acquired response
    - a. Natural or native immunity
    - b. Acquired immunity
      - i. active acquired immunity
      - ii. passive acquired immunity
  - 2. Primary versus secondary immunity
    - a. Primary or initial immune response
    - b. Secondary or anamnestic immune response
  - 3. Humoral versus cell-mediated immunity
    - a. B-cell lymphocyte
    - b. T-cell lymphocyte
- C. Introduction of the immune response
  - 1. Antigens and immunogens
    - a. Antigens
    - b. Immunogen
    - c. Tolerance
    - d. Molecular size
      - i. larger—proteins, polysaccharides, and nucleic acids
      - ii. smaller—amino acids, monosaccharides, and fatty acids
      - iii. haptens—smaller molecules which become immunogenic
  - 2. Histocompatibility antigens (HLA antigens)
    - a. HLA complexes or major histocompatibility complexes (MHC)
    - b. Role of HLA antigens
  - 3. Blood group antigens
    - a. Rh system
    - b. ABO system
- D. Humoral immune response
  - 1. B-cell lymphocytes
    - a. Formation
      - i. lymphoid stem cell
      - ii. generation of clonal diversity
      - iii. clonal selection
      - iv. activated B-cell
        - a) immunoglobulin-secreting plasma cells
        - b) memory cells
  - 2. Immunoglobulins
    - a. Differences between immunoglobulins and antibodies
    - b. Structure of immunoglobulin molecules
    - c. Function of antibodies
      - i. agglutination



- ii. precipitation
      - iii. neutralization
        - a) bacterial toxins
        - b) viruses
        - c) opsonization of bacteria
        - d) activation of inflammatory processes
        - e) classes of immunoglobulins
        - f) antibodies as antigens
      - iv. isotypic antigens
      - v. allotypic antigens
      - vi. idiotypic antigenic determinants
    - d. Monoclonal antibodies
  - 3. Secretory immune system
    - a. Mucosal-associated lymphoid tissue
      - i. lacrimal glands
      - ii. salivary glands
      - iii. bronchial-associated lymphoid tissue
      - iv. mammary-associated lymphoid tissue
      - v. gut-associated lymphoid tissue
      - vi. genital-associated lymphoid tissue
    - b. Circulates independently of other lymphocytes
      - i. mucosal-associated lymphoid tissue
      - ii. regional lymph nodes
      - iii. thoracic duct
      - iv. blood
    - c. First line of defense
    - d. Local rather than systemically
- E. Cell-mediated immune response
  - 1. T-cells
    - a. Five types of mature T-cells
      - i. memory cells
      - ii. Td cells or lymphokine-producing cells
      - iii. Tc cells or cytotoxic cells
      - iv. Th cells or helper T-cells
      - v. Ts cells or suppressor T-cells
    - b. Proliferation and differentiation
  - 2. Major effects of cell-mediated immune response
    - a. Cytotoxicity
    - b. Delayed hypersensitivity
    - c. Memory
    - d. Control
- F. Cellular interactions in the immune response
  - 1. Cytokines
    - a. Lymphokines
    - b. Monokines

- 2. Antigen processing, presentation, and recognition
  - a. Antigen degradation
  - b. Classes of histocompatible antigens (HLA)
  - c. T-cell receptors
  - d. Interleukin-1 (IL-1)
- 3. T-cell and B-cell differentiation
  - a. T-cell differentiation
  - b. B-cell differentiation
  - c. Control of B and T-cell development
- G. Fetal and neonatal immune function
  - 1. Fetal immunological capabilities
    - a. Immunologic responses
    - b. Antibody capabilities
  - 2. Antibody levels
    - a. Umbilical cord blood
    - b. Neonatal circulation
  - 3. Trophoblasts
- H. Aging and the immune response in elderly
  - 1. T-cell function
  - 2. Antibody production

## VIII. Inflammation

- A. The acute inflammatory response
  - 1. Triggers
    - a. Lethal cellular injury
    - b. Non-lethal cellular injury
    - c. Other microorganisms
  - 2. Response
    - a. Vascular responses to inflammation
    - b. Cellular responses to inflammation
- B. Mast cells
  - 1. Degranulation of vasoactive amines and chemotactic factors
    - a. Stimulation of degranulation
      - i. physical injury
      - ii. chemical agents
      - iii. immunological (IgE-mediated hypersensitivity)
    - b. Vasoactive amines
      - i. histamine
      - ii. serotonin
    - c. Chemotactic factors
      - i. neutrophil
      - ii. eosinophil
  - 2. Synthesis of leukotrienes and prostaglandins
    - a. Leukotrienes or slow-reacting substances of anaphylaxis (SRS-A)
      - i. composition
      - ii. function

- b. Prostaglandins
      - i. composition
      - ii. function
- C. Plasma protein systems
  - 1. Complement system
    - a. Structure and function
    - b. Activation
      - i. classic pathway
      - ii. alternative pathway
  - 2. Clotting system
    - a. Structure and function
    - b. Activation
      - i. extrinsic pathway
      - ii. intrinsic pathway
  - 3. Kinin system
    - a. Structure and function
    - b. Activation -- Plasma kinin cascade
  - 4. Control and interaction of the plasma protein system
    - a. Reason for control
    - b. Types of control
      - i. antagonists
      - ii. histamine control
      - iii. interaction of control processes
- D. Cellular components of inflammation
  - 1. Functions of phagocytes
    - a. Margination
    - b. Diapedesis
    - c. Exudation into inflamed tissue
    - d. Process of phagocytosis
  - 2. Polymorphonuclear neutrophils
    - a. Predominance in early inflammatory response
    - b. Role
  - 3. Monocytes and macrophages
    - a. Monocyte—young macrophage
      - i. structure
      - ii. role
    - b. Macrophages
      - i. structure
      - ii. role
  - 4. Eosinophils
    - a. Structure
    - b. Role
- E. Cellular products
  - 1. Interleukins (ILs)
    - a. Interleukin-1
    - b. Interleukin-2

2. Lymphokines
  - a. Production
  - b. Types and effects
    - i. migration-inhibitory factor
    - ii. macrophage-activation factor
3. Interferon
  - a. Structure
  - b. Actions and effects
- F. Systemic responses of acute inflammation
  1. Fever
    - a. Activation
    - b. Effects
  2. Leukocytosis
    - a. Activation
    - b. Effects
  3. Increase in circulating plasma proteins or acute-phase reactants
    - a. Activation
    - b. Effects
- G. Chronic inflammation responses
  1. Causes
    - a. Unsuccessful acute inflammatory response
    - b. Persistence of infection or antigen
  2. Characteristics
    - a. Persistence of acute inflammation response
    - b. Neutrophil degranulation and death
    - c. Lymphocyte activation
    - d. Fibroblast activation
    - e. Infiltration (pus)
    - f. Tissue repair (scar)
- H. Local inflammation responses
  1. Vascular changes
    - a. Vasodilation
    - b. Increased capillary permeability
  2. Exudation
    - a. Functions
    - b. Compositions
- I. Phases of resolution and repair
  1. Definitions
    - a. Regeneration
    - b. Repair
    - c. Debridement
    - d. Primary intention
    - e. Secondary intention
  2. Reconstruction phase
    - a. Initial wound response
    - b. Granulation
    - c. Epithelialization

3. Maturation phase
    - a. Completion of contraction, differentiation, and remodeling of scar tissue
    - b. Disappearance of capillaries from scar tissue
  4. Dysfunctional wound healing
    - a. Dysfunction during the inflammatory response
    - b. Dysfunction during the reconstruction phase
      - i. impaired collagen synthesis
      - ii. impaired epithelialization
      - iii. wound disruption
      - iv. impaired contraction
  - J. Aging and self-defense mechanisms
    1. Newborn
    2. Elderly
- IX. Variances in Immunity and Inflammation
- A. Hypersensitivity: allergy, autoimmunity, and isoimmunity
    1. Definitions
      - a. Hypersensitivity
      - b. Allergy
      - c. Autoimmunity
      - d. Isoimmunity
    2. Mechanisms of hypersensitivity
      - a. Immediate versus delayed reactions
      - b. IgE reactions
        - i. role of IgE
        - ii. mechanism of IgE
        - iii. clinical indications
        - iv. genetic predisposition
        - v. IgE-mediated hypersensitivity tests
        - vi. desensitization
      - c. Tissue-specific reactions
        - i. tissue-specific antigens
        - ii. mechanisms
      - d. Immune-complex mediated injury
        - i. mechanisms
        - ii. immune-complex disease
      - e. Cell-mediated tissue destruction
        - i. mechanisms
        - ii. clinical instances
    3. Targets of hypersensitivity
      - a. Allergy
        - i. allergens
        - ii. neoantigen
      - b. Autoimmunity
        - i. breakdown of tolerance

- ii. original insult
        - iii. genetic factors
      - c. Isoimmunity
        - i. transient neonatal diseases
        - ii. transplant rejections and transfusion reactions
    - 4. Autoimmune and isoimmune diseases
      - a. Grave's disease
      - b. Rheumatoid arthritis
      - c. Myasthenia gravis
      - d. Immune thrombocytopenic purpura
      - e. Isoimmune neutropenia
      - f. Systemic lupus erythematosus (SLE)
      - g. Rh and ABO isoimmunization
  - B. Immunity and inflammation deficiencies
    - 1. Congenital immune deficiencies
    - 2. Acquired deficiencies
      - a. Nutritional deficiencies
      - b. Iatrogenic deficiencies
      - c. Deficiencies caused by trauma
      - d. Deficiencies caused by stress
      - e. AIDS
    - 3. Replacement therapies for immune deficiencies
      - a. Gamma globulin therapy
      - b. Transplantation and transfusion
      - c. Gene therapy
- X. Stress and Disease
  - A. Concepts of stress
    - 1. Triad of manifestation
    - 2. General adaptation syndrome (Selye)
      - a. Alarm stage
      - b. Resistance or adaptation stage
      - c. Exhaustion stage
      - d. Definition of physiological stress
    - 3. Psychologic mediators and specificity
      - a. Psychologic factors effects on physiological responses to stress
      - b. Pituitary gland and adrenal cortex sensitivity to emotional, psychologic and social influences
    - 4. Homeostasis as a dynamic steady state
      - a. Definitions
        - i. dynamic steady state
        - ii. turnover
      - b. Reaction of body to stressors

- B. Stress responses
  - 1. Psychoneuroimmunologic response
    - a. Interaction of consciousness, brain and central nervous system, and the body's defense mechanisms
    - b. Stress response
  - 2. Neuroendocrine regulation
    - a. Catecholamines
      - i. components
        - a) epinephrine
        - b) norepinephrine
      - ii. physiologic actions of alpha and beta receptors
        - a)  $\alpha_1$
        - b)  $\alpha_2$
        - c)  $\beta_1$
        - d)  $\beta_2$
      - iii. physiologic effects of catecholamines
        - a) brain
        - b) cardiovascular
        - c) pulmonary
        - d) muscle
        - e) liver
        - f) adipose tissue
        - g) skin
        - h) skeleton
        - i) g.i. and g.u. systems
        - j) lymphoid tissue
    - b. Cortisol
      - i. source
      - ii. primary effects of cortisol
        - a) stimulation of glucogenesis
        - b) formation of glycogen
        - c) cortisol effects of cell-mediated immunity
      - iii. other physiologic effects of cortisol
        - a) protein metabolism
        - b) digestive function
        - c) urinary function
        - d) connective tissue function
        - e) muscle function
        - f) bone function
        - g) vascular system and myocardial function
        - h) central nervous system function
    - c. Other hormones
      - i. endorphins
      - ii. growth hormone
      - iii. prolactin
      - iv. testosterone

- d. Role of the immune system
  - i. interaction of immune, nervous, and endocrine systems during a stress response
  - ii. influence of stress response on immune system
  - iii. relationship between stress and immune-related conditions and diseases
    - a) cardiovascular
    - b) muscles
    - c) connective tissue
    - d) pulmonary system
    - e) immune system
    - f) G.I. system
    - g) G.U. system
    - h) skin
    - i) endocrine
    - j) central nervous system
- C. Stress, coping, and illness interrelationships
  - 1. Stress as interdependent processes
    - a. Definition of physiologic stress and psychologic distress
    - b. Effects of psychologic distress
    - c. Relationship between distress and immune dysfunction
  - 2. Potential stress effects on
    - a. Healthy individuals
      - i. ineffective coping
      - ii. effective coping
    - b. Symptomatic individuals
      - i. ineffective coping
      - ii. effective coping
    - c. Medical interventions
      - i. ineffective coping
      - ii. effective coping



# Life Span Development

## Life Span Development

### Paramedic Education Standard

Integrates comprehensive knowledge of life span development.

### Paramedic-Level Instructional Guideline

The Paramedic Instructional Guidelines in this section include all the topics and material at the AEMT level, PLUS the following material:

- I. Infancy (birth to 1 year)
  - A. Physiological
    - 1. Vital signs
      - a. Heart rate
      - b. Respiratory
      - c. Blood pressure
      - d. Temperature ranges
    - 2. Weight
    - 3. Cardiovascular system
    - 4. Pulmonary system
    - 5. Renal system
    - 6. Immune system
    - 7. Nervous system
      - a. Movements
      - b. Reflexes
      - c. Fontanelles
      - d. Sleep
    - 8. Musculoskeletal system
      - a. Bone growth
      - b. Muscle weight
    - 9. Dental system
    - 10. Growth and development in infants -- Rapid changes over first year
  - B. Psychosocial development
    - 1. Family processes-reciprocal socialization
      - a. Scaffolding
      - b. Attachment
      - c. Trust versus mistrust
      - d. Secure attachment
    - 2. Temperament
      - a. Easy child
      - b. Difficult child
      - c. Slow to warm-up child

3. Crying
  - a. Basic cry
  - b. Anger cry
  - c. Pain cry
4. Trust
5. Situational crisis
  - a. Protest
  - b. Despair
  - c. Withdrawal
6. Growth charts

## II. Toddler (12 to 36 months) and pre-school age (3 to 5 years)

- A. Physiological
  1. Vital signs
    - a. Heart rate
    - b. Respiratory rate
    - c. Systolic blood pressure
    - d. Temperature
  2. Weight
  3. Cardiovascular system
  4. Pulmonary system
  5. Renal system
  6. Immune system
  7. Nervous system
  8. Musculoskeletal system
  9. Dental system
  10. Elimination patterns -- Toilet training
  11. Sensory
- B. Psychosocial
  1. Cognitive
  2. Play
  3. Sibling relationships
  4. Peer group functions
  5. Parenting styles and its effect on children
    - a. Authoritarian parenting
    - b. Authoritative parenting
    - c. Permissive-indifferent parenting
    - d. Permissive-indulgent parenting
  6. Divorce effects on child development
  7. Television
  8. Modeling

## III. School age children (6 to 12 years)

- A. Physiological
  1. Vital signs
    - a. Heart rate
    - b. Respiratory rate

- c. Systolic blood pressure
      - d. Temperature
    - 2. Growth rate
    - 3. Bodily functions
  - B. Psychosocial
    - 1. Families
    - 2. Develop self-concept
    - 3. Moral development
      - a. Pre-conventional reasoning
      - b. Conventional reasoning
      - c. Post-conventional reasoning
      - d. Individuals move through development at different paces
- IV. Adolescence - (13 to 18 years)
  - A. Physiological
    - 1. Vital signs
      - a. Heart rate
      - b. Respiratory rate
      - c. Blood pressure
      - d. Temperature
    - 2. Growth rate
      - a. Secondary sexual development occurs
      - b. Endocrine changes
        - i. female
        - ii. male
      - c. Reproductive maturity
      - d. Muscle mass and bone growth
      - e. Body fat
      - f. Blood chemistry nearly equal to adult levels
      - g. Skin toughens
  - B. Psychosocial
    - 1. Family
    - 2. Develop identity
    - 3. Ethical development
- V. Early adulthood (20 to 40 years)
  - A. Physiological
    - 1. Vital signs
      - a. Heart rate
      - b. Respiratory rate
      - c. Blood pressure
      - d. Temperature
  - B. Psychosocial
- VI. Middle adulthood (41 to 60 years)
  - A. Physiological

1. Vital signs
  - a. Heart rate
  - b. Respiratory rate
  - c. Blood pressure
  - d. Temperature
2. Varying degrees of degradation
3. Vision
4. Hearing
5. Cardiovascular health
  - a. Cardiac output
  - b. Cholesterol
6. Cancer
7. Weight control
8. Menopause
- B. Psychosocial
  1. Social clock
  2. Approach to problems
  3. Empty-nest syndrome
  4. Often burdened by financial commitments

## VII. Late adulthood (61 years and older)

- A. Physiological
  1. Vital signs
    - a. Heart rate
    - b. Respiratory rate status
    - c. Blood pressure
    - d. Temperature
  2. Life span
  3. Life expectancy
  4. Cardiovascular function changes
    - a. Blood vessels
    - b. Heart
    - c. Blood cells
  5. Respiratory system
  6. Endocrine system changes
  7. Gastrointestinal system
  8. Renal system
  9. Sensory changes
  10. Nervous system
- B. Psychosocial
  1. Terminal drop hypothesis
  2. Wisdom attributed to age in some cultures
  3. Challenges
    - a. Self worth
    - b. Declining well being
    - c. Financial burdens

# Public Health

## Public Health

### Paramedic Education Standard

Applies fundamental knowledge of principles of public health and epidemiology including public health emergencies, health promotion, and illness and injury prevention.

### Paramedic-Level Instructional Guideline

The Paramedic Instructional Guidelines in this section include all the topics and material at the AEMT level, PLUS the following material:

- I. Basic Principles of Public Health
  - A. Role of public health
    - 1. Many definitions
    - 2. Public health mission and functions
    - 3. Public health differs from individual patient care
    - 4. Review accomplishments of public health
      - a. Widespread vaccinations
      - b. Clean drinking water and sewage systems
      - c. Declining infectious disease
      - d. Fluoridated water
      - e. Reduction in use of tobacco products
      - f. Prenatal care
      - g. Others
  - B. Public health laws, regulations and guidelines
  - C. EMS interface with public health
    - 1. EMS is a public health system
      - a. EMS provides a critical public health function
      - b. Incorporate public health services into EMS system
      - c. Collaborations with other public health agencies
    - 2. Roles for EMS in public health
      - a. Health prevention and promotion
        - i. primary prevention—preventing disease development
          - a) vaccination
          - b) education
        - ii. secondary prevention—preventing the complications and/or progression of disease
        - iii. health screenings
      - b. Disease surveillance
        - i. EMS providers are first line care givers
        - ii. patient care reports may provide information on epidemics of disease

3. Injury prevention
  - a. Safety equipment
  - b. Education
    - i. car seat safety
    - ii. seat belt use
    - iii. helmet use
    - iv. driving under the influence
    - v. falls
    - vi. fire
    - vii. injury surveillance

# Pharmacology

## Principles of Pharmacology

### Paramedic Education Standard

Integrates comprehensive knowledge of pharmacology to formulate a treatment plan intended to mitigate emergencies and improve the overall health of the patient.

### Paramedic-Level Instructional Guideline

The Paramedic Instructional Guidelines in this section include all the topics and material at the AEMT level PLUS the following material:

- I. Medication Safety
- II. Medication Legislation
  - A. Pure Food and Drug Act
  - B. Federal Food, Drug and Cosmetic Act
  - C. Harrison Narcotic Act
  - D. Controlled Substances Act
    - 1. Schedule I
    - 2. Schedule II
    - 3. Schedule III
    - 4. Schedule IV
    - 5. Schedule V
  - E. Drug Enforcement Agency
  - F. Development of Pharmaceuticals
    - 1. Food and Drug Administration approval process
    - 2. Special Considerations
      - a. Pregnancy
      - b. Pediatrics
      - c. Geriatrics
- III. Naming
  - A. Chemical
  - B. Generic
  - C. Propriety/Trade
  - D. Official
  - E. Authoritative sources of drug information
    - 1. United States Pharmacopeia (USP)
    - 2. Physician's Desk Reference (PDR)
    - 3. Drug Package Inserts
    - 4. Drug Handbooks

5. AMA Drug Evaluation
6. Hospital Formulary (HF)

#### IV. Classifications

- A. Body System
- B. Class of Agent
- C. Mechanism of Action
  1. Alkalinizing Agents
  2. Analgesics
  3. Antibiotics
  4. Anticonvulsant – Sedative
  5. Antihypertensives
  6. Beta – Agonists
  7. Beta-blockers
  8. Calcium Channel Blockers
  9. Corticosteroids
  10. Diuretics
  11. Dysrhythmics
  12. Fibrinolytics
  13. Neuromuscular Blocking Agents
  14. Platelet Inhibitors
  15. Sympathomimetics
  16. Xanthines
- D. Classifications by Body System
  1. Central Nervous System
    - a. Autonomic Pharmacology
      - i. cholinergics
      - ii. anticholinergics
      - iii. adrenergics
      - iv. antiadrenergic
    - b. Analgesics
    - c. Anesthetics
    - d. Paralytics
    - e. Sedative/Hypnotic
    - f. Anticonvulsants
    - g. Stimulants
  2. Cardiovascular drugs
    - a. Anti-dysrhythmia
    - b. Cardiac Glycosides
    - c. Antihypertensives
    - d. Antianginal Drugs
    - e. Antihyperlipidemia Drugs
    - f. Antihistamine
  3. Drugs affecting the Blood
    - a. Anticoagulants
    - b. Fibrinolytics



- c. Antihemophilic Agents
  - d. Platelet Inhibitors
  - e. Glycoprotein IIB/IIIA Receptor Blockers
  - f. Hemostatic Agents
  - g. Antihyperlipidemic Agents
- 4. Psychiatric Medications
  - a. Neuroleptics
  - b. Antidepressants
  - c. Antimanic Drugs
- 5. Respiratory System
  - a. Mucolytics
  - b. Cholinergic Antagonists
  - c. Sympathomimetics
  - d. Xanthine Derivatives
  - e. Cough Suppressants
  - f. Nasal Decongestants
  - g. Antihistamines
- 6. Endocrine System
  - a. Drugs affecting the Pituitary Gland
    - i. anterior pituitary hormones
    - ii. posterior pituitary hormones
  - b. Drugs affecting the Thyroid Gland
  - c. Drugs affecting the Adrenal Cortex
    - i. glucocorticoids
    - ii. mineralcorticoids
    - iii. adrenal steroid inhibitors
  - d. Drugs affecting the Pancreas
    - i. insulin preparations
    - ii. oral hypoglycemic agents
    - iii. hyperglycemic agents
- 7. Infectious Disease
  - a. Anthelmintic Agents
  - b. Antiparasitic Agents
  - c. Antifungal Agents
  - d. Antibiotics
  - e. Antiviral
- 8. Immune System
  - a. Immunosuppressants
  - b. Immunomodulators
- 9. Gastrointestinal System
  - a. Antacid
  - b. Antiflatulents
  - c. Digestants
  - d. Antiemetics
  - e. Emetic Agents
  - f. H2 Receptor Antagonists

- g. Laxatives
  - h. Antidiarrheals
  - i. Cholesterol Synthesis
- 10. Urinary System
  - a. Diuretic Drugs
- 11. Reproductive System
  - a. Contraceptives
  - b. Replacement Hormone Therapies
  - c. Erectile Dysfunction
  - d. Oxytocics
  - e. Premature Labor Inhibitors
- 12. Ophthalmic Drugs
  - a. Antiglaucoma Agents
  - b. Mydriatic Agents
  - c. Antiinfective Agents
  - d. Topical Anesthetic Agents
- 13. Neoplastic Diseases
  - a. Alkylating Agents
  - b. Antimetabolites
  - c. Plant Alkaloids
  - d. Antitumor antibiotic
- 14. Herbal Preparations
- 15. Over the Counter Medications

V. Schedules

- A. Controlled Substances Act
  - 1. Schedule I
  - 2. Schedule II
  - 3. Schedule III
  - 4. Schedule IV
  - 5. Schedule V

VI. Drug Storage and Security

- A. Factors affecting Drug Potency
  - 1. Temperature
  - 2. Light
  - 3. Moisture
  - 4. Shelf Life
- B. Controlled Substances
  - 1. Storage
  - 2. Accountability

VII. Phases of Medication Activity

- VIII. Medication Interactions
  - A. Intestinal Absorption
  - B. Competition for Plasma Protein Binding
  - C. Biotransformation
  - D. Drug Metabolism
  - E. Renal Excretion
  - F. Drug – Drug Interaction

- IX. Toxicity

- X. Drug Terminology
  - A. Antagonism
  - B. Bolus
  - C. Contraindications
  - D. Cumulative Action
  - E. Depressant
  - F. Habituation
  - G. Hypersensitivity
  - H. Idiosyncrasy
  - I. Indication
  - J. Potentiation
  - K. Refractory
  - L. Side Effects
  - M. Stimulant
  - N. Synergism
  - O. Therapeutic action
  - P. Tolerance
  - Q. Untoward effect

- XI. Sources of Drugs
  - A. Inorganic
    - 1. Minerals
  - B. Organic
    - 1. Extracts
    - 2. Alkaloids
  - C. Chemical
  - D. Genetic
  - E. Drug Forms
    - 1. Liquids
    - 2. Solids
    - 3. Gases

## XII. Pharmacological concepts

### A. Pharmacokinetics

1. Absorption
  - a. Solubility
  - b. Bioavailability
  - c. Mechanism of Absorption
    - i. diffusion
    - ii. osmosis
    - iii. filtration
2. Distribution
  - a. Drug Reservoirs
    - i. plasma protein binding
    - ii. tissue binding
  - b. Barriers to Drug Distribution
    - i. blood Brain Barrier
    - ii. placental Barrier
3. Biotransformation
  - a. First Pass Metabolism
  - b. Active Metabolites
  - c. Inactive Metabolites
4. Metabolism and Excretion
  - a. Organs of Elimination
    - i. kidneys
    - ii. intestine
    - iii. lungs
    - iv. exocrine glands
      - a) sweat
      - b) salivary
      - c) mammary

### B. Pharmacodynamics

1. Mechanism of Action
  - a. Drug Receptor Interaction
    - i. agonists
    - ii. antagonists
    - iii. affinity
    - iv. efficacy
  - b. Drug Enzyme Interaction
2. Medication Response Relationship
  - a. Plasma Levels
  - b. Biologic Half – life
  - c. Therapeutic Threshold
  - d. Therapeutic Index
  - e. LD 50
  - f. Factors Altering Drug Response
    - i. age
    - ii. sex

- iii. body mass index
- iv. pathologic state
- v. genetic factors
- vi. time of administration
- vii. psychological factors
- viii. predictable responses
  - a) tolerance
  - b) cross tolerance
- ix. iatrogenic responses
- x. drug allergy
- xi. anaphylactic reaction
- xii. delayed reaction ("serum sickness")
- xiii. hypersensitivity
- xiv. idiosyncrasy
- xv. cumulative effect
- xvi. drug dependence
- xvii. drug antagonism
- xviii. summation (addition or additive effect)
- xix. synergism
- xx. potentiation
- xxi. interference
- xxii. toxicity

# Pharmacology

## Medication Administration

### Paramedic Education Standard

Integrates comprehensive knowledge of pharmacology to formulate a treatment plan intended to mitigate emergencies and improve the overall health of the patient.

### Paramedic-Level Instructional Guideline

The Paramedic Instructional Guidelines in this section include all the topics and material at the AEMT level PLUS the following material:

- I. Routes of Administration
  - A. Alimentary Tract
    - 1. Oral
    - 2. Sublingual
    - 3. Rectal
  - B. Parenteral
    - 1. Topical
    - 2. Intradermal
    - 3. Subcutaneous
    - 4. Intramuscular
    - 5. Intravenous
      - a. IV Bolus
      - b. IV Piggyback
    - 6. Endotracheal
    - 7. Intraosseous
    - 8. Inhalational
    - 9. Intranasal
- II. Administration of Medication to a Patient
  - A. The “Rights” of Drug Administration
    - 1. Right Patient -- Prescribed to Patient
    - 2. Right Medication -- Patient Condition
    - 3. Right Route -- Patient Condition
    - 4. Right Dose -- Prescribed to Patient
    - 5. Right Time -- Within Expiration Date
  - B. Drug Dose Calculations
    - 1. System of weights and measures
      - a. Metric System
        - i. prefixes
        - ii. conversions

2. Drug calculations
    - a. Desired dose
    - b. Concentration on hand
    - c. Volume on hand
  3. Calculate
    - a. Volume-based bolus
    - b. IV drip rate
    - c. Weight-based IV bolus
    - d. Weight-based IV drip
  - C. Techniques of Medication Administration (Advantages, Disadvantages, Techniques)
    1. Peripheral Venous Cannulation
    2. Intraosseous
    3. Intramuscular (Manual)
    4. Subcutaneous (Manual)
    5. Aerosolized
    6. Nebulized
    7. Sublingual
    8. Intranasal
    9. Transtracheal
    10. Intravenous Push/Infusion
    11. Nasogastric
    12. Rectal
    13. Topical
    14. Accessing Implanted/Central Intravenous Port
  - D. Reassessment
    1. Data -- Indications for Medication
    2. Action -- Medication Administered
    3. Response -- Effect of Medication
  - E. Documentation
- III. Standardization of Drugs
- A. Techniques to assure purity and potency
  - B. Generic Drugs
- IV. Medication Classifications
- A. Phelebotomy
    1. Procedure
  - B. Transfusion
    1. Indications
      - a. Transfusion Reactions
      - b. Hemolytic Reaction
      - c. Fever Reaction

# Pharmacology

## Emergency Medications

### Paramedic Education Standard

Integrates comprehensive knowledge of pharmacology to formulate a treatment plan intended to mitigate emergencies and improve the overall health of the patient.

### Paramedic-Level Instructional Guideline

The Paramedic Instructional Guidelines in this section include all the topics and material at the AEMT level PLUS the following material:

The paramedic must know (to a complex depth) the names, mechanism of action, indications, contraindications, complications, routes of administration, side effects, interactions, dose, and any specific administration considerations, for all of the following emergency medications and intravenous fluids. Individual training programs have the authority to add any medication used locally by paramedic.

- I. Specific Medications
  - A. Activated Charcoal
  - B. Adenosine
  - C. Albuterol
  - D. Amiodarone
  - E. Amyl Nitrite
  - F. Aspirin
  - G. Atropine
  - H. Dextrose (50%, 25%, 10%)
  - I. Diazepam
  - J. Diltiazem
  - K. Diphenhydramine HCl
  - L. Dopamine
  - M. Epinephrine
  - N. Fentanyl
  - O. Glucagon
  - P. Glucose
  - Q. Intravenous Fluids
    - 1. Dextrose 5% in Water
    - 2. Normal Saline
    - 3. Lactated Ringer's
  - R. Ipratropium
  - S. Lidocaine
  - T. Lorazepam
  - U. Magnesium



V. Midazolam  
W. Morphine  
X. Naloxone  
Y. Nitroglycerin  
    1. Paste  
    2. Spray  
    3. Tablets  
Z. Nitrous Oxide  
AA. Oxygen  
BB. Oxytocin  
CC. Promethazine HCl  
DD. Thiamine

# Airway Management, Respiration, and Artificial Ventilation

## Airway Management

### Paramedic Education Standard

Integrates complex knowledge of anatomy, physiology, and pathophysiology into the assessment to develop and implement a treatment plan with the goal of assuring a patent airway, adequate mechanical ventilation, and respiration for patients of all ages.

### Paramedic-Level Instructional Guideline

The Paramedic Instructional Guidelines in this section include all the topics and material at the AEMT level PLUS the following material:

- I. Airway Anatomy
  - A. Sinuses
    - 1. Frontal
    - 2. Sphenoid
    - 3. Ethmoid
    - 4. Maxillary
  - B. Upper Airway Tract
    - 1. Nose
    - 2. Mouth and Oral Cavity
    - 3. Jaw
    - 4. Pharynx
      - a. Nasopharynx
      - b. Oropharynx
      - c. Hypopharynx
      - d. Laryngopharynx
        - i. Vallecula
          - a) Pyriform Sinus
  - 5. Larynx
    - a. Cartilages
      - i. epiglottis
      - ii. arytenoid cartilage
        - a) corniculate cartilage
        - b) cuneiform cartilage
        - c) posterior arytenoids
      - iii. vocal cords
        - a) false vocal cord
        - b) true vocal cord
      - iv. thyroid cartilage

- v. cricoid ring
      - a) arch of cricoid cartilage
      - b) lamina of cricoid cartilage
      - c) cricothyroid membrane (ligament)
    - b. Bone
      - i. Hyoid bone
        - a) Hyo-epiglottic ligament
  - C. Jugular notch
  - D. Lower Airway Tract
    - 1. Trachea -- Spatial relationship to esophagus
    - 2. Carina -- Angle of Louis
    - 3. Bronchi
    - 4. Lungs
      - a. Bronchioles
        - i. bronchial smooth muscle
        - ii. beta-two adrenergic receptors
      - b. Pulmonary cilia
      - c. Alveoli -- Surfactant
  - E. Support Structures
    - 1. Chest Cage
      - a. Ribs
      - b. Muscles of respiration
        - i. intercostal muscles
        - ii. diaphragm
      - c. Pleura
        - i. parietal pleura
        - ii. visceral pleura
    - 2. Phrenic nerve
    - 3. Mediastinum

## II. Airway Assessment

- A. Purpose
  - 1. Identify inadequate airway
  - 2. Identify an unstable airway
  - 3. Identify potentially difficult airways
- B. Procedure
  - 1. Gag Reflex
  - 2. Airway obstruction
    - a. Soft tissue obstruction
    - b. Foreign bodies
    - c. Complete and incomplete
    - d. Upper vs. Lower
  - 3. Work of breathing
  - 4. Laryngospasm
  - 5. Laryngeal edema
  - 6. Penetrating injuries

- C. Anticipating the difficult airway
  - 1. Trauma/bleeding
  - 2. Vomiting
  - 3. History
  - 4. Mouth opening
  - 5. Mandibular length
  - 6. Mallampati classifications
  - 7. Obstructions
  - 8. Neck mobility
  - 9. Facial hair
- III. Techniques of assuring a patent airway
  - A. Manual airway maneuvers
  - B. Mechanical airway devices
  - C. Relief of Foreign Body Airway Obstruction
    - 1. Refer to current American Heart Association guidelines
    - 2. Removal of foreign body airway obstructions using direct laryngoscopy
      - a. Purpose
      - b. Indications
      - c. Contraindications
      - d. Complications
      - e. Procedure
      - f. Limitation
    - 3. Airway suctioning
      - a. Review and elaborate on the upper airway suctioning material from the EMR, EMT and AEMT levels
      - b. Tracheobronchial Suctioning
        - i. purpose
        - ii. indications
        - iii. contraindications
        - iv. complications
        - v. procedure
        - vi. limitation
  - D. Blind insertion airway devices
  - E. Endotracheal intubation
    - 1. Direct laryngoscopy (visualized)
      - a. Purpose
      - b. Indications
      - c. Contraindications
      - d. Complications
      - e. Procedure (including confirmation techniques)
      - f. Limitations
    - 2. Non-visualized
      - a. Nasal
        - i. purpose
        - ii. indications

- iii. contraindications
      - iv. complications
      - v. procedure (including confirmation techniques)
      - vi. limitations
    - b. Digital
      - i. purpose
      - ii. indications
      - iii. contraindications
      - iv. complications
      - v. procedure (including confirmation techniques)
      - vi. limitations
    - c. Lighted stylet
      - i. purpose
      - ii. indications
      - iii. contraindications
      - iv. complications
      - v. procedure (including confirmation techniques)
      - vi. limitations
    - d. Fiber optic (Shikaini Seeing Optical Stylet (SOS), Glide scope)
      - i. purpose
      - ii. indications
      - iii. contraindications
      - iv. complications
      - v. procedure (including confirmation techniques)
      - vi. limitations
  - F. Percutaneous cricothyrotomy
    - 1. Purpose
    - 2. Indications
    - 3. Contraindications
    - 4. Complications
    - 5. Procedure (including confirmation techniques)
    - 6. Limitations
- IV. Consider age-related variations in pediatric and geriatric patients
- A. See Special Patient Populations section

# Airway Management, Respiration, and Artificial Ventilation

## Respiration

### Paramedic Education Standard

Integrates complex knowledge of anatomy, physiology, and pathophysiology into the assessment to develop and implement a treatment plan with the goal of assuring a patent airway, adequate mechanical ventilation, and respiration for patients of all ages.

### Paramedic-Level Instructional Guideline

The Paramedic Instructional Guidelines in this section include all the topics and material at the AEMT level PLUS the following material:

- I. Anatomy of the Respiratory System
  - A. Includes all airway anatomy covered in the Airway Management section
  - B. Additional Respiratory System Anatomy
    - 1. Chest Cage
      - a. Ribs
      - b. Muscles of respiration
        - i. intercostal muscles
        - ii. diaphragm
      - c. Pleura
        - i. parietal pleura
        - ii. visceral pleura
    - 2. Phrenic nerve
    - 3. Mediastinum
- II. Physiology of Respiration
  - A. Control of Respiration
    - 1. Nervous Control of Respiration
      - a. Medulla oblongata
        - i. ventral respiratory group
        - ii. dorsal respiratory group
        - iii. reticular activating system
      - b. Innervation of the Respiratory Musculature
        - i. spinal cord innervation
        - ii. phrenic nerve
        - iii. Hering Breuer reflex
    - 2. Conscious Control of Respiration
      - a. Somatic nerves related to intercostal innervation
    - 3. Chemical Control of Respiration
      - a. Chemoreceptors

- B. Mechanics of Respiration
  - 1. Pulmonary Ventilation
    - a. Movement of the Thoracic Wall
      - i. vertical diameter
      - ii. transverse diameter
      - iii. anteroposterior diameter
    - b. Intrathoracic pressure gradients
      - i. Boyle's Law
      - ii. inspiration
      - iii. expiration
    - c. Phases of Ventilation
      - i. active phase
      - ii. passive phase
    - d. Modes of Breathing
      - i. quiet breathing
      - ii. forced breathing
    - e. Lung Volumes and Capacities
      - i. volumes
        - a) tidal volume
        - b) minute volume
        - c) residual volume
        - d) dead space volume
      - ii. capacities
        - a) total lung capacity
        - b) vital capacity
      - iii. maximum inspiratory force
      - iv. maximum expiratory force
      - v. significance of pulmonary volumes and capacities
  - 2. Gas Exchange
    - a. Mixed gases in ambient air
    - b. Partial pressures
      - i. Henry's Law
      - ii. PaO<sub>2</sub>
      - iii. PCO<sub>2</sub>
    - c. Oxygenation
    - d. Alveolar air versus atmospheric air
    - e. Respiration
      - i. internal versus external respiration
      - ii. diffusion of gases through respiratory membrane
      - iii. diffusion of gases from capillaries to cells
        - a) role of ATP in cellular function
        - b) aerobic metabolism
        - c) anaerobic metabolism

3. Gas Transport
    - a. Red Blood Cells
      - i. hemoglobin chemistry
      - ii. hematocrit
    - b. Oxygen-Hemoglobin dissociation curve
  4. Ventilation perfusion ratio
    - a. Anatomical shunts
    - b. Blood flow across the alveoli
  - C. Blood volume circulation disturbances due to Cardiac, Trauma, Systemic Vascular Resistance
    1. Orthostatic hypotension
    2. Oncotic fluid pressure
    3. Hydrostatic fluid pressure
    4. Capacitance of the venules and veins
  - D. Cardiac output and the role in adequate circulation maintenance
    1. Cardiac rate
      - a. Tachycardia
      - b. bradycardia
    2. Stroke volume
      - a. End-diastolic volume
      - b. Preload
    3. Role of alpha stimulation in the heart
    4. Role of beta stimulation in the heart
    5. Atrioventricular Synchronization
    6. Total peripheral Resistance
      - a. Precapillary arterioles and smooth muscle effects of alpha and beta cholinergic receptors, effects of hypoxia, acidosis, temperature changes, neural factors and catecholamines.
      - b. Cell and tissue beds and disruptions of membrane integrity, enzyme systems and acid-base balance.
  - E. Buffer systems
    1. Blood
    2. Respiratory
    3. Renal
- III. Pathophysiology of Respiration
- A. Pulmonary ventilation
    1. Interruption of Nervous Control
      - a. Drugs
      - b. Trauma
      - c. Muscular dystrophy
      - d. Poliomyelitis
      - e. Neuromuscular junction blocking agents
    2. Structural Damage to the Thorax



3. Bronchoconstriction
4. Disruption of airway patency
  - a. Infection
  - b. Trauma/burns
  - c. Foreign body obstruction
  - d. Allergic reaction
  - e. Unconsciousness (loss of airway tone)
- B. Oxygenation
- C. Respiration
  1. External
    - a. Deficiencies due to environmental factors
      - i. altitude
      - ii. closed environments
      - iii. toxic or poisonous environments
    - b. Carbon dioxide retention
  2. Internal
    - a. Pathology typically related to changes in alveolar - capillary gas exchange
    - b. Typical disease processes
      - i. emphysema
      - ii. pulmonary edema
      - iii. pneumonia
      - iv. environmental/occupational exposure
      - v. drowning
  3. Cellular
- D. Rapid ventilation, exhaustion, dead space air movement
- E. Mechanical ventilation
  1. Moving noncompliant lungs
- F. Breathing against an elevated diaphragm
- G. Decreases in lung compliance such as pneumonia, emphysema, and trauma
- H. Ventilation-perfusion mismatch
  1. Ventilation defects
    - a. Pulmonary edema
    - b. Pneumonia
    - c. Atelectasis
    - d. Obstruction due to mucus plugs
    - e. Increased dead space ventilation due to emphysema
  2. Perfusion defects
    - a. Pulmonary emboli
    - b. Disruption of the normal chest architecture
- I. Disruptions in oxygen transport associated with diminished oxygen carrying capacity
  1. Anemia
  2. Blood loss
- J. Disruptions in effective circulation
  1. Shock

- a. Blood loss
      - b. Diminished peripheral resistance
      - c. Cardiac failure
    - 2. Emboli
    - 3. Increased capillary permeability
  - K. Disruptions at the cellular level
    - 1. Acid-base balance
    - 2. Poisons/toxins
    - 3. Blood sugar changes
    - 4. Hormone effects
    - 5. Drugs
    - 6. Hypoxia
- IV. Assessment of Adequate and Inadequate Respiration
- A. Capnometry/Capnography
    - 1. Purpose/definition
    - 2. Indications
    - 3. Contraindications
    - 4. Complications
    - 5. Procedure
- V. Management of Adequate and Inadequate Respiration
- A. Respiratory Compromise
    - 1. Assure an adequate airway
    - 2. Review supplemental oxygen therapy
    - 3. Continuous Positive Airway Pressure (CPAP)/Bi-Level Positive Airway Pressure (BiPAP)
      - a. Definitions/Purpose
        - i. CPAP – device to provide continuous positive airway pressure in the spontaneously breathing patient
        - ii. BiPAP – device to provide differential positive airway pressure in the spontaneously breathing patient.
          - a) higher positive pressure during inspiration (e.g., 10 cm water pressure)
          - b) lower positive pressure during expiration (e.g., 5 cm water pressure)
          - c) Augments patient's spontaneous breathing with positive pressure ventilation during inspiration
        - iii. increase lung compliance
        - iv. reduce alveolar collapse
        - v. increase laminar airflow
        - vi. decrease intubation rates
      - b. Indications
        - i. CHF/Acute pulmonary edema
        - ii. COPD/Asthma

- iii. near drowning
    - iv. similar equipment may be used for home treatment of sleep apnea
  - c. Contraindications
    - i. inability to tolerate the mask
  - d. Complications
    - i. requires adequate tidal volume
    - ii. patient must be alert and follow instructions
    - iii. patient must tolerate mask
    - iv. gastric insufflation
    - v. vomiting and aspiration risk
    - vi. barotrauma
    - vii. facial hair
    - viii. dysmorphic faces
  - e. Procedure
- 4. Assisted positive pressure ventilations
  - a. Purpose/definition
  - b. Indications
  - c. Contraindications
  - d. Complications
  - e. Procedure

## VI. Supplemental Oxygen Therapy

- A. Review and elaborate on the oxygen delivery devices used by EMRs, EMTs and AEMTs
- B. Oxygen administration and the patient with hypercapnia

## VII. Age-Related Variations in Pediatric and Geriatric Patients

# Airway Management, Respiration, and Artificial Ventilation

## Artificial Ventilation

### Paramedic Education Standard

Integrates complex knowledge of anatomy, physiology, and pathophysiology into the assessment to develop and implement a treatment plan with the goal of assuring a patent airway, adequate mechanical ventilation, and respiration for patients of all ages.

### Paramedic-Level Instructional Guideline

The Paramedic Instructional Guidelines in this section include all the topics and material at the AEMT level PLUS the following material:

- I. Comprehensive ventilation assessment
  - A. Purpose
  - B. Procedure
  - C. Minute Volume
  - D. Alveolar Volume
  - E. Evaluating the effects of artificial ventilation
  - F. Pulse oximetry
    - 1. Purpose
    - 2. Indications
    - 3. Contraindications
    - 4. Complications
    - 5. Procedure
  - G. Blood gas analysis
    - 1. pH
    - 2. PaCO<sub>2</sub>
    - 3. PaO<sub>2</sub>
    - 4. Bicarbonate
    - 5. Base deficit
  - H. Capnography Review
    - 1. Purpose
    - 2. Indications
    - 3. Contraindications
    - 4. Complications
    - 5. Procedure
- II. Review of ventilation devices used by EMRs, EMTs and AEMTs
  - A. Manual devices
    - 1. Purpose
    - 2. Indications
    - 3. Contraindications

4. Complications
  5. Procedures
  - B. Mechanical devices
    1. Purpose
    2. Indications
    3. Contraindications
    4. Complications
    5. Procedures
- III. Assisting patient ventilations
- A. Review of techniques used by EMRs, EMTs and AEMTs
    1. Purpose
    2. Indications
    3. Contraindications
    4. Complications
    5. Procedures
  - B. Review of the physiologic differences between normal and positive pressure ventilation
  - C. BiPAP/CPAP
    1. Purpose
    2. Indications
    3. Contraindications
    4. Complications
    5. Procedure
  - D. Positive End Expiratory Pressure (PEEP)
    1. Purpose
      - a. provide positive airway pressure to prevent alveolar collapse at the end of expiration
      - b. refers to positive pressure situations
      - c. to increase lung compliance
    2. Indications
      - a. hemodynamically stable patient receiving positive pressure ventilation
        - i. COPD
        - ii. CHF
        - iii. drowning
      - b. Patient transfer
    3. Contraindications
    4. Complications
      - a. can diminish venous return
      - b. can cause barotrauma
    5. Procedure
- IV. AgeRelated Variations in Pediatric and Geriatric Patients

# Patient Assessment Scene Size-Up

## Paramedic Education Standard

Integrates scene and patient assessment findings with knowledge of epidemiology and pathophysiology to form a field impression. This includes developing a list of differential diagnoses through clinical reasoning to modify the assessment and formulate a treatment plan.

## Paramedic-Level Instructional Guideline

The Paramedic Instructional Guidelines in this section include all the topics and material at the AEMT level PLUS the following material:

- I. Scene Safety
  - A. Common scene hazards
    - 1. Environmental
    - 2. Hazardous substances
      - a. Chemical
      - b. Biological
    - 3. Violence
      - a. Patient
      - b. Bystanders
      - c. Crime scenes
    - 4. Rescue
      - a. Motor-vehicle collisions
        - i. extrication hazards
        - ii. roadway operation dangers
      - b. Special situations
  - B. Evaluation of the scene
    - 1. Is the scene safe?
      - a. Yes -- establish patient contact and proceed with patient assessment.
      - b. No -- is it possible to quickly make the scene safe?
        - i. yes -- assess patient
        - ii. no -- do not enter any unsafe scene until minimizing hazards
      - c. Request specialized resources immediately
- II. Scene management
  - A. Impact of the environment on patient care
    - 1. Medical
      - a. Determine nature of illness
      - b. Hazards at medical emergencies

2. Trauma
  - a. Determine mechanism of injury
  - b. Hazards at the trauma scene
3. Environmental considerations
  - a. Weather or extreme temperatures
  - b. Toxins and gases
  - c. Secondary collapse and falls
  - d. Unstable conditions
- B. Addressing hazards
  1. Protect the patient
    - a. After making the scene safe for the paramedic, the safety of the patient becomes the next priority
    - b. If the paramedic cannot alleviate the conditions that represent a health or safety threat to the patient, move the patient to a safer environment
  2. Protect the bystanders
    - a. Minimize conditions that represent a hazard for bystanders
    - b. If the paramedic cannot minimize the hazards, remove the bystanders from the scene.
  3. Request resources
    - a. Request additional resources needed at the scene immediately.
      - i. Multiple patients -- additional ambulances
      - ii. Fire hazard -- fire department.
      - iii. Traffic or violence issues -- law enforcement
  4. Scan the scene for information related to
    - a. Mechanism of injury
    - b. Nature of the illness
- C. Violence
  1. Paramedics should not enter a scene or approach a patient if the threat of violence exists.
  2. Park away from the scene and wait for the appropriate law enforcement officials to minimize the danger
- D. Need for additional or specialized resources
  1. A variety of specialized protective equipment and gear is available for specialized situations.
    - a. Chemical and biological suits can provide protection against hazardous materials and biological threats of varying degrees.
    - b. Specialized rescue equipment may be necessary for difficult or complicated extrications.
    - c. Ascent or descent gear may be necessary for specialized rescue situations.
  2. Only specially trained responders should wear or use the specialized equipment.

- E. Standard precautions
  - 1. Overview
    - a. Based on the principle that all blood, body fluids, secretions, excretions (except sweat), non-intact skin, and mucous membranes may contain transmissible infectious agents.
    - b. Include a group of infection prevention practices that apply to all patients, regardless of suspected or confirmed infection status, in any healthcare delivery setting
    - c. Universal precautions were developed for protection of healthcare personnel
    - d. Standard precautions focus on protection of patients.
  - 2. Implementation
    - a. The extent of standard precautions used is determined by the anticipated blood, body fluid, or pathogen exposure.
      - i. handwashing
      - ii. gloves
      - iii. gowns
      - iv. masks
      - v. protective eyewear
  - 3. Personal Protective Equipment
    - a. Personal protective equipment includes clothing or specialized equipment that provides some protection to the wearer from substances that may pose a health or safety risk.
    - b. Wear PPE appropriate for the potential hazard
      - i. steel-toe boots
      - ii. helmets
      - iii. heat-resistant outerwear
      - iv. self-contained breathing apparatus
      - v. leather gloves
- F. Multiple patient situations
  - 1. Number of patients and need for additional support
    - a. How many patients
    - b. Does the dispatch suggest the need for additional support
    - c. Protection of the patient
    - d. Protection of bystanders
      - i. remove
      - ii. isolate
      - iii. barricade
  - 2. Need for additional resources
    - a. Incident Command System (ICS or IMS)
    - b. Consider if this level of commitment is required



# Patient Assessment

## Primary Assessment

### Paramedic Education Standard

Integrates scene and patient assessment findings with knowledge of epidemiology and pathophysiology to form a field impression. This includes developing a list of differential diagnoses through clinical reasoning to modify the assessment and formulate a treatment plan.

### Paramedic-Level Instructional Guideline

The Paramedic Instructional Guidelines in this section include all the topics and material at the AEMT level PLUS the following material:

- I. Primary Survey/Primary Assessment
  - A. Initial General Impression - based on the patient's age appropriate appearance
    - 1. Appears stable
    - 2. Appears stable but potentially unstable
    - 3. Appears unstable
  - B. Level of Consciousness
    - 1. Alert
    - 2. Responds to verbal stimuli
    - 3. Responds to painful stimuli
    - 4. Unresponsive - no gag or cough
  - C. Airway status
    - 1. Unresponsive patient
      - a. Open the airway.
      - b. Clear any obstructions
    - 2. Responsive patient - Is the patient talking or crying?
      - a. If yes, assess for adequacy of breathing.
      - b. If no, open airway.
  - D. Breathing status
    - 1. Patient responsive
      - a. Breathing is adequate (rate and quality)
      - b. Breathing is too fast (> 24 breaths per minute)
      - c. Breathing is too slow (<8 breaths per minute)
      - d. Breathing absent (choking)
    - 2. Patient unresponsive
      - a. Breathing is adequate (rate and quality)
      - b. Breathing is inadequate
      - c. Breathing is absent

- E. Circulatory status
    - 1. Radial pulse present (rate and quality)
      - a. Normal rate
      - b. Fast
      - c. Slow
      - d. Irregular rate
    - 2. Radial pulse absent -- assess carotid pulse
    - 3. Assess if major bleeding is present
    - 4. Perfusion status
      - a. Skin color
      - b. Skin temperature
      - c. Skin moisture
      - d. Capillary refill (as appropriate)
  - F. Disability - Brief neurological evaluation
  - G. Exposure - Patient completely undressed
  - H. Identifying life threats
  - I. Assessment of vital functions
- II. Integration of treatment/procedures needed to preserve life
- III. Evaluating priority of patient care and transport
- A. Primary assessment: stable
  - B. Primary assessment: potentially unstable
  - C. Primary assessment: unstable

# Patient Assessment History Taking

## Paramedic Education Standard

Integrates scene and patient assessment findings with knowledge of epidemiology and pathophysiology to form a field impression. This includes developing a list of differential diagnoses through clinical reasoning to modify the assessment and formulate a treatment plan.

## Paramedic-Level Instructional Guideline

The Paramedic Instructional Guidelines in this section include all the topics and material at the AEMT level PLUS the following material:

- I. Components of the patient history
  - A. Overview
    - 1. Purpose
      - a. Is a problem-based history in pre-hospital environment
      - b. Emphasis is on:
        - i. identifying life-threatening conditions that require immediate intervention
        - ii. gives full attention to the needs of the moment
        - iii. provides information leading to appropriate care for the urgent, emergent and non-emergent patient requesting care
        - iv. identifies the potential for life-threats as well as the existence of a current life threat
      - c. Expanded history when appropriate
        - i. opportunities for patient education
        - ii. opportunities for service referral
    - 2. Communicating with the patient
      - a. Factors influencing communication
      - b. Language barriers
      - c. Listening
      - d. Techniques of questioning
        - i. open ended questions
        - ii. direct questions
        - iii. leading questions
- II. Interviewing Techniques
  - A. Setting the stage
    - 1. The environment
      - a. Proper environment enhances communication
      - b. Personal space

2. Your demeanor and appearance
  - a. Just as you are watching the patient, the patient will be watching you
  - b. Messages of body language
3. Note taking
  - a. Difficult to remember all details
  - b. Most patients are comfortable with note taking
    - i. if concerns arise, explain your purpose
    - ii. do not divert attention from the patient to take notes
- B. Learning about the present illness
  1. Greeting the patient
    - a. Greet by name
    - b. Avoid the use of unfamiliar or demeaning terms such as Granny or Honey, etc.
  2. The patient's comfort
    - a. Be alert to patient comfort levels
    - b. Inquire about the patient's feelings
  3. Opening questions
    - a. Find out why the patient is seeking medical care or advice
    - b. Use a general, open-ended question
    - c. Follow the patient's leads
      - i. facilitation
        - a) your posture, actions or words should encourage the patient to say more
        - b) making eye contact or saying phrases such as "Go on" or "I'm listening" may help the patient to continue
      - ii. reflection
        - a) repetition of the patient's words that encourage additional responses
        - b) typically does not bias the story or interrupt the patient's train of thought
      - iii. clarification
      - iv. empathetic responses
      - v. confrontation
      - vi. interpretation
      - vii. Asking about feelings
  4. Getting more information
    - a. Attributes of a symptom
      - i. location
        - a) where is it
        - b) does it radiate
      - ii. quality
      - iii. severity
        - a) how bad is it

- b) attempt to quantify the pain
        - i) 1 - 10 scale
        - ii) other scales
    - iv. timing
      - a) when did it start
      - b) how long does it last
    - v. the setting in which it occurs
      - a) emotional response
      - b) environmental factors
    - vi. factors that make it better or worse
    - vii. associated manifestations
  - C. Direct questions
    - 1. To gather additional information, direct questions may be required
    - 2. Should not be leading questions
    - 3. Ask one question at a time
    - 4. Use language that is (age) appropriate
  - D. Taking a history on sensitive topics
    - 1. Alcohol and drugs
    - 2. Physical abuse or violence
    - 3. Sexual history
  - E. Taking a history in the trauma patient
    - 1. Focuses on general underlying health
      - a. Special emphasis on conditions contributing to morbidity and mortality in trauma
      - b. Current medications
      - c. Allergies
    - 2. Special attention on

### III. Components of the patient history

- A. Chief complaint
  - 1. Brief statement of why the patient is seeking healthcare
  - 2. Should include what is wrong and why treatment is sought
- B. Present problem
  - 1. Provides a full, clear, chronological account of the symptoms
    - a. Onset
    - b. provocation/palliation
    - c. quality of pain and/or associated symptoms
    - d. radiation of pain
    - e. severity of pain symptoms
  - 2. State of health just prior to first onset of symptoms
- C. past medical history
  - 1. General state of health
    - a. Current medications
    - b. Allergies
  - 2. Childhood illnesses
  - 3. Adult illnesses

4. Accidents and injuries
5. Past surgery
6. Hospitalization
7. Physical disability due to previous illness or injury
8. Emotional status
- D. Family history or blood relatives with
  1. similar symptoms
  2. risk factor assessment of family diseases
- E. Personal social history as it relates to illness risk factors
  1. smoking, drinking, drug use
  2. diet
  3. sexual habits
  4. occupation
  5. environment
  6. travel
- F. Review of body systems
  1. Questions should be selected based on patient's chief complaint and present problem.
  2. General symptoms
    - a. Fever
    - b. chills
    - c. malaise
    - d. fatigue
    - e. night sweats
    - f. weight variations
  3. Skin, hair and nails
    - a. Rashes
    - b. itching
    - c. sweating
  4. Musculoskeletal
    - a. Joint pain
    - b. loss of motion
    - c. swelling
    - d. redness
    - e. heat or deformity
  5. Head and neck
    - a. General: headache, loss of consciousness
    - b. Eyes
      - i. Visual acuity
      - ii. Blurring
      - iii. Diplopia
      - iv. Photophobia
      - v. Pain
      - vi. changes in vision
      - vii. flashing

- c. Ears
  - i. Hearing loss
  - ii. Pain
  - iii. Discharge
  - iv. Tinnitus
  - v. vertigo
- d. Nose
  - i. Sense of smell
  - ii. Rinorrhea
  - iii. Obstruction
  - iv. Epistaxis
  - v. postnasal discharge
  - vi. sinus pain
- e. Throat and mouth
  - i. Sore throat
  - ii. Bleeding
  - iii. Pain
  - iv. dental issues
  - v. ulcers
  - vi. changes in taste sensation
- f. Endocrine
  - i. thyroid enlargement
  - ii. temperature intolerance
  - iii. skin changes
  - iv. swelling of hands and feet
  - v. weight changes
  - vi. polyuria
  - vii. polydipsia
  - viii. polyphagia
  - ix. changes in body and facial hair
  - x. males:
    - a) erectile dysfunction
    - b) emissions
    - c) testicular pain
  - xi. females:
    - a) menstrual regularity
    - b) last menstrual period
    - c) dysmenorrhea
    - d) discharge
    - e) bleeding,
    - f) pregnancies
    - g) contraception use
- g. Chest and lungs
  - i. Dyspnea
  - ii. cough (productivity and description)
  - iii. wheezing

- iv. hemoptysis
- v. TB status
- h. Heart and blood vessels
  - i. Chest pain
    - a) Onset
    - b) Duration
    - c) Quality
    - d) Provocation
    - e) Palliation
    - f) Palpitations
    - g) Orthopnea
    - h) Edema
    - i) past cardiac evaluation and tests
- i. Hematologic
  - i. Anemia
  - ii. Bruising
  - iii. fatigue
- j. Lymph nodes
  - i. Enlarging
  - ii. Tenderness
- k. Gastrointestinal
  - i. Appetite
  - ii. Digestion
  - iii. Food allergies or intolerance
  - iv. Heartburn
  - v. Nausea or vomiting
  - vi. Diarrhea
  - vii. Hematemesis
  - viii. Bowel regularity
  - ix. Stool changes
  - x. Flatulence
  - xi. Jundice
  - xii. Past GI evaluation and tests.
- l. Genitourinary
  - i. Dysuria
  - ii. Pain (flank or suprapubic)
  - iii. Frequency
  - iv. Urgency
  - v. Nocturia
  - vi. Hematuria
  - vii. Polyuria
  - viii. STDs
- m. Neurologic
  - i. Seizure
  - ii. Syncope
  - iii. Loss of sensation



- iv. Weakness
      - v. Paralysis
      - vi. Loss of coordination or memory
      - vii. Twitches
      - viii. Tremors
    - n. Psychiatric
      - i. Depression
      - ii. Mood changes
      - iii. Difficulty concentrating
      - iv. Anxiety
      - v. Suicidal or homicidal ideation
      - vi. Irritability
      - vii. Sleep disturbances
      - viii. Fatigue on waking
  - G. Clinical reasoning
    - 1. Requires use of knowledge of anatomy, physiology and pathophysiology to direct the questioning
      - a. Answers are analyzed as they are received
      - b. Results of questioning may allow you to think about associated problems and body systems
      - c. Clinical reasoning requires integrating the history with the physical assessment findings
    - 2. Start with broad possibility of systems that could contribute to patient's complaint
      - a. Consider chief complaint
      - b. Current symptoms
      - c. Past medical history
      - d. Identify any abnormal symptoms and physical findings
      - e. Analyze the findings by anatomical location
      - f. Interpret the findings in terms of pathological process
    - 3. Narrow possible systems involved
      - a. Develop a working hypothesis of the nature of the problem (differential diagnosis)
      - b. Test differential diagnosis list with questions and assessments relating to systems with similar types of signs and symptoms
      - c. Pay careful attention to the signs and symptoms that do not fit with the working differential diagnosis
  - H. Concluding questions
    - 1. Wrapping up the history
    - 2. Assuring that all the patients issues have been addressed
- IV. Cultural Competence
- A. Definition of culture
  - B. Developing cultural sensitivity

- C. Impact of culture
    - 1. ethnic culture
    - 2. drugs
    - 3. poverty
    - 4. age
  - D. Definitions in cultural discussion
  - E. Questions specific to cultural impact
    - 1. what do you think caused your problem
    - 2. why do you think it started when it did
  - F. Cultural Orientations
  - G. Cultural impact on disease
  - H. Religious beliefs that impact patient care
  - I. Cultural characteristics related to health care
  - J. Dietary practices
  - K. Family relationships
- V. Special challenges
- A. Silence
    - 1. Silence is often uncomfortable
    - 2. Silence has meaning and many uses
      - a. Patients may use this to collect their thoughts, remember details or decide whether or not they trust you
      - b. Be alert for nonverbal clues of distress
    - 3. Silence may be a result of the interviewer's lack of sensitivity
  - B. Overly talkative patients
    - 1. Faced with a limited amount of time interviewers may become impatient
    - 2. Although there are no perfect solutions, several techniques may be helpful
      - a. Give the patient free reign for the first several minutes
      - b. Summarize frequently
  - C. Patients with multiple symptoms
  - D. Anxious patients
    - 1. Anxiety is natural
    - 2. Be sensitive to nonverbal clues
  - E. Reassurance
    - 1. It is tempting to be overly reassuring
    - 2. Premature reassurance blocks communication
  - F. Anger and hostility
    - 1. Understand that anger and hostility are natural
    - 2. Do not get angry in return
  - G. Intoxication
    - 1. Be accepting not challenging
    - 2. Do not attempt to have the patient lower their voice or stop cursing; this may aggravate them
  - H. Crying
    - 1. Crying, like anger and hostility may provide valuable insight
    - 2. Be sympathetic

- I. Depression
  - 1. Be alert for signs of depression
- J. Confusing behaviors or histories
  - 1. Be prepared for the confusion and frustration of varying behaviors and histories
  - 2. Be alert for mental illness, delirium or dementia
- K. Limited intelligence
  - 1. Do not overlook the ability of these patients to provide you with adequate information
  - 2. Be alert for omissions
- L. Language barriers
  - 1. Take every possible step to find a translator
    - a. Appropriateness of the translator
    - b. Confidentiality issues
  - 2. A few broken words are not an acceptable substitute
- M. Hearing problems
  - 1. Very similar to patients with a language barrier
  - 2. If the patient can sign, make every effort to find a translator
- N. Blind patients
  - 1. Be careful to announce yourself and to explain who you are and why you are there
- O. Talking with family and friends
  - 1. Some patients may not be able to provide you with all information
  - 2. Try to find a third party who can help you get the whole story
- VI. Integration of therapeutic communication, history taking techniques, patient presentation and assessment findings -- Development of field impression
- VII. Treatment Plan -- Modify initial treatment plan
- VIII. Age-related considerations
  - A. Pediatrics
    - 1. History may be taken from parent or responsible adult
      - a. Every effort must be made to include the child
      - b. Explore the underlying fears that may not be expressed by the parents or child
      - c. Evaluate the relationship of the child to the caregiver
    - 2. Present problem or illness
    - 3. Past medical history
      - a. General health evaluation varies dependent on the child's age
        - i. Neonates and infants
          - a) Maternal health during pregnancy
            - i) specific maternal
            - ii) medications, hormones, vitamins
            - iii) drug use

- b) Birth
  - i) duration of pregnancy
  - ii) location of birth
  - iii) labor conditions
  - iv) delivery complications
  - v) condition of infant at birth
  - vi) birth weight
- c) Neonatal period
  - i) congenital anomalies
  - ii) jaundice, vigor, evidence of illness
  - iii) feeding issues
  - iv) developmental landmarks
- d) School age
  - i) grades, performance, problems
  - ii) dentition
  - iii) growth
  - iv) sexual development
  - v) illnesses
  - vi) Immunizations
- e) Adolescents
  - i) consider questioning patient in private
  - ii) risk taking behaviors
  - iii) self esteem issues
  - iv) rebelliousness
  - v) drug, alcohol use
  - vi) sexual activity
- b. Family history
  - i. Maternal gestational history
  - ii. Deceased siblings
- c. Personal and Social history
  - i. Personal status
  - ii. Home conditions
- d. Review of Systems
  - i. Skin: lesions
  - ii. Ears: otitis media
  - iii. Nose: snoring, mouth breathing, allergies
  - iv. Teeth: dental history

## B. Geriatrics

1. Sensory issues (hearing and vision) may require paramedic to interview at eye level so patient can read lips
2. The interview may need to be slowed down if the patient is stable
3. Multiple underlying chronic illnesses may confound the history
4. Disease symptoms may be less dramatic in the older patient
5. All symptoms may be vague and non-specific

6. Multiple pharmaceutical therapies may lead to:
    - a. Iatrogenic illnesses
    - b. Accidental overdose or adverse drug interaction
  7. Consider inclusion of a functional assessment during the systems review in the elderly patient with apparent disability
- C. Functional Assessment:
1. Mobility
  2. Upper extremity function
  3. Instrumental activities of daily living (IADL)
  4. Activities of daily living

# Patient Assessment

## Secondary Assessment

### Paramedic Education Standard

Integrates scene and patient assessment findings with knowledge of epidemiology and pathophysiology to form a field impression. This includes developing a list of differential diagnoses through clinical reasoning to modify the assessment and formulate a treatment plan.

### Paramedic-Level Instructional Guideline

The Paramedic Instructional Guidelines in this section include all the topics and material at the AEMT level PLUS the following material:

- I. Techniques of Physical Examination
  - A. Major Body Systems
  - B. Major Anatomical Regions
- II. Physical examination techniques will vary from patient to patient depending on the chief complaint, present illness, and history
  - A. The appropriate assessment of the patient depends on
    - 1. the stability of the patient
    - 2. the complaint
    - 3. the history
    - 4. ability to communicate
    - 5. the potential for unrecognized illness
  - B. Not all aspects of the physical assessment that the provider should be familiar with will be used on all patients
- III. Physical examination – approach and overview
  - A. Examination techniques
    - 1. Examination techniques
      - a. Inspection
      - b. Palpation
        - i. hand and finger techniques
          - a) fingertip
          - b) palmar hand surface
          - c) ulnar hand surface
          - d) dorsal hand surface
        - ii. light
        - iii. deep
      - c. percussion
        - i. technique
        - ii. percussion notes

- d. auscultation
      - i. locations
      - ii. findings
  - 2. Measurement of vital signs
    - a. Respirations
    - b. Pulse
    - c. Blood pressure
    - d. Pupils
    - e. Pulse Oximetry
    - f. Temperature
    - g. Pain level
  - 3. Height and weight estimation
- B. General Approach
  - 1. Examine the patient systematically
  - 2. Examine the patient in the most appropriate environment available
    - a. Consider issues of privacy, comfort
    - b. Most appropriate position for best assessment techniques
  - 3. Place special emphasis on areas suggested by the present illness and chief complaint
  - 4. Keep in mind that most patients view a physical exam with apprehension and anxiety – they feel vulnerable and exposed
  - 5. Maintain professionalism throughout the physical exam while displaying compassion towards your patient
- C. Overview of a comprehensive examination
  - 1. The categories of a physical exam includes
    - a. Mental status
    - b. General survey
    - c. Vital signs

#### IV. Mental Status

- A. Appearance and behavior
  - 1. Assess for level of consciousness
    - a. Alertness
    - b. Response to verbal stimuli
    - c. Response to touch or shake of shoulder (tactile)
    - d. Response to painful stimuli
    - e. Unresponsive
  - 2. Measurement tools for assessment of mental status
  - 3. Observe posture and motor behavior
    - a. Pace
    - b. Range
    - c. Character
    - d. Appropriateness of movement
    - e. Possible findings
      - i. Normal

- ii. abnormal
      - a) restlessness
      - b) agitation
      - c) bizarre postures
      - d) immobility
      - e) involuntary movements
  - 4. Dress, grooming, and personal hygiene
    - a. Kept
    - b. Unkempt
  - 5. Facial Expression
    - a. Anxiety
    - b. Depression
    - c. Elation
    - d. Anger
    - e. Fear
    - f. Withdrawn
    - g. Sadness
    - h. Pain
  - 6. Manner, affect, and relation to person and things
- B. Speech and language
  - 1. Assess
    - a. Quantity
    - b. Rate
    - c. Loudness
    - d. Fluency
    - e. Appropriateness
    - f. Possible findings
      - i. aphasia
      - ii. dysphonia
      - iii. dysarthria
      - iv. changes with mood disorders
- C. Mood
  - 1. Assess
    - a. Nature
    - b. Intensity
    - c. Duration
    - d. Stability of abnormal mood
    - e. Suicidal ideation
    - f. Possible findings
- D. Thought and perceptions
  - 1. Assess thought processes
    - a. Logic
    - b. Relevance
    - c. Organization
    - d. Coherence of thought
    - e. Possible findings



- i. loosening of associations
    - ii. flight of ideas
    - iii. incoherence
    - iv. confabulation
    - v. blocking
    - vi. transference
  - 2. Assess thought content
    - a. Unusual thoughts
    - b. Unpleasant thoughts
    - c. Possible findings
      - i. suicidal ideation
      - ii. homicidal
      - iii. obsessions
      - iv. compulsions
      - v. delusions
      - vi. feelings of unreality
  - 3. Assess perceptions
    - a. Unusual
    - b. Hearing things
    - c. Seeing things
    - d. Possible findings
      - i. illusions
      - ii. hallucinations
- E. Assess insight and judgment
  - 1. Insight into illness
  - 2. Level of judgment in making decisions or plans
  - 3. Possible findings
    - a. Recognition or denial of mental cause of symptoms
    - b. Bizarre, impulsive, or unrealistic judgment
- F. Memory and attention
  - 1. Assess orientation
    - a. Time
    - b. Person
    - c. Place
    - d. Disorientation
  - 2. Assess attention
    - a. Digit span
    - b. Serial sevens
    - c. Spelling backwards
  - 3. Assess remote memory (i.e., birthdays)
  - 4. Assess recent memory (i.e., events of the day)
  - 5. Assess new learning ability (recall of your name)

- V. Techniques of Physical Exam: General Survey
  - A. Introduction
    - 1. Wide range of “normal”
    - 2. Repetitive examination of multiple patients needed to establish one’s own baseline knowledge
  - B. Physical findings in relation to development
    - 1. Age
    - 2. Sexual development
    - 3. Weight
    - 4. Height
  - C. Body Structure
    - 1. Symmetry
    - 2. Body build
    - 3. Physical fitness
    - 4. Posture
  - D. Level of consciousness
    - 1. AVPU
    - 2. Level of orientation
  - E. Skin signs
    - 1. Color
    - 2. Temperature
    - 3. Condition
    - 4. Texture
    - 5. Hydration
  - F. Age variation
    - 1. Pediatric variation
    - 2. Geriatric variation
- VI. Vital Signs
  - A. Introduction
    - 1. Vital Signs as baseline measurement of function
      - a. Respiration
      - b. Circulation
      - c. Perfusion
    - 2. Position patient in normal position for accurate readings
  - B. Respiration
    - 1. Respiratory rate
      - a. Visualize
      - b. Expose as necessary
    - 2. Respiratory depth
    - 3. Respiratory effort
  - C. Circulation
    - 1. Pulse rate
    - 2. Pulse rhythm
      - a. Predictable
      - b. Adjust timing for irregularity

3. Pulse strength
4. Pulse location
  - a. Common locations
  - b. Relation to perfusion
- D. Perfusion
  1. Blood pressure
    - a. Equipment size
    - b. Placement of cuff
    - c. Position of patient
    - d. Position of arm
  2. Methods of measurement
    - a. Auscultation
    - b. Palpation
  3. Oxygen saturation
  4. Capnography
  5. Capillary refill
  6. Oral mucosal color
- VII. Examination by anatomical region or system
  - A. Skin, hair and nails
    1. Review of anatomy and physiology
    2. Review of related history
    3. Relevant past medical history
    4. Relevant family history
    5. Relevant personal and social history
    6. Age-related pertinent history and findings
      - a. Examination and Findings
        - i. skin
        - ii. common lesions
        - iii. characteristics
        - iv. exudates
        - v. patterns
        - vi. correlation to disease processes
      - b. Hair
        - i. inspection
        - ii. palpation
      - c. Nails
        - i. inspection
        - ii. common nail changes
        - iii. correlation to disease processes
    7. Infants and children
      - a. normal changes related to birth
      - b. related to underlying systemic conditions
    8. Adolescents
    9. Pregnancy
      - a. Pigmentation changes
      - b. Striae gravidarum

10. Geriatrics
  - a. Changes associated with aging
  - b. Changes due to immobility
11. Common abnormalities
- B. Lymphatic System
  1. Review of anatomy and physiology
  2. Review of related history
    - a. Relevant past medical history
    - b. Relevant family history
    - c. Age-related pertinent history and findings
  3. Examination and Findings
    - a. Inspection and palpation of lymph nodes
    - b. Head and Neck
    - c. Axillae
    - d. Other lymph nodes
  4. Associated findings
  5. Infants and children
  6. Common abnormalities
  7. Documentation terminology
- C. Head and Neck
  1. Review of anatomy and physiology
  2. Review of related history
    - a. Present problem
    - b. Past medical history
    - c. Personal and social history
    - d. Family history
  3. Examination and findings
    - a. Head and Face
      - i. inspection
      - ii. palpation
    - b. Neck
      - i. inspection
      - ii. palpation
  4. Infants and children
    - a. Findings related to birth and development
    - b. Head Control
    - c. Symmetry
  5. Common abnormalities
    - a. Adults
    - b. Infants
  6. Documentation terminology
- D. Eyes
  1. Review of anatomy and physiology
  2. Review of related history
    - a. Present problem
    - b. Past medical history

- c. Personal and social history
    - d. Family history
  - 3. Examination and findings
    - a. Visual acuity
    - b. External examination
    - c. Extraocular Muscles
    - d. Ophthalmoscopic examination
  - 4. Common abnormalities
  - 5. Infants and Children
    - a. Ethnic variation
    - b. Newborn variations
    - c. Congenital changes
- E. Ears, Nose, Throat, Neck
  - 1. Review of anatomy and physiology
  - 2. Review of related history
    - a. Present problem
    - b. Past medical history
    - c. Family history
  - 3. Examination and findings
    - a. Ear
      - i. external ear
      - ii. otoscopic examination
      - iii. tympanic membrane finding
      - iv. hearing
    - b. Nose
      - i. external nose
      - ii. nasal cavity
      - iii. lips
      - iv. buccal mucosa, teeth and gums
      - v. tongue
      - vi. oropharynx
    - c. Sinuses
    - d. Infants and Children
  - 4. Documentation terminology
- F. Chest and Lungs
  - 1. Review of anatomy and physiology
  - 2. Review of related history
    - a. Present problem
    - b. Past medical history
    - c. Family history
    - d. Personal and social history
  - 3. Examination and Findings
    - a. Inspection of chest
    - b. Evaluation of Respiration
      - i. terminology
      - ii. patterns of respiration
      - iii. signs of obstruction

- c. Palpation
    - i. deformity
    - ii. crepitation
    - iii. tactile fremitus
    - iv. chest expansion
  - d. Percussion
    - i. percussion techniques
    - ii. percussion tones
  - e. Auscultation
    - i. characteristics of normal breath sounds
    - ii. adventitious breath sounds
      - a) dry versus moist
      - b) continuous versus intermittent
      - c) coarse versus fine
    - iii. crackles
    - iv. rhonchi
    - v. wheezes
    - vi. other sounds
  - f. Vocal resonance
    - i. bronchophony
    - ii. egophony
    - iii. whispered pectoriloquy
  - g. Common causes of adventitious sounds and noisy breathing
  - h. Variations of age in children, infants, and older patients
  - i. Common abnormalities found in chest examination
  - j. Findings related to common disease processes
  - k. Documentation terminology
- G. Heart and blood vessels
  - 1. Review of anatomy and physiology
  - 2. Review of related history
    - a. Present problem
    - b. Past medical history
    - c. Personal and social history
    - d. Family history
    - e. Risk factors
  - 3. Examination and findings
    - a. Heart
      - i. Inspection
      - ii. Palpation
        - a) Apical pulse
        - b) Thrills
        - c) Heaves
        - d) Carotid pulse
      - iii. Percussion

- iv. Auscultation
      - a) Basic heart sounds
      - b) Splitting
        - i) identification
        - ii) significance
      - c) Extra heart sounds
        - i) identification
        - ii) significance
      - d) Murmurs
        - i) identification
        - ii) significance
        - iii) high output states
    - b. Peripheral arteries
      - i. Location of palpable arteries
      - ii. Pulse characteristics
      - iii. Significance of findings
      - iv. Amplitude scale
      - v. Auscultation
        - a) Indication
        - b) Findings
      - vi. Assessment of occlusion
    - c. Hypertension Classification
    - d. Peripheral Veins
      - i. Jugular venous pressure
        - a) Findings
        - b) Significance
      - ii. Venous obstruction
    - e. Thrombosis
    - f. Edema
    - g. Newborn and infant
      - i. Cardiovascular findings associated with birth
      - ii. Assessment for insufficiency
    - h. The older patient
  - 4. Common abnormalities of the heart and blood vessels
  - 5. documentation terminology
- H. Abdomen
  - 1. Review of anatomy and physiology
  - 2. Review of related history
    - a. Present problem
    - b. Past medical history
    - c. Personal and social history
    - d. Family history
    - e. Risk factors
  - 3. Examination and findings
    - a. Preparation
      - i. patient positioning
      - ii. landmarks

- b. Inspection
        - i. skin
          - a) lesions
          - b) venous patterns
          - c) scars
        - ii. symmetry
        - iii. shape
        - iv. size
        - v. herniation
        - vi. distention
        - vii. movement
      - c. Auscultation
        - i. bowel sounds
        - ii. bruits
      - d. Percussion
        - i. percussion tones
        - ii. liver span
        - iii. other organs
        - iv. gastric bubble
      - e. Palpation
        - i. technique
        - ii. expected findings
        - iii. identification of masses
        - iv. liver palpation techniques
        - v. gallbladder
        - vi. spleen
        - vii. kidney
      - f. Common abnormalities
      - g. Findings related to common disease processes
      - h. Common conditions causing abdominal pain
      - i. Findings in peritonitis
    - 4. Infants and children
      - a. Umbilical cord
      - b. Abdominal herniation
      - c. Auscultation and percussion
      - d. Palpation
    - 5. Older patients
    - 6. Documentation terminology
  - I. Genitalia
    - 1. Female - see Special Populations; Obstetrical and Medical Emergencies; Gynecological
    - 2. Male
      - a. Review of anatomy and physiology
      - b. Review of related history
        - i. present problem
        - ii. past medical history
        - iii. personal and social history



- c. Examination and Findings
      - i. inspection and palpation
      - ii. lesions
      - iii. priapism
      - iv. hernia
    - d. Common abnormalities
    - e. Documentation terminology
- J. Anus, Rectum
  - a. Review of anatomy and physiology
  - b. Review of related history
    - i. present problem
    - ii. past medical history
    - iii. personal and social history
    - iv. family history
  - c. Examination and findings
  - d. Common abnormalities
  - e. Documentation terminology
- K. Musculoskeletal system
  - 1. Review of anatomy and physiology
  - 2. Review of related history
    - a. Present problem
    - b. Past medical history
    - c. Personal and social history
  - 3. Examination and Findings
    - a. Inspection
    - b. Palpation
    - c. Range of Motion
    - d. Muscle strength
    - e. Specific joint assessment
  - 4. Specific landmarks in child development
  - 5. Older patients
    - a. Mobility changes
    - b. Joint and muscle changes
    - c. Muscle mass reduction
  - 6. Common abnormalities
- L. Neurological System
  - 1. Review of anatomy and physiology
  - 2. Review of related history
    - a. Present problem
    - b. Past medical history
    - c. Personal and social history
  - 3. Examination and Findings
    - a. Cognitive Abilities
    - b. Cranial Nerve assessment

- c. Proprioception and Cerebellar function
      - i. coordination and fine motor skills
      - ii. balance
    - d. Sensory function
      - i. primary
      - ii. cortical
    - e. Reflexes
  - 4. Examination of the non-responsive patient
    - a. Posturing
    - b. Painful stimulus response
  - 5. Infants and children
    - a. Newborn reflexes
    - b. Activity levels
  - 6. Older patients
    - a. Changes associated with aging
  - 7. Common abnormalities

VIII. Modifying the assessment for the patient with a life threatening emergency

- A. Head to toe approach
- B. Primary before Secondary
  - 1. Secondary medical assessment order
  - 2. Secondary trauma assessment order (see Trauma)

# Patient Assessment Monitoring Devices

## Paramedic Education Standard

Integrates scene and patient assessment findings with knowledge of epidemiology and pathophysiology to form a field impression. This includes developing a list of differential diagnoses through clinical reasoning to modify the assessment and formulate a treatment plan.

## Paramedic-Level Instructional Guideline

The Paramedic Instructional Guidelines in this section include all the topics and material at the AEMT level PLUS the following material:

- I. Continuous ECG monitoring
  - A. Purpose
  - B. Indication
    - 1. Patient's presenting with cardiac-related signs and symptoms or potential signs and symptoms of illnesses with cardiac impact
    - 2. Used as advanced monitoring in pre-hospital care
  - C. Procedure
  - D. Limitation
  - E. Interpretation (see Medical Emergency: Cardiology)
- II. 12-Lead ECG Interpretation
  - A. Purpose
    - 1. Shorten door to treatment time
    - 2. May assist in field care of patient with pharmacological intervention
  - B. Indication
  - C. Procedure
  - D. Interpretation (see Medical Emergency: Cardiology)
- III. Carbon Dioxide Monitoring
  - A. Capnometry (Colorimetric)
    - 1. Purpose
    - 2. Indication
    - 3. Procedure
    - 4. Limitation
      - a. Essentially a "yes/no" confirmation of device placement
      - b. Rapidly becomes inactivated with use, therefore must be periodically replaced for continuous monitoring
  - B. Capnography
    - 1. Purpose
    - 2. Indication

3. Procedure
4. Limitation
5. Interpretation (See Medical Emergency: Respiratory)

#### IV. Basic Blood Chemistry

##### A. Blood glucometer

1. Purpose
2. Indication
  - a. Known diabetic
  - b. Unconscious patient, for unknown reason
  - c. General malaise/weakness, for unknown reason
3. Procedure
4. Limitation
  - a. Appropriateness of use
  - b. Accuracy of reading

##### B. Cardiac biomarkers

1. Purpose
2. Indication
  - a. Cardiac patients
  - b. Patient's presenting with signs and symptoms of stroke
3. Procedure
4. Limitation
  - a. Appropriateness of use
  - b. Accuracy of reading

##### C. Other blood analyses

1. CHEM-7
2. BNP
3. Arterial blood gases (ABGs)

#### V. Other Monitoring Devices

A. As additional monitoring devices become recognized as the "standard of care" in the out-of-hospital setting, those devices should be incorporated into the primary education of those who will be expected to use them in practice.

1. State regulatory processes may elect to expand, delete or modify from the monitor devices in this section

# Patient Assessment Reassessment

## Paramedic Education Standard

Integrates scene and patient assessment findings with knowledge of epidemiology and pathophysiology to form a field impression. This includes developing a list of differential diagnoses through clinical reasoning to modify the assessment and formulate a treatment plan.

## Paramedic-Level Instructional Guideline

The Paramedic Instructional Guidelines in this section include all the topics and material at the AEMT level PLUS the following material:

- I. How and When to Reassess
- II. Patient Evaluation: Reassessment
  - A. Chief complaint
    - 1. Evaluate severity of chief complaint following treatment
    - 2. Monitor associated symptoms
  - B. Examination
  - C. Re-evaluate prioritization based on information
  - D. Modify treatment plan as necessary based on reassessment
- III. Documentation
- IV. Age-related Considerations
  - A. Pediatrics
  - B. Geriatrics

# Medicine

## Medical Overview

### Paramedic Education Standard

Integrates assessment findings with principles of epidemiology and pathophysiology to formulate a field impression and implement a comprehensive treatment/disposition plan for a patient with a medical complaint.

### Paramedic-Level Instructional Guideline

The Paramedic Instructional Guidelines in this section include all the topics and material at the AEMT level PLUS the following material:

- I. Assessment Factors
  - A. Scene safety
  - B. Environment
  - C. Chief complaint
    - 1. Primary reason for EMS response
    - 2. Verbal or non-verbal
    - 3. Possibly misleading
  - D. Life threatening conditions
  - E. Non-life threatening conditions
  - F. Distracting injuries
  - G. Tunnel vision
  - H. Patient cooperation
  - I. EMT attitude
- II. Major components of the patient assessment
  - A. Standard Precautions
  - B. Scene Size-Up
  - C. General Impression
  - D. Initial Assessment -- airway, ventilation, respiration and circulation
  - E. SAMPLE history
    - 1. Importance of a thorough history
      - a. Primary component of the overall assessment of the medical patient
      - b. Requires a balance of knowledge and skill to obtain a thorough and accurate history
      - c. Helps to ensure the proper care will be provided for the patient.
    - 2. Unresponsive patient
      - a. May be obtained from evidence at the scene
        - i. pill containers
        - ii. medical jewelry

- iii. family members
  - iv. bystanders
- 3. Responsive patient
  - a. Obtained directly from the patient
  - b. Focused on the patient's chief complaint
  - c. Additional history may be obtained from evidence at the scene
    - i. pill containers
    - ii. medical jewelry
    - iii. family members
    - iv. bystanders
- 4. OPQRST Mnemonic for evaluation of pain
  - a. O – Onset
    - i. focuses on what the patient was doing when the problem began.
    - ii. question(s): What were you doing when the problem began?
  - b. P – Provoke
    - i. focuses on what might provoke the problem for the patient.
    - ii. question(s): Does anything you do make the problem better or worse?
  - c. Q – Quality
    - i. focuses on the patients own description of the problem.
    - ii. questions
      - a) can you describe your pain/discomfort?
      - b) what does it feel like?
      - c) is it sharp? dull?
      - d) is it steady or does it come and go?
  - d. R - Region/Radiate
    - i. focuses on the specific area of the pain/discomfort.
    - ii. questions
      - a) can you point with one finger where you feel the pain/discomfort the most?
      - b) does the pain/discomfort radiate to any other areas of your body?
  - e. S – Severity
    - i. focuses on the severity of the pain/discomfort.
    - ii. questions
      - a) on a scale of 0 to 10, with 10 being the worst pain you have ever felt, how would you rate your pain right now?
      - b) how would you rate your pain when it first began?
      - c) has there been any change since it first began?
  - f. T – Time
    - i. focuses on the duration of the problem/pain/discomfort.
    - ii. question(s): When did your problem/pain/discomfort first begin?

- F. Baseline vital signs
- G. Secondary assessment
  - 1. May not be appropriate to perform a complete secondary assessment on all medical patients
  - 2. Designed to identify any signs or symptoms of illness that may not have been revealed during the initial assessment.
    - a. Head/scalp
      - i. pain
      - ii. shunt
    - b. Face
      - i. pain
      - ii. symmetry of facial muscles
    - c. Eyes
      - i. pupil size
      - ii. equality and reactivity to light
      - iii. pink moist conjunctiva
    - d. Ears
      - i. pain
      - ii. drainage
    - e. Nose
      - i. pain
      - ii. nasal flaring
    - f. Mouth
      - i. foreign body
      - ii. loose dentures
      - iii. pink & moist mucosa
    - g. Neck
      - i. pain
      - ii. accessory muscle use
      - iii. jugular vein distention
      - iv. medical jewelry
      - v. stoma
    - h. Chest
      - i. pain
      - ii. equal rise and fall
      - iii. guarding
      - iv. breath sounds
      - v. retractions
      - vi. scars
    - i. Abdomen
      - i. pain
      - ii. rigidity
      - iii. distention
      - iv. scars
    - j. Pelvis/genital
      - i. pain
      - ii. incontinence



- k. Arms
  - i. pain
  - ii. distal circulation
  - iii. sensation
  - iv. motor function
  - v. track marks
  - vi. medical jewelry
- l. Legs
  - i. pain
  - ii. distal circulation
  - iii. sensation
  - iv. motor function
  - v. track marks
  - vi. medical jewelry
- m. Back
  - i. pain
  - ii. scars

#### H. Continued assessment

### III. Forming a Field Impression

- A. Formation of differential diagnosis
  - 1. Integration of history and physical assessment findings
  - 2. Past experience
  - 3. “Gut instinct”
- B. Differentiation of the underlying cause of the patient’s condition from other possible causes
- C. Patient presentation often leads to a recognizable pattern common to multiple conditions with similar presentations
- D. Assess for clues to determine minor differences in patient presentation
- E. Determine field differential diagnosis based on available information
- F. Realize the differential diagnosis may change as the patient condition changes or additional information becomes available

# Medicine

## Neurology

### Paramedic Education Standard

Integrates assessment findings with principles of epidemiology and pathophysiology to formulate a field impression and implement a comprehensive treatment/disposition plan for a patient with a medical complaint.

### Paramedic-Level Instructional Guideline

The Paramedic Instructional Guidelines in this section include all the topics and material at the AEMT level PLUS the following material:

- I. Introduction—overview of neurological conditions
  - A. Epidemiology,
  - B. Pathophysiology
- II. Central Nervous System
  - A. Brain
  - B. Spinal cord
  - C. Autonomic and peripheral nervous systems
- III. Neurological assessment- normal and abnormal findings
  - A. General Appearance
  - B. Speech
  - C. Skin
  - D. Posture/Gait
  - E. Mental Status
  - F. Mood, thought, perception, judgment, memory and attention
  - G. Cranial nerve assessment
  - H. Glasgow coma scale
- IV. General management considerations
  - A. Airway, ventilation, respiration, circulation
  - B. Emotional support
  - C. Transport decisions
- V. Neurological conditions
  - A. Altered mental status
    - 1. AEIOUTIPS
    - 2. Assessment findings and symptoms for AMS
    - 3. Pharmacological and nonpharmacological management

- B. Stroke, intracranial hemorrhage, and Transient Ischemic Attacks (TIA)
  - 1. Incidence, mortality, morbidity, complications
  - 2. Types
    - a. Occlusive stroke
      - i. embolic
      - ii. thrombotic
    - b. Hemorrhagic
  - 3. Transient ischemic attack
  - 4. Assessment findings and symptoms
    - a. Stroke assessment scales/scores
    - b. Stroke alerts/protocols
  - 5. Pharmacologic and non-pharmacologic management
    - a. Consistent with current ILCOR consensus statement
- C. Seizures
  - 1. Incidence, mortality, morbidity, complications
  - 2. Types
    - a. Generalized
      - i. tonic – clonic
      - ii. absence
      - iii. pseudo seizures
    - b. Partial
      - i. simple partial
      - ii. complex partial
    - c. Status epilepticus
  - 3. Assessment findings and symptoms
  - 4. Pharmacologic and non-pharmacologic management
- D. Headache
  - 1. Types
    - a. Tension
    - b. Sinus
    - c. Migraine
    - d. Cluster
    - e. Headache as symptom
  - 2. Assessment findings and symptoms
  - 3. Pharmacologic and non-pharmacologic management
- E. Dementia
  - 1. Alzheimer's
  - 2. Pick's disease
  - 3. Huntington's disease
  - 4. Creutzfeldt-Jakob disease
  - 5. Wernicke's encephalopathy
  - 6. Assessment findings and symptoms
  - 7. Pharmacologic and non-pharmacologic management
- F. Central nervous system neoplasm
  - 1. Brain tumors
  - 2. Spinal tumors

3. Incidence, mortality, morbidity, complications
  4. Assessment findings and symptoms
  5. Pharmacologic and non-pharmacologic management
  - G. Demyelinating Neurological Disorders
    1. Multiple Sclerosis
    2. Guillain-Barré Syndrome
  - H. Parkinson's disease
    1. Incidence, mortality, morbidity, complications
    2. Assessment findings and symptoms
    3. Pharmacological and nonpharmacological management
  - I. Cranial nerve disorders
    1. Trigeminal neuralgia
    2. Hemifacial spasm
    3. Acoustic neuroma
    4. Glossopharyngeal neuralgia
    5. Vertigo
    6. Ménière's disease
    7. Disorders of the facial nerve
    8. Assessment findings and symptoms
    9. Prehospital implications
  - J. Movement disorders-- dystonia
    1. Assessment findings and symptoms
    2. Pharmacologic and non-pharmacologic management
  - K. Neurological infections/inflammation
    1. Encephalitis
    2. Meningitis
    3. Assessment findings and symptoms
    4. Pharmacologic and non-pharmacologic management
  - L. Spinal Cord Compression
  - M. Hydrocephalus
  - N. Wernicke's Encephalopathy
- VI. Age-related variations
- A. Pediatrics
    1. Epidemiology
    2. Anatomic and physiologic differences in children
    3. Pathophysiology
    4. Causes of altered mental status in children
    5. Assessment
      - a. History
      - b. Physical findings
    6. Meningitis
    7. Febrile seizures
    8. Altered mental status

- 9. Ventricular shunts
      - a. Infection
      - b. Malfunction
      - c. Hydrocephalus
    - 10. Management
  - B. Geriatrics- stroke risk high in this age group
- VII. Communication and documentation
- VIII. Transport decisions
- IX. Patient education and prevention of complications or future neurological emergencies.

# Medicine

## Abdominal and Gastrointestinal Disorders

### Paramedic Education Standard

Integrates assessment findings with principles of epidemiology and pathophysiology to formulate a field impression and implement a comprehensive treatment/disposition plan for a patient with a medical complaint.

### Paramedic-Level Instructional Guideline

The Paramedic Instructional Guidelines in this section include all the topics and material at the AEMT level PLUS the following material:

- I. Introduction
  - A. Epidemiology
    - 1. Incidence
    - 2. Mortality/ morbidity
    - 3. Risk factors
    - 4. Prevention strategies
- II. General pathophysiology, assessment and management
  - A. Pathophysiology of abdominal pain
    - 1. Bacterial contamination
    - 2. Chemical irritation
    - 3. Types of abdominal pain
      - a. Somatic pain
      - b. Visceral pain
      - c. Referred pain
  - B. Assessment findings
    - 1. Focused history
      - a. Onset
      - b. Provoking factors
      - c. Quality
      - d. Region/ radiation
      - e. Severity
      - f. Time
      - g. Previous history of same event
      - h. Nausea/ vomiting
      - i. Change in bowel habits/ stool
        - i. Constipation
        - ii. Diarrhea
      - j. Weight loss
      - k. Last meal

- l. Chest pain
    - m. Signs or symptoms of shock
    - n. ECG abnormalities
  - 2. Focused physical examination
    - a. Appearance, Posture
    - b. Level of consciousness
    - c. Apparent state of health, skin color
    - d. Inspect abdomen
    - e. Auscultate abdomen
    - f. Percuss abdomen
    - g. Palpate abdomen
  - 3. Assessment tools
- C. Management/ treatment plan
  - 1. Airway and ventilatory support
    - a. Maintain an open airway
    - b. High-concentration oxygen
  - 2. Circulatory support
    - a. IV fluid administration based on assessment for fluid loss
    - b. Medication administration
  - 3. Pharmacologic interventions for pain management
  - 4. Non-pharmacologic interventions
    - a. Nothing by mouth
    - b. Monitor level of consciousness
    - c. Monitor vital signs
    - d. Position of comfort
    - e. Nasogastric tube if indicated
  - 5. Transport consideration-- gentle but rapid transport
  - 6. Psychological support

### III. Specific Injuries/ illness: causes, assessment findings and management for each condition

- A. Upper gastrointestinal bleeding
  - 1. Ulcerative diseases
    - a. Peptic ulcer disease
    - b. Pathophysiology
    - c. Patient history
    - d. Erosive gastritis
  - 2. Esophagogastric varices
  - 3. Other causes
- B. Lower gastrointestinal bleeding
  - 1. Common causes
    - a. Non-life threatening
      - i. hemorrhoids
        - a) presentation
        - b) prehospital implications
      - ii. anal fissures
      - iii. other

- b. Potentially life-threatening
        - i. diverticulitis
        - ii. other
- C. Liver Diseases
  - 1. Hepatitis -- See infectious disease
  - 2. Cirrhosis
    - a. Pathophysiology
    - b. Signs and symptoms
    - c. Prehospital implications
  - 3. Hepatic encephalopathy
    - a. Pathophysiology
    - b. Signs and symptoms
    - c. Prehospital implications
- D. Infectious Disorders
  - 1. Pathophysiology
  - 2. Signs and symptoms
    - a. Fever
    - b. Ascites
    - c. Abdominal pain characteristics
    - d. Hemodynamic instability
    - e. Pharmacologic and non-pharmacologic interventions
  - 3. Peritonitis
  - 4. Gastroenteritis
    - a. Causative organisms
      - i. rotavirus, Norwalk virus, and many others
      - ii. parasites
        - a) protozoa giardia lamblia
        - b) crypto sporidium parvum
        - c) cyclosporidium cayetensis
      - iii. contracted via fecal-oral transmission, contaminated food and water
      - iv. cyclosporidium reported to be contracted by swimming in contaminated waters
    - b. Bacteria
      - i. Escherichia coli
      - ii. Klebsiella pneumoniae
      - iii. enterobacter
      - iv. campylobacter jejuni
      - v. vibrio cholera
      - vi. shigella
      - vii. salmonella
    - c. Prehospital management
- E. Ulcerative Disorders
- F. Irritable bowel syndrome
  - 1. Pathophysiology
  - 2. Signs and symptoms
  - 3. Prehospital implications



- G. Inflammatory bowel disease
  - 1. Ulcerative colitis
    - a. Pathophysiology
  - 2. Crohn's disease
    - a. Pathophysiology
    - b. Signs and symptoms
    - c. Prehospital implications
  - 3. Cholecystitis and Biliary Tract Disorders
    - a. Pathophysiology
    - b. Signs and symptoms
    - c. Prehospital implications
  - 4. Pancreatitis
    - a. Pathophysiology
    - b. Signs and symptoms
    - c. Pharmacologic and non-pharmacologic
  - 5. Appendicitis
    - a. Pathophysiology
    - b. Signs and symptoms
    - c. Prehospital implications
    - d. Prehospital management
  - 6. Diverticulitis
    - a. Pathophysiology
    - b. Signs and symptoms
    - c. Prehospital management
- H. Bowel obstruction
  - 1. Definition
  - 2. Small Bowel Obstruction
    - a. Causes
      - i. adhesions
      - ii. cancer
      - iii. Crohn's disease
      - iv. others
    - b. Pathophysiology
    - c. Morbidity and mortality
    - d. Signs and symptoms
    - e. Prehospital management
  - 3. Large Bowel Obstruction
    - a. Causes
      - i. cancer
      - ii. diverticulitis
      - iii. volvulus
    - b. Pathophysiology
    - c. Morbidity and mortality
    - d. Signs and symptoms
    - e. Prehospital management

- I. Hernias
    - 1. Definition
    - 2. Causes
    - 3. Locations
    - 4. Signs and symptoms
    - 5. Incarcerated hernia
      - a. Signs and symptoms
      - b. Prehospital management
  - J. Rectal foreign body obstruction
    - 1. Pass from upper GI tract
      - a. Gall stones
      - b. Fecaliths
      - c. swallowed foreign objects
    - 2. Introduced from anus
    - 3. Signs and symptoms
      - a. Pain
      - b. Signs of infection
    - 4. Management
      - a. Pain management
      - b. Transport for evaluation and removal
  - K. Rectal Abscess
  - L. Mesenteric Ischemia
- IV. Consider age-related variations
- A. Pediatrics
    - 1. Epidemiology
    - 2. Anatomic and physiologic differences in children
    - 3. Pathophysiology
      - a. Embryology of the GI tract
      - b. Vomiting mechanism
      - c. Electrolyte complications of gastroenteritis and pyloric stenosis
      - d. GI bleeding
    - 4. Assessment
      - a. History
      - b. Physical findings
    - 5. Vomiting
      - a. Gastroenteritis
      - b. Malrotation
      - c. Pyloric stenosis
    - 6. Lower GI Bleeding
    - 7. Gastrostomy tube dysfunction
    - 8. Neonatal Jaundice
    - 9. Management

- B. Geriatrics
  - 1. AAA more common
  - 2. May not exhibit rigidity or guarding
  - 3. Abdominal pain related to cardiac conditions
- V. Communication and documentation
- VI. Transport decisions
- VII. Patient education and prevention

# Medicine

## Immunology

### Paramedic Education Standard

Integrates assessment findings with principles of epidemiology and pathophysiology to formulate a field impression and implement a comprehensive treatment/disposition plan for a patient with a medical complaint.

### Paramedic-Level Instructional Guideline

The Paramedic Instructional Guidelines in this section include all the topics and material at the AEMT level PLUS the following material:

- I. Introduction
  - A. Incidence, morbidity, mortality of common or major immune system disorders
  - B. Collagen vascular disease
  - C. Allergic reaction and anaphylaxis
  - D. Hypersensitivity
  - E. Transplant disorders
- II. Pathophysiology
  - A. Immunity
    - 1. Natural
    - 2. Acquired
  - B. Immune response
    - 1. Humoral
    - 2. Cell-mediated
  - C. Allergic reaction
    - 1. Antigens
    - 2. Antibodies
    - 3. Mast cells and basophils
    - 4. Histamine, leukotrienes, histamine and other mediators
    - 5. Local reactions
    - 6. Systemic reactions
- III. Assessment
  - A. Mild allergic reaction
    - 1. Cutaneous
    - 2. Other
  - B. Moderate allergic reaction
    - 1. Upper airway
    - 2. Lower airway
    - 3. Cardiovascular

4. Cutaneous
5. Gastrointestinal
6. Neurological
- C. Severe allergic reaction/ anaphylaxis
  1. Upper airway
  2. Lower Airway
  3. Cardiovascular
  4. Cutaneous
  5. Gastrointestinal
  6. Neurological

#### IV. Anaphylactoid Reaction

- V. Managing an allergic reaction
  - A. Provide treatment specific to assessment findings and severity of reaction
  - B. Remove allergen if possible
  - C. Protect the airway -- Consider intubation
  - D. Ventilate if needed
  - E. IV access
    1. Fluid administration
    2. Medication administration
  - F. Pharmacologic interventions
    1. Oxygen
    2. Epinephrine
    3. Antihistamines
    4. Corticosteroids
    5. Vasopressors
    6. Beta agonists
    7. Magnesium sulfate
    8. Bronchodilators

#### VI. Collagen vascular disease

- A. Systemic lupus erythmatosis
  1. Effects on body
    - a. Cutaneous effects
    - b. Musculoskeletal
    - c. Pleural
    - d. Pericardial
    - e. Neurologic
    - f. Hematologic
  2. Prehospital implications
- B. Scleroderma
  1. Effects on body
    - a. Renal
    - b. Cardiovascular
  2. Prehospital implications

- VII. Transplant-related problems
  - A. Types of solid organ transplant
  - B. Assessment considerations
  - C. Common complications related to immunosuppression
    - 1. Infection
    - 2. Rejection
    - 3. Drug toxicity
      - a. Cyclosporine
        - i. interacts with many other drugs
        - ii. renal toxicity
      - b. Azathioprine
        - i. neutropenia
        - ii. hepatic and gastrointestinal effects
      - c. Corticosteroids
- VIII. Consider age-related variations in pediatric and geriatric patients
- IX. Communication and documentation
- X. Transport decisions
- XI. Patient education and prevention

# Medicine

## Infectious Diseases

### Paramedic Education Standard

Integrates assessment findings with principles of epidemiology and pathophysiology to formulate a field impression and implement a comprehensive treatment/disposition plan for a patient with a medical complaint.

### Paramedic-Level Instructional Guideline

The Paramedic Instructional Guidelines in this section include all the topics and material at the AEMT level PLUS the following material:

- I. Public health principles and agencies responsible for public health
  - A. Demographic
  - B. Epidemiology diseases
    - 1. Endemic
    - 2. Epidemic
    - 3. Pandemic
- II. Pathophysiology of Infectious Disease
  - A. Infectious agents
    - 1. Bacteria
    - 2. Viruses
    - 3. Fungi
    - 4. Protozoa
    - 5. Helminths (worms)
  - B. Factors that affect agent's ability to cause disease
  - C. Chain of infection
    - 1. Infectious agent
    - 2. Reservoir
    - 3. Portal of entry
    - 4. Mode of transmission
      - a. Direct contact
      - b. Droplet
      - c. Vector
    - 5. Portal of exit
    - 6. Factors that affect susceptibility
  - D. Body's response
    - 1. Barriers
      - a. External
        - i. flora
        - ii. skin

- iii. gastrointestinal system
      - iv. respiratory system
      - v. genitourinary system
    - b. Internal barriers
      - i. inflammatory response
      - ii. immune response
      - iii. limited to specific
  - E. Stages of infectious disease
    - 1. Latent
    - 2. Incubation period
    - 3. Communicability period
    - 4. Disease period
- III. Standard Precautions, personal protective equipment, and cleaning and disposing of equipment and supplies.
- A. Principles of standard precautions
  - B. Current hand washing guidelines
  - C. Current recommendations for standard precautions
  - D. Current recommendations for cleaning or sterilization of equipment
  - E. Current recommendations for disposing of contaminated linens and supplies including sharps
- IV. Specific diseases and conditions
- A. HIV and AIDS
    - 1. Incidence, morbidity, mortality, risk factors, modes of transmission
    - 2. Pathophysiology
    - 3. Body systems affected
    - 4. Progression of disease including opportunistic infections
    - 5. Healthcare worker susceptibility and transmission
    - 6. Assessment findings and symptoms
      - a. Often asymptomatic
      - b. Non-specific febrile illness
      - c. Sore throat, fatigue
      - d. Swollen spleen and lymph glands
      - e. Weight loss
      - f. Opportunistic infections
    - 7. Management for a patient with HIV or AIDS-related conditions
      - a. Prehospital care is supportive
      - b. Manage airway and support ventilation
      - c. IV if needed
      - d. Respiratory isolation if coughing
    - 8. Immunization and treatment of exposure
  - B. Hepatitis
    - 1. Introduction--Pathophysiology, incidence, types, causes, risk factors, methods of transmission, complications



2. General assessment findings and symptoms
    - a. Asymptomatic
    - b. Non-specific febrile illness
    - c. Light-colored stools
    - d. Dark urine
    - e. Fatigue
    - f. Nausea/vomiting
    - g. Abdominal pain/tenderness
    - h. Jaundice
    - i. Fulminant acute hepatitis
  3. Treatments for exposure/prevention; immunizations
  4. Types
    - a. Hepatitis A
    - b. Hepatitis B
    - c. Hepatitis C
    - d. Hepatitis D
    - e. Hepatitis E
    - f. Hepatitis G
    - g. Other
  5. Management for a patient with hepatitis
    - a. Prehospital care is supportive
    - b. Manage airway and support ventilation
    - c. IV if needed
- C. Pneumonia
1. Introduction--Pathophysiology, incidence, risk factors, methods of transmission, complications
  2. Etiologic agents/ causative organisms
    - a. Bacterial
    - b. Viral
    - c. Fungal
  3. General assessment findings and symptoms
    - a. Chills, high-grade fevers, chest pain with respirations, tachypnea, and dyspnea
    - b. Signs of respiratory distress
    - c. Productive cough—yellow or green
    - d. Signs of dehydration
    - e. Breath sounds
      - i. diminished breath sounds
      - ii. localized adventitious sounds
        - a) crackles
        - b) wheezes
    - f. Percussion
  4. General management for a patient with pneumonia
    - a. Airway and ventilatory support
    - b. Administer oxygen
    - c. Initiate intravenous therapy

- d. Consider pharmacologic interventions related to presenting signs and symptoms
  - e. Treatments for exposure; immunizations
- D. Meningitis
  - 1. Types
    - a. Meningococcal meningitis
      - i. neisseria meningitidis
      - ii. onset rapid, high mortality rate
      - iii. petechial rash
    - b. Streptococcus pneumoniae (bacteria)
    - c. Hemophilus influenza type B (bacteria)
    - d. Viruses (causes syndromes aseptic meningitis)
  - 2. Meningococcal meningitis
    - a. Introduction--Pathophysiology, incidence, types, causes, risk factors, methods of transmission, complications
    - b. General assessment findings and symptoms
      - i. altered mental status
      - ii. fever, chills
      - iii. photophobia
      - iv. joint pain
      - v. nuchal rigidity
        - a) Kernig's sign
        - b) Brudzinski's sign
      - vi. seizures
      - vii. projectile vomiting
      - viii. headache
      - ix. septic shock
      - x. rash
      - xi. disseminated intravascular coagulation
    - c. Infants and children
      - i. infants--fever, vomiting, irritability, and lethargy
      - ii. bulging fontanelle
      - iii. older children, positive Kernig's and Brudzinski's signs may be found
  - 3. General management for a patient with meningitis
    - a. Standard precautions
    - b. Airway and ventilatory support
    - c. Administer oxygen
    - d. Initiate IV
    - e. Pharmacologic management
      - i. seizures
      - ii. shock
    - f. Rapid transport
    - g. Post-exposure prophylaxis

- E. Tuberculosis
  - 1. Introduction--Pathophysiology, incidence, causes, risk factors, methods of transmission, complications
  - 2. General assessment findings and symptoms
    - a. Initially a subclinical infection
    - b. Indications of acute illness
      - i. cough
      - ii. fever
      - iii. night sweats
      - iv. weight loss
      - v. fatigue
      - vi. hemoptysis
  - 3. Management for a patient with tuberculosis
    - a. Supportive care
    - b. Airway and ventilatory support as needed
    - c. High-concentration oxygen
    - d. Respiratory barriers
      - i. Paramedic N-95 or HEPA mask
      - ii. mask on patient
      - iii. ensure ventilation in ambulance
  - 4. Post-exposure prophylaxis
- F. Tetanus
  - 1. Introduction-- Pathophysiology, incidence, causes, risk factors, methods of transmission, incubation, complications
  - 2. General assessment findings and symptoms
    - a. Muscular tetany
      - i. jaw
      - ii. neck muscles
      - iii. abdominal rigidity may be the first sign in children
      - iv. facial muscles
    - b. Weakness, myalgias, muscle cramps
    - c. Dysphagia, hydrophobia, drooling
    - d. Respiratory failure
  - 3. General management for a patient with tetanus
    - a. Supportive
    - b. Airway and support ventilation
    - c. Administer oxygen
    - d. Establish intravenous
    - e. Pharmacologic
  - 4. Post-exposure considerations
  - 5. Immunization
- G. Viral diseases
  - 1. Chickenpox
    - a. Introduction-- Pathophysiology, incidence, causes, risk factors, methods of transmission, complications

- b. General assessment findings and symptoms
      - i. respiratory symptoms, malaise and low-grade fever
      - ii. rash--small red spots then raised blisters on a red
      - iii. fluid-filled vesicles then dry into scabs
    - c. Patient management for a patient with chickenpox
      - i. supportive
      - ii. isolation
    - d. Post-exposure considerations
    - e. Vaccines
  - 2. Mumps
    - a. Introduction-- Pathophysiology, incidence, causes, risk factors, methods of transmission, complications
    - b. General assessment findings and symptoms
      - i. fever,
      - ii. swelling and tenderness of salivary glands, especially parotid
    - c. General management for a patient with mumps
      - i. supportive
      - ii. isolation
    - d. Post-exposure considerations
    - e. Immunization
  - 3. Rubella
    - a. Introduction-- Pathophysiology, incidence, causes, risk factors, methods of transmission, complications
    - b. General assessment findings and symptoms
      - i. fever and flu symptoms, followed by
      - ii. red maculopapular rash
    - c. General management for a patient with rubella
      - i. supportive
      - ii. isolation
    - d. Post-exposure considerations
    - e. Immunization
  - 4. Measles
    - a. Introduction-- Pathophysiology, incidence, causes, risk factors, methods of transmission, complications
    - b. General assessment findings and symptoms
      - i. prodrome - conjunctivitis, swelling of the eyelids, photophobia, high fevers, hacking cough, and malaise
      - ii. small, red-based lesions with blue-white centers in the mouth, called Koplik's spots
      - iii. generalized rash
    - c. General management for a patient with measles
      - i. supportive
      - ii. isolation
    - d. Post-exposure considerations
    - e. Immunization

5. Pertussis (Whooping cough)
  - a. Introduction-- Pathophysiology, incidence, causes, risk factors, methods of transmission, complications
  - b. General assessment findings and symptoms
    - i. cough paroxysms are violent, sometimes without an intervening inhalation
    - ii. high pitched whooping sound or crowing
    - iii. clear mucus, vomiting
  - c. General management for a patient with pertussis
    - i. supportive
    - ii. isolation
  - d. Post-exposure considerations
  - e. Immunization
- H. Other viral diseases
  1. Influenza
    - a. Introduction-- Pathophysiology, incidence, causes, risk factors, methods of transmission, complications
    - b. General assessment findings and symptoms
      - i. upper respiratory illness-type symptoms
      - ii. cough is often severe and protracted
      - iii. fever and body aches
    - c. General management for a patient with influenza
      - i. patient treatment is supportive
      - ii. IV fluids if dehydrated
    - d. Immunization and treatment of exposure
  2. Mononucleosis
    - a. Introduction-- Pathophysiology, incidence, causes, risk factors, methods of transmission, complications
    - b. General assessment findings and symptoms
      - i. fever, sore throat, oropharyngeal discharges,
      - ii. lymphadenopathy (especially posterior cervical), and splenomegaly
      - iii. lack of energy
    - c. General management for a patient with mononucleosis
      - i. patient treatment is supportive
      - ii. IV fluids if dehydrated
    - d. Immunization and treatment of exposure
  3. Herpes simplex virus type 1
    - a. Introduction-- Pathophysiology, incidence, causes, risk factors, methods of transmission, complications
    - b. General assessment findings and symptoms
      - i. cold sores and fever blisters, which are generally found on the lips, face, conjunctiva, or oropharynx
      - ii. newborns may get meningoencephalitis
      - iii. aseptic meningitis in adults

- c. General management for a patient with herpes simplex type I
      - i. supportive care
      - ii. IV fluids if dehydrated
    - d. Immunization and treatment of exposure
      - i. highly contagious
      - ii. antiviral medication
  - 4. Hantavirus
    - a. Introduction-- Pathophysiology, incidence, causes, risk factors, methods of transmission, complications
    - b. General assessment findings and symptoms
      - i. onset of illness is non-specific
      - ii. fever, malaise, aches, and generalized pains
      - iii. headache, nausea/vomiting, abdominal pain,
      - iv. diarrhea, cough, and weakness
      - v. respiratory distress ,severe dyspnea, dizziness, chest and back pain
      - vi. respiratory failure, pulmonary edema
    - c. General management for a patient with Hantavirus
- I. Sexually transmitted diseases
  - 1. Introduction-- Pathophysiology, incidence, causes, risk factors, methods of transmission, complications for common sexually transmitted diseases
  - 2. General management for a patient with sexually transmitted diseases
  - 3. Specific conditions, general assessment findings, symptoms
    - a. Syphilis
    - b. Gonorrhea
    - c. Chlamydia
    - d. Herpes simplex virus type 2 (genital herpes)
    - e. Scabies and Lice
    - f. Lyme disease
- J. Gastroenteritis
  - 1. Pathophysiology, incidence, causes, risk factors, methods of transmission, complications for gastroenteritis caused by an infectious agent
    - a. Rotavirus
    - b. Parasites
    - c. Bacteria
    - d. Other
  - 2. General assessment findings and symptoms for patients with gastroenteritis caused by an infectious agent
  - 3. General management for a patient with gastroenteritis caused by an infectious agent
  - 4. Antiemetic
  - 5. IV for fluid replacement

- K. Drug resistant bacterial conditions
  - 1. Pathophysiology, incidence, causes, risk factors, methods of transmission, complications for a patient with a drug resistant bacterial condition
  - 2. General assessment findings and symptoms for patients with a drug resistant bacterial condition
  - 3. General management for a patient with a drug resistant bacterial condition
  - 4. Common conditions
    - a. MRSA – methicillin resistant staphylococcus aureus
    - b. VRSA – vancomycin resistant staphylococcus aureus
    - c. VRE -- Vancomycin Resistant Enterococcus
    - d. Other
- L. Fungal infections
  - 1. Pathophysiology, incidence, causes, risk factors, methods of transmission, complications for a patient with a fungal infections
  - 2. General assessment findings and symptoms for a patient with fungal infections
  - 3. General management for a patient with fungal infections
- M. Rabies
  - 1. Definition:
  - 2. Epidemiology
  - 3. Prognosis:
    - a. Good, if treated with early post-exposure prophylaxis
    - b. Fatal when signs and symptoms appear
  - 4. Transmission
    - a. Infected saliva of a host is passed to an uninfected animal.
    - b. Bite with virus-containing saliva of an infected host.
      - i. raccoons
      - ii. skunks
      - iii. foxes
      - iv. coyotes
      - v. insectivorous bats
    - c. Contamination of mucous membranes (i.e., eyes, nose, mouth), aerosol transmission
    - d. Corneal transplantations.
  - 5. Incubation
  - 6. Signs and Symptoms
    - a. Autonomic instability
    - b. Dysphagia
    - c. Hydrophobia
    - d. Paresis
    - e. Paresthesia
    - f. Progressive worsening of neurologic signs is characteristic of rabies and should be considered as a positive indicator for rabies

7. Treatment
    - a. Clean wound and treat injuries associated with injury first
    - b. Consider potential for infection with all potential exposures
      - i. saliva of infected animals
      - ii. central neuro system of infected animals
    - c. Early post exposure prophylaxis
  8. Documentation
    - a. Type of exposure
      - i. bite
      - ii. mucosal
      - iii. scratch
      - iv. unknown
    - b. Duration of exposure if non-bite
- N. Scabies/Lice
1. Scabies
    - a. Definition: infestation of the skin with the microscopic mite *Sarcoptes scabiei*.
    - b. Epidemiology
      - i. prevalence - infestation is common, found worldwide, and affects people of all races and social classes.
      - ii. spread-skin-to-skin contact between people, such as in hospitals, institutions, child-care facilities, and nursing homes
      - iii. lifespan of mite
        - a) 24-72 hours away from a host
        - b) female can live one month on host
    - c. Signs and Symptoms:
      - i. pimple-like irritations
      - ii. burrows or rash of the skin
      - iii. intense itching
      - iv. sores on the body caused by scratching
    - d. Onset of Signs and Symptoms
      - i. 4-6 weeks in patient never having had them before
      - ii. several days for second exposure
    - e. Treatment
  2. Lice
    - a. Definition: infestation of the skin under the hair on people's head, bodies, or pubic areas.
    - b. Types
      - i. *pediculus humanus capitis* (head louse)
      - ii. *pediculus humanus corporis* (body or clothes louse)
      - iii. *pthirus pubis* (crab louse or pubic louse)
    - c. Epidemiology
    - d. Spread by close person to person contact
      - i. move by crawling, cannot fly or hop
      - ii. pubic lice spread by sexual contact



- e. Life-span
      - i. 24-48 hours away from a host
      - ii. 30 days on a host
      - iii. females lay 8 nits per day
    - f. Signs and Symptoms
      - i. itching
      - ii. appearance of nits
      - iii. appearance of lice
    - g. Treatment:
      - i. pediculicides for head lice
      - ii. 1% permethrin or a mousse containing pyrethrins and piperonyl butoxide for pubic lice
  - O. Lyme Disease
    - 1. Originally identified in Lyme, Ct, now most cases in North and Northeast
    - 2. Caused by the bacteria borrelia burgdorferi, spread by ticks
      - a. Phase I
        - i. large circular lesions
        - ii. muscle and joint pain
        - iii. fever, malaise, fatigue
        - iv. swollen lymph nodes
        - v. headache
        - vi. diffuse erythema
        - vii. conjunctivitis and periorbital edema
      - b. Phase II (weeks to months later)
        - i. pericarditis
        - ii. myocarditis
        - iii. AV conduction problems
        - iv. meningoencephalitis
        - v. cranial, peripheral neuropathies
      - c. Phase III
    - 3. Antibiotic treatment during phase I prevents progression
  - P. Antibiotic Resistant Infections
    - 1. Epidemiology
    - 2. Pathophysiology
    - 3. Psychosocial impact
    - 4. Reporting requirements
    - 5. Prognosis
    - 6. Assessment
    - 7. Management
- V. Consider age-related variations in pediatric and geriatric patients
- VI. Communication and documentation for a patient with a communicable or infectious disease
- VII. Transport decisions including special infection control procedures.

- VIII. Patient and family teaching regarding communicable or infectious diseases and their spread.
- IX. Legal requirements regarding reporting communicable or infectious diseases/conditions
  - A. Exposure of health care provider
    - 1. Current recommended treatment modalities and follow up
    - 2. Prevention of exposure or immunizations/vaccines
  - B. Required reporting to the health department or other health care agency

# Medicine

## Endocrine Disorders

### Paramedic Education Standard

Integrates assessment findings with principles of epidemiology and pathophysiology to formulate a field impression and implement a comprehensive treatment/disposition plan for a patient with a medical complaint.

### Paramedic-Level Instructional Guideline

The Paramedic Instructional Guidelines in this section include all the topics and material at the AEMT level PLUS the following material:

- I. Overview of endocrine conditions
  - A. Anatomy and Physiology-- Endocrine Glands
    - 1. Thyroid
    - 2. Hypothalamus
    - 3. Pineal
    - 4. Thymus
    - 5. Pituitary
    - 6. Parathyroids
    - 7. Adrenals
    - 8. Pancreas
    - 9. Ovary
    - 10. Testis
  - B. Hormones
    - 1. Cortisol
    - 2. Aldosterone
    - 3. Estrogen
    - 4. Progesterone
    - 5. Testosterone
    - 6. Insulin
    - 7. Parathyroid hormone
- II. Pathophysiology, causes, Incidence, morbidity, and mortality, assessment findings, management for endocrine conditions
  - A. Pancreas disorders--Diabetes mellitus--
    - 1. Insulin—relationship with glucose
    - 2. Pathophysiology of diabetes
      - a. Long-term complications
      - b. Impact on prehospital assessment
    - 3. Diabetes
      - a. Type 1 (formerly known as Juvenile or Type I)

- b. Type 2 (formerly known as adult-onset or Type II)
    - c. Gestational
  - 4. Drugs to manage diabetes
    - a. Insulins
      - i. Types
      - ii. Delivery methods
    - b. Oral agents
      - i. Classes
      - ii. Risks of hypoglycemia
      - iii. Drug interactions
    - c. Other hypoglycemic agents
    - d. Drugs to treat hypoglycemia
  - 5. Diabetic ketoacidosis
  - 6. Hyperglycemic Hyperosmolar nonketotic coma
  - 7. Hypoglycemia
    - a. Pathophysiology
    - b. Signs and Symptoms
    - c. Management
      - i. Pharmacologic
      - ii. Non-pharmacologic
  - 8. Other disorders of pancreas
- B. Thyroid disorders
  - 1. Hyperthyroidism
  - 2. Hypothyroidism
  - 3. Myxedema
  - 4. Thyroid storm
  - 5. Thyrotoxicosis
  - 6. Grave's disease
- C. Adrenal disorders
  - 1. Addison disease
  - 2. Cushing syndrome
- D. Other endocrine disorders

### III. Consider age-related variations

- A. Pediatric
  - 1. Usually Type 1 diabetes;
  - 2. Late stages of hyperglycemia may have cerebral edema
  - 3. Prone to seizures;
  - 4. Prone to dehydration
  - 5. Congenital adrenal hyperplasia
  - 6. Panhypopituitarism
  - 7. Inborn errors of metabolism
- B. Geriatric
  - 1. Can mask signs and symptoms of myocardial infarction;
  - 2. Prone to dehydration and infections

- IV. Communication and documentation
- V. Transport decisions
- VI. Patient education and prevention

# Medicine Psychiatric

## Paramedic Education Standard

Integrates assessment findings with principles of epidemiology and pathophysiology to formulate a field impression and implement a comprehensive treatment/disposition plan for a patient with a medical complaint.

## Paramedic-Level Instructional Guideline

The Paramedic Instructional Guidelines in this section include all the topics and material at the AEMT level PLUS the following material:

- I. Introduction
  - A. Prevalence
  - B. Medical legal considerations
  - C. Safety
- II. Pathophysiology
  - A. Biological/Organic
  - B. Environment
    - 1. Psychosocial
    - 2. Socio-cultural
  - C. Injury and illness
  - D. Substance-related
    - 1. Abuse
    - 2. Dependence
    - 3. Intoxication
    - 4. Medication non-compliance
- III. Understanding Behavior
  - A. Normal
  - B. Abnormal
  - C. Overt
  - D. Violent
- IV. Acute psychosis
  - A. Pathophysiology
    - 1. Related to mental illness
    - 2. Organic psychosis
  - B. Signs and symptoms

- C. Prehospital management
    - 1. Non-pharmacologic
    - 2. Pharmacologic
- V. Agitated delirium
  - A. Pathophysiology
  - B. Risk factors
  - C. Signs and symptoms
  - D. Management
- VI. Specific Behavioral/Psychiatric Disorders
  - A. Cognitive Disorders
  - B. Thought Disorders
    - 1. Schizophrenia
    - 2. Psychosis
  - C. Mood Disorders
    - 1. Bipolar
    - 2. Depression
  - D. Neurotic disorders
  - E. Substance-Related Disorders/Addictive behavior
  - F. Somatoform Disorders
  - G. Factitious Disorders
  - H. Fastidious Disorders
  - I. Impulse Control Disorders
  - J. Personality Disorders
  - K. Suicide
  - L. Patterns of Violence, Abuse, and Neglect
- VII. Assessment findings for behavioral/psychiatric patients
  - A. Mental Status Exam (MSE)
    - 1. consciousness
    - 2. orientation
    - 3. activity
    - 4. speech
    - 5. thought
    - 6. memory
    - 7. affect and mood
    - 8. perception)
  - B. Physiological changes
  - C. Medical/social history
  - D. Consider if patient is danger to self and/or others
  - E. Consider medical causes of acute crises
- VIII. Providing Empathetic and Respectful Management
  - A. Communication techniques
  - B. Crisis intervention skills
  - C. Use of force/restraints (chemical, physical, tasers)

- IX. Medications
  - A. Pharmacodynamics of prescribed medications for behavioral/psychiatric disorders
    - 1. Amphetamines
    - 2. Antidepressants
    - 3. Antipsychotic
    - 4. Phenothiazines
  - B. Problems associated with non-compliance
  - C. Emergency use
- X. Consider age-related variations in pediatric and geriatric patients
- XI. Communication to medical facility and documentation
- XII. Transport decisions



# Medicine

## Cardiovascular

### Paramedic Education Standard

Integrates assessment findings with principles of epidemiology and pathophysiology to formulate a field impression and implement a comprehensive treatment/disposition plan for a patient with a medical complaint.

### Paramedic-Level Instructional Guideline

The Paramedic Instructional Guidelines in this section include all the topics and material at the AEMT level PLUS the following material:

- I. Anatomy of the Cardiovascular System
  - A. Location
    - 1. Layers
      - a. Myocardium
      - b. Endocardium
      - c. Pericardium
        - i. visceral (epicardium)
        - ii. parietal
        - iii. pericardial fluid
    - 2. Chambers
      - a. Atria
      - b. Ventricles
    - 3. Valves
      - a. Atrioventricular (AV) valves
        - i. tricuspid (right)
        - ii. mitral (left)
      - b. Semilunar valves
        - i. pulmonic (right)
        - ii. aortic (left)
    - 4. Papillary muscles
    - 5. Chordae tendineae
    - 6. Myocardial blood supply
      - a. Arteries
        - i. Left coronary artery
          - a) Anterior descending artery (LAD)
            - i) distribution to the conduction system
            - ii) distribution to the left and right ventricles
          - b) Circumflex artery
            - i) distribution to the conduction system

- ii) distribution to the left ventricle
    - iii) distribution to the left atrium
  - ii. Right coronary artery
    - a) Posterior descending artery
      - i) distribution to the conduction system
      - ii) distribution to left and right ventricles
    - b) Marginal artery
      - i) distribution to the conduction system
      - ii) distribution to the right ventricle
      - iii) distribution to the right atrium
  - b. Veins
    - i. Coronary sinus
    - ii. Great cardiac vein
- 7. Conduction system
  - a. Sinoatrial node
  - b. Atrioventricular node
  - c. Atrioventricular bundle (Bundle of His)
  - d. Bundle branches
    - i. left anterior fascicle
    - ii. left posterior fascicle
    - iii. right
  - e. Purkinje network
  - f. Internodal and interatrial pathways
    - i. Atrioventricular node
    - ii. Left Atrium (Bachmann's bundle)
    - iii. Middle internodal tract (Wenckebach's tract)
    - iv. Posterior internodal tract (Thorel's tract)
  - g. Anatomical tracts that bypass the atrioventricular node
    - i. considered possible conduction routes that account for anomalous atrioventricular conduction (Wolff-Parkinson-White syndrome, Lown-Ganong-Levine syndrome)
      - a) James fibers
      - b) Mahaim fibers
      - c) accessory bundle of Kent
- 8. Vascular system
  - a. Aorta
    - i. ascending
    - ii. thoracic
    - iii. abdominal
  - b. Arteries
  - c. Arterioles
  - d. Capillaries
  - e. Venules
  - f. Veins
  - g. Vena cava
    - i. superior
    - ii. inferior

- h. Venous return (preload)
  - i. skeletal muscle pump
  - ii. thoracoabdominal pump
  - iii. respiratory cycle
  - iv. gravity
  - v. effects of IPPB, PEEP, CPAP and BiPAP on venous return
- i. Systemic vascular resistance and capacitance (afterload)
- j. Pulmonary veins

## II. Physiology

### A. Cardiac cycle

1. Consists of systole and diastole of atria and ventricles
2. Cycle occurs in about 0.8 seconds and 70-80 cycles/minute average
3. Events that occur in 1 cardiac cycle:
  - a. Atrial systole
    - i. AV valves open and SL valves closed
    - ii. ventricles relaxed
    - iii. preceded by P wave on ECG
  - b. Isovolumetric contraction
    - i. between start of ventricular systole and opening of SL valves
    - ii. ventricular volume remains constant
    - iii. onset coincides with R wave on ECG
    - iv. first heart sound heard (S<sub>1</sub>)
      - a) caused by ventricles contracting and closure of cuspid valves
      - b) "lubb" sound
  - c. Ejection -- Initial, shorter, rapid ejection followed by longer phase of reduced ejection
    - i. Residual volume of blood remains in ventricles following ejection phase
    - ii. Residual volume increases in states of heart failure
  - d. Isovolumetric relaxation
    - i. period between closure of SL valves and opening of AV valves
    - ii. ventricles are relaxing
    - iii. second heart sound heard during this phase (S<sub>2</sub>)
      - a) caused by closure of SL valves
      - b) "dubb" sound
  - e. Rapid ventricular filling
  - f. Reduced ventricular filling (diastasis)

### B. Cardiac output

1. Heart rate X stroke volume
  - a. Starling's law
  - b. Contractility

- III. Electrophysiology
  - A. Characteristics of myocardial cells
    - 1. Automaticity
    - 2. Excitability
    - 3. Conductivity
    - 4. Contractility
  - B. Electrical potential
    - 1. Action potential – important electrolytes
      - a. Sodium
      - b. Potassium
      - c. Calcium
      - d. Chloride
      - e. Magnesium
    - 2. Excitability
      - a. Thresholds
      - b. Depolarization
      - c. Repolarization
        - i. relative refractory period
        - ii. absolute refractory period
    - 3. Neurotransmitters
      - a. Acetylcholine
        - i. effects on myocardium
        - ii. effects on systemic blood vessels
      - b. Cholinesterase
        - i. effects on myocardium
        - ii. effects on system blod vessels
  - C. Autonomic nervous system relationship to cardiovascular system
    - 1. Medulla
    - 2. Carotid sinus and baroreceptor
      - a. Location
      - b. Significance
    - 3. Parasympathetic system
      - a. Inhibitory
      - b. Vagal release of acetylcholine
    - 4. Sympathetic system
      - a. Stimulatory
      - b. Release of norepinephrine
      - c. Alpha receptors
      - d. Beta receptors
        - i. inotropic effect
        - ii. dromotropic effect
        - iii. chronotropic effect
- IV. Epidemiology
  - A. Incidence
    - 1. Prevalence of cardiac death outside of a hospital

2. Prevalence of prodromal signs and symptoms
3. Increased redognition of the need for early reperfusion
- B. Morbidity/mortality
  1. Reduced with early recognition
  2. Reduced with early access to the EMS system
- C. Risk factors
  1. Age
  2. Family history
  3. Hypertension
  4. Lipids
    - a. Hypercholesterolemia
    - b. LDL/HDL ratios
  5. Gender
  6. Smoking
  7. Carbohydrate intolerance
- D. Possible contributing risks
  1. Diet
  2. Gender
  3. Obesity
  4. Oral contraceptives
  5. Sedentary living
  6. Personality type
  7. Psychosocial tensions
- E. Prevention strategies
  1. Early recognition
  2. Education
  3. Alteration of life style
- V. Primary survey for cardiovascular assessment
  - A. Level of responsiveness
  - B. Airway
    1. Patent
    2. Debris, blood
  - C. Breathing
    1. Absent
    2. Present
    3. Rate and depth
      - a. Effort
      - b. Breath sounds
        - i. characteristics
        - ii. significance
  - D. Circulation
    1. Pulse
      - a. Absent
      - b. Present
        - i. Pulse deficit

- ii. Pulsus paradoxus
    - iii. Pulsus alternans
  - 2. Skin
    - a. Color
    - b. Temperature
    - c. Moisture
    - d. Turgor
    - e. Mobility
    - f. Edema
  - 3. Blood pressure

VI. History and physical/ SAMPLE format

- A. Chief complaint
- B. Pain
  - 1. OPQRST
    - a. Onset/ origin
      - i. pertinent past history
      - ii. time of onset
    - b. Provocation
      - i. exertional
      - ii. non-exertional
    - c. Quality
    - d. Region/ radiation
    - e. Severity
    - f. Timing
      - i. duration
      - ii. worsening or improving
      - iii. continuous or intermittent
      - iv. at rest or with activity
- C. Dyspnea
  - 1. Continuous or intermittent
  - 2. Exertional
  - 3. Non-exertional
  - 4. Orthopneic
- D. Cough
  - 1. Dry
  - 2. Productive
- E. Related signs and symptoms
  - 1. Level of consciousness
  - 2. Diaphoresis
  - 3. Restlessness, anxiety
  - 4. Feeling of impending doom
  - 5. Nausea/ vomiting
  - 6. Fatigue
  - 7. Palpitations

8. Edema
  - a. Extremities
  - b. Sacral
9. Headache
10. Syncope
11. Behavioral change
12. Anguished facial expression
13. Activity limitations
14. Trauma
- F. Past medical history
  1. Coronary artery disease
  2. Atherosclerotic heart disease
    - a. Abnormal lipid metabolism or excessive intake of saturated fats and cholesterol
    - b. Subendothelial accumulation of fatty streaks
    - c. Altered endothelial function
    - d. Disruption of endothelium
    - e. Formation of mature fibrous plaque
    - f. Resultant diseases:
      - i. angina
      - ii. previous MI
      - iii. hypertension
      - iv. congestive heart failure
  3. Valvular disease
  4. Aneurysm
  5. Pulmonary disease
  6. Diabetes
  7. Renal disease
  8. Vascular disease
  9. Inflammatory cardiac disease
  10. Previous cardiac surgery
  11. Congenital anomalies
  12. Current/ past medications
    - a. Prescribed
      - i. compliance
      - ii. non-compliance
    - b. Borrowed
    - c. Over-the-counter
    - d. Home remedies
    - e. Recreational
  13. Allergies
  14. Family history
    - a. Stroke, heart disease, diabetes, hypertension
    - b. Age at death
  15. Known cholesterol levels

VII. Secondary survey for cardiovascular assessment

A. Inspection

1. Tracheal position
2. Neck veins
  - a. Appearance
  - b. Pressure
  - c. Clinical significance
3. Thorax
  - a. Configuration
  - b. A-P diameter
  - c. Movement with respirations
4. Epigastrium
  - a. Pulsation
  - b. Distention
  - c. Clinical significance

B. Auscultation

1. Neck
  - a. Normal
  - b. Abnormal
2. Breath sounds
  - a. Depth
  - b. Equality
  - c. Adventitious sounds
    - i. crackles/rales
    - ii. wheezes/rhonchi
      - a) gurgling
      - b) frothing (mouth and nose)
        - i) blood tinged
        - ii) foamy
3. Heart sounds
  - a. Auscultatory sites
  - b. Identify S<sub>1</sub>, S<sub>2</sub>
  - c. Identify abnormal sounds (S<sub>3</sub>, S<sub>4</sub>)

C. Palpation

1. Areas of crepitus or tenderness
2. Thorax
3. Epigastrium
  - a. Pulsation
  - b. Distention

VIII. Electrocardiographic (ECG) monitoring

A. Electrophysiology and wave forms

1. Origination
2. Production
3. Relationship of cardiac events to wave forms



4. Intervals
  - a. Normal
  - b. Clinical significance
5. Segments
- B. Leads and electrodes
  1. Electrode
  2. Leads
    - a. Anatomic positions
    - b. Correct placement
  3. Surfaces of heart and lead systems
    - a. Inferior
    - b. Left lateral
    - c. Anterior/ posterior
  4. Artifact
- C. Standardization
  1. Amplitude
  2. Height
  3. Rate
    - a. Duration
    - b. Wave form
    - c. Segment
    - d. Complex
    - e. Interval
- D. Wave form analysis
  1. Isoelectric
  2. Positive
  3. Negative
  4. Calculation of ECG heart rate
    - a. Regular rhythm
      - i. ECG strip method
      - ii. "300"/triplicate method
    - b. Irregular rhythm
      - i. ECG strip method
      - ii. "300"/triplicate method
- E. Lead systems and heart surfaces
  1. ECG rhythm analysis
    - a. Value
    - b. Limitations
  2. Heart surfaces
    - a. Inferior
    - b. Left lateral
    - c. Precordial
  3. Acute signs of ischemia, injury and necrosis
    - a. Rationale

- i. possible early identification of patients with acute myocardial infarction for intervention (thrombolysis PTCA)
    - ii. the role of out-of-hospital 12-lead ECG is not universally available but is appropriate in most EMS settings with proper medical oversight
  - b. Advantages/ disadvantages
  - c. ST segment elevation
    - i. height, depth and contour
    - ii. ST (acute changes)
      - a) anterior wall -- significant ST elevation in V1- V4 may indicate anterior involvement
      - b) inferior wall -- significant ST elevation in II, III and aVF may indicate inferior involvement
    - iii. ST segment depression in eight or more leads
    - iv. ST segment elevation in aVR and V1
  - d. Q waves
    - i. depth, duration and significance
      - a) greater than 5 mm, greater than .04 seconds
      - b) may indicate necrosis
      - c) may indicate extensive transient ischemia
- F. Cardiac arrhythmias
  - 1. Approach to analysis
    - a. P wave
      - i. configuration
      - ii. duration
      - iii. arial rate and rhythm
    - b. P-R (P-Q) interval
    - c. QRS complex
      - i. configuration
      - ii. duration
      - iii. ventricular rate and rhythm
    - d. S-T segment
      - i. contour
      - ii. elevation
      - iii. depression
    - e. Q-T interval
      - i. duration
      - ii. implication of prolongation
    - f. Relationship of P waves to QRS complexes
      - i. consistent
      - ii. progressive prolongation
      - iii. no relationship
    - g. T waves
    - h. U waves

2. Interpretation of the ECG
  - a. Origin of complex
  - b. Rate
  - c. Rhythm
  - d. Clinical significance
3. Arrhythmia originating in the sinus node
  - a. Sinus bradycardia
  - b. Sinus tachycardia
  - c. Sinus arrhythmia
  - d. Sinus arrest
4. Arrhythmias originating in the atria
  - a. Premature atrial complex
  - b. Atrial (ectopic) tachycardia
  - c. Re-entrant tachycardia
  - d. Multifocal atrial tachycardia
  - e. Atrial flutter
  - f. Atrial fibrillation
  - g. Atrial flutter or atrial fibrillation with junctional rhythm
  - h. Atrial flutter or atrial fibrillation with pre-excitation syndromes
5. Arrhythmias originating within the AV junction
  - a. First degree AV block
  - b. Second degree AV block
    - i. Type I (Wenkebach)
    - ii. Type II/ infranodal (Classical)
  - c. Complete AV block (third degree block)
6. Arrhythmias sustained or originating in the AV junction
  - a. AV nodal re-entrant tachycardia
  - b. AV reciprocating tachycardia
    - i. narrow
    - ii. wide
  - c. Junctional escape rhythm
  - d. Premature junctional complex
  - e. Accelerated junctional rhythm
  - f. Junctional tachycardia
7. Arrhythmias originating in the ventricles
  - a. Idioventricular rhythm
  - b. Accelerated idioventricular rhythm
  - c. Premature ventricular complex (ventricular ectopic)
    - i. R on T phenomenon
    - ii. paired/ couplets
    - iii. multiformed
    - iv. frequent uniform
  - d. "Rule of bigeminy" pertaining to precipitating ventricular arrhythmias
  - e. Ventricular tachycardia
    - i. monomorphic
    - ii. polymorphic (including torsades de pointes)

- f. Ventricular fibrillation
- g. Ventricular standstill
- h. Asystole
- 8. Abnormalities originating within the bundle branch system
  - a. Incomplete or complete
  - b. Right bundle branch block
  - c. Left bundle branch block
- 9. Differentiation of wide QRS complex tachycardia
  - a. Potential causes
    - i. supraventricular tachycardia with bundle branch block
    - ii. accessory pathways
  - b. Differentiation
    - i. physical evaluation
      - a) Cannon "A" waves
      - b) vary intensity of first heart tone
      - c) beat to beat changes in blood pressure
    - ii. ECG differences
      - a) aberration as a result of premature atrial complex
        - i) identify PAC in previous ST segment or T wave
        - ii) sudden change in rate with bundle branch aberration
        - iii) concealed retrograde conduction
        - iv) right bundle branch refractoriness - may be time dependent
        - v) compare with previous ECG, when available
      - b) RBBB aberration -  $V_1$  – positive
        - i) biphasic lead I with a broad terminal S-wave
        - ii) triphasic QRS in  $V_4$
      - c) LBBB aberration -  $V_1$  – negative
        - i) monophasic notched lead I
        - ii) slurred, notched or  $RSr'$  in lead  $V_4$ ,  $V_5$ , or  $V_6$
      - d) Concordant precordial pattern
        - i) totally negative precordial pattern is diagnostic of ventricular tachycardia
        - ii) totally positive precordial pattern is suggestive of ventricular tachycardia
      - e) Preexisting BBB prior to onset of tachycardia (by history)
    - iii. Other considerations
      - a) When in doubt:
        - i) cardioversion when hemodynamic state is compromised or changing as evidenced by CNS changes

- ii) never use verapamil
    - iii) if hemodynamic state is stable - consider lidocaine
  - b) Pitfalls
    - i) age is not a differential
    - ii) slower rates may present with stable hemodynamic
    - iii) preexisting BBB prior to onset of the tachycardia
  - c) Regularity
    - i) monomorphic V-tach and SVT are usually very regular and SVT frequently is faster
    - ii) polymorphic V-tach is irregular
- 10. Pulseless electrical activity
  - a. Electrical mechanical dissociation
  - b. Mechanical impairments to pulsations/ cardiac output
  - c. Other possible causes
- 11. Other ECG phenomena
  - a. Accessory pathways
  - b. Preexcitation phenomenon
  - c. Aberration versus ectopy
- 12. ECG changes due to electrolyte imbalances
  - a. Hyperkalemia
  - b. Hypokalemia
- 13. ECG changes in hypothermia

## IX. Management of the patient with an arrhythmia

- A. Assessment
  - 1. Symptomatic
  - 2. Hypotensive
  - 3. Hypoperfusion
  - 4. Mechanical
  - 5. Vagal maneuvers - if the heart rate is too fast
  - 6. Stimulation - If heart rate is too slow
  - 7. Cough
- B. Pharmacological interventions
  - 1. Gases
  - 2. Sympathomimetic
  - 3. Anticholinergic
  - 4. Antiarrhythmic
  - 5. Beta blocker
    - a. Selective
    - b. Non-selective
  - 6. Vasopressor
  - 7. Calcium channel blocker
  - 8. Purine nucleoside

9. Platelet aggregate inhibitor
  10. Alkalinizing agents
  11. Cardiac glycoside
  12. Narcotic/ analgesic
  13. Diuretic
  14. Nitrate
  15. Antihypertensive
- C. Electrical interventions
1. Purpose
  2. Methods
    - a. Synchronized cardioversion
    - b. Defibrillation
    - c. Cardiac pacing
      - i. Implanted pacemaker functions
        - a) Characteristics
        - b) Pacemaker artifact
        - c) ECG tracing of capture
        - d) Failure to sense
          - i) ECG indications
          - ii) clinical significance
        - e) Failure to capture
          - i) ECG indications
          - ii) clinical significance
        - f) Failure to pace
          - i) ECG indications
          - ii) clinical significance
        - g) Pacer-induced tachycardia
          - i) ECG findings
          - ii) clinical significance
          - iii) refer to ILCOR Consensus for treatment
      - ii. Transcutaneous pacing
        - a) Criteria for use
          - i) bradycardia
            - (a) patient is hypotensive/  
hypoperfusing with CNS  
involvement
            - (b) refer to ILCOR Consensus for  
treatment
          - ii) second degree av block
            - (a) patient is hypotensive/  
hypoperfusing with CNS  
involvement
            - (b) refer to ILCOR Consensus for  
treatment

- iii) complete AV block
          - (a) patient is hypotensive/  
hypoperfusing with CNS  
involvement
          - (b) refer to ILCOR Consensus for  
treatment
  - d. Set-up
    - i. placement of electrodes
    - ii. rate and milliamperage (mA) settings
    - iii. pacemaker artifact
    - iv. capture
    - v. failure to sense
      - a) causes
      - b) implications
      - c) interventions
    - vi. failure to capture
      - a) causes
      - b) implications
      - c) interventions
    - vii. failure to pace
      - a) causes
      - b) implications
      - c) interventions
    - viii. hazards
    - ix. complications
  - D. Transport
    - 1. Indications for rapid transport
    - 2. Indications for no transport required
    - 3. Indications for referral
  - E. Support and communications strategies
    - 1. Explanation for patient, family, significant others
    - 2. Communications and transfer of data to the physician
- X. Acute coronary syndrome
- A. Epidemiology
  - B. Precipitating causes
    - 1. Atherosclerosis
    - 2. Vasospastic (Prinzmetal's)
  - C. Morbidity/ mortality
    - 1. Not a self-limiting disease
    - 2. Chest pain may dissipate, but myocardial ischemia and injury can continue
    - 3. A single anginal episode may be a precursor to myocardial infarction
    - 4. May not be cardiac in origin
    - 5. Must be diagnosed by a physician

6. Related terminology
  - a. Defined as a brief discomfort, has predictable characteristics and is relieved promptly - no change in this pattern
  - b. Stable
    - i. occurs at a relative fixed frequency
    - ii. usually relieved by rest and/ or medication
  - c. Unstable
    - i. occurs without fixed frequency
    - ii. may or may not be relieved by rest and/ or medication
  - d. Initial - first episode
  - e. Progressive - accelerating in frequency and duration
  - f. Preinfarction angina
    - i. pain at rest
    - ii. sitting or lying down
7. Differential diagnoses
  - a. Cholecystitis
  - b. Acute viral pericarditis or any other inflammatory cardiac disease
  - c. Aneurysm
  - d. Hiatal hernia
  - e. Esophageal disease
  - f. Gastric reflux
  - g. Pulmonary embolism
  - h. Peptic ulcer disease
  - i. Pancreatitis
  - j. Chest wall syndrome
  - k. Costochondritis
  - l. Acromioclavicular disease
  - m. Pleural irritation
  - n. Respiratory infections
  - o. Aortic dissection
  - p. Pneumothorax
  - q. Dyspepsia
  - r. Herpes zoster
  - s. Chest wall tumors
  - t. Chest wall trauma
- D. Primary survey findings
  1. Airway/ breathing
    - a. Labored breathing may or may not be present
  2. Circulation
    - a. Peripheral pulses
      - i. quality
      - ii. rhythm
    - b. Peripheral perfusion
      - i. changes in skin (color, temperature and moisture)



- E. History of the present illness/SAMPLE history
  - 1. Chief complaint
    - a. Typical - sudden onset of discomfort, usually of brief duration, lasting three to five minutes, maybe 5 to 15 minutes; never 30 minutes to 2 hours
    - b. Typical - usually relieved by rest and/or medication
    - c. Epigastric pain or discomfort
    - d. Atypical
  - 2. Denial
  - 3. Contributing history
    - a. Initial recognized event
    - b. Recurrent event
    - c. Increasing frequency and/or duration of event
- F. Secondary survey findings
  - 1. Airway
  - 2. Breathing
    - a. May or may not be labored
    - b. Breath sounds
      - i. may be clear to auscultation
      - ii. may be congested in the bases
  - 3. Circulation
    - a. Alterations in heart rate and rhythm may occur
    - b. Peripheral pulses are usually not affected
    - c. Blood pressure may be elevated during the episode and normalize afterwards
    - d. ECG Devices
      - i. monitor
      - ii. transmission
      - iii. documentation
      - iv. computerized pattern identification
      - v. pitfalls
      - vi. common errors
    - e. Findings
      - i. ST segment changes are often not specific
      - ii. arrhythmias and ectopy may not be present
- G. Management
  - 1. Position of comfort
  - 2. Refer to ILCOR Consensus for treatment
  - 3. ECG
    - a. Whenever possible, and scene time is not delayed, record and transmit 3-lead and/ or 12-lead ECG during pain, since ECG may be normal during the pain-free period
    - b. Measure, record and communicate ST segment changes
  - 4. Indications for Rapid Transport
    - a. Sense of urgency for reperfusion
    - b. No relief with medications

- c. Hypotension/hypoperfusion with CNS involvement
      - d. Significant changes in ECG
    - 5. No transport
      - a. Patient refusal
      - b. Referral
  - H. Support and communications strategies
    - 1. Explanation for patient, family, significant others
    - 2. Communications and transfer of data to the physician
- XI. Acute myocardial infarction/Angina
- A. Epidemiology
  - B. Precipitating causes (as with angina)
    - 1. Atherosclerosis
    - 2. Persistent angina
    - 3. Occlusion
    - 4. Non-traumatic
      - a. Recreational drugs
    - 5. Trauma
  - C. Morbidity/ mortality
    - 1. Sudden death
    - 2. Extensive myocardial damage
    - 3. May result in ventricular fibrillation
  - D. Primary survey findings
    - 1. Airway/ breathing
    - 2. Circulation
      - a. Peripheral pulses
        - i. quality
        - ii. rhythm
      - b. Peripheral perfusion
        - i. changes in skin
          - a) color
          - b) temperature
          - c) moisture
  - E. History of the present illness/SAMPLE history
    - 1. Chief complaint
      - a. Typical onset of discomfort, usually of long duration, over 30 minutes
      - b. Typically unrelieved by rest and/ or nitroglycerin preparation
      - c. Epigastric pain or discomfort
      - d. Atypical
    - 2. Contributing history
      - a. First time
      - b. Recurrent
      - c. Increasing frequency and/ or duration
    - 3. Denial

- F. Secondary survey findings
  - 1. Airway
  - 2. Breath sounds
    - a. May be clear to auscultation
    - b. Congestion in bases may be present
  - 3. Circulation
    - a. Skin
      - i. pallor during the episode
      - ii. temperature may vary
      - iii. diaphoresis is usually present
    - b. Alterations in heart rate and rhythm may occur
    - c. Peripheral pulses are usually not affected
    - d. Blood pressure may be elevated or lowered
    - e. ECG findings
      - i. ST segment elevation
        - a) height, depth and contour
        - b) ST changes
        - c) ST segment depression in reciprocal leads
      - ii. Q waves
        - a) depth, duration and significance
        - b) greater than 5 mm, greater than .04 seconds
        - c) may indicate necrosis
        - d) may indicate extensive transient ischemia
      - iii. ECG Rhythm analysis
        - a) criteria for patient selection for rapid transport and reperfusion
        - b) value
        - c) signs of acute ischemia, injury, and necrosis
        - d) criteria for patient selection for rapid transport and reperfusion
          - i) time of onset of pain
          - ii) location of ischemia and infarction
          - iii) ST segment elevation
        - e) cardiac arrhythmias
          - i) sinus tachycardia with or without ectopy
          - ii) narrow or wide QRS complex tachycardia
          - iii) sinus bradycardia
          - iv) heart blocks
          - v) ventricular fibrillation
          - vi) pulseless electrical activity (PEA)
          - vii) asystole (confirmed in a second lead)
- G. Management
  - 1. Position of comfort
  - 2. Refer to ILCOR Consensus for treatment

3. Transport
  - a. Criteria for rapid transport
    - i. no relief with medications
    - ii. hypotension/ hypoperfusion
    - iii. significant changes in ECG
      - a) ectopy
      - b) arrhythmias
  - b. ECG criteria for rapid transport and reperfusion
    - i. time of onset of pain
    - ii. ECG rhythm abnormalities
4. Indications for “no transport”
  - a. Refusal
  - b. No other indications for no-transport
5. Support and communications strategies
  - a. Explanation for patient, family, significant others
  - b. Communications and transfer of data to the physician

## XII. Heart failure

- A. Epidemiology
- B. Precipitating causes
  1. Left-sided failure
  2. Right-sided failure
  3. Myocardial infarction
  4. Pulmonary embolism
  5. Hypertension
  6. Cardiomegaly
  7. High output failure
  8. Low output failure
- C. Related terminology
  1. Preload
  2. Afterload
  3. Congestive heart failure
  4. Chronic versus acute
    - a. First time event
    - b. Multiple events
- D. Morbidity/ mortality
  1. Pulmonary edema
  2. Respiratory failure
  3. Death
- E. Primary survey
  1. Airway/ breathing
  2. Circulation
    - a. Peripheral pulses
      - i. quality
      - ii. rhythm
    - b. Peripheral perfusion
      - i. changes in skin (color, temperature and moisture)

- F. History of the present illness/SAMPLE history
  - 1. Chief complaint
    - a. Progressive or acute SOB
    - b. Progressive accumulation of edema
    - c. Weight gain over short period of time
    - d. Episodes of paroxysmal nocturnal dyspnea
    - e. Prescribed medication history
      - i. Compliance
      - ii. Non-compliance
      - iii. Borrowed
      - iv. Over-the-counter
      - v. Home remedies
    - f. Home oxygen use
- G. Secondary survey findings
  - 1. Level of consciousness
    - a. Unconscious
    - b. Altered levels of consciousness
  - 2. Airway/ breathing
    - a. Dyspnea
    - b. Productive cough
    - c. Labored breathing
      - i. most common, often with activity
      - ii. paroxysmal nocturnal dyspnea (PND)
      - iii. tripod position
      - iv. adventitious sounds
      - v. retraction
  - 3. Circulation
    - a. Heart rate/ rhythm
      - i. any tachycardia with ectopy
      - ii. any bradycardia with ectopy
      - iii. atrial arrhythmias
    - b. Changes in skin
      - i. color
      - ii. temperature
      - iii. moisture
    - c. Peripheral pulses
      - i. quality
      - ii. rhythm
    - d. Edema
      - i. pitting versus non-pitting
      - ii. extremities
        - a) localized in ankles
        - b) to the midcalf
        - c) to the knees
        - d) obliteration of pulses
      - iii. ascites
      - iv. sacral

- H. Complications
  - 1. Pulmonary edema (signs and symptoms)
    - a. Tachypne
    - b. wheezing/rhonchi
    - c. crackles/rales at both bases
    - d. frothy sputum
    - e. elevated jugular venous pressure
    - f. pulsus paradoxus
    - g. rapid "thready" pulse
    - h. pulsus alternans
    - i. cyanosis in advanced stages
    - j. abnormalities of apical pulse
      - i. due to displaced cardiac apex
      - ii. abnormal bulges
- I. Management
  - 1. Position of comfort
  - 2. Refer to ILCOR Consensus for treatment
  - 3. Transport
    - a. Refusal
    - b. No other indications for no-transport
- J. Support and communications strategies
  - 1. Explanation for patient, family, significant others
  - 2. Communications and transfer of data to the physician

### XIII. Non-Traumatic Cardiac tamponade

- A. Pathophysiology
  - 1. Defined as impaired diastolic filling of the heart caused by increased intrapericardiac pressure
- B. Precipitating causes
  - 1. Gradual onset with neoplasm or infection
  - 2. Acute onset with infarction
  - 3. Trauma
    - a. Can occur with CPR
    - b. Penetrating injury
    - c. Non-penetrating injury
  - 4. Secondary to renal disease
  - 5. Hypothyroidism
- C. Morbidity/ mortality
- D. Primary survey
  - 1. Airway/ breathing
  - 2. Circulation
    - a. Peripheral pulses
      - i. quality
      - ii. rhythm

- b. Peripheral perfusion
      - i. Skin color
      - ii. Temperature
      - iii. Moisture
  - E. History of the present illness/SAMPLE history (consider precipitating causes listed above)
  - F. Secondary survey
    - 1. Airway/ breathing
      - a. Dyspnea
      - b. Orthopnea
    - 2. Circulation
      - a. Pulse rate and rhythm
      - b. Chest pain
      - c. Tachycardia
      - d. Ectopy
      - e. Elevated venous pressures (early sign)
      - f. Decreased systolic pressure (early sign)
      - g. Narrowing pulse pressure (early sign)
      - h. Pulsus paradoxus
      - i. Heart sounds normal early on, progressively faint or muffled
      - j. ECG changes
        - i. low voltage QRS and T waves
        - ii. ST elevation or non-specific T wave changes
        - iii. electrical alternans of PQRST
        - iv. usually inconclusive - should not be used as a diagnostic tool
  - G. Management
    - 1. Airway management and ventilation
    - 2. Refer to ILCOR Consensus for treatment
    - 3. Rapid transport for pericardiocentesis
  - H. Support and communications strategies
    - 1. Explanation for patient, family, significant others
    - 2. Communications and transfer of data to the physician
- XIV. Hypertensive emergencies
  - A. Epidemiology
  - B. Precipitating causes
    - 1. History of hypertension
    - 2. Non-compliance with medication or any other treatment
    - 3. Toxemia of pregnancy
  - C. Morbidity/ mortality
    - 1. Hypertensive encephalopathy
    - 2. Stroke
  - D. Primary examination
    - 1. Airway/ breathing
    - 2. Circulation

- a. Peripheral pulses
      - i. quality
      - ii. rhythm
    - b. Peripheral perfusion
      - i. changes in skin color
      - ii. changes in skin temperature
      - iii. changes in skin moisture
- E. History of the present illness/SAMPLE history (consider precipitating causes listed above)
  - 1. Chief complaint
  - 2. Medication history
    - a. Prescribed
      - i. compliance
      - ii. non-compliance with medication or treatment
    - b. Borrowed
    - c. Over-the-counter
    - d. Home remedies
  - 3. Home oxygen use
- F. Secondary survey
  - 1. Airway
  - 2. Circulation
    - a. Pulse
    - b. Vital signs
  - 3. Diagnostic signs/ symptoms
    - a. General appearance
    - b. Level of consciousness
      - i. unconscious
      - ii. altered level of consciousness
      - iii. responsive
    - c. Skin color
    - d. Skin hydration
    - e. Skin temperature
    - f. Peripheral pulses
    - g. Edema
    - h. Paroxysmal nocturnal dyspnea
    - i. Labored breathing (SOB)
    - j. Orthopnea
    - k. Vertigo
    - l. Epistaxis
    - m. Tinnitus
    - n. Changes in visual acuity
    - o. Nausea/vomiting
    - p. Seizures
    - q. Lateralizing signs
    - r. ECG findings



- G. Management
    - 1. Position of comfort
    - 2. Airway and ventilation
    - 3. Refer to ILCOR Consensus for treatment
    - 4. Rapid transport
      - a. Refusal
      - b. No other indications for no transport
  - H. Support and communications strategies
    - 1. Explanation for patient, family, significant others
    - 2. Communications and transfer of data to the physician
- XV. Cardiogenic shock
- A. Pathophysiology
  - B. Precipitating causes
    - 1. Myocardial infarction
    - 2. Age
    - 3. Trauma
  - C. Primary survey
    - 1. Airway/ breathing
    - 2. Circulation
      - a. Peripheral pulses
        - i. quality
        - ii. rhythm
      - b. Peripheral perfusion
        - i. changes in skin color
        - ii. changes in skin temperature
        - iii. changes in skin moisture
  - D. History of the present illness/SAMPLE history (consider precipitating causes listed above)
    - 1. Chief complaint
    - 2. Medication history
      - a. Prescribed
        - i. compliance
        - ii. non-compliance
      - b. Borrowed
      - c. Over-the-counter
      - d. Home remedies
  - E. Secondary survey
    - 1. Critical findings
      - a. Unconscious
      - b. Altered levels of consciousness
      - c. Airway
        - i. dyspnea
        - ii. productive cough
        - iii. labored breathing
          - a) paroxysmal nocturnal dyspnea (PND)
          - b) tripod position

- c) adventitious sounds
    - d) retraction
  - d. ECG rhythm analysis
    - i. any tachycardia
    - ii. atrial arrhythmias
    - iii. ectopics
  - e. Changes in skin
    - i. color
    - ii. temperature
    - iii. moisture
  - f. Peripheral pulses
    - i. quality
    - ii. rhythm
  - g. Edema
    - i. pitting versus non-pitting
    - ii. extremities
    - iii. obliteration of pulses
    - iv. sacral
- F. Management
  - 1. Position of comfort
  - 2. Refer to ILCOR Consensus for treatment
  - 3. Transport
    - a. Refusal
    - b. No other indications for no transport
- G. Support and communications strategies
  - 1. Explanation for patient, family, significant others
  - 2. Communications and transfer of data to the physician

## XVI. Cardiac arrest

- A. Pathophysiology
- B. Precipitating causes
  - 1. Trauma
  - 2. Medical conditions (for example)
    - a. End stage renal disease
    - b. Hyperkalemia with renal disease
- C. Primary survey critical findings
  - 1. Unresponsive
  - 2. Apneic
  - 3. Peripheral pulses absent
  - 4. Heart rate/ rhythm
    - a. Ventricular fibrillation
    - b. ventricular tachycardia
    - c. asystole
    - d. PEA

- D. History of the present illness/SAMPLE history (consider precipitating causes listed above)
  - 1. Witnessed event
  - 2. Witnessed by EMS personnel
  - 3. Bystander cardiopulmonary resuscitation (CPR)
  - 4. Time from discovery to activation of CPR
  - 5. Time from discovery to activation of EMS
  - 6. Past medical history
- E. Management
  - 1. Related terminology
    - a. Resuscitation - to provide efforts to return spontaneous pulse and breathing to the patient in full cardiac arrest
    - b. Survival - patient is resuscitated and survives to hospital discharge
    - c. Return of spontaneous circulation (ROSC) - patient is resuscitated to the point of having pulse without CPR; may or may not have return of spontaneous respirations; patient may or may not go on to survive
  - 2. Indications for WITHHOLDING resuscitation efforts
  - 3. Advanced airway management and ventilation
  - 4. Circulation
  - 5. IV therapy as appropriate
  - 6. Refer to ILCOR Consensus for treatment
  - 7. Rapid transport
- F. Support and communications strategies
  - 1. Explanation for patient, family, significant others
  - 2. Communications and transfer of data to the physician
- G. Termination of resuscitation efforts
  - 1. Inclusion criteria (for example)
    - a. 18 or older
    - b. Arrest is presumed cardiac in origin and not associated with a condition potentially responsive to hospital treatment (for example - hypothermia, drug overdose, toxicologic exposure, etc.)
    - c. Endotracheal intubation has been successfully accomplished and maintained
    - d. Standard advanced cardiac life support (ACLS) measures have been applied throughout the resuscitative effort
    - e. On-scene ALS resuscitation efforts have been sustained for 25 minutes or the patient remains in asystole through four rounds of appropriate ALS drugs
    - f. Patient has a cardiac rhythm of asystole or agonal rhythm at the time the decision to terminate is made and this rhythm persists until the arrest is actually terminated
    - g. Victims of blunt trauma in arrest whose presenting rhythm is asystole, or who develop asystole while on scene

2. Exclusion criteria - for example
  - a. Under the age of 18 years
  - b. Etiology for which specific in-hospital treatment may be beneficial
  - c. Persistent or recurrent ventricular tachycardia or fibrillation
  - d. Transient return of pulse
  - e. Signs of neurological viability
  - f. Arrest was witnessed by EMS personnel
  - g. Family or responsible party opposed to termination
3. Criteria NOT to be considered as inclusionary or exclusionary
  - a. Patient age - for example, geriatric
  - b. Time of collapse prior to EMS arrival
  - c. Presence of a non-official do-not-resuscitate (DNR) order
  - d. "Quality of life" valuations
4. Procedures (according to local protocol)
  - a. Direct communication with medical oversight
    - i. medical condition of the patient
    - ii. known etiologic factors
    - iii. therapy rendered
    - iv. family present and apprised of the situation
    - v. communicate any resistance or uncertainty on the part of the family
    - vi. maintain continuous documentation to include the ECG
    - vii. mandatory review after the event
      - a) grief support (according to local protocol)
        - i) EMS assigned personnel
        - ii) community agency referral
      - b) law enforcement (according to local protocol)
        - i) on-scene determination if the event/ patient requires assignment of the patient to the medical examiner
        - ii) on-scene law enforcement communicates with attending physician for the death certificate
        - iii) if there is any suspicion about the nature of the death, or if the physician refuses or hesitates to sign the death certificate
        - iv) no attending physician is identified (the patient will be assigned to the medical examiner)

## XVII. Vascular disorders

- A. Epidemiology
  1. Trauma
  2. Non-traumatic
  3. Precipitating causes
    - a. Atherosclerosis

- b. Aneurysm
      - i. atherosclerotic
      - ii. dissecting
      - iii. infections
      - iv. congenital
    - c. Marfan's syndrome
    - d. Inflammation
      - i. arterial
      - ii. peripheral arterial atherosclerotic disease
    - e. Occlusive disease
      - i. trauma
      - ii. thrombosis
      - iii. tumor
      - iv. embolus
      - v. idiopathic
    - f. Venous thrombosis
      - i. phlebitis
      - ii. varicose veins
- B. Morbidity/ mortality
  - 1. Pulmonary occlusion
  - 2. Cerebral occlusion
  - 3. Mesenteric occlusion
  - 4. Hypoperfusion state
  - 5. Death
- C. Primary survey
  - 1. Airway/ breathing
  - 2. Circulation (distal to or over the affected area)
    - a. Pain
    - b. Pallor
    - c. Pulselessness
    - d. Paralysis
    - e. Paresthesia
  - 3. Skin
    - a. Pallor or mottled distal to or over the affected area
    - b. Skin temperature may vary
- D. History of the present illness/SAMPLE history (consider precipitating causes listed above)
  - 1. Chief complaint
    - a. Sudden or gradual onset of discomfort
    - b. May be localized
    - c. Pain
      - i. chest, abdominal or involved extremity
        - a) sudden or gradual
        - b) radiating or localized
        - c) claudication
      - ii. relief with rest or not

2. Contributing history
  - a. Initial recognized event
  - b. Recurrent event
  - c. Increasing frequency and/ or duration of event
- E. Secondary survey
  1. Airway
  2. Breath sounds
    - a. May be clear to auscultation
  3. Circulation
    - a. Alterations in heart rate and rhythm may occur
    - b. Peripheral pulses absent or diminished over the affected extremity
    - c. Blood pressure
    - d. Bruit over affected vessel(s)
    - e. Skin
      - i. may be cool reflecting diminished circulation to the affected area or extremity
      - ii. may be moist or dry reflecting diminished circulation to the affected area or extremity
    - f. ECG findings may be non contributory
- F. Management
  1. Position of comfort
  2. Refer to ILCOR Consensus for treatment
  3. Transport
    - a. Indications for rapid transport
      - i. no relief with medications
      - ii. hypotension/ hypoperfusion
    - b. No transport
      - i. refusal
      - ii. relief and refusal
- G. Support and communications strategies
  1. Explanation for patient, family, significant others
  2. Communications and transfer of data to the physician

## XVIII. Aortic Aneurysm/Dissection

- A. Thoracic
- B. Abdominal

## XIX. Thromboembolism

- A. Arterial Occlusion
- B. Venous Thrombosis

## XX. Congenital Heart Disease

- A. Pulmonary Stenosis
  1. Stenosis of pulmonary valve

- 2. Increased Resistance to Outflow
- 3. Elevates Right Ventricular Pressure
- 4. Limits pulmonary blood flow
- B. Septal Defects
  - 1. Atrial -- Blood from left atrium passes into right atrium
  - 2. Ventricular -- Blood from left ventricle passes into right ventricle
- C. Patent Ductus Arteriosus
  - 1. Ductus Arteriosus fails to close during embryonic development
  - 2. Blood flow continuously from aorta through ductus into the pulmonary artery
  - 3. Increases workload of left ventricle

#### XXI. Valvular Heart Disease

- A. Stenosis
- B. Regurgitation

#### XXII. Coronary Artery Disease

- A. Atherosclerosis
- B. Intravascular Lesion
  - 1. Coronary Vasospasm
    - a. Reduced blood flow
    - b. Decreased oxygen delivery to myocardium
    - c. May be drug induced (cocaine)
  - 2. Plaque rupture
    - a. Vasoconstriction
    - b. Platelet Adherence
    - c. Thrombus formation
      - i. partial occlusion
      - ii. complete occlusion

#### XXIII. Infectious Diseases of the Heart

- A. Result from intravascular contamination by pathogen
  - 1. Endocarditis
  - 2. Pericarditis
  - 3. Myocarditis
- B. Damages heart valves
- C. Damages heart muscle
- D. Embolizes

#### XXIV. Cardiomyopathy

- A. Dilated
- B. Hypertrophic

#### XXV. Specific Hypertensive Emergencies

- A. Accelerated and Malignant Hypertension
- B. Hypertensive Encephalopathy

- C. Intracranial Hemorrhage
- D. Acute Left Ventricular Failure
- E. Acute Cardiac Ischemia
- F. Acute Aortic Dissection
- G. Eclampsia

## XXVI. Infectious Diseases of the Heart

- A. Epidemiology
  - 1. Incidence
  - 2. Morbidity and mortality
  - 3. Risk factors
    - a. Injection drug use
    - b. Recent dental surgery
    - c. Permanent central venous access lines
    - d. Prior valve surgery
    - e. Weakened valves
  - 4. Prevention strategies
- B. Pathophysiology
  - 1. Chronic versus acute
    - a. First time event
    - b. Multiple events
  - 2. Involvement
    - a. Heart Muscle
    - b. Heart Valves
    - c. Heart lining
- C. Specific Disease
  - 1. Endocarditis
  - 2. Pericarditis
  - 3. Rheumatic Fever
  - 4. Scarlet Fever
- D. Assessment
  - 1. Primary exam
  - 2. Secondary exam
- E. Management (refer to ILCOR consensus treatment)
  - 1. Initial general therapy
  - 2. Management of arrhythmias
  - 3. Adjunctive prehospital therapy
- F. Consider age-related variations for pediatric and geriatric patients

## XXVII. Congenital Abnormalities and Age-Related Variations

- A. Epidemiology
  - 1. Incidence
  - 2. Morbidity and mortality
  - 3. Risk factors
  - 4. Prevention strategies



- B. Pathophysiology
  - 1. Causes
    - a. Genetic mutations
    - b. Environmental insults
      - i. maternal rubella
      - ii. maternal ingestion of alcohol
      - iii. maternal ingestion of drugs or certain medications
  - 2. Altered embryonic development of heart structures
    - a. Visible
    - b. Microscopic
  - 3. Malformations lead to altered cardiac function and hemodynamics
- C. Specific Diseases
  - 1. Left to right shunt
    - a. Coarctation of the aorta (CoA)
    - b. Atrial septal defect (ASD)
    - c. Ventricular septal defect (VSD)
    - d. Patent ductus arteriosus (PDA)
    - e. Truncus arteriosus
    - f. Congestive heart failure
  - 2. Valvular and vascular lesions
    - a. Tricuspid atresia
    - b. Hypoplastic left heart syndrome (HLHS)
    - c. Tetralogy of Fallot (ToF)
  - 3. Transposition
    - a. Transposition of the great arteries (TGA)
    - b. Total anomalous pulmonary venous return (TAPVR)
  - 4. Congenital Arrhythmias
    - a. Heart Blocks
    - b. Supraventricular tachycardia
- D. Assessment
  - 1. Primary exam
  - 2. Secondary exam
- E. Management (refer to ILCOR consensus treatment)
  - 1. Initial general therapy
  - 2. Management of arrhythmias
  - 3. Adjunctive prehospital therapy

## XXVIII. Integration

- A. Apply pathophysiological principles to the assessment of a patient with cardiovascular disease
- B. Formulation of field impression; decisions based on:
  - 1. Primary examination
  - 2. History of the present illness/SAMPLE history
  - 3. Secondary examination

- C. Develop and execute a patient management plan based on field impression
  - 1. Initial management
    - a. Airway support
    - b. Ventilation support
    - c. Circulation support
    - d. Non-pharmacological interventions
    - e. Pharmacological interventions
    - f. Electrical interventions
  - 2. Re-assessment
  - 3. Transport criteria
    - a. Appropriate mode
    - b. Appropriate facility
  - 4. Non-transport criteria
  - 5. Advocacy
  - 6. Communications
  - 7. Prevention
  - 8. Documentation
  - 9. Quality assurance

# Medicine

## Toxicology

### Paramedic Education Standard

Integrates assessment findings with principles of epidemiology and pathophysiology to formulate a field impression and implement a comprehensive treatment/disposition plan for a patient with a medical complaint.

### Paramedic-Level Instructional Guideline

The Paramedic Instructional Guidelines in this section include all the topics and material at the AEMT level PLUS the following material:

- I. Epidemiology of toxicology emergencies
  - A. Review of epidemiology of poisoning
    - 1. Local
    - 2. Regional
    - 3. National
  - B. National Resources for Poisoning
    - 1. National Poison Control Center
    - 2. National Courses in Toxicology
    - 3. Centers for Disease Control and Prevention (CDC)
  - C. Types of toxicological emergencies
    - 1. Unintentional poisoning
      - a. Dosage errors
      - b. Idiosyncratic reactions
      - c. Childhood poisoning
      - d. Environmental exposure
      - e. Occupational exposures
    - 2. Drug/ alcohol abuse
    - 3. Intentional poisoning/ overdose
      - a. Chemical warfare
      - b. Assault/ homicide
      - c. Suicide attempts
  - D. Pharmacokinetics
  - E. Routes of absorption
    - 1. Ingestion
    - 2. Inhalation
    - 3. Injection
    - 4. Absorption
  - F. Poisoning by ingestion
    - 1. Examples

2. Anatomy and physiology review
  - a. Absorption
  - b. Distribution
3. Assessment findings
4. General management considerations
- G. Poisoning by inhalation
  1. Examples
  2. Anatomy and physiology review
    - a. Absorption
    - b. Distribution
  3. Assessment findings
  4. General management considerations
- H. Poisoning by injection
  1. Examples
    - a. Intravenous drug abuse
    - b. Venomous bites and stings
  2. Anatomy and physiology review
    - a. Absorption
    - b. Distribution
  3. Assessment findings
  4. General management considerations
- I. Poisoning by absorption
  1. Examples
  2. Anatomy and physiology review
    - a. Absorption
    - b. Distribution
  3. Assessment findings
  4. General management considerations
- II. Toxic syndromes (Toxidromes) including drugs of abuse
  - A. Introduction--Pathophysiology, incidence, toxic agents, risk factors, methods of transmission, complications
  - B. Cholinergics
    1. Common causative agents - pesticides (organophosphates, carbamates) and nerve agents (Sarin, Soman)
    2. Assessment findings and symptoms for patients with exposure to cholinergics
      - a. Headache, dizziness, weakness, nausea
      - b. SLUDGE (salivation, lacrimation, urination, defecation, GI Upset, Emesis)
      - c. Bradycardia, wheezing, bronchoconstriction, myosis, coma, convulsions
      - d. Diaphoresis, seizures
    3. Management for a patient with exposure to cholinergics
      - a. Decontamination
      - b. Airway and ventilation and circulation

- c. Pharmacological
      - i. atropine
      - ii. pralidoxime chloride (2-PAM)
      - iii. diazepam
      - iv. activated charcoal
    - d. Non-pharmacological
- C. Anticholinergic
  - 1. Common causative agents
  - 2. Assessment findings and symptoms for patients with exposure to anticholinergics
    - a. Delirium, Flushed Skin, Dilated Pupils, Urinary Retention
    - b. Memory Loss, Seizures
  - 3. Management for a patient with exposure to anticholinergics
    - a. Airway and ventilation
    - b. Pharmacological
    - c. Non-pharmacological
- D. Marijuana and cannabis compounds
  - 1. Common causative agents
  - 2. Assessment findings and symptoms for patients with exposure/use of cannabis
  - 3. Management for a patient with exposure to cannabis
    - a. Airway and ventilation and circulation
    - b. Pharmacological
    - c. Non-pharmacological
- E. Sympathomimetics/Stimulates
  - 1. Common causative agents
    - a. Cocaine
    - b. Methamphetamine
    - c. Ecstasy
    - d. ICE
    - e. Other
  - 2. Assessment findings and symptoms for patients with exposure to/use of Sympathomimetics/Stimulates
    - a. Agitated delirium
    - b. Hypertensive emergencies
    - c. Psychosis/ seizures
    - d. Malignant Hyperthermia
    - e. Cardiac damage
  - 3. Management for a patient with exposure to/use of Sympathomimetics/Stimulates
    - a. Airway and ventilation and circulation
    - b. Pharmacological/Sedation/restraint
    - c. Non-pharmacological

- F. Barbiturates/sedatives/ hypnotics
  - 1. Common causative agents
  - 2. Assessment findings and symptoms for patients with exposure to/use of Barbiturates/sedatives/ hypnotics
    - a. Respiratory depression/ respiratory arrest
    - b. Hypotension
    - c. CNS
  - 3. Management for a patient with exposure to/use of Barbiturates/sedatives/ hypnotics
    - a. Airway and ventilation and circulation
    - b. Pharmacological
    - c. Non-pharmacological
- G. Hallucinogens
  - 1. Common causative agents
    - a. lysergic acid diethylamide (LSD)
    - b. phencyclidine (PCP)
    - c. peyote, mushrooms, jimson weed, mescaline
    - d. Other
  - 2. Assessment findings and symptoms for patients with exposure to/use of Hallucinogens
    - a. CNS and behavioral
    - b. Chest pain
  - 3. Management for a patient with exposure to/use of Hallucinogens
    - a. Airway and ventilation and circulation
    - b. Pharmacological/sedation/restraint
    - c. Non-pharmacological
- H. Opiates
  - 1. Common causative agents
    - a. heroin, morphine, methadone
    - b. codeine, meperidine, propoxyphene
    - c. fentanyl, lortab, oxycontin
    - d. other
  - 2. Assessment findings and symptoms for patients with exposure to/use opiates
    - a. CNS—Euphoria, decreased level of consciousness, sedation
    - b. Hypotension
    - c. Respiratory depression/ arrest
    - d. Nausea, Pinpoint pupils
    - e. Seizures and Coma
  - 3. Management for a patient with exposure to/use of opiates
    - a. Airway and ventilation and circulation
    - b. Pharmacological/sedation/restraint
    - c. Non-pharmacological
- I. Huffing Agent (Halogenated Hydrocarbons)
  - 1. Common causative agents

2. Assessment findings and symptoms for patients with exposure to/use of Huffing agents
  - a. Cardiovascular collapse and Ventricular arrhythmias
  - b. Seizure
  - c. Psychosis
3. Management for a patient with exposure to/use of huffing agents
  - a. Airway and ventilation and circulation
  - b. Pharmacological/sedation/restraint
  - c. Non-pharmacological

### III. Alcoholism

- A. Introduction—Epidemiology, risk factors, morbidity/ mortality complications
- B. Pathophysiology of long term and acute alcohol abuse and withdrawal
  1. End organ damage
    - a. Brain
    - b. Liver
    - c. Heart
    - d. Bone
    - e. Pancreas
  2. Assessment findings and symptoms for patients with acute and chronic alcohol abuse and withdrawal
  3. Management for a patient with exposure to/use of with acute and chronic alcohol abuse and withdrawal
    - a. Airway and ventilation and circulation
    - b. Pharmacological/restraint
    - c. Non-pharmacological

### IV. Poisonings and exposures

- A. Chemicals
  1. Agents
    - a. Cyanide
    - b. Solvents
    - c. Carbon monoxide
    - d. Alcohols
    - e. Hydrocarbons
    - f. Caustics
    - g. Metals
    - h. Hydrogen Fluoride
    - i. Hydrogen Sulfide
    - j. Oxides of Nitrogen
    - k. Ammonia
    - l. Chlorine
  2. Assessment findings and symptoms for patients with chemical poisoning/exposure

3. Management for a patient with chemical poisoning/exposure
  - a. Airway and ventilation and circulation
  - b. Pharmacological
  - c. Non-pharmacological

V. Household Poisons

- A. Pesticides
  1. Organophosphates
  2. Carbamates
  3. Warfarins
  4. Pyrethrums (Raid)
- B. Household Cleaning poisonings
  1. Bleach
  2. Cleaning agents
  3. Pine oil products
- C. Poisonous Plants
  1. China Berry
  2. Foxglove
  3. Mistletoe
  4. Dieffenbachia
  5. Others
- D. Assessment findings and symptoms for patients with poisoning/exposure to household poisons
- E. Management for a patient with chemical poisoning/exposure to household poisons
  1. Airway and ventilation and circulation
  2. Pharmacological
  3. Non-pharmacological

VI. Medication overdose-- Introduction--Pathophysiology, incidence, toxic agents, risk factors, complications

- A. Cardiac medications
- B. Psychiatric medications
- C. Non-prescription pain medications including Salicylates and Acetaminophen
- D. Other
- E. Assessment findings and symptoms for patients with medication overdose
- F. Management for a patient with medication overdose
  1. Airway and ventilation and circulation
  2. Pharmacologic
  3. Non-pharmacologic

VII. General Treatment modalities for Poisonings

- A. Facilitated Airway Control
- B. Respiratory Support
- C. Circulation Support



- D. Antidote Therapy
  - 1. Methylene Blue
  - 2. Cyanide Antidotes
  - 3. Physostigmine
  - 4. Alkalization and Sodium Bicarbonate
  - 5. Atropine and Pralidoxime (2-PAM)
  - 6. Narcan
  - 7. Sedatives
  - 8. Solu-medrol, decadron
  - 9. Beta Agonist
  - 10. Ipecac
  - 11. Haldol
  - 12. Glucagon
  - 13. Flumazenil
  - 14. Dimercapel
  - 15. Digibind
  - 16. Calcium Gluconate
  - 17. Activated Charcoal
- E. Decontamination

VIII. Communication and documentation for patients with toxicological emergencies

IX. Transport decisions with toxicological emergencies

X. Age-related variations for pediatric and geriatric patients

XI. Patient education and prevention of toxicological emergencies and drug and alcohol abuse

# Medicine

## Respiratory

### Paramedic Education Standard

Integrates assessment findings with principles of epidemiology and pathophysiology to formulate a field impression and implement a comprehensive treatment/disposition plan for a patient with a medical complaint.

### Paramedic-Level Instructional Guideline

The Paramedic Instructional Guidelines in this section include all the topics and material at the AEMT level PLUS the following material:

- I. Introduction
  - A. Epidemiology
    - 1. Mortality/ morbidity
    - 2. Risk factors
      - a. Intrinsic factors which increase the risk of developing respiratory disease
        - i. genetic predisposition
        - ii. associated cardiac or circulatory pathologies
        - iii. stress
      - b. Extrinsic factors which increase the risk of developing respiratory disease
        - i. smoking
        - ii. environmental pollutants
  - B. Anatomy and physiology review
    - 1. Global physiology of the pulmonary system
      - a. Function
      - b. Physiology
        - i. ventilation
        - ii. diffusion
        - iii. perfusion
    - 2. Anatomy of the pulmonary system
      - a. The upper airway
        - i. functions
        - ii. structures
          - a) nose
          - b) pharynx
          - c) larynx
      - b. The lower airway
        - i. functions
        - ii. structures

- a) trachea
  - b) bronchi
  - c) bronchioles
  - d) cilia
- c. The gas exchange interface
  - i. functions
  - ii. structures
    - a) alveoli
    - b) interstitial space
    - c) pulmonary capillary bed
- d. The chest wall
  - i. functions
  - ii. structures
    - a) diaphragm is the major muscle of respiration
    - b) intercostal muscles
    - c) accessory muscles
    - d) pleural space
- e. The neurologic control of breathing
  - i. functions
  - ii. structures
    - a) medulla
    - b) phrenic nerve innervate the diaphragm
    - c) spinal nerves (thoracic levels) innervate the intercostal
    - d) Hering-Breuer reflex prevents overinflation

## II. General system pathophysiology, assessment and management

### A. Pathophysiology

#### 1. Specific conditions

##### a. Ventilation

- i. upper airway obstruction
  - a) trauma
  - b) epiglottitis
  - c) laryngotracheobronchitis
  - d) abscess
  - e) foreign body obstruction
  - f) inflammation of the tonsils
- ii. lower airway obstruction
  - a) trauma
  - b) obstructive/restrictive lung diseases
    - i) emphysema
    - ii) chronic bronchitis
  - c) mucous accumulation
  - d) reactive airway disease
    - i) smooth muscle spasm including asthma
  - e) airway edema

- iii. chest wall impairment
      - a) spontaneous pneumothorax
      - b) pleural inflammation and effusion
      - c) neuromuscular diseases (such as muscular sclerosis or muscular dystrophy)
  - b. Diffusion
    - i. inadequate oxygen concentration in ambient air
    - ii. alveolar pathology
      - a) asbestosis, other environmental lung diseases
      - b) blebs/ bullae associated with chronic obstructive lung disease
      - c) inhalation injuries
    - iii. interstitial space pathology
    - iv. adult respiratory distress syndrome (ARDS)
    - v. submersion/drowning
  - c. Perfusion
    - i. inadequate blood volume/ hemoglobin levels
      - a) hypovolemia
      - b) anemia
    - ii. impaired circulatory blood flow
- B. Assessment Findings
  - 1. Scene size-up
    - a. Pulmonary complaints may be associated with exposure to a wide variety of toxins, including carbon monoxide, toxic products of combustion, or environments that have deficient ambient oxygen (such as silos, enclosed storage spaces etc.)
    - b. It is critical to assure a safe environment for all EMS personnel before initiating patient contact
  - 2. Initial assessment -- signs of life threatening respiratory distress
    - a. Alterations in mental status
    - b. absent alveolar breath sounds
    - c. cyanosis
    - d. audible stridor/grunting respirations
    - e. 1-2 word dyspnea
    - f. tachycardia > 130 beats/ minute
    - g. pallor and diaphoresis
    - h. presence of retractions/ use of the accessory muscles
    - i. nasal flaring
  - 3. Focused history and physical examination
    - a. Chief complaint
      - i. dyspnea
      - ii. chest pain
      - iii. cough
        - a) productive
        - b) non-productive
        - c) hemoptysis

- iv. wheezing
- v. signs of infection
  - a) fever/ chills
  - b) increased sputum production
- b. History
  - i. previous experiences with similar/identical symptoms
  - ii. known pulmonary diagnosis
  - iii. history of previous intubation
  - iv. medication history
    - a) current medications
    - b) medication allergies
    - c) pulmonary medications
      - i) sympathomimetic
      - ii) corticosteroid
      - iii) chromolyn sodium
      - iv) methylxanthines (theophyllin preparations)
      - v) antibiotics
      - vi) other
    - d) cardiac-related drugs
  - v. history of the present episode
  - vi. exposure/ smoking history
- c. Physical exam
  - i. general impression
    - a) position
    - b) mentation
    - c) ability to speak
    - d) respiratory effort
    - e) color
  - ii. vital signs
    - a) pulse
      - i) tachycardia is a sign of hypoxemia and the use of sympathomimetic medications
      - ii) in the face of a pulmonary etiology, bradycardia is an ominous sign of severe hypoxemia and imminent cardiac arrest
    - b) blood pressure
    - c) respiratory rate
      - i) the respiratory rate is not a very accurate indicator of respiratory status unless it is very slow
      - ii) trends are essential in evaluating the chronic patient
    - d) respiratory patterns
      - i) eupnea
      - ii) tachypnea
      - iii) Cheyne-Stokes

- iv) central neurogenic hyperventilation
    - v) Kussmaul
    - vi) ataxic (Biot's)
    - vii) apneustic
    - viii) apnea
  - iii. head/ neck
    - a) pursed lip breathing
    - b) use of accessory muscles
    - c) sputum
    - d) jugular venous distention
  - iv. chest
    - a) signs of trauma
    - b) barrel chest
    - c) retractions
    - d) symmetry
    - e) breath sounds
      - i) normal
      - ii) abnormal
  - v. extremities
    - a) peripheral cyanosis
    - b) clubbing
    - c) carpopedal spasm
  - d. Diagnostic testing
    - i. pulse oximetry
    - ii. peak flow
    - iii. end-tidal carbon dioxide assessment
      - a) capnometry
      - b) capnography

### C. Management

1. Airway and ventilation
2. Circulation—intravenous therapy
3. Pharmacological
4. Non-pharmacological -- Continuous positive airway pressure
5. Monitoring and devices used in pulmonary care
  - a. Pulse oximetry
  - b. Peak flow
  - c. Capnometry or capnography
  - d. Other
6. Transport considerations

### III. Specific illness/injuries: causes, assessment findings and management for each condition

- A. Acute/ adult respiratory distress syndrome
- B. Chronic obstructive airway diseases
  1. Asthma
  2. Chronic bronchitis
  3. Emphysema

- C. Pneumonia
- D. Pulmonary edema
  - 1. High pressure (cardiogenic)
    - a. Acute myocardial infarction
    - b. Chronic hypertension
    - c. Myocarditis
  - 2. High permeability (non-cardiogenic)
    - a. Acute hypoxemia
    - b. Drowning
    - c. Post-cardiac arrest
    - d. Post shock
    - e. High altitude exposure
    - f. Inhalation of pulmonary irritants
    - g. Adult respiratory distress syndrome (ARDS)
- E. Pulmonary thromboembolism
- F. Neoplasms of the lung
- G. Pertussis
- H. Cystic fibrosis
- I. Upper respiratory infection
- J. Spontaneous pneumothorax
- K. Hyperventilation syndrome

#### IV. Consider age-related variations

- A. Pediatric
  - 1. Anatomic and physiologic differences in children
  - 2. Pathophysiology
    - a. Respiratory distress
    - b. Respiratory failure
    - c. Respiratory arrest
  - 3. Upper airway obstruction
    - a. Croup
    - b. Foreign body aspiration
    - c. Bacterial tracheitis
    - d. Epiglottitis
    - e. Tracheostomy dysfunction
  - 4. Lower airway disease
    - a. Asthma
    - b. Bronchiolitis
    - c. Pneumonia
    - d. Foreign body lower airway obstruction
    - e. Pertussis
    - f. Cystic fibrosis
    - g. Bronchopulmonary dysplasia

#### V. Communication and documentation for patients with a respiratory condition or emergency

- VI. Transport decisions
- VII. Patient education and prevention of complications or future respiratory emergencies.



# Medicine

## Hematology

### Paramedic Education Standard

Integrates assessment findings with principles of epidemiology and pathophysiology to formulate a field impression and implement a comprehensive treatment/disposition plan for a patient with a medical complaint.

### Paramedic-Level Instructional Guideline

The Paramedic Instructional Guidelines in this section include all the topics and material at the AEMT level PLUS the following material:

- I. Introduction
  - A. Epidemiology
    - 1. Incidence
    - 2. Morbidity/mortality
  - B. Anatomy and physiology review
    - 1. Blood
    - 2. Plasma
    - 3. Blood-forming organs
    - 4. Normal red cell production, function and destruction
    - 5. Normal white cell production and function
    - 6. The inflammatory process
    - 7. Immunity
      - a. Cellular immunity
      - b. Humoral immunity
      - c. Autoimmune diseases
    - 8. Blood groups
    - 9. Hemostasis
      - a. Vascular components
      - b. Coagulation mechanisms
- II. General assessment findings and symptoms
  - A. Level of consciousness
  - B. Skin
  - C. Visual disturbances
  - D. Gastrointestinal
  - E. Skeletal
  - F. Cardiorespiratory
  - G. Genitourinary

- III. General management for a patient with a hematological condition or emergency
  - A. Airway, ventilation, and circulation
  - B. Pharmacological
  - C. Non-pharmacological
  - D. Transport considerations
  - E. Psychological/ communication strategies
  
- IV. Sickle Cell Disease
  - A. Definition, pathophysiology, epidemiology, mortality and morbidity
    - 1. Types of emergent presentations
      - a. Vaso-occlusive crisis
        - i. description
        - ii. signs and symptoms
        - iii. implications
      - b. Acute chest syndrome
        - i. description
        - ii. signs and symptoms
        - iii. implications
      - c. Acute splenic sequestration syndrome (pediatric)
        - i. description
        - ii. signs and symptoms
        - iii. implications
    - 2. Patient management
      - a. Administer high-concentration oxygen
      - b. Initiate IV therapy-administer IV fluids to hydrate
      - c. Maintain normothermic
      - d. Rest
      - e. Pain management
  
- V. Hematological conditions
  - A. Definitions, Pathophysiology, epidemiology , mortality and morbidity, and complications
  - B. Specific assessment findings and symptoms
  - C. Specific management considerations
  - D. Conditions
    - 1. Sickle Cell Crisis
    - 2. Anemia
      - a. types
      - b. hemolytic
      - c. Sickle cell
    - 3. Leukopenia
    - 4. Thrombocytopenia
    - 5. Leukemia
    - 6. Lymphomas
    - 7. Polycythemia
    - 8. Disseminated intravascular coagulopathy

9. Hemophilia
10. Hemophilia A, deficiency in factor VIII
11. Hemophilia B, deficiency in factor IX
12. Multiple myeloma
13. Homestatic Disorders

VI. Blood Transfusion Complications

- A. Hemolytic
- B. Febrile
- C. Allergic
- D. Transfusion-related lung injury
- E. Circulatory overload
- F. Bacterial infection

VII. Consider age-related variations in pediatric and geriatric patients

VIII. Patient education and prevention

# Medicine

## Genitourinary/Renal

### Paramedic Education Standard

Integrates assessment findings with principles of epidemiology and pathophysiology to formulate a field impression and implement a comprehensive treatment/disposition plan for a patient with a medical complaint.

### Paramedic-Level Instructional Guideline

The Paramedic Instructional Guidelines in this section include all the topics and material at the AEMT level PLUS the following material:

- I. Introduction
  - A. Review of genitourinary System
    - 1. General anatomy
      - a. Structure of the kidneys, ureters, bladder, and urethra
      - b. Structure and function of the nephron
    - 2. Functions of the urinary system
      - a. Regulating water and electrolytes
      - b. Regulating acid-base
      - c. Excreting waste products and foreign chemicals
      - d. Regulating arterial blood pressure
      - e. Producing red blood cells
      - f. Producing glucose
- II. Renal Diseases
  - A. Overview of renal conditions
    - 1. Pathophysiology
      - a. Prerenal- Decreased blood flow to kidneys
      - b. Intrarenal- Disease or damage within the kidneys
      - c. Postrenal- Blockage to urine collecting system
    - 2. Incidence, morbidity, and mortality
      - a. Acute renal failure
        - i. definition
        - ii. causes
      - b. Chronic renal failure
        - i. definition
        - ii. causes
      - c. End Stage Renal Disease (ESRD)

- B. Assessment findings and symptoms for renal failure
1. Acute
    - a. Reduced or no urinary output
    - b. Excessive urinary output at night
    - c. Lower extremity swelling
    - d. Neuropathies of hands and feet
    - e. Anorexia
    - f. Altered mental status
    - g. Metallic taste in mouth
    - h. Tremors or seizures
    - i. Easy bruising or prolonged bleeding
    - j. Flank pain
    - k. Tinnitus
    - l. Hypertension
    - m. Abdominal pain or discomfort
  2. Chronic renal failure
    - a. Headache
    - b. Weakness
    - c. Anorexia
    - d. Vomiting
    - e. Increased urination
    - f. Rusty or brown-colored urine
    - g. Increased thirst
    - h. Hypertension
    - i. Pruritis
  3. End stage renal disease
    - a. Confusion
    - b. Altered levels of consciousness
    - c. Shortness of breath
    - d. Peripheral edema
    - e. Chest pain
    - f. Bone pain
    - g. Pruritis
    - h. Nausea, vomiting, diarrhea
    - i. Bruising
    - j. Muscle twitching, tremors, seizures
    - k. Hallucinations
- C. Dialysis
1. Hemodialysis
    - a. Shunt
    - b. Fistula
    - c. Graft
    - d. Blood filtered through dialysate
  2. Peritoneal dialysis
  3. Special considerations for hemodialysis patients
    - a. Obtaining B/P
    - b. IV site, blood draw

4. Complications/Adverse effects of dialysis
  - a. Hypotension
  - b. Muscle cramps
  - c. Nausea/Vomiting
  - d. Disequilibrium syndrome
  - e. Hemorrhage especially from access site
  - f. Air embolism
  - g. Myocardial ischemia
  - h. Infection at access site
  - i. Electrolyte imbalance
5. Missed dialysis treatment
  - a. Hyperkalemia with associated ECG changes
  - b. Weakness
  - c. Pulmonary edema
  - d. Uremic frost
- D. Management for a patient with acute renal condition, chronic renal conditions with acute exacerbations or dialysis problems, or end stage renal disease.
  1. Management
    - a. ABCs, support ventilation, intubate if necessary
    - b. Stop bleeding from shunt as needed
    - c. IV— restrict fluids or give fluids based
    - d. Pharmacological interventions

### III. Urinary System Conditions

- A. Urinary retention—pathophysiology, incidence, causes
  1. Assessment findings and symptoms
    - a. Unable to urinate
    - b. Bladder enlargement/distention
    - c. Lower abdominal pain
    - d. Delirium, especially in elderly
  2. Management
    - a. Primarily supportive
    - b. Transport
    - c. IV KVO if abdominal pain
    - d. Insert catheter if local medical director approval
- B. Urinary tract infection (UTI)-- pathophysiology, incidence, causes
  1. Urinary bladder infection (cystitis)
  2. Pyelonephritis
  3. Assessment findings and symptoms
    - a. Burning sensation or pain when urinating
    - b. Increased urgency and frequency of urination
    - c. Cloudy or rust-colored urine
    - d. Unusual or foul odor to urine
    - e. Febrile in pyelonephritis
    - f. Back or flank pain in pyelonephritis

- g. Blood in urine
  - h. abdominal pain--suprapubic
- 4. Management
  - a. Primarily supportive, IV if febrile or abdominal pain
  - b. Transport
- C. Renal calculi (kidney stones) - pathophysiology, incidence, causes.
  - 1. Assessment findings and symptoms
    - a. Severe flank or back pain
    - b. Abdominal pain
    - c. Pain may radiate to pelvis, groin, or genitals
    - d. Increased urgency of urination
    - e. Painful urination
    - f. Blood in urine
    - g. Febrile
    - h. skin pale and clammy
  - 2. Management
    - a. IV fluids
    - b. Transport in position of comfort
    - c. Pain analgesia as needed
      - i. narcotics
      - ii. nitrous oxide
      - iii. may be drug seeking
- D. Acid base disturbances- pathophysiology, incidence, causes.
  - 1. Assessment findings and symptoms
  - 2. Management
- E. Fluid and electrolyte- pathophysiology, incidence, causes.
  - 1. Assessment findings and symptoms
  - 2. Management
- F. Infection- pathophysiology, incidence, causes.
  - 1. Assessment findings and symptoms
  - 2. Management

#### IV. Male genital tract conditions

- A. Review of male reproductive system anatomy and physiology.
- B. Blunt trauma to external genitalia
  - 1. Assessment findings and symptoms
    - a. Scrotum or penis--swollen and tender
    - b. Severe pain
    - c. Blood at tip of penis
  - 2. Management
    - a. Control bleeding
    - b. Cold compress
    - c. Assess and treat for shock or pelvic fracture
- C. Epididymitis or orchitis-- pathophysiology, incidence, causes
  - 1. Assessment findings and symptoms
    - a. Swelling and pain in the scrotum

- b. Enlarged testes
    - c. Swollen groin on affected side
    - d. Testicular pain that worsens with bowel movement
    - e. Fever
    - f. Urethral discharge
  - 2. Prehospital management
    - a. Supportive
    - b. Analgesics may be needed
- D. Fournier's gangrene- pathophysiology, incidence, causes
  - 1. Assessment findings and symptoms
    - a. Crepitus of skin
    - b. Gray-black color of tissues
    - c. Drainage of pus from tissues
    - d. Fever
    - e. Scrotal Pain
  - 2. Management
    - a. Prompt transport to emergency department
    - b. Assess and treat for shock
- E. Structural conditions
  - 1. Phimosis or paraphimosis-- pathophysiology, incidence, causes
    - a. Assessment findings and symptoms
    - b. Management
      - i. may apply cold compresses
      - ii. prompt transport to facility
  - 2. Priapism- pathophysiology, incidence, causes
    - a. Assessment findings and symptoms
    - b. Management of priapism
      - i. pain control
      - ii. may need surgical intervention
  - 3. Benign prostate hypertrophy (BPH)- pathophysiology, incidence, causes
  - 4. Testicular masses-- pathophysiology, incidence, causes
  - 5. Testicular torsion-- pathophysiology, incidence, causes
    - a. Assessment findings and symptoms
      - i. sudden onset of severe pain in one testis
      - ii. may occur with or without blunt trauma
      - iii. swelling on one side of scrotum
      - iv. testicular lump
      - v. blood in semen
    - b. Management
      - i. prompt transport
      - ii. care and comfort
      - iii. analgesics to control pain
- V. Consider age-related variations for pediatric and geriatric patients
- VI. Communication and documentation



VII. Transport decisions

VIII. Patient education and prevention

# Medicine

## Gynecology

### Paramedic Education Standard

Integrates assessment findings with principles of epidemiology and pathophysiology to formulate a field impression and implement a comprehensive treatment/disposition plan for a patient with a medical complaint.

### Paramedic-Level Instructional Guideline

The Paramedic Instructional Guidelines in this section include all the topics and material at the AEMT level PLUS the following material:

- I. Introduction
  - A. Female reproductive system anatomy review
    - 1. External genitalia
    - 2. Internal organs and structures
- II. Physiology
  - A. Menstrual and ovarian cycles
    - 1. Proliferative phase
    - 2. Secretory phase
    - 3. Menstrual phase
    - 4. Menopause
- III. Symptoms and Assessment findings
  - A. Abdominal pain or vaginal pain
  - B. Vaginal bleeding
  - C. Vaginal discharge
  - D. Fever
  - E. Nausea and vomiting
  - F. Syncope
- IV. General management
  - A. Protect privacy and modesty
  - B. Communication techniques
  - C. Consider pregnancy and/or sexually transmitted diseases
  - D. Oxygen and IV fluids if needed
- V. Vaginal Bleeding
  - A. Anatomy and physiology
  - B. Epidemiology
  - C. Pathophysiology

- D. Psychosocial impact
  - E. Assessment findings/presentation
  - F. Prognosis
  - G. Management
    - 1. Pharmacological
    - 2. Non-pharmacological
- VI. Sexual Assault
- A. Anatomy and physiology,
  - B. Epidemiology
  - C. Pathophysiology
  - D. Psychosocial impact
  - E. Assessment findings/presentations
  - F. Prognosis
  - G. Management
    - 1. Pharmacological
    - 2. Non-pharmacological
- VII. Infection (including Pelvic inflammatory disease, Bartholin's abscess, and vaginitis/vulvovaginitis)
- A. Pathophysiology
  - B. Assessment findings/presentation
  - C. Prehospital Management
- VIII. Ovarian cyst and ruptured ovarian cyst
- A. Pathophysiology
  - B. Assessment findings/presentation
  - C. Prehospital Management
- IX. Ovarian torsion
- A. Pathophysiology
  - B. Assessment findings/presentation
  - C. Prehospital Management
- X. Endometriosis
- A. Pathophysiology
  - B. Assessment findings/presentation
  - C. Prehospital Management
- XI. Dysfunctional uterine bleeding
- A. Pathophysiology
  - B. Assessment findings/presentation
  - C. Prehospital Management
- XII. Prolapsed uterus
- A. Pathophysiology

- B. Assessment findings/presentation
- C. Prehospital Management
- XIII. Vaginal foreign body
  - A. Pathophysiology
  - B. Assessment findings/presentation
  - C. Prehospital Management
- XIV. Age-related variations
  - A. Pediatrics—menarche could be cause of bleeding
  - B. Geriatrics—menopausal women can get pregnant
- XV. Communication and documentation
- XVI. Transport decisions

# Medicine

## Non-Traumatic Musculoskeletal Disorders

### Paramedic Education Standard

Integrates assessment findings with principles of epidemiology and pathophysiology to formulate a field impression and implement a comprehensive treatment/disposition plan for a patient with a medical complaint.

### Paramedic-Level Instructional Guideline

The Paramedic Instructional Guidelines in this section include all the topics and material at the AEMT level PLUS the following material:

- I. Introduction
  - A. Epidemiology
    - 1. Incidence
    - 2. Morbidity/mortality
  - B. Anatomy and physiology review
    - 1. Bones
    - 2. Muscles
    - 3. Tendons and ligaments
    - 4. Articulating surfaces—joints, bursa, disc, etc
- II. General assessment findings and symptoms
  - A. Pain or tenderness
  - B. Swelling
  - C. Abnormal or Loss of movement
  - D. Sensation changes
  - E. Circulatory changes
  - F. Deformity
- III. General Management for a patient with a common or major non-traumatic musculoskeletal disorder.
  - A. Airway, ventilation, and circulation
  - B. Pharmacological
  - C. Non-pharmacological
  - D. Transport considerations
  - E. Psychological/ communication strategies
- IV. Non-traumatic musculoskeletal conditions
  - A. Bony abnormalities (including Osteomyelitis and Tumors)
    - 1. Epidemiology
    - 2. Anatomy, physiology, and pathophysiology

3. Assessment
  4. Prehospital Management
  - B. Disorders of the spine (including Disc disorders, Low back pain (cauda equine syndrome, sprain, strain)
    1. Epidemiology
    2. Anatomy, physiology, and pathophysiology
    3. Assessment
    4. Prehospital Management
  - C. Joint abnormalities (including Arthritis (Septic, Gout, Rheumatoid, Osteoarthritis) and slipped capital femoral epiphysis)
    1. Epidemiology
    2. Anatomy, physiology, and pathophysiology
    3. Assessment
    4. Prehospital Management
  - D. Muscle abnormalities (Myalgia/myositis, Rhabdomyolysis)
    1. Epidemiology
    2. Anatomy, physiology, and pathophysiology
    3. Assessment
    4. Prehospital Management
  - E. Overuse syndromes (including Bursitis, Muscle strains, Peripheral nerve syndrome, Carpal tunnel syndrome, Tendonitis)
    1. Epidemiology
    2. Anatomy, physiology, and pathophysiology
    3. Assessment
    4. Prehospital Management
  - F. Soft tissue infections (Fascitis, Gangrene, Paronychia, Flexor tenosynovitis of the hand)
- V. Consider age-related variations in pediatric and geriatric patients
- A. Pediatric--slipped femoral epiphysis juvenile arthritis
  - B. Geriatric--osteoporosis
- VI. Patient education and prevention

# Medicine

## Diseases of the Eyes, Ears, Nose, and Throat

### Paramedic Education Standard

Integrates assessment findings with principles of epidemiology and pathophysiology to formulate a field impression and implement a comprehensive treatment/disposition plan for a patient with a medical complaint.

### Paramedic-Level Instructional Guideline

The Paramedic Instructional Guidelines in this section include all the topics and material at the AEMT level PLUS the following material:

- I. Introduction
  - A. Epidemiology
    - 1. Incidence
    - 2. Morbidity/mortality
  - B. Anatomy and physiology review
    - 1. Eye
    - 2. Ear
    - 3. Nasal bones and nasopharynx
    - 4. Mouth, oral cavity, oropharynx, larynx
- II. General assessment findings and symptoms
  - A. Pain or tenderness
  - B. Swelling
  - C. Abnormal or Loss of movement
  - D. Sensation changes
  - E. Circulatory changes
  - F. Deformity
  - G. Visual or hearing changes
  - H. Airway compromise
- III. General Management
  - A. Airway, ventilation, and circulation
  - B. Pharmacological
  - C. Non-pharmacological
  - D. Transport considerations
  - E. Psychological/ communication strategies
- IV. Diseases of the eyes, ears, nose, and throat.
  - A. Definitions, Pathophysiology, epidemiology , mortality and morbidity, and complications

- B. Specific assessment findings and symptoms
  - C. Specific management considerations
  - D. Conditions
    - 1. Eye
      - a. Burn of eye and adnexa
      - b. Conjunctivitis
      - c. Corneal abrasions
      - d. Foreign body
      - e. Inflammation of the eyelid
        - i. chalazion
        - ii. hordeolum
      - f. Glaucoma
      - g. Hyphema
      - h. Iritis
      - i. Papilledema
      - j. Retinal detachment and defect
      - k. Cellulitis of orbit
    - 2. Ear
      - a. Foreign body
      - b. Impacted cerumen
      - c. Labyrinthitis
      - d. Meniere's disease
      - e. Otitis external and media
      - f. Perforated tympanic membrane
    - 3. Nose
      - a. Epistaxis
      - b. Foreign body
      - c. Rhinitis
      - d. Sinusitis
  - E. Oropharynx/throat
    - 1. Dentalgia and dental abscess
    - 2. Diseases of oral soft tissue/ Ludwig's angina
    - 3. Foreign body
    - 4. Epiglottitis
    - 5. Laryngitis
    - 6. Tracheitis
    - 7. Oral candidiasis
    - 8. Peritonsillar abscess
    - 9. Pharyngitis/tonsillitis
    - 10. Temporomandibular joint disorders
- V. Consider age-related variations in pediatric and geriatric patients
- A. Pediatric--foreign bodies of ears and nose common ear infections common, epiglottitis more common in children
- VI. Patient education and prevention



# Shock and Resuscitation

## Shock and Resuscitation

### Paramedic Education Standard

Integrates comprehensive knowledge of causes and pathophysiology into the management of cardiac arrest and peri-arrest states.

Integrates a comprehensive knowledge of the causes and pathophysiology into the management of shock, respiratory failure or arrest with an emphasis on early intervention to prevent arrest.

### Paramedic-Level Instructional Guideline

The Paramedic Instructional Guidelines in this section include all the topics and material at the AEMT level PLUS the following material:

- I. Ethical Issues in Resuscitation
  - A. Ethics Foundation
    - 1. Patient Autonomy
      - a. Advance Directives
      - b. Surrogate Decision Makers
    - 2. Principles of Futility
  - B. Withholding Resuscitation Attempts
    - 1. Irreversible death
    - 2. Do Not Resuscitate Orders
  - C. Withdrawing Resuscitation
    - 1. Termination of Resuscitation Efforts
  - D. Providing Emotional Support for Family
  - E. Organ and Tissue Donation
- II. Pre-Morbid Conditions
  - A. Healthy Patient (Adult)
    - 1. Coronary Syndromes (conduction abnormalities, atherosclerosis)
      - a. Modifiable Risk Factors
      - b. Non-modifiable risk factors
    - 2. Drowning
    - 3. Electrocution
    - 4. Electrolyte Imbalance
    - 5. Hypothermia
    - 6. Toxic Exposure
    - 7. Drug Toxicity
    - 8. Pulmonary Embolus

- B. Unhealthy Patient (Adult)
  - 1. Congestive Heart Failure (CHF)
  - 2. Renal Failure
  - 3. Uncontrolled Hypertension
  - 4. Uncontrolled Diabetes
  - 5. Obesity
  - 6. Electrolyte Imbalance
  - 7. Drug Toxicity
  - 8. Stroke (CVA)
- III. Anatomy and physiology review
  - A. Respiratory system
    - 1. Review Anatomy and Physiology Section at Paramedic level.
  - B. Cardiovascular system
    - 1. Review Anatomy and Physiology Section at Paramedic level.
- IV. Physiology of normal blood flow
  - A. Generally speaking, the heart pumps blood out of the left ventricle, around the circulatory system and back to the right side of the heart.
  - B. The negative intrathoracic pressure created by normal ventilation assists venous return.
    - 1. With every breath, muscle contractions in the chest and diaphragm reduce the pressure within the lungs and chest cavity.
    - 2. When the airway is open, air rushes from the higher-pressure zone outside the body into the low-pressure zone inside the chest.
    - 3. The great vessels also enter the chest from above and below.
    - 4. That same low pressure created within the chest during inspiration sucks blood into the cavity and right atrium.
- V. Physiology of blood flow during CPR
  - A. Heart Pump Theory
    - 1. Heart is squeezed through direct compression between the sternum and the spinal column.
    - 2. Pressure is increased within the chambers of the heart
      - a. Blood flows from higher pressure chambers to lower pressured vessels and organs
      - b. Heart valves prevent retrograde flow
  - B. Thoracic Pump Theory
    - 1. Compression of the sternum during CPR
      - a. Raises the pressure in the entire chest cavity
      - b. Pressure in the extrathoracic spaces remains low
    - 2. After establishing the pressure gradient
      - a. Venous collapse prevents a backflow of blood
      - b. Open arteries allow forward flow out of the chest
      - c. Epinephrine (and other vasopressors) helps those arteries to remain open

- C. Harder and faster compressions increase the pressure to a greater degree
- D. Negative Intrathoracic Pressure
  - 1. Since patients in cardiac arrest are not breathing, they do not produce negative inspiratory pressure to assist the circulatory system.
  - 2. During CPR, some negative pressure develops in the chest as the sternum and ribs rebound to their normal position during the decompression or relaxation phase.
    - a. When a greater amount of negative pressure can be achieved in the chest, a greater amount of blood will be returned to the heart
    - b. Then with the next compression, a greater amount will be forced to the lungs and other vital organs.
  - 3. If the chest is not allowed to fully recoil during CPR, venous return may be critically decreased.

## VI. Cardiac Arrest

- A. Epidemiology
- B. Pathophysiology
  - 1. If the heart stops contracting, no blood will flow.
  - 2. The body cannot survive when the heart stops.
    - a. Organ damage begins quickly after the heart stops.
    - b. Brain damage
      - i. begins 4-6 minutes after the patient suffers cardiac arrest.
      - ii. becomes irreversible in 8-10 minutes.
  - 3. General reasons for the heart to stop beating
    - a. Sudden death and heart disease
    - b. Breathing stops, especially in infants and children
    - c. Medical emergencies
    - d. Trauma

## VII. Resuscitation

- A. System components to maximize survival
  - 1. Early access
    - a. Public education and awareness
      - i. rapid recognition of a cardiac emergency
      - ii. rapid notification before CPR starts - "phone first"
    - b. 911-pre-arrival instructions and dispatcher directed CPR
  - 2. Early CPR
    - a. Lay public
      - i. family
      - ii. bystanders
    - b. Emergency Medical Responders
  - 3. Early defibrillation
  - 4. Early advanced care
- B. Basic Cardiac Life Support (Refer to current American Heart Association guidelines)
  - 1. Adult CPR and foreign body airway obstruction
  - 2. Child CPR and foreign body airway obstruction

3. Infant CPR and foreign body airway obstruction
  4. Neonatal sequence
  - C. Alternative CPR Techniques (i.e. Interposed Abdominal Compression)
  - D. Airway Control and Ventilation
    1. Airway Adjuncts
      - a. Basic adjuncts
      - b. Advanced adjuncts (as defined by Scope of Practice)
        - i. role of advanced airways in resuscitation
        - ii. endotracheal intubation
        - iii. alternatives to endotracheal intubation
    2. Ventilation
      - a. Hazards of over-ventilation
      - b. Devices to assist ventilation
  - E. Chest compressions
    1. Factors which decreases effectiveness
      - a. Compression that are too shallow
      - b. Slow compression rate
      - c. Sub-maximum recoil
      - d. Frequent interruptions
    2. Devices to assist circulation
      - a. Active compression-decompression CPR
      - b. Impedance threshold device
      - c. Mechanical piston device
      - d. Load-distributing band or vest CPR
- VIII. Automated external defibrillation (Refer to current American Heart Association guidelines)
- A. Adult sequence
  - B. Child sequence
  - C. Infant sequence
  - D. Special situations
    1. Pacemaker/Implanted cardioverter/defibrillator
    2. Wet victims
    3. Transdermal medication patches
- IX. Advanced Life Support - Refer to the current American Heart Association guidelines
- A. Electrical therapies
    1. Manual defibrillation
    2. Synchronized cardioversion
    3. Transcutaneous pacing
  - B. Intravenous access
  - C. Arrest rhythms
    1. Ventricular fibrillation/pulseless ventricular tachycardia
    2. Pulseless electrical activity
    3. Asystole

- D. Non-arrest rhythms
  - 1. Bradycardia
  - 2. Tachycardia
- X. Special arrest and peri-arrest situations - Refer to the current American Heart Association guidelines
  - A. Electrolyte abnormalities
    - 1. Epidemiology
    - 2. Pathophysiology
    - 3. Specific electrolytes
      - a. Potassium
      - b. Sodium
      - c. Magnesium
      - d. Calcium
    - 4. Modifications to management
  - B. Toxic exposure
    - 1. Epidemiology
    - 2. Pathophysiology
    - 3. Specific problems
      - a. Respiratory arrest
      - b. Bradycardia
      - c. Tachycardia
      - d. Hypertension
      - e. Acute coronary syndrome
      - f. Impaired conduction
      - g. Shock
      - h. Cardiac arrest
    - 4. Modifications to management
  - C. Drowning
    - 1. Epidemiology
    - 2. Pathophysiology
    - 3. Modifications to management
  - D. Hypothermia
    - 1. Epidemiology
    - 2. Pathophysiology
    - 3. Modifications to management
  - E. Near-Fatal Asthma
    - 1. Epidemiology
    - 2. Pathophysiology
    - 3. Modifications to management
  - F. Anaphylaxis
    - 1. Epidemiology
    - 2. Pathophysiology
    - 3. Modifications to management
  - G. Traumatic cardiac arrest
    - 1. Epidemiology

- 2. Pathophysiology
  - 3. Modifications to management
- H. Cardiac arrest associated with pregnancy
  - 1. Epidemiology
  - 2. Pathophysiology
  - 3. Modifications to management
- I. Electric shock and lightning strikes
  - 1. Epidemiology
  - 2. Pathophysiology
  - 3. Modifications to management
- XI. Postresuscitation support - Refer to the current American Heart Association guidelines
  - A. Return of spontaneous circulation (ROSC)
    - 1. Temperature regulation -- Induced hypothermia
    - 2. Glucose control
    - 3. Organ specific support
      - a. Respiratory system
      - b. Cardiovascular system
      - c. Central nervous system
- XII. Shock
  - A. Definition
  - B. Anatomy and physiology review
  - C. Essential components for normal perfusion
    - 1. Functioning pump
      - a. Stroke volume
        - i. preload
        - ii. afterload
        - iii. Starling's Law
      - b. Cardiac output
      - c. Blood pressure
        - i. mean arterial pressure
        - ii. pulse pressure
      - d. Baroreceptors
      - e. Nervous control of heart
        - i. sympathetic nervous system
        - ii. parasympathetic nervous system
    - 2. Adequate volume
      - a. Formed elements
      - b. Plasma
    - 3. Intact container/vessels
      - a. Arteries
      - b. Arterioles
      - c. Capillary beds
      - d. Sphincters
      - e. Venules

- f. Veins
  - g. Capacity of each vessel
  - h. Sympathetic nervous system control of each vessel
  - i. Blood flow controlled by cellular tissue demands
  - j. Sphincter control
- D. Tissue hypoperfusion
  - 1. Inadequate fluid volume
  - 2. Inadequate pump
  - 3. Inadequate container size
- E. Physiologic response to shock
  - 1. Cellular
    - a. Fick principle
    - b. Waste removal
    - c. Aerobic metabolism/glycolysis
    - d. Anaerobic metabolism
  - 2. Cardiovascular system implications
    - a. Preload
    - b. Afterload
    - c. Cardiac Output
    - d. Peripheral vascular resistance/systemic vascular resistance
    - e. Blood pressure
    - f. Mean arterial pressure
    - g. Pulse pressures
    - h. Starling's Law
    - i. Chemoreceptors
    - j. Baroreceptors
  - 3. Sympathetic nervous system and endocrine implications
    - a. Epinephrine
    - b. norepinephrine
  - 4. Kidneys
    - a. Renin
    - b. Angiotensin
    - c. Aldosterone mechanism
  - 5. Pituitary gland and hypothalamus
    - a. Arginine vasopressin (AVP)
    - b. Adrenocorticotrophic hormone cortisol system (ACTH)
    - c. Somatotropin
  - 6. Pancreas
    - a. Insulin
    - b. Glucagon
  - 7. Spleen
  - 8. Osmosis
- F. Stages of shock
  - 1. Compensated shock
  - 2. Decompensated shock
  - 3. Irreversible shock

- G. Specific types of shock
  - 1. Hypovolemic
    - a. Hemorrhage classifications
      - i. hemostasis
      - ii. vascular phase
      - iii. platelet phase
      - iv. coagulation phase
      - v. factors affecting clotting/coagulation
    - b. Stages of hemorrhage
      - i. Class I
      - ii. Class II
      - iii. Class III
      - iv. Class IV
  - 2. Distributive
    - a. Neurogenic
    - b. Anaphylactic
    - c. Septic
    - d. Psychogenic (vasovagal)
  - 3. Cardiogenic
    - a. Intrinsic causes
      - i. heart muscle damage
        - a) physiology
        - b) signs/symptoms
        - c) assessment
        - d) management
      - ii. dysrhythmia
        - a) physiology
      - iii. myocardial insufficiency
        - a) signs/symptoms
        - b) assessment
        - c) management
      - iv. valvular disruption
        - a) physiology
        - b) signs/symptoms
        - c) assessment
        - d) management
    - b. Extrinsic causes
      - i. cardiac tamponade
      - ii. tension pneumothorax
  - 4. Obstructive/mechanical
    - a. Cardiac tamponade
    - b. Tension pneumothorax
    - c. Pulmonary emboli
  - 5. Respiratory
- H. Complications of Shock
  - 1. Acute renal failure



2. Acute adult respiratory distress syndrome
3. Hematologic failure
4. Hepatic failure
5. Multiple Organ Dysfunction Syndrome (MODS)
  - a. Sepsis
  - b. Acute Respiratory Distress Syndrome (ARDS)
  - c. Death of organs
  - d. Death of organism
6. Disseminated Intravascular Coagulation (DIC)
- I. Patient Assessment
  1. Scene size-up
  2. Perform a primary assessment
  3. Obtain a relevant history
  4. Perform a secondary assessment
  5. Perform a reassessment
- J. Management
  1. Manual in-line spinal stabilization, as needed
  2. Comfort, calm, and reassure the patient
  3. Do not give food or drink
  4. Airway control
  5. Breathing
    - a. Assist ventilation, as needed
    - b. Oxygen administration (high concentration)
  6. Circulation
    - a. Attempt to control obvious external bleeding
    - b. Patient position
    - c. Keep patient warm - attempt to maintain normal body temperature
  7. Pneumatic anti-shock garment (PASG) application
  8. Fluid resuscitation
    - a. Controllable external hemorrhage
    - b. Uncontrollable external hemorrhage
    - c. Internal hemorrhage
  9. Consider medications, as needed
  10. Begin transport at the earliest possible moment
  11. Treat any additional injuries that might be present
- K. Devices to assist circulation
  1. Impedance Threshold Device
- L. Age-related variations
  - A. Pediatrics
    1. Common causes of shock
      - a. Trauma
      - b. Fluid loss
      - c. Neurological injury
      - d. Anaphylaxis
      - e. Heart disease
      - f. Chest wall injury

2. Presentation
    - a. Cardiovascular
    - b. Skin signs
    - c. Mental status
    - d. Decreased fluid output
    - e. Vital signs
  3. Anatomical and physiologic implications
    - a. Unreliable indicators
    - b. Indicators of shock
      - i. smaller absolute volume loss
      - ii. tachycardia for age
      - iii. weak distal pulses
      - iv. delayed capillary refill time
      - v. cool mottled extremities
      - vi. altered mental status
  4. Management
    - a. Inline spinal stabilization, as needed
    - b. Suction, as needed
    - c. High concentration oxygen
    - d. Control bleeding
    - e. Positioning
    - f. Maintain body temperature
    - g. Fluid replacement
    - h. Transport
- B. Geriatrics
1. Assessment
    - a. Body system changes affecting presentation of shock
      - i. nervous system
      - ii. cardiovascular
        - a) difficulty tolerating hypotension from hemorrhage
        - b) beta-blocker and calcium channel blockers can alter physiologic response to hemorrhage
      - iii. respiratory
      - iv. integumentary
      - v. renal
      - vi. gastrointestinal
    - b. Vital signs changes
      - i. altered mental status
        - a) sudden onset
        - b) other causes
      - ii. hypoxia
    - c. Airway
      - i. decreased cough reflex
      - ii. cervical arthritis
      - iii. loose dentures

- d. Breathing
  - i. higher resting respiratory rate
  - ii. lower tidal volume
  - iii. less elasticity/compliance of chest wall
- e. Circulation
  - i. higher resting heart rate
  - ii. irregular pulses
- f. Skin
  - i. dry, less elastic
  - ii. cold
  - iii. fever, not common
  - iv. hot
- 2. Management
  - a. In-line spinal stabilization
  - b. Suction, as needed
  - c. High flow oxygen
  - d. Control bleeding
  - e. Positioning
  - f. Maintain body temperature
- 3. Transport

# Trauma

## Trauma Overview

### Paramedic Education Standard

Integrates assessment findings with principles of epidemiology and pathophysiology to formulate a field impression to implement a comprehensive treatment/disposition plan for an acutely injured patient.

### Paramedic-Level Instructional Guideline

The Paramedic Instructional Guidelines in this section include all the topics and material at the AEMT level PLUS the following material:

- I. Identification and Categorization of Trauma Patients
  - A. Entry-level students need to be familiar with:
    - 1. National Trauma Triage Protocol
      - a. Centers for Disease Control and Prevention. Guidelines for Field Triage of Injured Patients: Recommendations of the National Expert Panel on Field Triage. MMWR 2008;58 RR-1:1-35.
      - b. <http://cdc.gov/fieldtriage> contains the National Trauma Triage Protocols and additional instructional materials.
- II. Incidence/significance of Trauma
  - A. Mortality -- Incidence of death
  - B. Morbidity -- New cases where death is not an outcome, nonfatal injury
  - C. Years of Life Lost -- Subtract age of death from life expectancy
  - D. Deaths due to trauma in the United States
    - 1. All external causes of mortality
    - 2. Motor-Vehicle Crashes
    - 3. Pedestrian
    - 4. Motorcycle
    - 5. Falls
    - 6. Mechanical forces (struck by object, machinery)
    - 7. Drowning
    - 8. Electrical current
    - 9. Intentional self harm
    - 10. Assaults (firearms)
- III. Trauma System
  - A. Components -- Hospital categorizations
  - B. Levels and qualifications
  - C. Transport considerations

- IV. Types of Injury
  - A. Blunt Trauma
    - 1. Non-bleeding
    - 2. Multiple forces and conditions can cause blunt trauma
  - B. Penetrating trauma
    - 1. High velocity
    - 2. Medium velocity
    - 3. Low velocity
- V. Trauma Assessment
  - A. Major components of the patient assessment
    - 1. Standard Precautions
    - 2. Scene Size-up
    - 3. General Impression
    - 4. Mechanism of Injury
    - 5. Primary Assessment
    - 6. Baseline Vital Signs
    - 7. History
    - 8. Secondary Assessment
    - 9. Re-Assessment
  - B. Mechanism of Injury (MOI)
    - 1. Significant MOI (including, but not limited to)
      - a. Multiple body systems injured
      - b. Vehicle crashes with intrusion
      - c. Falls from heights
      - d. Pedestrian versus vehicle collision
      - e. Motorcycle crashes
      - f. Death of an occupant in the same vehicle
    - 2. Non-Significant MOI (including, but not limited to)
      - a. Isolated trauma to a body part
      - b. Falls without loss of consciousness (adult)
      - c. Falls without loss of consciousness (pediatric)
    - 3. Pediatric Considerations
      - a. Falls >10 feet without loss of consciousness
      - b. Falls <10 feet with loss of consciousness
      - c. Bicycle collision
      - d. Medium to high-speed vehicle collision (>25 mph)
    - 4. Re-evaluating the MOI
    - 5. Special Considerations
      - a. Spinal precautions must be initiated soon as practical based on the MOI.
      - b. When practical, log roll the supine patient on their side to allow for an appropriate assessment of the posterior body.
  - C. Primary Survey
    - 1. Airway
      - a. Clear airway; chin-lift, suction, finger sweep

- b. Protect airway
      - i. decrease LOC, bleeding is ET without neck movement
      - ii. surgical airways
  - 2. Breathing
    - a. Assess ventilation capability
    - b. Oxygenation, 100%
    - c. Check thorax and neck
      - i. deviated trachea
      - ii. tension pneumothorax
      - iii. chest wounds and chest wall motion
      - iv. sucking chest wound
      - v. neck and chest crepitation
      - vi. multiple broken ribs
      - vii. fractured sternum
    - d. Listen for breath sounds
      - i. re-check any et tube placement
      - ii. hemopneumothorax
    - e. Circulation
      - i. apply pressure to sites of external exsanguinations
      - ii. establish two large bore IVs
        - a) fluid bolus
        - b) consider IO
        - c) consider catheter site location
      - iii. assess blood volume status
      - iv. radial and carotid pulse locations, B/P determination
      - v. jugular venous filling
      - vi. quality of heart tones
    - f. Beck's triad present?
    - g. Hypovolemia
    - h. Disability
      - i. brief neurological exam
      - ii. pupil size and reactivity
      - iii. limb movement
      - iv. Glasgow Coma Scale
    - i. Exposure
      - i. completely remove all clothes
      - ii. logroll as part of inspection
- D. Secondary Assessment - Head-to-toe physical exam (Review)
  - 1. Head/scalp – symmetry
  - 2. Face – symmetry of facial muscles
  - 3. Eyes – pupil size, equality and reactivity to light, pink moist conjunctiva
    - a. Adie's pupil
    - b. Oculomotor nerve paralysis
    - c. Horner's syndrome
    - d. One eye blindness
    - e. Deviations of the eye – paralytic strabismus

4. Ears – drainage, tympanic membrane rupture
5. Mouth – foreign body, loose/broken teeth, blood, pink and moist mucosa
6. Nose – drainage, singed nostrils, nasal flaring
7. Neck – accessory muscle use, tracheal deviation, jugular vein distention, medical jewelry, stoma, subcutaneous emphysema
8. Chest – equal rise and fall, guarding, paradoxical movement, breath sounds, scars, heart sounds
  - a. Pulse types
    - i. small, weak pulses
    - ii. large, bounding pulses
    - iii. bisferiens pulse
    - iv. pulsus alternans
    - v. bigeminal pulse
    - vi. paradoxical pulse
  - b. Location of lung fields in the chest for auscultation
  - c. Location of normal bronchovesicular and bronchial breath sounds in the chest and the meaning of abnormal locations.
  - d. Role of hyperresonance and tympany in percussion of the chest
9. Abdomen – guarding, rigidity, distention, scars, wounds
10. Pelvis/genital – incontinence, stability
11. Arms – distal circulation, sensation, motor function, medical jewelry
12. Legs – distal circulation, sensation, motor function, medical jewelry
13. Back – guarding, paradoxical movement, scars
- E. Secondary Assessment
  1. Rapid Method
  2. Modified secondary assessment

## VI. Role of Documentation in Trauma

- A. Topical Anatomy
- B. Scenario sections of Patient Care Reports
  1. Mechanism of Injury with specifics
  2. Response time
  3. Time on scene
  4. Initial findings
  5. Changes in assessment findings
  6. Care provided
  7. Important negative findings
  8. Recreate the scene
  9. Bystander care provided prior to arrival
  10. A complete report is essential and will be referred to by hospital personnel

## VII. Trauma Scoring Scales

## VIII. Trauma Center Designations

## IX. Transfer of patients to the most appropriate hospital

# Trauma Bleeding

## Paramedic Education Standard

Integrates assessment findings with principles of epidemiology and pathophysiology to formulate a field impression to implement a comprehensive treatment/disposition plan for an acutely injured patient.

## Paramedic-Level Instructional Guideline

The Paramedic Instructional Guidelines in this section include all the topics and material at the AEMT level PLUS the following material:

- I. Incidence
  - A. Mortality and morbidity
  - B. Populations at risk
- II. Anatomy and function
  - A. Respiratory system
  - B. Circulatory system
  - C. Central nervous system
    - 1. Autonomic nervous system
    - 2. Peripheral nervous system
- III. Pathophysiology
  - A. Review knowledge from previous levels
  - B. Centers around
    - 1. Failure to deliver nutrients to tissues
    - 2. Failure to excrete metabolic waste products
    - 3. Failure to excrete carbon dioxide
  - C. Organ involvement in shock
    - 1. Heart
      - a. Four chambers functioning properly
      - b. Autonomic innervation in balance
      - c. Cardiac Output and blood pressure homeostasis
        - i. cardiac output
        - ii. arterial blood pressure
        - iii. stroke volume
          - a) preload
          - b) afterload
          - c) contractility



2. Blood vessels
  - a. Arteries
    - i. role of autonomic nervous system
    - ii. arterial oxygen content
  - b. Veins
    - i. role of capacitance
    - ii. role of precapillary sphincters
  - c. Capillaries
  - d. Balance of hydrostatic pressure and oncotic pressure
3. Blood
  - a. Delivery of nutrients – oxygen, glucose, proteins, fats, electrolytes
    - i. red blood cells
    - ii. plasma
    - iii. hematocrit
    - iv. hemoglobin
    - v. oxyhemoglobin dissociation curve
    - vi. leukocytes
    - vii. platelets
  - b. Excretion of waste products -
  - c. Oxygen delivery
    - i. role of heart rate
    - ii. role of stroke volume
    - iii. role of hemoglobin concentration
    - iv. role of arterial oxygen saturation
4. Cellular metabolism
  - a. Glycolysis
  - b. Krebs cycle
  - c. Electron transport
- D. Classifications of Shock
  1. Respiratory failure
    - a. Obstruction – airway, embolism
    - b. Chest wall movement
    - c. Diffusion failure – ARDS
    - d. Toxic Exposures – Carbon monoxide, cyanide
  2. Hypovolemic
    - a. External
    - b. Internal
    - c. Third space losses – fractures, thermal burns
  3. Vascular failure
    - a. Central nervous system loss
    - b. Sepsis
    - c. Anaphylaxis
  4. Cardiac failure
    - a. Intrinsic
    - b. Extrinsic
      - i. cardiac tamponade
      - ii. tension pneumothorax

- E. Compensatory Mechanisms in Shock
    - 1. Respiratory Compensation
      - a. Baroreceptors
      - b. Chemoreceptors
    - 2. Sympathetic Nervous System
      - a. Alpha receptors
      - b. Beta receptors
      - c. Role of shunting
    - 3. Neuroendocrine Response
      - a. ACTH
      - b. Aldosterone
      - c. Renin
      - d. Vasopressin
      - e. ADH
    - 4. Fluid shifts in shock
  - F. Decompensation in Shock
    - 1. Life effects
      - a. Age
      - b. Physical fitness
      - c. Alcohol use
      - d. Medications
    - 2. Irreversible shock
    - 3. Blood loss in shock
      - a. 750 cc's in healthy people is well tolerated (15%)
      - b. up to 30% more significant
        - i. tachycardia
        - ii. anxiety
        - iii. narrow pulse pressure
      - c. greater than 30%
        - i. hypotension
        - ii. pronounced tachycardia
        - iii. confusion
      - d. more than 40%
  - G. Complications of Shock
    - 1. Acute Respiratory Distress Syndrome (ARDS)
      - a. Seen 24-48 hours after insult/injury
      - b. Loss of alveolar and capillary wall integrity
      - c. Treated with PEEP
    - 2. Acute Renal Failure
      - a. Damage to renal tubules
      - b. Failure to excrete products of metabolism
    - 3. Multiple Organ Failure Syndrome (MOFS)
- IV. Assessment consideration in Shock
- A. Review knowledge from previous levels
  - B. Scene size-up

1. Assure personal safety
  - a. Hazard awareness
  - b. Traffic safety
  - c. Ambulance placement strategy
  - d. Mood of bystanders
  - e. Vehicle stability
2. Number of patients present
3. Significant MOI (including, but not limited to)
  - a. Multi-systems trauma
  - b. Ejection from vehicle
  - c. Fall >20 feet without loss of consciousness
  - d. Fall <20 feet with loss of consciousness
  - e. Vehicle roll-over
  - f. High-speed vehicle collision
  - g. Vehicle vs. pedestrian collision
  - h. Motorcycle collision
  - i. Significant external blood loss (>1000cc)
  - j. Penetrations of the head, chest, abdomen or pelvis
  - k. Unresponsive or altered mental status with suspected traumatic origin
  - l. Death or major injury of another occupant in same vehicle
4. Crime scene considerations
5. Scene time consideration -- not exceed 10 minutes
6. Airway
  - a. Foreign Body Obstructions
  - b. Airway integrity
    - i. structural damage
    - ii. edema
    - iii. airway movement over trachea
7. Ventilation
  - a. Breathing patterns
    - i. tracheal tugging
    - ii. diaphragmatic movement
    - iii. Cheyne-Stokes
    - iv. CNS involvement
  - b. Chest
    - i. wall integrity
    - ii. breath sound assessment
  - c. Jugular vein assessment
8. Circulation
  - a. Cardiac output assessment
    - i. presence of pulse
    - ii. location of pulse -- estimation to blood pressure
  - b. Skin color and temperature
    - i. color
      - a) role of vasoconstriction and color
      - b) role of hypovolemia vs circulatory stasis

- c. Hemorrhage
      - i. rapid detection and control of external hemorrhage
        - a) role of patient position
        - b) role of lighting (night)
        - c) patient movement after insult
      - ii. internal causes
        - a) MOI
        - b) restlessness
        - c) chest considerations
        - d) abdominal considerations
        - e) extremity consideration
    - d. Other causes of shock
      - i. vascular resistance
      - ii. pump failure
  - 9. Vital signs
    - a. Respiratory rate considerations
    - b. Pulse rate considerations
    - c. Blood pressure considerations
  - 10. Disability
    - a. Rapid neurological considerations
      - i. alert
      - ii. stimuli
      - iii. unresponsive
      - iv. posturing
        - a) decorticate
        - b) decerebrate
      - v. pupil assessment considerations
      - vi. pulse, sensory and motor considerations

## V. Shock Management strategies and considerations

- A. Scene safety
- B. Body substance isolation precautions
- C. Restore Tissue oxygenation
  - 1. Airway – open throughout care
    - a. Manual maneuvers (in line considerations)
    - b. Unconscious patient airway considerations
    - c. Definitive airway considerations
  - 2. Ventilation – adequate minute volume
    - a. Hyperventilation contraindicated
    - b. Monitor via oxygenation level
  - 3. Oxygenation –
    - a. Maintain SaO<sub>2</sub> between 90% and 92%
    - b. Small drops in SaO<sub>2</sub> below 90% shift oxyhemoglobin curve dramatically
    - c. Unable to maintain +90% - investigate cause (tension pneumothorax)

4. Field impression of cause
  - a. Assess mechanism of injury/illness
  - b. Complete rapid patient assessment
    - i. immobilization techniques
    - ii. exposure of patient
  - c. Determine cause of Shock
    - i. use proper treatment plan based upon cause
      - a) hypovolemic (bleeding, burns, dehydration)
      - b) respiratory failure
      - c) cardiac failure
    - ii. vascular failure (anaphylaxis)
5. Transport decision
  - a. Based upon cause of shock
    - i. cause of shock rarely definitively treated in the field
    - ii. specialty centers
      - a) trauma
      - b) burns
      - c) cardiac
      - d) stroke
6. Improve stroke volume
  - a. Control external hemorrhage
  - b. Improve preload -- intravenous therapy
    - i. 20 m – 30 mL/Kg
    - ii. Fluid bolus
    - iii. Large bore, short length catheter
    - iv. Monitor patient response to therapy
    - v. Do not overhydrate patients
      - a) Hemodilution
      - b) Platelet agglutination
    - vi. Fluid choice
      - a) Types of fluid (Refer to American College of Surgeons guidelines)
        - i) Advantages
        - ii) Disadvantages
        - iii) Role of hydrostatic pressure
        - iv) Role of colloid oncotic pressure
      - b) Blood substitute products
      - c) Blood administration in the field
  - c. Afterload considerations -- systemic vascular resistance
  - d. Temperature considerations
    - i. external environmental considerations – blankets
    - ii. internal considerations

## VI. Bleeding considerations

- A. Physiology and Pathophysiology
  1. Review knowledge from previous levels

2. Products and characteristics of blood
  3. Blood clotting
  4. Arterial bleeding
  5. Venous bleeding
  6. Location of bleeding
    - a. External
    - b. Internal
      - i. head
      - ii. chest
      - iii. abdomen
      - iv. extremities
- B. Assessment of Bleeding
- C. Management considerations in bleeding
- D. Review knowledge from previous levels

# Trauma

## Chest Trauma

### Paramedic Education Standard

Integrates assessment findings with principles of epidemiology and pathophysiology to formulate a field impression to implement a comprehensive treatment/disposition plan for an acutely injured patient.

### Paramedic-Level Instructional Guideline

The Paramedic Instructional Guidelines in this section include all the topics and material at the AEMT level PLUS the following material:

- I. Incidence of chest trauma
  - A. Morbidity/mortality
  - B. Prevention strategies
- II. Traumatic Aortic Disruption
  - A. Pathophysiology
    - 1. Review knowledge from previous levels
    - 2. Role of deceleration and speed as MOI
      - a. Events regarding the ligamentum arteriosum
      - b. Rupture of descending aorta at the isthmus
    - 3. Partial tear
      - a. Bleeding in the left chest
      - b. Role of tunica intima and tunica adventitia in prevention of complete tear
      - c. Expanding hematoma may compress esophagus or laryngeal nerve
    - 4. Complete tear – fatality likely on arrival
  - B. Specific Assessment considerations
    - 1. Review knowledge from previous levels
    - 2. Mechanism of Injury
      - a. High index of suspicion necessary for survival
      - b. Rapid deceleration
    - 3. High percent have no signs of external chest trauma
    - 4. Hypotension
    - 5. Signs of Shock
    - 6. Chest pain – tearing in nature
    - 7. Suspicion raises with chest wall injury
    - 8. Unusual pulses or blood pressure in upper extremities
    - 9. Voice changes
      - a. Hoarseness

- b. Stridor
      - 10. Difficulty swallowing
    - C. Management considerations
      - 1. Review knowledge from previous levels
      - 2. AVO management
      - 3. High index of suspicion based upon MOI
      - 4. Do not overhydrate
      - 5. Do not use pressor agents
- III. Pulmonary Contusions
- A. Pathophysiology
    - 1. Review knowledge from previous levels
    - 2. Blunt trauma with associated injuries (rib fractures)
    - 3. Capillary leakage into alveoli prevents gas exchange
    - 4. Decrease lung compliance
    - 5. V/Q mismatch
    - 6. Slowly developing process
    - 7. Diffuse vs localized
  - B. Assessment considerations
    - 1. Review knowledge from previous levels
    - 2. Respiratory distress symptoms
    - 3. Hemoptysis
    - 4. Chest pain from blunt trauma
    - 5. Cough
    - 6. rales or rhonchi
    - 7. Hypoxia
    - 8. High index of suspicion based on MOI
  - C. Management Considerations
    - 1. Review knowledge from previous levels
    - 2. AVO
    - 3. IV fluid administration – over hydration is contraindicated (see Trauma: Bleeding)
- IV. Blunt Cardiac Injury
- A. Pathophysiology
    - 1. Review knowledge from previous levels
    - 2. May not have histological findings - heart is “stunned”
    - 3. Cardiac arrhythmias occur
    - 4. Heart Failure may occur
      - a. Review of right sided heart failure
      - b. Review of left-sided heart failure
  - B. Assessment considerations
    - 1. Review knowledge from previous levels
    - 2. High index of suspicion with anterior blunt chest trauma
    - 3. Clinical signs vary due to injury location in heart – vessels, muscle mass or conduction system



4. Tachycardia
  5. May not exhibit external chest discoloration
  6. Chest pain – retrosternal (MI type pain)
  - C. Management Considerations
    1. Review knowledge from previous levels
    2. High index of suspicion
    3. AVO
    4. Limit fluids if signs of heart failure are present
      - a. lung crackles
      - b. Jugular venous distension
    5. Be prepared for deteriorations in patients with rapid or irregular pulses
- V. Hemothorax
- A. Pathophysiology
    1. Review knowledge from previous levels
    2. Tears in lung parenchyma
    3. Penetrating wounds – puncture great vessels or heart
    4. Intercostal vessel wounds
    5. Internal mammary artery wounds
    6. Clotting in the chest may release fibrolyns – continue bleeding process
    7. Loss of circulating blood in vessels
  - B. Specific Assessment considerations
    1. Review knowledge from previous levels
    2. Shock
    3. Unequal breath sounds
    4. Dullness on percussion
    5. JVD assessment
      - a. Flat with hypovolemia
      - b. Distended if increased intrathoracic pressure
  - C. Specific Management consideration
    1. Review knowledge from previous levels
    2. AVO
    3. Fluid bolus and continued hypovolemia assessment (see Trauma: Bleeding)
    4. Rapid transport to appropriate facility
- VI. Pneumothorax
- A. Open
    1. Pathophysiology
      - a. Review knowledge from previous levels
      - b. Open wound to the chest wall
      - c. Underlying organ and vessel injuries
      - d. Fracture of chest wall structure
      - e. Hypoxia
      - f. Loss of lung adhesion to chest wall due to loss of surface tension-collapse of lung

2. Specific Assessment considerations
    - a. Review knowledge from previous levels
    - b. AVO assessment
    - c. Chest Assessment
      - i. inspection
      - ii. auscultation
      - iii. percussion
    - d. Subcutaneous emphysema
    - e. Hypovolemia signs
    - f. Pulsus paradoxus
    - g. Cardiac dysrhythmia
      - i. may be irregular pulse
      - ii. may be ventricular tachycardia/Vfib in pulseless patient
  3. Specific Management considerations for penetrating chest trauma
    - a. Review knowledge from previous levels
    - b. Management may vary depending upon organs injured in the chest
    - c. Airway
    - d. Ventilation
      - i. inspect chest
      - ii. excessive pressure ventilation can cause tension pneumothorax
    - e. Oxygenation
    - f. Pneumothorax complications
    - g. Dysrhythmia treatment
- B. Simple
1. Pathophysiology
    - a. Review knowledge from previous levels
    - b. Defect in chest wall allow air to enter pleural space
    - c. Most common from gunshot wound
    - d. Some low velocity wounds self-seal not allow atmospheric air into the chest but air from inspiration into the chest can occur in the same patient
    - e. If chest wall hole is 2/3 size of trachea, more air will enter from the atmosphere – sucking sound will be present
    - f. With large holes air enters both the trachea and the hole rapidly collapsing the lung
    - g. Delayed or improper treatment will lead to tension pneumothorax with large open wounds
  2. Specific Assessment considerations
    - a. Review knowledge from previous levels
    - b. Airway
    - c. Ventilation
      - i. cover large (2/3 size of trachea) open wound immediately – nonporous dressing
      - ii. positive pressure ventilation will aggravate condition
    - d. Oxygenation
    - e. Unequal breath sounds

3. Specific Management considerations
  - a. Review knowledge from previous levels
  - b. Small simple pneumothorax is well tolerated in young and fit individuals
  - c. Consider removing dressing if signs and symptoms of tension pneumothorax develop – may need to open the wound

C. Tension

1. Pathophysiology
  - a. Review knowledge of previous levels
  - b. Formation of one-way valve – air from either lungs or atmosphere
  - c. Increased pleural pressure – shift of mediastinal structures to contralateral side – causes kinking of great veins decreasing cardiac output
  - d. May be closed – untreated rupture of alveolar sac
  - e. May be open – penetrating trauma – injury to bronchus or bronchi
2. Specific Assessment considerations
  - a. Review knowledge of previous levels
  - b. Severe respiratory distress
  - c. Jugular vein distention
  - d. Deviation of the trachea – difficult to assess
  - e. Tachycardia
  - f. Narrow pulse pressure
  - g. Absent breath sounds on affected side
  - h. Unequal chest rise
  - i. Pulsus paradoxus
3. Specific Management considerations
  - a. Review knowledge of previous levels
  - b. Fluid infusion may not affect blood pressure and pulse due to great vessel compression

VII. Cardiac Tamponade

A. Pathophysiology

1. Review knowledge from previous levels
  - a. Penetrating trauma – rare in blunt
  - b. Right ventricle most penetrated
2. Blood in the pericardial sac
  - a. Perforation of heart muscle
  - b. Amount of blood dependent in where blood originates
    - i. left ventricle
    - ii. coronary artery
    - iii. venous blood
3. Knife wounds more frequently cause
4. Pericardial laceration seals and hemorrhage fills the sac
5. Sac is not elastic – no stretching
6. Small amounts (55cc) can cause reduction in cardiac output
7. Increased sac pressure puts pressure on coronary arteries

- B. Specific Assessment considerations
    - 1. Review knowledge from previous levels
      - a. Jugular vein distention – increase in CVP
      - b. Increased diastolic pressure
      - c. Narrowed pulse pressure
    - 2. Beck's triad
      - a. Increased venous pressure – JVD
      - b. Decreased blood pressure – hypotension
      - c. Muffled heart tones – unreliable
  - C. Specific Management considerations in cardiac tamponade
    - 1. Review knowledge from previous levels
    - 2. AVO
    - 3. Rapid IV fluid bolus
    - 4. Rapid Transport for pericardiocentesis
- VIII. Rib fractures
- A. Pathophysiology
  - B. Assessment
  - C. Management
- IX. Flail Chest
- A. Pathophysiology
  - B. Assessment
  - C. Management
- X. Commotio cordis
- A. Pathophysiology
  - B. Assessment
  - C. Management
- XI. Tracheobronchial disruption
- A. Pathophysiology
  - B. Assessment
  - C. Management
- XII. Diaphragmatic rupture
- A. Pathophysiology
  - B. Assessment
  - C. Management
- XIII. Traumatic asphyxia
- A. Pathophysiology
  - B. Assessment
  - C. Management

- XIV. Pediatric considerations in chest trauma
  - A. Review of anatomical differences
  - B. Review of physiological differences
  - C. Review of differences in mechanism of injury
  - D. Specific management considerations
    - 1. Airway management (see AVO: Pediatric considerations)
    - 2. Fluid replacement (see Trauma: Bleeding: Pediatric considerations)
    - Respiratory distress symptoms
    - 3. Hemoptysis
    - 4. Chest pain from blunt trauma
    - 5. Cough
    - 6. rales or rhonchi
    - 7. Hypoxia
    - 8. High index of suspicion based on MOI
  - E. Management Considerations
    - 1. Review knowledge from previous levels
    - 2. AVO
      - a. PEEP is best
      - b. Ventilator support in later stages
    - 3. Intubation if indicated
    - 4. Proper IV fluid administration – over hydration is contraindicated
  - F. Geriatric considerations in chest trauma

# Trauma

## Abdominal and Genitourinary Trauma

### Paramedic Education Standard

Integrates assessment findings with principles of epidemiology and pathophysiology to formulate a field impression to implement a comprehensive treatment/disposition plan for an acutely injured patient.

### Paramedic-Level Instructional Guideline

The Paramedic Instructional Guidelines in this section include all the topics and material at the AEMT level PLUS the following material:

- I. Incidence
  - A. Morbidity/Mortality
  - B. Prevention strategies
- II. Vascular injury
  - A. Pathophysiology
    - 1. Review knowledge from previous levels
    - 2. Injuries may be blunt or penetrating
    - 3. Structures
      - a. Abdominal aorta
      - b. Mesenterics – superior and inferior
      - c. Renal artery
      - d. Gonadal arteries
      - e. Gastric artery
      - f. Splenic artery
      - g. Hepatic artery
      - h. Iliac arteries
      - i. Hepatic portal system
      - j. Inferior venae cavae
    - 4. Internal bleeding – related to which and how many blood vessels injured
    - 5. Potential bleeding space in the abdomen
    - 6. Length time from injury to surgery
    - 7. Often masked by other injuries
    - 8. Internal venous bleeding may be more severe because arterial bleeds can occlude the lumen of the artery.
  - B. Special Assessment Findings
    - 1. Review knowledge from previous levels
    - 2. High level of suspicion with MOI
    - 3. Solid organs injured with blunt trauma – liver spleen
    - 4. Patient history of the injury pattern/cause

5. Seat belts – proper use of – in rapid deceleration
6. Entrance and Exit wounds
7. Abdominal tenders in four quadrants
8. Lower rib tenderness
9. Guarding
10. Presence of lower pulses
11. Kehr's sign
12. Use of ultrasound
- C. Special management considerations
  1. Review knowledge from previous levels
  2. AVO
  3. Hypotension treatment – fluid bolus
  4. Recognition of injury – others may mask
  5. Rapid transport
  6. Use of PASG
  7. Do not hemodilute patients – disrupts clot formation

### III. Solid and hollow organ injuries

- A. Pathophysiology
  1. Review knowledge from previous levels
    - a. Solid organs
      - i. liver
        - a) review functions of the liver
        - b) difficult to control hemorrhage in surgery
        - c) require massive blood transfusions in surgery
      - ii. spleen
        - a) largest lymphoid organ in body
        - b) review functions of the spleen
        - c) blood cell reservoir
      - iii. kidney
        - a) review functions of kidney
        - b) classification of renal injury
      - iv. abdominal vessels
      - v. pancreas
    - b. Hollow organs
      - i. stomach
      - ii. small bowel
      - iii. large bowel
      - iv. urinary bladder
      - v. gallbladder
        - a) review pH of fluids in hollow organs
        - b) review presence of bacteria in hollow organs
    - c. Review co-morbidity of abdominal diseases and abdominal trauma
- B. Special Assessment Findings
  1. Review knowledge from previous levels

2. Findings relate to
  - a. Solid vs hollow organ
  - b. Comorbid injuries that may mask
  - c. Time since injury
  - d. Vascularity of organ
  - e. Blunt vs penetrating trauma
  - f. How the organ is or is not attached to the abdominal wall
  - g. Size of the insult
3. Splenic and liver injuries have classifications
4. Patient history surrounding MOI is important
5. Inspection of the abdomen is critical
6. Stability of the pelvis
7. Seat belt use and fit across abdomen
8. Kehr's sign
9. Abdominal tenderness
- C. Special management considerations
  1. Review knowledge from previous levels
  2. AVO
  3. Circulation
  4. High index of suspicion
  5. Rapid transport
  6. Role of ultrasound
  7. Changes with repeated assessments

#### IV. Blunt vs. Penetrating Abdominal Injury

- A. Pathophysiology
  1. Review knowledge from previous levels
  2. Hole in abdominal wall
  3. Underlying solid and hollow organs is major concern
  4. Route for infection
  5. Cavitation
  6. Abdominal wall bleeding
- B. Special Assessment Findings
  1. Review knowledge from previous levels
  2. Most patients with penetrating abdominal injury have underlying solid and hollow organ injuries (cover elsewhere)
  3. Inspection
    - a. Entrance and exit wounds
    - b. Lacerations
    - c. Discoloration of skin
    - d. Distention
  4. Palpation
    - a. Accomplished by quadrant – start furthest away from injury
    - b. Blood will not cause immediate peritonitis
    - c. Chemical peritonitis may be abrupt from stomach acids
    - d. Bacterial peritonitis may take hours to develop



5. Patient affect
  - a. Quiet, non-complaining patients may have severe injuries
  - b. Lots of patient movement indicates less chance for peritonitis
  - c. Hypovolemia changes LOC
6. Referred pain to shoulder
7. Large amounts of intra-abdominal bleeding may occur without much external evidence
8. Field ultrasound
9. Hematuria
10. Grey-Turner's sign – flank discoloration
11. Rectal bleeding
- C. Special management considerations
  1. Review knowledge from previous levels
  2. AVO
  3. Circulation
  4. Cover exposed bowel with sterile saline dressings
  5. Field ultrasound

## V. Evisceration

- A. Pathophysiology
  1. Review knowledge from previous levels
  2. Open injury to abdominal wall which allows protrusion of abdominal contents
  3. Strangulation of bowel by abdominal wall
  4. Loss fluid and temperature regulation of exposed bowel
- B. Special Assessment Findings
  1. Review knowledge from previous levels
  2. exposed bowel – may be large or small
  3. Bowel protrudes with increase in abdominal pressure – cough
  4. Maybe recent post-surgical patient at home – cough, straining
- C. Special management considerations
  1. Review knowledge from previous levels
  2. AVO
  3. Circulation
  4. Pain relief considerations
  5. Cover bowel with sterile saline gauze
  6. Patient may find relief with knee bent
  7. Avoid coughing

## VI. Retroperitoneal injury

- A. Pathophysiology
- B. Special Assessment Findings
- C. Special management considerations

- VII. Injuries to external genitalia
  - A. Pathophysiology
    - 1. Male
      - a. Scrotum
        - i. holds large volumes of blood or fluids
        - ii. blunt, penetrating or crushing injury
      - b. Penis
        - i. blunt, penetration or crushing injury
        - ii. amputation
        - iii. urethra penetration
    - 2. Female
  - B. Special Assessment Findings
    - 1. Male external genitalia
      - a. Pain
      - b. Swelling
    - 2. Female
      - a. Pain
      - b. Bleeding
      - c. Clues of sexual assault
      - d. History of foreign object penetration
    - 3. Review knowledge from previous levels
  - C. Special management considerations
    - 1. Review knowledge from previous levels
    - 2. Male
      - a. Treat amputations as with other amputations
      - b. Do not relieve pressure in scrotum
      - c. Do not remove impaled objects
      - d. Provide pain management
      - e. Ice to reduce swelling
      - f. Emotional support
    - 3. Female
      - a. Control external hemorrhage
      - b. Emotional considerations in assault/rape
      - c. Do not remove impaled objects
      - d. Reporting requirements with assault
      - e. Review sexual assault at lower levels

- VIII. Age-related variations
  - A. Pediatrics
  - B. Geriatrics

# Trauma

## Orthopedic Trauma

### Paramedic Education Standard

Integrates assessment findings with principles of epidemiology and pathophysiology to formulate a field impression to implement a comprehensive treatment/disposition plan for an acutely injured patient.

### Paramedic-Level Instructional Guideline

The Paramedic Instructional Guidelines in this section include all the topics and material at the AEMT level PLUS the following material:

- I. Incidence
  - A. Morbidity/Mortality
    - 1. Upper extremity
    - 2. Lower extremity
  - B. Prevention
- II. Pediatric fractures
  - A. Pathophysiology
    - 1. Review previous knowledge
    - 2. Types of fractures
      - a. Epiphyseal – at bone growth plate
      - b. Greenstick – incomplete fracture from bending bone
      - c. Torus – buckling of cortex of bone
    - 3. Immature growth of bones
    - 4. Growth plates at end of bones and complications of epiphyseal fractures
  - B. Special assessment findings
    - 1. Review previous knowledge
    - 2. MOI – assess for abuse
    - 3. Motor, sensory, pulse assessment distal to injury
    - 4. Child/parent interaction
    - 5. Age differences and reaction to trauma
    - 6. Assess for comorbidity
  - C. Special management considerations
    - 1. Review previous knowledge
    - 2. AVO
    - 3. Transport with family members
    - 4. Consent issues when family not present, injury not serious
    - 5. Inform family, teachers, guardians of transport location
    - 6. Immobilization the same as adults
    - 7. Ice will reduce swelling

- III. Tendon lacerations/transection/rupture (Achilles and patellar)
  - A. Pathophysiology
    - 1. Review previous knowledge
    - 2. Physiology of tendons
    - 3. Achilles Tendon rupture
    - 4. Patellar - knee
      - a. Twisting of the knee in sports activities
      - b. Anterior cruciate ligament
      - c. Posterior cruciate ligament
      - d. Lateral collateral ligament
      - e. Medial collateral ligament
      - f. Compression injury – direct blow to knee
      - g. Lateral and medial sprains – abnormal twisting
      - h. Torsion injuries – feet fixed in one direction while body is moving in different direction
      - i. Hyperextension – knee extended beyond normal straight leg position
    - 5. Shoulder
      - a. Sternoclavicular sprain – direct blow or twisting of posteriorly extended arm
      - b. Rotator cuff tendon injuries – acute or chronic – deltoid muscle involvement – violent pull on arm, an abnormal rotation, or fall on outstretched arm which tears or ruptures tendons
  - B. Special assessment findings
    - 1. Review previous knowledge
    - 2. Muscle weakness
    - 3. Pain
    - 4. Edema
    - 5. Loss of range of motion
  - C. Special management considerations
    - 1. Review previous knowledge
    - 2. Ice
    - 3. Elevation
    - 4. Sensory, motor function
    - 5. Inspection
    - 6. palpation – symmetry with other limbs
    - 7. tests to determine if mobility is normal or abnormal
    - 8. Assess as soon after injury as possible
    - 9. Psychological support
    - 10. Immobilization if necessary
    - 11. Support of other allied health professions – athletic trainers
- IV. Open fractures
  - A. Pathophysiology
    - 1. Review previous knowledge
    - 2. Bone disruption with opening in the skin

3. Role of osteoblasts
  4. Method of fracture healing
    - a. Bleeding at site
    - b. Hematoma forms fibrous network
    - c. Invasion of osteoblasts
    - d. Callus formation – new bone built up, dead bone removed
    - e. Remodeling
  5. Osteomyelitis
  6. Fat embolism
  - B. Special assessment findings
    1. Review previous knowledge
    2. Open wounds over any injured bone
    3. Bone involvement – does not have to be sticking out to be open
    4. Motor, sensory, distal pulse/circulation evaluation
  - C. Special management considerations
    1. Review previous knowledge
    2. Control bleeding
      - a. External
      - b. Internal
    3. Prevent infection
    4. Immobilization techniques
      - a. Traction control hemorrhage by apply pressure on internal bleeding within muscles wrapped by muscle sheaths.
      - b. Align in anatomical position
    5. Comorbidity – multi-system trauma
- V. Closed fractures
- A. Pathophysiology
    1. Review previous knowledge
    2. Closed fractures contribute to internal vascular or nerve injuries
    3. Muscle spasms surrounding fracture cause bone ends to rub
    4. Fat embolism
  - B. Special assessment findings
    1. Review previous knowledge
    2. Edema
    3. Pain
    4. Motor, sensory, distal circulation
    5. Isolated fracture – focus assessment and management
    6. Comorbidity with multi-system trauma
  - C. Special management considerations
    1. Review previous knowledge
    2. Immobilization techniques
      - a. Unique depending bone fractured

## VI. Dislocations

### A. Pathophysiology

1. Review previous knowledge
2. Joint involvement
  - a. Elbow – fall on outstretched arm, radius and ulna forced backward
  - b. Fingers – hit on fingers, forced upward away from palm
  - c. Hip – force along long axis of femur
    - i. posterior – femur shaft is adducted and flexed (more common to the two)
    - ii. anterior – flexed, adducted and internally rotated
  - d. Humeral head – forced out of articular capsule, fall with inward rotation and abduction of an arm
  - e. Knee – foot planted, outward displacement with patella stable in place
  - f. Shoulder joint – maintained in place by ligaments, impact drives acromion downward away from clavicle which sustains its position
  - g. Wrist – wrist is in a hyperextended position
3. Joint moved beyond its normal limits
4. Subluxations – partial dislocation
5. Luxations – complete dislocation

### B. Special assessment findings

1. Loss of limb function
2. Deformity – almost always present
3. Immediate swelling and point tenderness
4. Review previous knowledge

### C. Special management considerations

1. Review previous knowledge
2. Figure 8 splinting for shoulders (sternoclavicular joint)
3. Sling and swath for acromioclavicular joint
4. Elbow splinted in position found if distal circulation present
5. Wrist – padded board or pillow splint with sling and swath
6. Hip – position found with blankets or pillows for comfort
7. Knee – true emergency – position found unless distal circulation compromised, then anatomical alignment
8. Ice to reduce swelling
9. Elevation
10. Pain relief

## VII. Compartment syndrome

### A. Pathophysiology

1. Review previous knowledge
2. Locally increased pressure compromises local circulation and neuromuscular function
3. Occur with crush injuries
4. Burns
5. Tight casts as part of fracture management

6. Occlusion of arterial blood supply
  7. Snake bites
  8. Rhabdomyolysis
- B. Special assessment findings
1. Review previous knowledge
  2. Severe limb pain
  3. Muscle compartment extremely tight
  4. Decreased sensation to touch
  5. Paresthesia
  6. Loss of distal circulation
  7. Paralysis
- C. Special management considerations
1. Review previous knowledge
  2. Removal of plaster casts
  3. Elevation
  4. Ice
  5. Rapid transport to appropriate facility
  6. Treatment of acidemia
  7. Treatment of Rhabdomyolysis
  8. Pain Management

# Trauma

## Soft Tissue Trauma

### Paramedic Education Standard

Integrates assessment findings with principles of epidemiology and pathophysiology to formulate a field impression to implement a comprehensive treatment/disposition plan for an acutely injured patient.

### Paramedic-Level Instructional Guideline

The Paramedic Instructional Guidelines in this section include all the topics and material at the AEMT level PLUS the following material:

- I. Incidence of soft tissue injury
  - A. Mortality/morbidity
- II. Anatomy and Physiology of soft tissue injury
  - A. Layers of the skin
  - B. Function of the skin
- III. Pathophysiology of wound healing
  - A. Hemostasis
  - B. Inflammation phase
  - C. Epithelialization
  - D. Neovascularization
  - E. Collagen synthesis
  - F. Alteration of wound healing
    - 1. Anatomic factors
    - 2. Concurrent drug use
    - 3. Medical conditions/disease
    - 4. High risk wounds
  - G. Abnormal scar formation
    - 1. Keloid
    - 2. Hypertrophic scar formation
    - 3. Wounds requiring closure
      - a. Cosmetic regions
      - b. Gaping wounds
      - c. Wounds over tension lines/areas
        - i. static tension
        - ii. dynamic tension
      - d. Degloving injury
      - e. Ring injury
      - f. Skin tearing



#### IV. Wounds

##### A. Avulsions

1. Pathophysiology
  - a. Description – shearing force causes tissue to completely separated from base, and either lost or left with a flap.
  - b. Depth influences amount of bleeding
  - c. Secondary infection
  - d. Wound healing process
  - e. Scar tissue and its function/ability
2. Special assessment finding
  - a. Lost soft tissue
  - b. Skin “flap” which can be returned to anatomical position
  - c. Contaminated wounds
  - d. Serosanguineous drainage
3. Special management considerations
  - a. Control hemorrhage
  - b. Ice to area
  - c. Wound cleaning techniques
  - d. Long term care vs emergent care

##### B. Bite Wounds

1. Pathophysiology
  - a. Types
    - i. animal
      - a) dog may cause any time of soft tissue injury
      - b) elderly and young most susceptible to infection
      - c) cat bites, more infectious, *Pasteurella multocida*
    - ii. human
      - a) may cause any time of soft tissue wound
      - b) most frequently the hand
      - c) secondary infection due to delay in treatment
      - d) multiple types of bacteria may cause the infection
    - iii. insect
      - a) spider bites
        - i) black widow
        - ii) brown recluse
      - b) fire ants
      - c) wasps
      - d) bees
      - e) tick bites
      - f) scorpion stings
    - iv. rabies
2. Special assessment finding
  - a. Animal
    - i. note time since bite
    - ii. type of animal

- b. Human
      - i. cause of wound
      - ii. location
      - iii. presence of infection due to delayed in seeking treatment
    - c. Insect
      - i. black widow
      - ii. brown recluse
      - iii. fire ants
      - iv. tick bites
        - a) woods, parks (know the area where bites occur)
        - b) Look for tick attached to the skin
        - c) febrile illness present
        - d) bulls eye rash seen with Lyme disease
        - e) Rocky Mountain spotted fever
        - f) know tick bite prevention strategies
  - 3. Special management considerations
    - a. Animal
      - i. scene safety – assure animal secured
      - ii. control hemorrhage
      - iii. clean wound
      - iv. report type of animal bite
    - b. Human
      - i. cause of bite
      - ii. abuse, neglect and reporting responsibilities
    - c. Insect
      - i. spider bites
      - ii. fire ants
        - a) remove victim and crew from ant mounds
        - b) brush off ants
        - c) supportive care
      - iii. tick bites
        - a) inspect for ticks when suspicious
        - b) pull tick straight out of skin with tweezers
        - c) do not crush the tick when removing
        - d) likely needs specialized hospital care if severely ill
        - e) supportive care

## C. Lacerations

- 1. Pathophysiology
  - a. Tears in the skin
  - b. Multiple causes
  - c. Bleeding affected by location, type of blood vessels injured
  - d. Underling soft tissue involvement – tendons, ligaments
  - e. Underlying organ involvement – bones, body cavities, organs
  - f. Review bleeding and shock
- 2. Special assessment finding
  - a. Review previous knowledge

- b. Consider the location on the body and tissues injured
    - c. Consider loss of function of the tissue
    - d. Consider role of infection for delayed treatment
  - 3. Special management considerations
    - a. Review previous knowledge
    - b. Review hemorrhage control procedures
- D. Puncture wounds
  - 1. Pathophysiology
    - a. Considerations around depth of wound
    - b. Considerations on type and speed of object that punctured the skin
    - c. Consideration around infection
    - d. Considerations on injury to underlying organs and tissues
    - e. Considerations on location of the puncture
    - f. Considerations about the size of the hole the object leaves in the body
    - g. Most bleeding is internal
  - 2. Special assessment finding
    - a. Mechanism of injury
    - b. Inspect the wound, do not probe
    - c. Know underlying complications
    - d. Infection problems when patient did not seek care
    - e. Role to edema
  - 3. Special management considerations
    - a. Role of tetanus antitoxin
    - b. Infection prevention
    - c. Wound management
    - d. Supportive care
- V. Burns
  - A. Electrical
    - 1. Pathophysiology
      - a. Ohm's Law – role of voltage and resistance
      - b. Joule's Law – relationship between heat production, current and resistance.
      - c. Body tissues vary in type of resistance to current
      - d. Electrical current follows path of least resistance
      - e. Severity influenced by
        - i. type of voltage of circuit
        - ii. amperage of current
        - iii. resistance of the body
        - iv. pathway of the current
        - v. duration of the current
      - f. Types of injury
        - i. thermal due to burning of clothing, etc

- ii. arc-type – causes high skin temperature leading to burns
    - iii. electrical injury – as it travels through body it heats up causing tissue necrosis with entrance and exit wounds
  - 2. Special assessment finding
    - a. Review previous knowledge
    - b. Cardiac arrest
    - c. Neuromuscular injuries
      - i. peripheral nerve deficit
      - ii. muscle coordination and strength
    - d. Spinal cord involvement/injury
  - 3. Special management considerations
    - a. SCENE SAFETY
    - b. Cardiac arrest management
    - c. Cervical spine protection
    - d. IV fluids if hypotension is present
    - e. Transport to appropriate facility
- B. Chemical
  - 1. Pathophysiology
    - a. Many sources may cause burn
    - b. Alkali exposure – produces
      - i. liquefaction necrosis
      - ii. breakdown of protein and collagen
      - iii. saponification of fats
      - iv. dehydration of tissues
      - v. thrombosis of blood vessels
      - vi. deep penetrating injury
      - vii. little pain
      - viii. typically are cleaners – oven, fertilizers, industrial
    - c. Acids
      - i. cause coagulation necrosis and immediate pain
      - ii. frequently doesn't injure deeper tissues
      - iii. amount of damage depends on concentration of agent, quality of the agent, length of exposure, depth of penetration.
    - d. Organic compounds
  - 2. Special assessment finding
    - a. Skin damage will depend on agent, length of exposure, BSB
    - b. Know the agent
    - c. Read the label
    - d. Seek consultation with poison center
  - 3. Special management considerations
    - a. Use protective clothing/equipment when necessary
    - b. Flush with copious amounts of water
    - c. Alkalis may require several hours of irrigation
    - d. Do not use neutralizing agents

- C. Thermal
  - 1. Pathophysiology
    - a. Heat absorbed exceeds capacity to dissipate it
    - b. Depth will depend on time of contact and source
    - c. Age variances with burns
    - d. Severity depends on
      - i. burn agent
      - ii. burn circumstances
      - iii. location of the burn on the body
      - iv. age of the patient
      - v. concomitant injuries
      - vi. preexisting injuries
    - e. Epidermis injured
    - f. Epidermis and varying layers of dermis
    - g. Burn extends into subcutaneous tissue possibly including bone and muscle tissue
    - h. Burns and burn effect on other body systems
      - i. cardiovascular involvement
      - ii. pulmonary involvement
      - iii. renal involvement
      - iv. GI involvement
      - v. hematological involvement
      - vi. endocrine involvement
  - 2. Special assessment finding
    - a. Superficial partial thickness burn
    - b. Moderate-deep partial thickness
      - i. red, moist surface, with extreme sensitivity (pain) to any stimuli
      - ii. formation of blisters is very common
      - iii. in partial thickness burns, the deeper the burn the more painful.
      - iv. have intact deep pressure sensation
      - v. color of deep partial thickness burns may be deceptive
    - c. Full thickness
      - i. white, waxy appearance
      - ii. charred/parched tan appearance
      - iii. black appearance
      - iv. skin dry, hard
      - v. lack of sensation or pain
      - vi. skin is incapable of self-regeneration
    - d. Review percent of body surface burn estimation methods for adults, children and infants
    - e. Lund and Browder chart and BSB
    - f. Classification Systems
      - i. minor burn
      - ii. moderate burn
      - iii. major burn

3. Special management considerations
  - a. Review previous knowledge
  - b. AVO
  - c. Patient with greater than 20% BSB need fluid resuscitation
  - d. Parkland Burn Formula
  - e. Know signs of adequate fluid resuscitation
  - f. Know signs of inadequate fluid resuscitation
  - g. Pain management

- VI. High-pressure injection wounds
  - A. Pathophysiology
  - B. Special assessment finding
  - C. Special management considerations

# Trauma

## Head, Facial, Neck, and Spine Trauma

### Paramedic Education Standard

Integrates assessment findings with principles of epidemiology and pathophysiology to formulate a field impression to implement a comprehensive treatment/disposition plan for an acutely injured patient.

### Paramedic-Level Instructional Guideline

The Paramedic Instructional Guidelines in this section include all the topics and material at the AEMT level PLUS the following material:

- I. Introduction
  - A. Incidence
    - 1. Head injury
    - 2. Brain injury
    - 3. Face injury
  - B. Mechanisms of Injury
    - 1. Motor vehicle crashes
    - 2. Sports
    - 3. Falls
    - 4. Penetrating trauma
    - 5. Blunt trauma
  - C. Morbidity and Mortality
  - D. Categories of Injury
    - 1. Coup
    - 2. Contrecoup
    - 3. Diffuse axonal injury (DAI)
    - 4. Focal
  - E. Causes of brain injury
    - 1. Direct/primary
    - 2. Indirect/secondary/tertiary
  - F. Associated Injuries
    - 1. Airway compromise
    - 2. Cervical spine injury
  - G. Prevention
- II. Unstable Facial Fractures
  - A. Pathophysiology
    - 1. Categories of Unstable Facial Fractures
      - a. Le Fort I - Fracture separates hard palate and lower maxilla from remainder of skull

- b. Le Fort II - Fracture separates the nasal and lower maxilla from the facial skull and remainder of the cranial bones
        - c. Le Fort III (craniofacial disjunction) - Fracture separates the entire midface from the cranium.
      - 2. Blunt trauma to the facial area most frequent cause
    - B. Specific assessment considerations
      - 1. Facial instability
      - 2. Epistaxis
      - 3. Edema
      - 4. Pain
    - C. Specific management considerations
      - 1. Simple airway maneuvers are difficult
      - 2. Intubation is method of choice for airway protection
      - 3. Ventilation without intubation is difficult
      - 4. Manual in-line intubation
      - 5. Bleeding into the oral cavity; suction
      - 6. Cricothyroidotomy if indicated
      - 7. Soft tissue bleeding
- III. Orbital Fractures
  - A. Pathophysiology
    - 1. Blunt trauma to the eye causes increased pressure to the globe of the eye. The pressure causes the weakest area (orbital floor) to give way, causing herniation of orbital contents (inferior oblique muscle entrapment) into the maxillary sinus.
  - B. Specific assessment considerations
    - 1. Mechanism of injury
    - 2. Sports injury (balls)
    - 3. enophthalmos
    - 4. impaired ocular mobility
    - 5. diplopia
    - 6. infraorbital hypoesthesia
  - C. Specific management considerations
    - 1. Assess for other injuries
    - 2. Patching both eyes
    - 3. Ice to reduce edema
- IV. Perforated tympanic membrane
  - A. Pathophysiology
    - 1. Pressure trauma – diving, water skiing
    - 2. Direct blows
    - 3. Explosion or barotraumas
    - 4. Foreign objects
  - B. Specific assessment considerations
    - 1. hemorrhagic otorrhea
    - 2. hearing loss



- C. Specific management considerations
  - 1. Supportive care
- V. Skull fractures
  - A. Pathophysiology (fracture without brain injury)
    - 1. Linear
    - 2. Depressed
    - 3. Basilar
    - 4. Location and type of fracture is important
    - 5. Suspicion of underlying brain injury
  - B. Specific assessment considerations
    - 1. LOC
    - 2. Hemorrhage control
      - a. Depressed skull fractures may require circumferential digital pressure to control an open skull fracture bleed
    - 3. Fracture lines that cross the middle meningeal artery can be serious
    - 4. Underlying hematoma size can be significant
    - 5. CSF leakage
  - C. Specific management considerations
    - 1. Spinal cord precautions
    - 2. AVO
      - a. High flow oxygen
      - b. Adequate ventilation (not hyperventilation)
      - c. No nasal airways of any kind for basilar skull fractures
    - 3. Document neurological assessment
    - 4. Transport to appropriate facility
    - 5. Monitor vital signs
    - 6. Supportive care
- VI. Penetrating neck trauma (non-cord involvement)
  - A. Pathophysiology
    - 1. Blunt
    - 2. Penetrating
    - 3. Upper airway passages
    - 4. Larynx
    - 5. Vascular supply to brain
    - 6. Upper GI system
    - 7. Epiglottis
  - B. Specific assessment considerations
    - 1. Changes in voice
    - 2. Subcutaneous emphysema
    - 3. Equal carotid pulse strength
    - 4. Dysphagia
    - 5. Hemorrhage
    - 6. Hemoptysis
    - 7. Tracheal ring fracture

- C. Specific management considerations
  - 1. Hemorrhage control (digital for carotid artery puncture)
  - 2. Intubation to protect the airway
  - 3. Voice rest (limited history)
- VII. Laryngeotracheal injuries
  - A. Pathophysiology
    - 1. Trauma directly to structures
    - 2. Edema
    - 3. Hemorrhage
  - B. Specific assessment considerations
    - 1. Swelling
    - 2. Voice changes
    - 3. hemoptysis
    - 4. subcutaneous emphysema
    - 5. structural irregularity
  - C. Specific management considerations
    - 1. AVO
      - a. Airway obstruction common
      - b. May need surgical airway
    - 2. Supportive multi-system care
- VIII. Spine trauma (non-CNS involvement)
  - A. Pathophysiology
  - B. Specific assessment considerations
    - 1. Pain
    - 2. Point tenderness
    - 3. Neurologically intact/normal
  - C. Specific management considerations
    - 1. Spinal immobilization
      - a. Seated
      - b. Standing
    - 2. AVO
    - 3. Supportive multi-system care
- IX. Mandibular fractures
  - A. Pathophysiology
  - B. Specific assessment considerations
    - 1. Malocclusion of the teeth
    - 2. Pain
    - 3. Point tenderness
    - 4. ecchymosis on the floor of the mouth
  - C. Specific management considerations
    - 1. AVO
    - 2. Non-use of nasal airways
    - 3. ice
    - 4. monitor closely

# Trauma

## Nervous System Trauma

### Paramedic Education Standard

Integrates assessment findings with principles of epidemiology and pathophysiology to formulate a field impression to implement a comprehensive treatment/disposition plan for an acutely injured patient.

### Paramedic-Level Instructional Guideline

The Paramedic Instructional Guidelines in this section include all the topics and material at the AEMT level PLUS the following material:

- I. Incidence
  - A. Morbidity/mortality
  - B. Prevention strategies
- II. Cauda equine syndrome
  - A. Pathophysiology
    - 1. Cauda equine are spinal nerves descending at the end of the spinal cord. Not part of the cord, but a series of nerves that appears like a tail at the end of the spinal cord.
    - 2. The syndrome results from trauma to the lower back
  - B. Special assessment considerations (signs and symptoms are never root dependent)
    - 1. weakness of lower muscles (depended upon which nerve root is injured)
    - 2. loss of reflexes
    - 3. hyperesthesia and later anesthesia in groin
    - 4. incontinence
    - 5. sexual dysfunction
  - C. Special management considerations
- III. Nerve root injury (To be reviewed for inclusion later)
  - A. Pathophysiology
  - B. Special assessment considerations
  - C. Special management considerations
- IV. Peripheral nerve injury
  - A. Pathophysiology
    - 1. Trauma damages a nerve, or nerve group between the ganglion and its intervention point.
    - 2. Damage causes muscle or sections of the muscle not to function properly
    - 3. Damage causes sensation on the skin to be lost

- B. Special assessment considerations
    - 1. MOI
      - a. Fracture
      - b. Laceration involving nerve pathway
      - c. Penetrating trauma
      - d. Pressure (weight against a nerve pathway)
    - 2. Anesthesia
    - 3. Numbness
    - 4. Muscle weakness
  - C. Special management considerations
    - 1. Immobilize in anatomical position
    - 2. Reduce swelling
- V. Traumatic brain injury
- A. Pathophysiology
    - 1. Brain is very oxygen dependent
    - 2. Brain has very limited oxygen storing capacity
    - 3. Loss of blood flow for 5-10 seconds causes unconsciousness
    - 4. Low PacO<sub>2</sub> causes vasodilation
    - 5. High PacO<sub>2</sub> causes vasoconstriction
    - 6. Coup injury to the brain
    - 7. Contrecoup injury to the brain
    - 8. Primary brain injury
    - 9. Secondary brain injury
    - 10. Center of consciousness (reticular activating system)
    - 11. Coma
    - 12. Posturing (decerebrate, decorticate)
    - 13. Normal intracranial pressure (2 – 12 mmHg)
    - 14. Cushing's triad (increased blood pressure, decreased pulse and irregular respirations)
    - 15. Brain herniation
      - a. Uncal herniation
      - b. Central herniation syndrome
      - c. Cerebellar herniation
    - 16. Skull fractures
      - a. Linear
      - b. Depressed
      - c. Open
      - d. Basilar
    - 17. Concussion
    - 18. Diffuse axonal injury
    - 19. Contusion
    - 20. Cerebral lacerations
    - 21. Epidural hematoma
    - 22. Subdural hematoma
      - a. acute
      - b. chronic

23. Subarachnoid hemorrhages
  24. Intracerebral hematomas
  25. Penetrating Brain trauma
  - B. Specific assessment considerations
    1. LOC
    2. AVO
    3. Spinal Concerns
    4. Vital sign irregularities
    5. Posturing
    6. Pupil reactions
    7. CSF presence
    8. Cranial nerve damage signs
    9. Bilateral strength of muscle groups
    10. Doll's eyes
    11. Coma assessment
    12. Neurological exam
      - a. LOC
      - b. Pupil function
      - c. Peripheral Sensory/Motor
      - d. Reflexes
  - C. Special management considerations
    1. AVO with spinal precautions/immobilization
      - a. Neuromuscular blocking agents
      - b. Surgical airways with massive facial trauma
      - c. Ventilate/assist to maintain PaO<sub>2</sub> of 90mmHg
    2. MOI
      - a. Blunt
      - b. Penetrating
    3. History
      - a. Amnesia
      - b. Retrograde amnesia
    4. Vital signs
      - a. Cheyne-Strokes
      - b. Cushing's triad
    5. Pharmacological agents
    6. Seizure precautions/treatment
    7. Volume replacement in multi-system trauma
    8. Role of Hypothermia
    9. Role of neuroprotective agents
    10. Role of steroids
- VI. Spinal cord injury
- A. Pathophysiology
    1. Mechanism of injury
      - a. Axial loading
      - b. Flexion

- c. Hyperflexion
  - d. Hyperrotation
  - e. Lateral bending
  - f. Distraction
  - g. Cord concussion
  - h. Cord contusion
  - i. Cord compression
  - j. Laceration
- 2. Complete cord lesions
- 3. Incomplete cord lesions
  - a. Brown-Sequard's syndrome – penetrating trauma
  - b. Anterior cord syndrome – pressure/damage on anterior spinal cord
  - c. Central cord syndrome – contusion to cord, hyperextension or flexion mechanisms.
- 4. Neurogenic shock
  - a. Loss of control between injury site and brain
  - b. Vasodilation
  - c. Loss of balance between parasympathetic and sympathetic nervous systems
- 5. Paralytic ileus
- B. Special assessment considerations
  - 1. Dermatome assessment
  - 2. Complete
    - a. No pain below injury site
    - b. No sensation to pressure below injury site
    - c. No feeling of sensation below injury site
    - d. No movement below injury site
  - 3. Incomplete
    - a. Brown-Sequard
      - i. signs on one side of body
      - ii. ipsilateral motor loss
      - iii. ipsilateral loss of proprioception
      - iv. contralateral loss of pain and temperature sensation
    - b. Anterior
      - i. loss of voluntary and reflex motor activity
      - ii. loss of pain and temperature sensation
      - iii. preservation of proprioception, vibratory sense, and ability to sense light pressure
    - c. Central Cord
      - i. changes mainly effect upper extremities
      - ii. loss of feeling in upper extremities but presence in lower extremities
      - iii. paresis often more pronounced distally in upper extremities than proximal
- C. Special management considerations
  - 1. Spinal immobilization

2. AVO
3. Pharmacological agents (anti-inflammatory)
4. Dermatome assessment and anatomical regional effects with spinal injury.

VII. Spinal shock

- A. Pathophysiology
  1. Loss of control between injury site and brain
  2. Vasodilation
  3. Loss of balance between parasympathetic and sympathetic nervous systems
  4. Lasts 7 to 20 days
  5. Autonomic hyperreflexia
- B. Special assessment considerations
  1. Flaccid muscles
  2. Paralysis
  3. Absence of sensation
  4. Hypotension
  5. Hypothermia
- C. Special management considerations
  1. AVO
  2. IV bolus
  3. Vasopressor considerations
  4. Pharmacological assistance

# Trauma

## Special Considerations in Trauma

### Paramedic Education Standard

Integrates assessment findings with principles of epidemiology and pathophysiology to formulate a field impression to implement a comprehensive treatment/disposition plan for an acutely injured patient.

### Paramedic-Level Instructional Guideline

The Paramedic Instructional Guidelines in this section include all the topics and material at the AEMT level PLUS the following material:

- I. Trauma in Pregnancy
  - A. Incidence
    - 1. Mortality/morbidity
    - 2. Risk factors
    - 3. Prevention
  - B. Pathophysiology
    - 1. Exhibit responses different due to physiologic changes during pregnancy
    - 2. Mother
      - a. Blood volume changes
      - b. Respiratory changes
      - c. GI and intra-abdominal changes
    - 3. Fetus
    - 4. Fetal death caused by
      - a. Maternal loss – trauma leading to shock
      - b. Abruptio placentae – need high index of suspicion
    - 5. Abdominal injuries
    - 6. Pelvic fracture
    - 7. Traumatic arrest
    - 8. Seat belt injuries
    - 9. Sexual assault
  - C. Special Considerations in assessment
    - 1. Increased heart rate is not an early sign of hypovolemic shock
    - 2. Significant blood loss may not be reflective of usual signs of shock
    - 3. RR less than 20 should not be considered adequate ventilation
    - 4. loss of landmarks for chest compressions in arrest
    - 5. MOI and signs of abruption placentae
    - 6. Estimate gestational age of baby
    - 7. Palpate uterine fundus
    - 8. Attempt to listen to fetal heart tones – 4 o'clock position, about 2" from mother umbilicus



- D. Special considerations in management
  - 1. Airway, Breathing, and Circulation
  - 2. Maternal management
  - 3. Fetal Assessment

## II. Pediatric Trauma

- A. Unique Pediatric Aspects of Trauma
  - 1. Most common is motor vehicle-related
  - 2. Blunt trauma most prevalent MOI
  - 3. Intentional injuries
  - 4. Suicide in adolescents
  - 5. Children in trauma more rapidly decompensate
  - 6. Child abuse causes trauma
  - 7. Strong catecholamine capabilities
- B. Pathophysiology
  - 1. Head – most common injured
    - a. Larger than adults
    - b. Large occiput flexes head compromising airway
    - c. Suture flexibility in very young
    - d. Newborns and infants can become hypotensive with head injuries
  - 2. Spine
    - a. SCIWORA
  - 3. Chest
    - a. Very compliant – injury requires great force
    - b. Commotio cordis – sudden impact of blunt force to the chest resulting in cardiac dysfunction, even death
  - 4. Abdomen
    - a. Larger solid organs
    - b. Weak abdominal muscles
  - 5. Musculoskeletal
    - a. Epiphyseal plate
    - b. Bones heal faster
- C. Special Considerations in assessment
  - 1. Airway, Breathing, and Circulation
    - a. Small mouth and airways, easy obstructed
    - b. Use of sniffing position
    - c. Large tongue in infant makes ET more difficult
    - d. Mainstem intubation precautions
  - 2. Circulation
    - a. Hypotension appears late, use other signs of inadequate circulation
    - b. Inadequate oxygenation cause bradycardia
    - c. Capillary refill may be helpful
    - d. LOC may indicate inadequate circulation
    - e. B/P estimated as  $80 + 2 \text{ times the age}$
    - f. Appropriate B/P cuff size
    - g. 80ml/Kg blood loss can cause shock

3. Head
  - a. Very vascular, even scalp laceration can cause shock
  - b. Falls less than 5 feet are significant
  - c. Beware of shaken baby syndrome
  - d. GCS less than 8 means increased ICP
4. Chest
  - a. Significant internal injury can be present without any external signs
  - b. Tension-pneumothorax is difficult to evaluate
5. Abdomen
  - a. Spleen most common injured
  - b. Cullen's sign
  - c. Kehr's sign
6. Musculoskeletal Trauma
- D. Special considerations in management
  1. Airway, Breathing, and Circulation (improper management is the most common cause of preventable pediatric death)
    - a. Intubation complications
    - b. High-concentration oxygen and saturation
    - c. Proper endotracheal tube size considerations
    - d. Nasotracheal intubation is contraindicated
  2. Circulation
    - a. IV's at 20ml/Kg bolus
    - b. IO if no damage in lower extremity
  3. Head
    - a. Elevate during transport
    - b. Seizure precautions
  4. Spinal –
    - a. adequate size C-collars are important
    - b. padding with immobilization
  5. Abdomen
  6. Extremity
  7. Transportation

### III. Geriatric Trauma

- A. Unique Geriatric Aspects of Trauma
- B. Pathophysiology
  1. Most changes occur after age 80 if the patient is in general good health
  2. Respiratory
    - a. Chest wall less compliant
    - b. Less vital capacity
    - c. Decrease in ciliary action
  3. Cardiovascular
    - a. Heart rate and stroke volume decrease
    - b. Dysrhythmia changes

4. Neurological system
    - a. Neuron mass reduction
    - b. Velocity of impulses
    - c. Mentation changes
    - d. Thermoregulation changes
  5. Gastrointestinal
  6. Renal
  7. Musculoskeletal
  8. Integumentary
  9. Immune
  - C. Special considerations in assessment
    1. History
      - a. Unreliable historian's
      - b. Mentation, dementia
      - c. Family members as historians
    2. Decreased tolerance to heat loss
  - D. Special considerations in management
    1. Airway, Breathing, and Circulation
      - a. Mask seal
      - b. Cervical kyphosis
      - c. Oxygen saturation can quickly deteriorate
    2. Circulation
      - a. Over hydration in patient with cardiac history
  - E. Specific injuries/diseases management
    1. Shock
    2. Head injuries
    3. Musculoskeletal injuries
    4. Burns
    5. Abuse
- IV. Cognitively impaired patient
- A. Unique challenges with cognitive impaired patients
    1. ability of individual to communicate complaints
    2. unreliable historian's
    3. unusual presentation of common disorders
    4. reduced pain threshold
    5. consent to treat complications
    6. most commonly mental retardation (IQ less than 70)
    7. 1 to 2.5% of population has mental retardation
    8. Autism – differences in social, communication and ability to purposefully shift attention (may become agitated with touch)
  - B. Special considerations in assessment
    1. Level of development
      - a. 5 or 6<sup>th</sup> grade level is common
      - b. use open-ended questions to assess development
      - c. particular difficulty with time and causality concepts

- d. use a high function concept and have them repeat it back
  - 2. Use family and caregivers as part of history gathering
    - a. How does patient normally communicate?
    - b. How aware are they of environment?
    - c. What are usual motor skills and level of activity?
    - d. What are the patient's usual sleep patten and appetite?
  - 3. Assess/determine hearing and sight problems
  - 4. Take vital signs when patient is calm
  - 5. Typically helpful to have a caregiver present during physical exam
- C. Special considerations in management
  - 1. Treatment is the same
  - 2. Suspect common disorders in the age population
    - a. Injuries
    - b. Infections
    - c. Seizures
    - d. Delirium
    - e. Psychiatric disorders
    - f. GI disorders

# Trauma

## Environmental Emergencies

### Paramedic Education Standard

Integrates assessment findings with principles of epidemiology and pathophysiology to formulate a field impression to implement a comprehensive treatment/disposition plan for an acutely injured patient.

### Paramedic-Level Instructional Guideline

The Paramedic Instructional Guidelines in this section include all the topics and material at the AEMT level PLUS the following material:

- I. Incidence
  - A. Morbidity/Mortality
  - B. Risk Factors
    - 1. Pediatric considerations
    - 2. Geriatric considerations
    - 3. Fitness/Body Mass Index
    - 4. Age
    - 5. Gender
    - 6. Medical conditions
    - 7. Medications
    - 8. Hydration
  - C. Prevention
    - 1. Personal Protection Equipment (PPE)
    - 2. Climate acclimatization
    - 3. Policies/procedures for work conditions
    - 4. Hydration with food, beverage, electrolyte replacement
    - 5. Measuring heat stress index
      - a. Wet-bulb globe temperature (humidity)
      - b. Dry bulb temperature (radiant)
      - c. Black globe temperature (ambient)
    - 6. Minimize fatigue
    - 7. Muscular strength and endurance training
- II. Submersion incidents
  - A. Pathophysiology
    - 1. Near drowning
      - a. Patient survives 24 hours after submersion incident (asphyxiation)
      - b. Wet drowning
      - c. Dry drowning

- d. Hypoxia causes the chain of events toward death
    - e. Post-submersion syndrome
  - B. Special Assessment considerations
    - 1. Diving emergencies
      - a. Signs of bends occur with 15 minutes to 12 hours after surfacing
      - b. Signs of bends
        - i. happens in patients with a recent diving history
        - ii. pain in joints
        - iii. fatigue
        - iv. weakness
      - c. B/P cuff over affected joint
    - 2. Near drowning
      - a. Apnea to cardiac arrest
      - b. Post-submersion syndrome
      - c. Injury prevention participation
  - C. Special management considerations
    - 1. Diving
      - a. Rapid transport to decompression facility
      - b. 100% oxygen administration
    - 2. Near-drowning
- III. Temperature-related illness
  - A. Pathophysiology
    - 1. Heat Illness
      - a. Heat physiology
        - i. conduction
        - ii. convection
        - iii. radiation
        - iv. evaporation
        - v. thermosensors
        - vi. central nervous system function
        - vii. thermoregulatory effectors
      - b. Predisposing factors for heat illness
      - c. Fever vs hyperthermia
      - d. Thermometry
      - e. Heat cramps
        - i. brief, muscle cramps of fatigued muscles
        - ii. related to electrolyte imbalance in muscles
      - f. Heat syncope
        - i. mostly seen in elderly
        - ii. much blood in periphery to increase heat loss causes inability to compensate/control blood pressure when standing
      - g. Prickly Heat
      - h. Heat exhaustion
        - i. Water depletion
        - ii. Salt depletion

- i. Heat Stroke
      - i. malfunction of sodium pump in thermoregulatory cells
      - ii. exact temperature which causes is unknown but near 112°F
      - iii. damage is dependent on multiple factors
      - iv. failure to perfuse skin with heated core blood dramatically increases rate of heat storage
      - v. loss of sweating mechanism does not cause heat stroke
  - 2. Cold-related illness
    - a. Frost bite
    - b. Accidental hypothermia
- B. Special Assessment considerations
  - 1. Heat Illness
    - a. Prickly heat, gland ducts can become infectious
    - b. Heat exhaustion
      - i. variable and nonspecific
      - ii. weakness, fatigue, headache, impaired judgment, vertigo
      - iii. moderately elevated core temperature
    - c. Heat stroke
      - i. prolonged heat stress/exhaustion
      - ii. signs of CNS dysfunction (coma, seizures, delirium)
      - iii. hot, dry skin
      - iv. tachycardia
      - v. often under diagnosed due to lack of presence of classic symptoms
  - 2. Frostbite
    - a. Pathophysiology
      - i. freezing injury cascade
      - ii. microvasoconstriction and local fluid shifting
      - iii. temperature in local area drops below 0°C
      - iv. ice forms outside the cell causing osmotic disequilibrium
      - v. cells function lost
      - vi. freezing of circulation fluids
      - vii. anaerobic function of cells, pressure on cells, thrombus in local tissues, ischemia to necrosis
    - b. Predisposing factors
    - c. Types during local tissue freezing
      - i. frostnip
      - ii. chilblains
      - iii. trench foot
  - 3. Accidental hypothermia
    - a. Due to submersion or prolonged exposure to cold temperatures
    - b. Risk is high for young and elderly, patients who can not generate heat (diseases and medications)
    - c. Vasoconstriction produces peripheral tissue ischemia
    - d. Continued drops in temperature causes hypothalamic center to stimulate shivering

- e. If cold continues, vasoconstriction is lost and then vasodilation occurs with loss of core heat to the periphery
  - f. At 85 degrees the individual become stuporous, cardiac output drops, cerebral blood flow is decreased
  - g. At 78 degrees V-fib and cardiovascular collapse are common
- C. Special management considerations
  - 1. Heat Illness
    - a. Heat cramps
      - i. IVs of salt containing solutions
      - ii. oral intake of electrolyte solutions
  - 2. Heat Syncope
    - a. Lay victim flat
    - b. Keep people moving in heated environments
  - 3. Heat exhaustion
    - a. IV therapy
    - b. Cool environment
  - 4. Heat stroke
    - a. Initial cooling
    - b. Ice water or ice application
    - c. Fanning of patient who is wet with cold/ice water
    - d. Supportive care for seizures, electrolyte imbalance)
    - e. IV therapy
    - f. Sedation if agitated
  - 5. Frostbite
    - a. Consider re-warming only if potential to re-freeze does not exist
    - b. Remove wet clothing
    - c. Move to warm environment
    - d. If re-warming, tepid, near body heat, water immersion of extremity, usually requires 10 to 30 minutes immersion
    - e. Pain relief medications are essential with re-warming
  - 6. Accidental hypothermia
    - a. AVO
      - i. consider intubation if no gag reflex
    - b. Circulation
      - i. cardiac monitor
      - ii. IV insertion, fluid challenge, warm fluids
      - iii. CPR if indicated
    - c. Passive re-warming techniques
    - d. Active re-warming techniques

#### IV. Bites and Envenomations

- A. Injuries of concern
  - 1. Spider bites
  - 2. Snake bites
  - 3. Hymenoptera (bees, wasps, ants, yellow jackets)
- B. Pathophysiology of bites and envenomations



1. Spider bites (black widow)
  - a. Inject neuro toxins, designed to digest its prey
  - b. Toxin plays role in function of acetylcholine in nerve impulse transmission
2. Snake bites
  - a. Toxins effect blood and nervous system both at the bite site and systemically
  - b. Many toxins cause the patients cells to release bradykinins, histamines, and serotonin
  - c. Patient age and size cause different effects
  - d. Amount of toxin injected has effect (often none at all)
  - e. Initial 6 – 8 hours care is essential
3. Hymenoptera
  - a. Cause allergic reactions in sensitized (allergic) people
  - b. Often leads to anaphylactic response
- C. Signs and Symptoms
  1. Spider bite (black widow)
    - a. Localized swelling initially
    - b. Chest or abdominal pain depending on bite site
    - c. Dangerous in children, may be fatal
  2. Rattlesnake bite
    - a. Time of bite to care is important
    - b. Pain at site
    - c. Edema
    - d. Progressive weakness
    - e. Nausea and vomiting
    - f. Seizures
    - g. Vision problems
    - h. Changes in LOC
  3. Bee, Wasp, and other stings
    - a. Pain at site
    - b. Swelling
    - c. Signs of allergic reaction
    - d. Signs of anaphylaxis
- D. Unique management considers of bites and stings
  1. Spider bite (black widow)
    - a. Ice pack to area of bite
    - b. Clean wound with soap and water
    - c. Transport immediately with supportive care
  2. Rattlesnake bite
    - a. Note time of bite to transport
    - b. Slow venous return, place venous constricting bands
    - c. Keep patient calm
    - d. Immobilize extremity
    - e. Clean bite site with soap and water
    - f. Identify snake if possible

3. Bees, wasps, and other stings
  - a. Quickly remove stinger or venom sac
  - b. if anaphylaxis develops follow protocol

V. Electrical injury – Lightning strikes

- A. Pathophysiology
  1. Pathophysiology similar to electrical burns
  2. MOI
    - a. Direct strike
    - b. Side flash “splash”
    - c. Ground current or step voltage
    - d. Blunt trauma
    - e. Contact
  3. Major problem is cardiorespiratory arrest (massive DC countershock)
  4. May cause head trauma, cardiac damage, burns, extremity vasospasm, paresis or paresthesias.
- B. Special Assessment considerations
  1. Scene safety
  2. Assess for cardiac arrest
- C. Special management considerations
  1. AVO
  2. Cardiac arrest management
  3. Burn wound care
  4. Transport

VI. High altitude illness

- A. Pathophysiology
- B. Special Assessment considerations
  1. Vary depending on speed of ascent and time at elevation
    - a. Headache, anorexia, nausea, fatigue, dizziness, difficulty sleeping
  2. HAPE (high altitude pulmonary edema)
  3. High altitude retinal hemorrhage
- C. Special management considerations
  1. Reduce altitude as fast as possible
  2. Mild cases are self limited
  3. Moderate, aspirin, acetaminophen,
  4. Severe requires diuretics, oxygen, steroids
  5. Prevention is best, many patients take acetazolamide

# Trauma

## Multi-System Trauma

### Paramedic Education Standard

Integrates assessment findings with principles of epidemiology and pathophysiology to formulate a field impression to implement a comprehensive treatment/disposition plan for an acutely injured patient.

### Paramedic-Level Instructional Guideline

The Paramedic Instructional Guidelines in this section include all the topics and material at the AEMT level PLUS the following material:

- I. Kinematics of trauma
  - A. Definition
    - 1. Looking a trauma scene and attempting to determine what injuries might have resulted
    - 2. Kinetic energy – function of weight of an item and its speed.
    - 3. Blunt trauma
      - a. Objects collide during crashes
        - i. car with object
        - ii. victim with part of car
        - iii. organs collide inside body
      - b. Unbelted drivers and front seat passengers suffer multi-system trauma due to multiple collisions of the body and organs
      - c. Direction of the force has impact on type of injury
        - i. frontal impacts
        - ii. rear impacts
        - iii. side impacts
        - iv. rotational impacts
        - v. roll-overs
    - 4. Deceleration Injuries
    - 5. Penetrating Trauma
      - a. Types of bullets have affect
        - i. distance from shooter
        - ii. size of bullet
        - iii. fragmentation
        - iv. cavitation
      - b. Energy levels have effect
        - i. low energy -- stabbings
        - ii. medium energy -- handguns and some rifles
        - iii. high energy -- military weapons

- c. Organs stuck have effect
  - i. head
  - ii. chest
  - iii. abdomen
  - iv. extremities

## II. Multi-System Trauma

### A. Definition

1. Almost all trauma effects more than one system
2. Typically a patient considered to have “multi-trauma” has more than one major system or organ involved
  - a. Examples:
    - i. head and spinal trauma
    - ii. chest and abdominal trauma
    - iii. chest and multiple extremity trauma
3. Multi-trauma treatment will involve a team of physicians to treat the patient such as neurosurgeons, thoracic surgeons, and orthopedic surgeons
4. Multi-trauma has a high level of morbidity and mortality

### B. The golden principles of out of hospital trauma care

1. Safety of patient and rescue personnel
2. Determination of additional resources
3. Kinematics
  - a. Mechanism of injury
  - b. High index of suspicion
4. Identify and manage life threats
5. Airway management while maintaining cervical spinal immobilization
6. Support ventilation and oxygenation
7. Control external hemorrhage
8. Basic shock therapy
  - a. Maintain normal body temperature
  - b. Splint musculoskeletal injuries
9. Maintain spinal immobilization on long board
  - a. Standing patients
  - b. Sitting patients
  - c. Rapid transport considerations
  - d. Prone patients
  - e. Supine patients
10. Transportation considerations
  - a. Golden period
  - b. Closest appropriate facility
  - c. ‘Platinum 10 Minutes’
11. Obtain medical history
12. Secondary survey after maintenance of life threats
13. “Do No Further Harm”

- C. Critical Thinking in multi-system trauma care
1. Airway, ventilation and oxygenation are key elements to success
    - a. Airways must be opened and clear throughout care
    - b. Adequate ventilation must occur
    - c. Oxygenation in multi-system trauma is high concentrations of oxygen
  2. Oxygenation can not occur when patients are bleeding profusely
    - a. Stop arterial bleeding rapidly
    - b. Consider use of tourniquets in emergent, hostile or multiple patient situations where bleeding is considerable
  3. Sequence of treating patients
    - a. Not all treatments are linear. At times care must be adjusted depending on the needs of the patient.
    - b. Example:
      - i. control arterial bleeding in an awake patient first
      - ii. much care can be done en route
  4. Rapid transport is essential
    - a. The definitive care for multi-system trauma is surgery which can not be done in the field
    - b. On scene time is critical and should not be delayed
    - c. Rapid extraction is an important consideration
    - d. Use of ALS intercept and air medical resources in a multi-trauma patient should be highly considered
    - e. Early notification of hospital resources is essential once rapidly leaving the scene
    - f. Transport to the appropriate facility is critical
  5. Backboards
  6. Documentation and Reporting
    - a. EMTs are the eyes and ears of the physicians
    - b. EMTs need to re-create the scene
    - c. Important kinematics and mechanisms of injury are important to trauma teams
    - d. Changes in vital signs or assessment findings while en route are critical to report and document
  7. Personal safety
    - a. Most important when arriving on scene, and throughout care, an injured EMT can not provide care
    - b. Be sure to assess your environment
      - i. passing automobiles
      - ii. hazardous situation
      - iii. hostile environments
      - iv. unsecured crime scenes
      - v. suicide patients who may become homicidal

8. Experience
  - a. Newly licensed paramedics who have not seen many multi-system trauma patients need to stick with the basics of life saving techniques
  - b. Do not develop “tunnel” vision by focusing on patients who complain of lots of pain and are screaming for your help while other quiet patients who may be hypoxic or bleeding internally can not call out for help because of decreases in level of consciousness
  - c. Be suspicious at trauma scenes, sometimes an obvious injury is not the critical cause one the potential for harm.
  - d. Trauma care is a leading cause of death of young people. It is essential you keep important care principles in mind when providing care.

### III. Specific injuries related to multi system trauma

#### A. Blast injuries

1. Types of Blast Injuries (explosions)
  - a. Blast waves
  - b. Blast winds
  - c. Ground shock
  - d. Heat
2. Pathophysiology
  - a. Blast waves when the victim is close to the blast cause disruption of major blood vessels, rupture of major organs, and lethal cardiac disturbances
  - b. Blast winds and ground shock can collapse buildings cause trauma
3. Signs/symptoms
  - a. Hollow organs are injured first
  - b. Multi-system injury sign and symptom patterns
    - i. lungs
    - ii. heart
    - iii. major blood vessels
4. Management considerations in blast injuries
  - a. Multi-system trauma care
  - b. Immediate transport to appropriate facility
  - c. Multi-casualty care

# Special Patient Population

## Obstetrics

### Paramedic Education Standard

Integrates assessment findings with principles of pathophysiology and knowledge of psychosocial needs to formulate a field impression and implement a comprehensive treatment/disposition plan for patients with special needs.

### Paramedic-Level Instructional Guideline

The Paramedic Instructional Guidelines in this section include all the topics and material at the AEMT level PLUS the following material:

- I. Introduction
  - A. Anatomy and physiology review of the female reproductive system
    - 1. uterus
    - 2. cervix
    - 3. ovaries
    - 4. vagina
    - 5. breasts
  - B. Female reproductive cycle
    - 1. female hormones
      - a. estrogen
      - b. progesterone
      - c. prostaglandins
    - 2. neurohormonal basis
    - 3. ovarian cycle
    - 4. menstrual cycle
  - C. Cultural values affecting pregnancy
  - D. Special considerations of adolescent pregnancy
- II. Physiology
  - A. Normal anatomical, physiological, and psychological changes in pregnancy
    - 1. reproductive system
    - 2. respiratory system
    - 3. cardiovascular system
    - 4. gastrointestinal system
    - 5. urinary tract
    - 6. skin, hair, and eyes
    - 7. musculoskeletal system
    - 8. metabolism

- 9. endocrine
  - a. system
  - b. hormones in pregnancy
- 10. psychological
- B. Identify normal events of pregnancy
- C. Conception and fetal development
  - 1. ovulation
  - 2. fertilization
  - 3. implantation
  - 4. fetal circulatory system
  - 5. embryonic stage
  - 6. fetal stage
- D. Development and functions of the placenta
  - 1. placental circulation
  - 2. placental functions
  - 3. transfer of gases
  - 4. transport of nutrients
  - 5. hormone production
  - 6. protection

### III. General system physiology, assessment, and management of the obstetrical patient.

- A. Premonitory signs of labor
  - 1. lightening
  - 2. Braxton Hicks
  - 3. cervical changes
  - 4. bloody show
  - 5. rupture membrane
  - 6. other
- B. Stages of labor and delivery
  - 1. first stage
    - a. latent
    - b. active
    - c. transition
  - 2. second stage
    - a. spontaneous birth
    - b. positional changes of the fetus
      - i. descent
      - ii. flexion
      - iii. internal rotation
      - iv. extension
      - v. restitution
      - vi. external rotation
      - vii. expulsion
  - 3. third stage
    - a. placental separation
    - b. placental delivery



4. maternal response to labor
  - a. cardiovascular
  - b. respiratory
  - c. renal
  - d. gastrointestinal
  - e. immune system
  - f. pain
5. fetal response to labor
  - a. heart rate
  - b. acid-base status
  - c. hemodynamic
  - d. sensation
- C. Assessment of the Pregnant Patient
  1. airway, breathing, circulation
  2. initial assessment
  3. SAMPLE history
  4. vital signs
  5. obstetrical history
  6. physical examination
  7. evaluating gestational age
    - a. fundal measurement
    - b. calculating estimated date of birth
  8. fetal movement
  9. fetal heart tones
  10. deep tendon reflexes
  11. inspect for crowning
- D. Management of a normal delivery obstetrical patient
  1. Treatment modalities
    - a. oxygen
    - b. non-pharmacological intervention
      - i. positioning
      - ii. IV access
      - iii. cardiac monitor
    - c. pharmacological interventions
      - i. fluids
      - ii. analgesia
- E. Postpartum Care
  1. assessment of fundus
  2. quality of lochia
  3. signs of hemorrhage
- IV. Complications Related to Pregnancy
  - A. Abuse
  - B. Substance abuse
  - C. Supine hypotensive disorder
  - D. Diabetes mellitus
    1. pathophysiology

- 2. assessment
  - 3. management
- E. Various cardiac disorders
  - 1. pathophysiology
  - 2. assessment
  - 3. management
- F. Bleeding Related to Pregnancy: pathophysiology, assessment, complications, management
  - 1. abortion
    - a. elective abortion
    - b. spontaneous abortion
    - c. threatened
    - d. imminent
    - e. complete
    - f. incomplete
    - g. missed
    - h. habitual
    - i. septic
  - 2. Ectopic pregnancy
- G. Placental problems: pathophysiology, assessment, management
  - 1. abruption placenta
  - 2. placenta previa
- H. Hyperemesis gravidum
  - 1. pathophysiology
  - 2. assessment
  - 3. management
- I. Hypertensive disorders: pathophysiology, assessment, management
  - 1. pregnancy induced hypertension
  - 2. preeclampsia
  - 3. eclampsia
- J. Rh sensitization
- K. Infections
  - 1. HIV
  - 2. TORCH
    - a. toxoplasmosis
    - b. rubella
    - c. cytomegalovirus
    - d. herpes
  - 3. urinary tract
  - 4. vaginal
  - 5. Sexually Transmitted Infections
    - a. candidiasis
    - b. trichomoniasis
    - c. bacterial vaginosis
    - d. chlamydial infection
    - e. gonorrhea

- f. syphilis
  - g. human papilloma virus
- V. High Risk Pregnancy: pathophysiology, assessment, complications, management
  - A. precipitous labor and birth
  - B. post term pregnancy
  - C. meconium staining
  - D. fetal macrosomia
  - E. multiple gestation
  - F. intrauterine fetal death
  - G. amniotic fluid embolism
  - H. hydramnios
  - I. cephalopelvic disproportion
- VI. Complications of Labor: pathophysiology, assessment, complications, management
  - A. premature rupture of membranes
  - B. preterm labor
  - C. uterus rupture
  - D. fetal distress
- VII. Complications of Delivery: pathophysiology, assessment, complications, management
  - A. cephalic presentation
    - 1. occiput – posterior
    - 2. face
    - 3. brow
    - 4. military
  - B. breech
    - 1. frank
    - 2. incomplete
    - 3. complete
    - 4. transverse
  - C. shoulder dystocia
  - D. nuchal cord
  - E. prolapse of cord
  - F. Postpartum Complications: pathophysiology, assessment, complications, management
    - 1. inverted uterus
    - 2. hemorrhage
      - a. early
        - i. uterine atony
        - ii. lacerations
        - iii. retained placental fragments
      - b. late
    - 3. embolism
    - 4. Post partum depression

# Special Patient Population

## Neonatal Care

### Paramedic Education Standard

Integrates assessment findings with principles of pathophysiology and knowledge of psychosocial needs to formulate a field impression and implement a comprehensive treatment/disposition plan for patients with special needs.

### Paramedic-Level Instructional Guideline

The Paramedic Instructional Guidelines in this section include all the topics and material at the AEMT level PLUS the following material:

- I. Introduction
  - A. Newborn
    - 1. A recently born infant; usually considered the first few hours of life
  - B. Neonate
    - 1. Considered the first 28 days of life
- II. General pathophysiology, assessment and management
  - A. Epidemiology
    - 1. Incidence
      - a. Approximately 6% of deliveries require life support
      - b. Incidence of complications increases as birth weight decreases
    - 2. Morbidity/ mortality
      - a. Neonatal mortality risk can be determined via graphs based on birth weight and gestational age
      - b. Resuscitation is required for about 80% of the 30,000 babies who weigh less than 1500 grams at birth
    - 3. Risk factors
      - a. Antepartum factors
        - i. multiple gestation
        - ii. inadequate prenatal care
        - iii. mother's age <16 or >35
        - iv. history of perinatal morbidity or mortality
        - v. post-term gestation
        - vi. drugs/ medications
        - vii. toxemia, hypertension, diabetes
        - viii. perinatal infections
        - ix. known fetal malformations/"high risk" OB patient
      - b. Intrapartum factors
        - i. premature labor
        - ii. meconium-stained amniotic fluid

- iii. rupture of membranes greater than **18** hours prior to delivery
    - iv. use of narcotics within four hours of delivery
    - v. abnormal presentation
    - vi. prolonged labor or precipitous delivery
    - vii. prolapsed cord
    - viii. bleeding
  - 4. Treatment strategies
    - a. Preparation of resuscitation equipment
    - b. Determine appropriate destination
- B. Pathophysiology
  - 1. Transition from fetal to neonatal circulation
  - 2. Respiratory system must suddenly initiate and maintain oxygenation
  - 3. Infants are very sensitive to hypoxia
  - 4. Permanent brain damage will occur with hypoxemia
  - 5. Apnea in newborns
    - a. Primary
    - b. Secondary
  - 6. Congenital anomalies
    - a. diaphragmatic hernia
    - b. choanal atresia
    - c. Pierre Robin syndrome
    - d. Cleft lip
    - e. Other craniofacial Defects
    - f. Spina bifida
    - g. Exposed abdominal contents
      - i. Intact omphalocele
      - ii. Non intact omphalocele
    - h. Other common conditions
- C. Assessment of the newborn
  - 1. Time of delivery
  - 2. Normal/ abnormal vital signs
  - 3. Airway and ventilation
    - a. Respiratory rate
    - b. Respiratory effort
  - 4. Circulation
    - a. Heart rate
    - b. Color/ cyanosis
      - i. normal
      - ii. central versus peripheral
      - iii. mucosal membranes
    - c. End organ perfusion
      - i. compare strength of central pulses versus peripheral
      - ii. capillary refill
  - 5. APGAR
    - a. Appearance - skin color

- i. completely pink - 2
  - ii. body pink, extremities blue - 1
  - iii. blue, pale - 0
- b. **Pulse rate**
  - i. above 100 - 2
  - ii. below 100 - 1
  - iii. absent - 0
- c. **Grimace - irritability**
  - i. cries - 2
  - ii. grimaces - 1
  - iii. no response - 0
- d. **Activity - muscle tone**
  - i. active motion - 2
  - ii. some flexion of extremities - 1
  - iii. limp - 0
- e. **Respiratory - effort**
  - i. strong cry - 2
  - ii. slow and irregular - 1
  - iii. absent - 0

D. Treatment

- 1. Prior to delivery, prepare environment and equipment
- 2. During delivery, suction mouth and nose as head delivers
- 3. After delivery
  - a. Airway and ventilation
    - i. drying
      - a) head and face
      - b) body
    - ii. warming
      - a) appropriate techniques
      - b) minimize heat loss via head
    - iii. position
    - iv. suction
      - a) technique
        - i) mouth first, than nares
        - ii) nasal suctioning is a stimulus to breathe
      - b) equipment
        - i) bulb suction
        - ii) suction catheters
        - iii) meconium aspirator
    - v. stimulation
      - a) flicking soles of feet
      - b) stroking back
    - vi. blow-by oxygen
      - a) never withhold oxygen
      - b) oxygen should be warmed

- c) use when
    - i) newborn is cyanotic and
    - ii) heart rate > 100 and
    - iii) adequate respiratory rate and effort
  - d) 5 liters/ minute maximum
    - i) complications due to hypothermia
    - ii) direct rather than tangential flow on face
  - e) appropriate techniques
- vii. oral airways - rarely used for neonates
  - a) necessary to keep mouth open for ventilation
  - b) bilateral choanal atresia
  - c) Pierre Robin syndrome
  - d) macroglossia
  - e) craniofacial defects affecting airway
- viii. bag-valve-mask
  - a) mask characteristics
    - i) appropriate size
    - ii) minimize dead-space
  - b) bag characteristics
    - i) pop-off valve should be disabled
    - ii) risk of pneumothorax with excessive pressures
    - iii) initial breath may require high pressures
  - c) use when
    - i) apneic
    - ii) inadequate respiratory rate or effort
    - iii) heart rate less than 100
  - d) technique
    - i) initial ventilations require higher pressure to expand lungs
    - ii) rate
- ix. intubation
  - a) indications
    - i) prolonged positive pressure ventilation
    - ii) bag and mask ventilations ineffective
    - iii) tracheal suctioning required
    - iv) diaphragmatic hernia suspected
    - v) craniofacial defects that impede ability to maintain adequate airway.
  - b) technique
    - i) suction equipment
    - ii) laryngoscope
    - iii) blades-straight
      - (a) #1- full term
      - (b) #0- preterm
    - iv) endotracheal tubes -- 2.5 to 4.0 mm id

- v) shoulder roll
    - vi) adhesive tape
  - c) confirmation
    - i) visualization
      - (a) tube passing through the cords
      - (b) chest expansion with ventilation
    - ii) auscultation
      - (a) laterally and high on the chest wall
      - (b) epigastric region
    - iii) patient improvement
    - iv) EtCO<sub>2</sub>
    - v) pulse oximetry
  - d) PEEP
- x. gastric decompression
  - a) abdominal distention is impeding ventilation
  - b) presence of diaphragmatic hernia
  - c) tracheo-esophageal fistula
- b. Circulation
  - i. vascular access
    - a) indications
      - i) to administer fluids
      - ii) to administer medications
    - b) peripheral vein cannulation
    - c) intraosseous cannulation
  - ii. chest compression (in addition to assisted ventilation with BVM) Refer to current ILCOR/AHA guidelines
- c. Pharmacological
  - i. bradycardia
  - ii. low blood volume
  - iii. respiration depression secondary to narcotics
  - iv. metabolic acidosis
  - v. hypoglycemia
- d. Non-pharmacological
  - i. temperature control
  - ii. positioning
- e. Transport consideration
  - i. rapid transportation of the distressed infant
  - ii. position newborn on their side to prevent aspiration
  - iii. adequate securing of ETT
- f. Psychological support/ communication strategies

### III. Specific situations

#### A. Meconium stained amniotic fluid

##### 1. Epidemiology

##### a. Incidence

- i. may occur either in utero or intrapartum
- ii. mostly in post-term and small-for-gestational-age newborns



- b. Morbidity/ mortality
      - i. high mortality
      - ii. hypoxemia
      - iii. aspiration pneumonia
      - iv. pneumothorax
      - v. pulmonary hypertension
    - c. Risk factors
      - i. fetal distress during labor and delivery
      - ii. post-term infants
      - iii. thin particulate meconium versus thick
  - 2. Anatomy and physiology review
  - 3. Pathophysiology
    - a. Hypoxia or physiologic cause
    - b. Aspiration of meconium stained amniotic fluid
      - i. Complete airway obstruction
        - a) Atelectasis
        - b) right-to-left shunt across the foramen ovale
      - ii. Incomplete airway obstruction
        - a) Ball valve type obstruction
        - b) developing pneumothorax
        - c) chemical pneumonitis
    - c. Patient deterioration
      - i. hypoxia
      - ii. hypercapnia
      - iii. acidosis
  - 4. Assessment findings
    - a. Thin and watery
    - b. Thick and particulate
  - 5. Management considerations for thick or particulate meconium
    - a. Airway and ventilation
      - i. do not stimulate the infant to breathe
      - ii. tracheal suction under direct visualization
        - a) airway is clear
        - b) infant breathes on own
        - c) bradycardia
      - iii. ventilate with 100% oxygen
    - b. Circulation
    - c. Pharmacological
    - d. Non-pharmacological
      - i. needle decompression may be required
      - ii. hypothermia prevention
    - e. Transport consideration
      - i. identify facility to handle high-risk newborn
    - f. Psychological support/ communication strategies
      - i. do not discuss "chances of survival" with family
      - ii. explain what is being done for the newborn

- B. Apnea in the neonate
  - 1. Epidemiology
    - a. Incidence
    - b. Morbidity/ mortality
    - c. Risk factors
      - i. prematurity
      - ii. in newborn, prolonged or difficult labor and delivery
      - iii. drug exposure
      - iv. maternal Infection
  - 2. Anatomy and physiology review
  - 3. Pathophysiology
    - a. Usually due to hypoxia or hypothermia
    - b. May be due to other causes
      - i. narcotics or central nervous system depressant
      - ii. airway and respiratory muscle weakness
      - iii. oxyhemoglobin dissociation curve shift
      - iv. septicemia
      - v. metabolic disorder
      - vi. central nervous system disorders
  - 4. Assessment findings
    - a. Failure to breathe spontaneously after stimulation
    - b. Respiratory pauses greater than 20 seconds
  - 5. Management considerations
    - a. Airway and ventilation
      - i. stimulate the baby to breathe
        - a) flicking the soles of the feet
        - b) rubbing the back
      - ii. ventilate with BVM
        - a) disable pop-off valve
        - b) subsequent ventilations with minimal pressure to cause chest rise
      - iii. suction as needed
      - iv. intubation
        - a) indications
          - i) heart rate less than 60 with adequate BVM ventilation and chest compressions
          - ii) prolonged positive-pressure ventilations
          - iii) prolonged apnea
          - iv) central cyanosis despite adequate ventilations
          - v) craniofacial defects which impede airway control/maintenance
        - b) complications
          - i) tube dislodgement
          - ii) tube occlusion by mucous or meconium

- iii) pneumothorax
    - iv) use of LMA as alternative means of airway control
  - b. Circulation
    - i. monitor heart rate continuously
    - ii. circulatory access
      - a) peripheral iv
      - b) intraosseous
  - c. Pharmacological
    - i. consider narcotic antagonists if narcotic administered within four hours of delivery
    - ii. NO narcotic antagonist should be utilized if mother is a drug abuser
    - iii. consider dextrose (D10) administration if hypoglycemic
    - iv. consider fluid bolus
  - d. Non-pharmacological
  - e. Transport consideration
  - f. Psychological support/ communication strategies
    - i. relatively good outcome if treated early and aggressively
    - ii. explain what is being done for the infant
- C. Diaphragmatic hernia in the neonate
  - 1. Epidemiology
    - a. Incidence
    - b. Morbidity/ mortality
    - c. Risk factors
  - 2. Anatomy and physiology review
  - 3. Pathophysiology
    - a. Abdominal contents are displaced into the thorax
    - b. Heart may be displaced
  - 4. Assessment findings
    - a. Little to severe distress
    - b. May have cyanosis unresponsive to ventilations
      - i. may be difficult to ventilate at “normal” airway pressures
      - ii. may have associated hypoplastic lung on involved side.
      - iii. if significant prenatal shift in mediastinum, may have some degree pulmonary hypoplasia on contralateral side.
    - c. Scaphoid (flat) abdomen
    - d. Bowel sounds heard in chest
    - e. Heart sounds displaced to right
  - 5. Management considerations
    - a. Airway and ventilation
      - i. assure adequate oxygen
      - ii. place an orogastric tube and apply low, intermittent suction
      - iii. endotracheal intubation may be necessary
      - iv. exercise caution if needle decompression
    - b. Circulation -- monitor heart rate continuously

- c. Pharmacological -- none indicated for primary problem
  - d. Non-pharmacological -- surgical repair required
  - e. Transport consideration -- identify facility to handle high-risk newborn
  - f. Psychological support/ communication strategies
- D. Bradycardia in the neonate
- 1. Epidemiology
    - a. Incidence
      - i. most commonly caused by hypoxia
      - ii. increased intracranial pressure
      - iii. hypothyroidism
      - iv. acidosis
      - v. congenital AV node block in infants of mothers with lupus
    - b. Morbidity/ mortality
      - i. minimal risk if hypoxia is corrected quickly
      - ii. risk level relative to underlying causation if not due to hypoxia
    - c. Risk factors
      - i. treatment via pharmacological measures alone
      - ii. prolonged suction or airway instrumentation
      - iii. vagal stimulation from inadequately secured ETT movements
      - iv. vagal effect of ventilation not synchronized to respiratory effort.
  - 2. Anatomy and physiology review
  - 3. Pathophysiology -- Primarily caused by hypoxia
  - 4. Assessment findings
    - a. Assess upper airway for obstruction
      - i. secretions
      - ii. tongue and soft tissue positioning
      - iii. foreign body
    - b. Assess patient for hypoventilation
    - c. Palpate umbilical stump or brachial artery
  - 5. Management considerations
    - a. Airway and ventilation
      - i. suction
      - ii. positive pressure ventilation with 100% oxygen
      - iii. endotracheal intubation
    - b. Circulation
      - i. heart rate less than 100 -- BVM ventilation with 100% oxygen and reassess
      - ii. heart rate less than 60 -- begin chest compressions
      - iii. heart rate between 60 and 80 but not responding to assisted ventilations with BVM -- begin chest compressions
      - iv. discontinue chest compressions when heart rate reaches 100

- c. Pharmacological -- epinephrine
  - d. Non-pharmacological -- maintain temperature
  - e. Transport consideration -- identify facility to handle high-risk newborn
  - f. Psychological support/ communication strategies
- E. Premature infants
- 1. Epidemiology
    - a. Incidence
      - i. born prior to 37 weeks gestation
      - ii. weight ranges from .6-2.2 kg
      - iii. often related to comorbidity
        - a) trauma
        - b) neonatal sepsis
        - c) maternal Infection
          - i) UTI
          - ii) chorioamnionitis
          - iii) illness resulting in dehydration
        - d) congenital Anomalies
          - i) genetic disorders
          - ii) congenital malformations
            - (a) congenital heart defect
            - (b) spina bifida
          - iii) placental insufficiency
          - iv) oligohydramnios
          - v) polyhydramnios
        - e) previous premature deliveries
          - i) incompetent cervix
          - ii) relative large fetal size
        - f) multiple gestation
        - g) eclampsia
          - i) pre-eclampsia
          - ii) pregnancy Induced hypertension
  - b. Morbidity/ mortality
    - i. healthy premature infants weighing greater than 1700 g have a survivability and outcome approximately that of full-term infants
    - ii. respiratory suppression
    - iii. hypothermia risk
    - iv. head/ brain injury
      - a) hypoxemia
      - b) change in blood pressure
      - c) intraventricular hemorrhage
      - d) fluctuations in serum osmolarity
  - c. Risk factors
2. Anatomy and physiology review

3. Pathophysiology (retinopathy of prematurity)
    - a. result of long term oxygen use
    - b. extreme prematurity
    - c. should not be a factor in short term management
    - d. hypoxemia causes irreparable brain damage
  4. Assessment findings
    - a. Degree of immaturity determines the physical characteristics
      - i. maternal dates
        - a) ultrasound exam
        - b) calculated expected date of confinement (EDC)
      - ii. Dubowitz scale
      - iii. size for gestational age
    - b. Generally a large trunk and short extremities
    - c. Skin is transparent and less wrinkles
    - d. Less subcutaneous fat
  5. Management considerations
    - a. Attempt resuscitation if the infant has any sign of life
    - b. Airway and ventilation
      - i. suction
      - ii. assure adequate oxygenation
    - c. Circulation -- chest compressions if indicated
    - d. Pharmacological -- epinephrine
    - e. Non-pharmacological -- maintain body temperature
    - f. Transport consideration -- transport to a facility with special services for low birth weight newborns
    - g. Psychological support/ communication strategies
- F. Respiratory distress/ cyanosis in the neonate
1. Epidemiology
    - a. Incidence
      - i. prematurity is the single most common factor
      - ii. occurs most frequently in infants less than 1200 grams and 30 weeks gestation
      - iii. multiple gestations increase risk
      - iv. prenatal maternal complications increase risk
    - b. Morbidity/ mortality
      - i. premature infants have a immature central respiratory control center
      - ii. easily affected by environmental or metabolic changes
    - c. Risk factors
  2. Anatomy and physiology review
    - a. Fetal versus neonatal circulation
      - i. closure of ductus arteriosus
      - ii. ductal dependent lesions
  3. Pathophysiology
    - a. Lung or heart disease
    - b. Primary pulmonary hypertension

- c. CNS disorders
- d. Mucus obstruction of nasal passages
- e. Spontaneous pneumothorax
- f. Meconium aspiration
- g. Amniotic fluid aspiration
- h. Lung immaturity
- i. Pneumonia
- j. Shock and sepsis
- k. Metabolic acidosis
- l. Diaphragmatic hernia
- m. Tracheoesophageal Fistula
- n. Can lead to cardiac arrest
- 4. Assessment findings
  - a. Tachypnea
  - b. Paradoxical breathing
  - c. Periodic breathing
  - d. Intercostal retractions
  - e. Nasal flaring
  - f. Expiratory grunt
  - g. Choking/gagging/cyanosis with feeding
- 5. Management considerations
  - a. Airway and ventilation
  - b. Circulation
  - c. Pharmacological
  - d. Non-pharmacological -- maintain normal body temperature
  - e. Transport consideration
  - f. Psychological support/ communication strategies
- G. Seizures in the neonate
  - 1. Epidemiology
    - a. Incidence -- occur in a very small percentage of all newborns
    - b. Morbidity/ mortality -- represent relative medical emergencies as they are usually a sign of an underlying abnormality
    - c. Risk factors -- prolonged and frequent multiple seizures may result in metabolic changes and cardiopulmonary difficulties
  - 2. Anatomy and physiology review
    - a. Degree of myelination will affect manner of seizure presentation/observed clinical signs
  - 3. Pathophysiology
    - a. Types of seizures
      - i. subtle seizure
        - a) eye deviation
        - b) blinking
        - c) sucking
        - d) swimming movements of the arms
        - e) pedaling movements of the legs
        - f) apnea

- ii. tonic seizure
      - a) tonic extension of the limbs
      - b) less commonly, flexion of the upper extremities and extension of the lower extremities
      - c) more common in premature infants, especially in those with intraventricular hemorrhage
    - iii. multi focal seizure
      - a) clonic activity in one extremity
      - b) randomly migrates to another area of the body
      - c) occur primarily in full-term infants
    - iv. focal clonic seizure
      - a) clonic localized jerking
      - b) occur in both full-term and premature infants
    - v. myoclonic seizure
      - a) flexion jerks of the upper or lower extremities
      - b) may occur singly or in a series of repetitive jerks
  - b. Causes
    - i. hypoglycemia
    - ii. other
      - a) hypoxic-ischemic encephalopathy
      - b) intracranial hemorrhage
      - c) metabolic disturbances
      - d) meningitis or encephalopathy
      - e) developmental abnormalities
      - f) drug withdrawal
    - iii. seizure imitators
      - a) gastro esophageal reflux disease (GERD)
      - b) choking episode
      - c) tremors
      - d) myoclonic jerks
- 4. Assessment findings
  - a. Decreased level of consciousness
  - b. Seizure activity
  - c. Apnea/bradycardia
- 5. Management considerations
  - a. Airway and ventilation
  - b. Circulation
  - c. Pharmacological
    - i. consider  $D_{10}$  for hypoglycemia
    - ii. consider anticonvulsant
    - iii. consider benzodiazepine for status epilepticus
  - d. Non-pharmacological -- maintain normal body temperature
  - e. Transport consideration -- identify facility to handle high-risk newborn
  - f. Psychological support/ communication strategies



- H. Fever in the neonate
  - 1. Epidemiology
    - a. Incidence
      - i. rectal temperature  $\geq 100.4$  F (38.0 degrees C)
      - ii. average normal temperature - 99.5 degrees F (37.5 degrees C)
    - b. Morbidity/ mortality
      - i. limited ability to control body temperature
      - ii. limited ability to respond to infection
    - c. Risk factors
      - i. dehydration may contribute to hyperthermia
      - ii. maternal infection prior to delivery
  - 2. Anatomy and physiology review
  - 3. Pathophysiology
    - a. Increased use of glucose to maintain normal body temperature
    - b. Anaerobic metabolism results due to a lack of glucose
  - 4. Assessment findings
    - a. Mental status changes (irritability/ somnolence)
    - b. Decreased intake
    - c. Caretaker history
    - d. Feels warm
    - e. Observe patient for rashes, petechia
    - f. Term newborns will produce beads of sweat on their brow but not over the rest of their body
    - g. Premature infants will have no visible sweat
    - h. Increased work of breathing
    - i. Apnea
    - j. Decreased perfusion/capillary refill prolonged
    - k. Mottled appearance
  - 5. Management considerations
    - a. Airway and ventilation
    - b. Circulation
    - c. Pharmacological -- administration of antipyretic agent is questionable in the prehospital setting
    - d. Non-pharmacological
    - e. Transport consideration
    - f. Psychological support/ communication strategies
- I. Hypothermia in the neonate
  - 1. Epidemiology
    - a. Incidence -- body temperature drops below 35 degrees C
    - b. Morbidity/ mortality -- infants may die of cold exposure at temperatures adults find comfortable
    - c. Risk factors (need to be controlled)
      - i. Evaporation
      - ii. Conduction
      - iii. Convection
      - iv. Radiation

2. Anatomy and physiology review
  3. Pathophysiology -- Increased surface-to-volume relation makes newborns extremely sensitive to environmental conditions, especially when wet after delivery
    - a. Can be an indicator of sepsis in the neonate
    - b. Increased metabolic demand can cause metabolic acidosis, pulmonary hypertension and hypoxemia
  4. Assessment findings
    - a. Pale color
    - b. Cool to touch, particular in extremities
    - c. Cyanosis of the extremities
    - d. Respiratory distress
    - e. Apnea
    - f. Bradycardia
    - g. Central cyanosis
    - h. Irritability initially
    - i. Lethargy in late stage
    - j. Generally do not shiver
  5. Management considerations
    - a. Airway and ventilation
    - b. Circulation
    - c. Pharmacological
      - i. D10 if hypoglycemic
      - ii. warm IV fluids
    - d. Non-pharmacological
      - i. environmental conditions should be 24 to 26.5 degrees C
      - ii. warm hands prior to touching patient
    - e. Transport consideration -- identify facility to handle high-risk newborn
    - f. Psychological support/ communication strategies
- J. Hypoglycemia in the neonate
1. Epidemiology
    - a. Incidence
      - i. blood glucose concentration should be determined on all sick infants
      - ii. may be due to inadequate glucose intake or increased utilization of glucose
    - b. Morbidity/ mortality
    - c. Risk factors
      - i. asphyxia
      - ii. toxemia
      - iii. smaller twin
      - iv. CNS hemorrhage
      - v. sepsis
      - vi. infant of diabetic mother
      - vii. large or small for gestational age

2. Anatomy and physiology review
  3. Pathophysiology
    - a. A blood glucose screening test less than 45 mg/dl indicates hypoglycemia
    - b. Glycogen stores are sufficient to meet glucose requirements for 8 to 12 hours
    - c. Body releases counter-regulatory hormones including glucagon, epinephrine, cortisol and growth hormone
    - d. Hormones may cause symptoms of hyperglycemia that last for several hours
    - e. Increased fetal insulin level due to maternal hyperglycemia
  4. Assessment findings
    - a. Twitching or seizures
    - b. Limpness
    - c. Lethargy
    - d. Poor feeding
    - e. Decreased suck
    - f. Eye-rolling
    - g. High pitched cry
    - h. Apnea
    - i. Irregular respirations
    - j. Cyanosis
  5. Management considerations
    - a. Airway and ventilation
    - b. Circulation
    - c. Pharmacological -- administer D10
    - d. Non-pharmacological -- maintain normal body temperature
    - e. Transport consideration -- identify facility to handle high-risk newborn
    - f. Psychological support/ communication strategies
- K. Vomiting in the neonate
1. Epidemiology
    - a. Incidence
      - i. persistent vomiting is a warning sign
      - ii. vomiting mucus, occasionally blood streaked, in the first few hours of life is not uncommon
    - b. Morbidity/ mortality
      - i. vomiting in the first 24 hours of life suggests obstruction in the upper digestive tract or increased intracranial pressure
      - ii. vomitus containing dark blood is usually a sign of a life-threatening illness
      - iii. bilious vomiting indicative of obstruction in proximal portion of duodenum
        - a) Malrotation with volvulus
        - b) Jejunal atresia
    - c. Risk factors

- i. aspiration of vomitus can cause respiratory insufficiencies or obstruction of the airway
    - ii. fluid and electrolyte imbalances due to vomiting
      - a) dehydration
      - b) hyponatremia
      - c) hypokalemia
      - d) hypochloremic metabolic alkalosis
  - 2. Anatomy and physiology review
  - 3. Pathophysiology
    - a. Vomiting of non-bile-stained fluid
      - i. anatomic or functional obstruction at or above the first portion of the duodenum
      - ii. gastroesophageal reflux
    - b. Vomiting of bile-stained fluid
  - 4. Assessment findings
    - a. Distended stomach
    - b. Infection
    - c. Increased ICP
    - d. Drug withdrawal
    - e. Temperature instability
    - f. Apnea/bradycardia
    - g. Abdominal tenderness /guarding/rebound
    - h. High pitched or absent bowel sounds
  - 5. Management considerations
    - a. Airway and ventilation
      - i. maintain a patent airway
      - ii. suction/ clear vomitus from airway
      - iii. assure adequate oxygenation
    - b. Circulation -- bradycardia may be caused by vagal stimulus
    - c. Pharmacological -- fluid administration may be required
    - d. Non-pharmacological
      - i. provide supportive measures
      - ii. consider nasogastric or orogastric tube to decompress stomach/reduce emesis or vagal effects of distension
    - e. Transport consideration
      - i. place infant on side
      - ii. identify facility to handle high-risk newborn
  - 6. Psychological support/ communication strategies
    - a. Explain what is being done for the infant
- L. Diarrhea in the neonate
  - 1. Epidemiology
    - a. Incidence
    - b. Morbidity/ mortality
      - i. severe cases can cause dehydration
      - ii. bacterial or viral infection may be involved
    - c. Risk factors

2. Anatomy and physiology review
  3. Pathophysiology
    - a. Gastroenteritis
    - b. Necrotizing Enterocolitis
    - c. Lactose intolerance
    - d. Phototherapy
    - e. Neonatal abstinence syndrome
    - f. Thyrotoxicosis
    - g. Cystic fibrosis
    - h. Allergic Process
  4. Assessment findings
    - a. Loose stools
    - b. Decreased urinary output
    - c. Signs of dehydration
  5. Management considerations
    - a. Airway and ventilation
    - b. Circulation
    - c. Pharmacological -- fluid therapy may be indicated
    - d. Transport consideration -- identify facility to handle high-risk newborn
    - e. Psychological support/ communication strategies
- M. Common birth injuries in the newborn
1. Epidemiology
    - a. Incidence
    - b. Morbidity/ mortality
      - i. birth trauma
      - ii. anoxic injuries
    - c. Risk factors
      - i. precipitous delivery
      - ii. shoulder dystocia
      - iii. breech delivery
  2. Anatomy and physiology review
  3. Pathophysiology
    - a. Cranial injuries
      - i. Molding of the head and overriding of the parietal bones
      - ii. Erythema, abrasions, ecchymosis and subcutaneous fat necrosis can occur with forceps delivery
      - iii. Subconjunctival and retinal hemorrhage
      - iv. Subperiosteal hemorrhage
      - v. Fracture of the skull
    - b. Intracranial hemorrhage
    - c. Spine and spinal cord -- Spinal Cord Injury With Out Radiological Abnormality (SCIWORA)
    - d. Peripheral nerve injury
      - i. Brachial plexus
      - ii. Sciatic nerve
      - iii. Peroneal nerve

- e. Liver contusion or fracture
- f. Rupture of the spleen
- g. Adrenal hemorrhage
- h. Fracture
  - i. Clavicle
  - ii. Extremities
- i. Hypoxia-ischemia
- j. Umbilical cord tear
- 4. Assessment findings
  - a. Diffuse, sometimes ecchymotic, edematous swelling of the soft tissues of the scalp
  - b. Paralysis below the level of spinal cord injury
  - c. Paralysis of the upper arm with or without paralysis of the forearm
  - d. Diaphragmatic paralysis
  - e. Movement on only one side of the face when the newborn cries
  - f. Does not move arm freely on side of fractured clavicle
  - g. Lack of spontaneous movement of the affected extremity
  - h. Hypoxia
  - i. Shock
  - j. Hemorrhage
- 5. Management considerations
  - a. Airway and ventilation
  - b. Circulation
  - c. Pharmacology
  - d. Non-pharmacological
  - e. Transport consideration -- Identify facility to handle high-risk newborn
  - f. Psychological support/ communication strategies

# Special Patient Population

## Pediatrics

### Paramedic Education Standard

Integrates assessment findings with principles of pathophysiology and knowledge of psychosocial needs to formulate a field impression and implement a comprehensive treatment/disposition plan for patients with special needs.

### Paramedic-Level Instructional Guideline

The Paramedic Instructional Guidelines in this section include all the topics and material at the AEMT level PLUS the following material:

- I. Pediatric Anatomical Variations and Assessment
  - A. Head compared to an adult's
    1. Compared to the body, the head is proportionally larger in size
    2. The head contributes a larger portion of the body's surface area than in adults
    3. Anterior and posterior fontanelles open
      - a. Anterior closes by 1 year
      - b. Posterior closes by 3-4 months
    4. Implications for the health care provider
      - a. Higher proportion of blunt trauma involves the head
      - b. Cover an infant's head to prevent excessive heat loss
      - c. Properly placing an infant in "sniffing position" to open the airway may require a towel or roll under the shoulders
      - d. Examine fontanelle in infants
        - i. Bulging fontanelle in a ill-appearing non-crying infant suggests increased intracranial pressure
        - ii. Sunken fontanelle in an ill-appearing infant suggests dehydration
  - B. Airway compared to an adult's
    1. Much smaller in diameter and shorter in length
    2. Infant's tongues take up more room in the oropharynx
    3. The jaw is proportionally smaller
    4. Infants are nasal breathers
    5. The vocal cords are higher (C 2-3) and more anterior
    6. In children younger than 10 years, narrowest part of the airway is *below* the vocal cords at the non-distensible cricoid cartilage
    7. Tracheal cartilage is softer and more collapsible
    8. The epiglottis in infants and toddlers is long, floppy, narrow, and extends at a 45-degree angle into airway
    9. Implications for the health care provider

- a. Suctioning to clear the nares of infants in respiratory distress can not be overemphasized
  - b. Smaller airways are more easily obstructed by
    - i. Flexion or hyperextension
    - ii. Particulate matter
    - iii. Soft tissue swelling (injury, inflammation)
  - c. Posterior displacement of the tongue may cause airway obstruction
  - d. Differences in intubation technique
    - i. More delicate tissues require a gentler touch
    - ii. Straight blades are more useful for direct visualization of the cords
    - iii. Actually lifting the large, floppy epiglottis with the end of a straight laryngoscope blade will help expose the vocal cords
    - iv. Because in children younger than 10 years, the narrowest part of the airway is *below* the vocal cords, uncuffed tubes are used
    - v. Appropriate endotracheal tube selection is estimated based upon age
    - vi. Securing the endotracheal tube at the appropriate depth is crucial since changes in even one centimeter can mean a right mainstem intubation or unplanned extubation
- C. Chest and lungs compared to an adult's
- 1. Ribs are more cartilaginous and pliable
  - 2. Less overlying muscle and fat to protect ribs and vital organs
  - 3. Young children breathe primarily with their diaphragms; their chest muscles are immature and fatigue easily
  - 4. Lung tissue is more fragile
  - 5. Mediastinum (the heart and major vessels) is more mobile within the chest
  - 6. Thin chest wall allows for easily transmitted breath sounds
  - 7. Implications for the health care provider
    - a. Infants and children are dependent on effective diaphragmatic excursion for adequate ventilation; a distended abdomen may not allow for this
    - b. Rib fractures are less common; but when present represent a significant force generally accompanied by multi-system injury
    - c. The elastic thorax may result in significant underlying organ injury despite a fairly normal appearing external exam
    - d. Pulmonary contusions are more common
    - e. Lungs more prone to pneumothorax from excessive pressures while bag-mask ventilating
    - f. Mobility of mediastinal structures makes children more sensitive to tension pneumothorax and flail chest
    - g. Pneumothoraces and esophageal intubations are often missed due to the ease with which breath sounds are transmitted all over the thorax through the thin chest wall



- D. Abdomen compared to an adult's
  - 1. Less developed abdominal muscles offer less protection
  - 2. Abdominal organs are situated more anteriorly and are less protected by ribs
  - 3. Liver and spleen are proportionally larger
  - 4. Implications for the health care provider
    - a. Seemingly insignificant forces can cause serious internal injury; therefore abdominal pain after trauma should be taken seriously
    - b. Liver, spleen, and kidneys are more frequently injured
    - c. Multiple organs injured more commonly
- E. Extremities compared to adult's
  - 1. Bones are softer
  - 2. Injuries to the growth plates of long bones may result in poor bone growth
  - 3. Open growth plates are weaker than ligaments and tendons
  - 4. Growth plates generally disappear 2 years after girls have their first periods; in boys it is usually by mid to late high school
  - 5. Implications for the health care provider
    - a. Immobilize any "sprain" or "strain" as it is more likely a fracture
    - b. Angle slightly away from the growth plate when inserting an intraosseous needle
- F. Skin and body surface area compared to an adult's
  - 1. Thinner with less subcutaneous fat
  - 2. Larger surface area to body mass
  - 3. Implications for the health care provider
    - a. Skin is more easily, quickly, and deeply burned
    - b. Larger surface area means larger losses of fluid and heat
    - c. Be diligent about preventing core hypothermia (even in a burn patient)
    - d. Hypothermia can limit resuscitative efforts and interfere with the body's ability to clot properly
- G. Respiratory system compared to an adult's
  - 1. Tidal volume of breaths is smaller (10-15 mL/kg)
  - 2. Higher oxygen demand per kilogram of body weight (2 times that of an adult)
  - 3. Smaller lung oxygen reserves
  - 4. Implications for the health care provider
    - a. Higher oxygen demand with less reserves means that hypoxia develops rapidly with apnea or ineffective bagging
    - b. When ventilating a pediatric patient, the bag should have *no less than* 450-500 mL volume
    - c. Err on using a larger bag for ventilating the pediatric patient; regardless of the size of the bag used for ventilation, one should only use enough force to make the chest rise slightly to limit pneumothorax

- d. Higher oxygen demand and metabolic rate mean that infants and children generally become symptomatic from inhaled toxic exposures prior to adults
- H. Nervous system and spinal column compared to an adult's
  - 1. Continually evolves throughout childhood allowing them to develop new abilities
  - 2. Brain tissue is more fragile and prone to bleeding from injury
  - 3. The subarachnoid space is relatively smaller offering less cushioning to the brain
  - 4. The brain requires nearly twice the cerebral blood flow as does an adult's
  - 5. Brain and spinal cord are less well protected by a thinner skull and spinal column
  - 6. Spinal column
    - a. The ligaments and joint capsules of the vertebrae are more flexible
    - b. Vertebral bodies are wedged anteriorly and can slide forward with flexion
  - 7. Implications for the health care provider
    - a. The large cerebral blood flow requirement makes children with head injuries extremely susceptible to hypoxia; hypoxia and hypotension in a child with a head injury can cause ongoing damage as bad as the initial injury itself
    - b. Less cushioning by the subarachnoid space means that head momentum is more likely to result in bruising and damage to the brain
    - c. Though spinal cord injuries are less common in pediatrics, they more frequently occur with normal appearing x-rays; this phenomenon is referred to as SCIWORA (spinal cord injury without radiographic abnormalities)
    - d. Cervical spine injuries when present are more commonly ligamentous injuries rather than secondary to broken vertebrae
    - e. Since the weaker neck supports a relatively heavier head and therefore flexes more easily with trauma, cervical spine injuries sustained are usually higher (C1-3)
    - f. When in doubt about the presence of a cervical spine injury, assume the worst and maintain immobilization of the child's head and neck
- I. Metabolic differences compared to an adult
  - 1. Infants and children have limited glucose stores
  - 2. Infants and children are prone to hypothermia due to increased body surface area
  - 3. Newborns and infants less than 1 month are the most susceptible to hypothermia
  - 4. Implications for the health care provider
    - a. Keep the infant or child warm during treatment and transport
    - b. Make sure to cover the head (not the face, though) to minimize heat loss

- c. Have a very low threshold for checking blood glucose levels, especially in children who are having a seizure or are lethargic on your exam
- d. Newborns particularly need to be kept warm; hypothermia is a “killer” and can predispose them to spontaneous head bleeds
- e. However, newborns who are requiring a difficult, prolonged resuscitation after delivery, should not be overwarmed, as this can worsen their neurologic outcome

## II. Growth and Development

### A. Infancy

#### 1. birth-2 months

- a. Physical development
  - i. Begin to better control gazing at faces, turning their heads, and sucking
  - ii. Sleep accounts for up to 16 hours a day; only half of that is at night
  - iii. Infants have a relatively large surface area which predisposes them to hypothermia
- b. Cognitive development
  - i. Crying is the only way infants communicate
  - ii. Crying peaks at 6 weeks to 3 hours a day; by 3 months it drops to 1 hour
  - iii. Infants cry for obvious reasons such as hunger and needing to be changed
  - iv. When obvious reasons for crying have been addressed, persistent crying can be a sign of significant illness
- c. Emotional development
  - i. Trust develops as infants learn that parents take care of their urgent needs
  - ii. Infants of this age whose crying is responded to timely by parents have been shown to cry less at 1 year and have decreased aggression at 2
- d. Implications for the health care provider
  - i. Persistent crying or irritability in a 0-2 month old can be a symptom of serious bacterial infections such as meningitis, supraventricular tachycardia (SVT), physical abuse, intussusception, cardiac problems, corneal abrasions, or electrolyte disturbances
  - ii. Though infants sleep a lot, they should be arousable; inability to arouse a baby should be considered an emergency
  - iii. Be diligent about keeping babies warm and dry to limit hypothermia

- iv. Infants do not develop head control until closer to 6 months, so when handling a baby, make sure to support the head and neck well
  - v. This is a particularly stressful time for parents adjusting to the eating, sleeping, and crying cycle; sometimes this is complicated by post-partum depression, too, which can be a risk factor for abuse.
- 2. 2-6 months
  - a. Physical development
    - i. Begin voluntarily smiling and increasing eye contact
    - ii. Both hands begin to be used to examine objects
    - iii. 70% of babies sleep through the night by 6 months
    - iv. Intentional rolling over begins
    - v. Begin to hold their heads up
  - b. Cognitive development
    - i. Increased awareness of what is going on around them
    - ii. Begin to explore their own bodies
  - c. Emotional development
    - i. Develop distinctive facial expressions of joy, anger, fear, surprise, etc.
    - ii. Begin actively seeking attention
  - d. Implications for the health care provider
    - i. Persistent crying or irritability can be a symptom of serious bacterial infections such as meningitis, SVT, physical abuse, intussusception, cardiac problems, corneal abrasions, or electrolyte disturbances
    - ii. Infants do not typically roll until around 3-4 months; a history of an infant less than that rolling himself off of a bed or table and sustaining major injuries may indicate abuse
    - iii. Infants of this age begin to identify and respond to facial expressions; approach them with a smile or funny face and a happy, soft spoken voice
    - iv. By 6 months, babies should make eye contact; no eye contact in a sick infant could be a sign of significant illness or depressed mental status
- 3. 6-12 months
  - a. Physical development
    - i. Begin to sit without support
    - ii. Develop a pincer grasp; everything goes to the mouth
    - iii. Begin to crawl
    - iv. Begin getting teeth and eating soft foods
  - b. Cognitive development
    - i. Begin babbling and by 12 months learn their first word
    - ii. Develop “object consistency;” they do not forget that something exists just because you take it away
    - iii. Interested in what objects do and what objects fit where

- c. Emotional development
      - i. Development of “separation anxiety” from their parents and the start of tantrums
      - ii. Sense of autonomy around feeding as they begin to eat finger foods
    - d. Implications for the health care provider
      - i. Persistent crying or irritability can be a symptom of serious bacterial infections such as meningitis, SVT, physical abuse, intussusception, cardiac problems, corneal abrasions, or electrolyte disturbances
      - ii. Infants explore objects with their mouths which greatly increases the risk of foreign body aspiration; do not give children exam gloves to play with
      - iii. Separation anxiety is best dealt with by keeping the child and parent together as much as possible during evaluation and involving the parent in the treatment if appropriate; if possible, interact first with the parent to build trust with infant
      - iv. With the increased mobility of crawling and walking comes exposure to physical dangers
- B. Toddler years
  - 1. 12-18 months
    - a. Physical development
    - b. Cognitive development
      - i. Imitation of older children and parents
      - ii. Make-believe play
      - iii. Understand more than what they can express
      - iv. Know major body parts
      - v. Know 4-6 words
    - c. Emotional development
    - d. Implications for the health care provider
      - i. Persistent crying or irritability can be a symptom of serious bacterial infections such as meningitis, SVT, physical abuse, intussusception, cardiac problems, corneal abrasions, or electrolyte disturbances
      - ii. The front teeth come in before the molars, which means that children may bite off large pieces of food and then not be able to grind them up before swallowing, increasing the risk of food aspiration; do not give children exam gloves to play with
      - iii. Separation anxiety is best dealt with by keeping the child and parent together as much as possible during evaluation and involving the parent in the treatment if appropriate; if possible, interact first with the parent to build trust with infant

- iv. With increased mobility comes exposure to physical dangers and injury
  - v. Talk to the child during the assessment even if the conversation is one-sided
  - vi. Distracting a child with a flashlight or toy may increase one's chances of getting a good physical exam
2. 18-24 months
- a. Physical development
    - i. Improved gait and balance
    - ii. Begin to run and climb
    - iii. Head begins to grow more slowly than the body
  - b. Cognitive development
    - i. Begin to understand cause and effect
    - ii. Start to use "tools"
    - iii. Play with dolls
    - iv. Begin to label objects
    - v. 10-15 words becomes 100 by 24 months
  - c. Emotional development
    - i. Increasing clinginess with parents
    - ii. Attachment to a special object, like a blanket
  - d. Implications for the health care provider
    - i. Persistent crying or irritability can be a symptom of serious bacterial infections such as meningitis, SVT, physical abuse, intussusception, cardiac problems, corneal abrasions, or electrolyte disturbances
    - ii. The front teeth come in before the molars, which means that children may bite off large pieces of food and then not be able to grind them up before swallowing, increasing the risk of food aspiration; do not give children exam gloves to play with
    - iii. Separation anxiety is best dealt with by keeping the child and parent together as much as possible during evaluation and involving the parent in the treatment if appropriate; if possible, interact first with the parent to build trust with infant
    - iv. With increased mobility comes exposure to physical dangers and injury
    - v. Talk to the child during the assessment even if the conversation is one-sided
    - vi. Distracting a child with a flashlight or toy may increase one's chances of getting a good physical exam
    - vii. Allow a child to hold objects of importance to them like a blanket, stuffed animal or doll

- viii. With the head beginning to grow at a slower rate than the body, children begin no longer requiring shoulder rolls limiting flexion of the neck when bag-valve-mask ventilating or intubating
    - ix. As children begin to relate cause and effect, painful procedures make lasting impressions; be considerate by limiting painful procedures and adequately treating pain
- 3. Preschool years (2-5 years)
  - a. Physical development
    - i. Bodies become leaner
    - ii. Develop 20/20 vision by age 4
    - iii. Have all their teeth by 3
    - iv. They perfect normal walking and running
    - v. Begin throwing, catching, kicking
    - vi. Generally establish left or right handedness
    - vii. Toilet training
  - b. Cognitive development
    - i. Most rapid increase in language
    - ii. Magical thinking
    - iii. Rules tend to be absolute
    - iv. Irrational fears
  - c. Emotional development
    - i. Learn what are acceptable behaviors
    - ii. Have tantrums around control issues
    - iii. Modesty develops
  - d. Implications for the health care provider
    - i. Avoid procedures on the dominant hand or arm
    - ii. The rapid increase in language means they will understand much of what you say if simple terms are used
    - iii. Respect the patient's modesty and cover them up after the physical exam
    - iv. Foreign body airway obstruction risk continues to be high
    - v. Offer choices to the patient if appropriate (i.e., Should I listen to your front first or the back?)
    - vi. Do not waste time trying to use logic to convince preschoolers; they are concrete thinkers; avoid frightening or misleading comments
    - vii. Appealing to their magical thinking may allow you to do more (eg., This magic smoke will help you breathe better (nebulizer))
    - viii. Preschoolers tend to hold rules true for all situations; if they have been told that no one should look at their privates, they will not understand why it is OK all of a sudden for the health care worker to do that
- 4. Middle Childhood years (6-12 years)
  - a. Physical development

- b. Cognitive development
    - i. Begin to think logically
    - ii. Life centers around school
  - c. Emotional development
    - i. Popularity and peer pressure become very important
    - ii. Children with chronic illness or disabilities begin to be very self-conscious
    - iii. Children begin to understand that death is final
  - d. Implications for the health care provider
    - i. With patients losing baby teeth and getting adult teeth, one must be particularly careful when intubating
    - ii. School aged children can understand simple explanations for illness and treatments
    - iii. Be honest about procedures which will cause them discomfort
    - iv. Give children some sense of control by giving choices if possible
    - v. Reassure children that everything is going to be all right, if appropriate, and that they are not going to die
    - vi. Respect the patient's modesty and cover them up after the physical exam
    - vii. Asking about school will often allow patients to warm up to you faster
- 5. Adolescence (12-20 years)
  - a. Physical development -- Puberty begins
    - i. Girls first develop breasts around 8-13 years; periods start between 9-16
    - ii. Boys first develop increase in testicle size which typically starts around 10
  - b. Cognitive development
    - i. Acquire the ability to reason
    - ii. Do not see possibilities as real things which could happen to them
    - iii. Develop morals
  - c. Emotional development
    - i. Self-conscious about body image
    - ii. Begin to understand who they are and begin to be comfortable with that
    - iii. Relationships generally transition from mostly same sex ones to those with the opposite sex
  - d. Implications for the health care provider
    - i. Explain things clearly and honestly as you would to an adult
    - ii. Give the patient choices when appropriate
    - iii. Respect the patient's modesty and cover them up after the physical exam



- iv. Be honest about procedures which will cause them discomfort
- v. Address adolescents' concerns and fears about the lasting effects of their injuries (especially cosmetic) and if appropriate, reassure them that everything is going to be all right
- vi. Adolescence is the tumultuous effect of hormonal surges, emotions, and peer pressure; these place children at risk for substance abuse, self-endangerment, pregnancy, and dangerous sexual practices

### III. Pediatrics: Specific Pathophysiology, Assessment, and Management

#### A. Respiratory Compromise

1. Introduction
  - a. Epidemiology
  - b. Anatomic and physiologic differences in children
2. Pathophysiology
  - a. Respiratory distress
  - b. Respiratory failure
  - c. Respiratory arrest
3. Assessment
  - a. History (age, preceding symptoms, choking episode, underlying disease, sick contacts, prematurity)
  - b. Physical findings (mental status, respiratory rate, pulse oximetry, capnometry, work of breathing, color, heart rate, degree of aeration, presence of stridor or wheeze)
4. Upper airway obstruction
  - a. Croup
  - b. Foreign body aspiration
  - c. Bacterial tracheitis
  - d. Epiglottitis
  - e. Tracheostomy dysfunction
5. Lower airway disease
  - a. Asthma
  - b. Bronchiolitis -- Respiratory Syncytial Virus (RSV) is common cause
    - i. Highly contagious
    - ii. Most common in infants under one year
    - iii. Infections usually occur epidemically in the winter
6. Pneumonia
7. Foreign body lower airway obstruction
8. Pertussis
9. Cystic fibrosis
10. Bronchopulmonary dysplasia (BPD)

- a. Chronic lung disease that usually occurs in infants born prematurely and treated with positive pressure ventilation and high oxygen concentrations
  - b. Recurrent respiratory infections and exercise induced bronchospasm are complications
  - c. Management
    - i. Airway positioning (chin lift, jaw thrust)
    - ii. Airway adjuncts (nasopharyngeal and oropharyngeal airways)
    - iii. Oxygen
    - iv. Inhaled medications bronchodilators (albuterol, ipratropium, racemic epinephrine)
    - v. Oral and intramuscular medications (prednisolone, dexamethasone) Corticosteroids
    - vi. Assisted ventilation (bag mask, CPAP, BiPAP, endotracheal intubation, cricothyroidotomy)
- B. Non Cardiogenic Shock
  - 1. Introduction
    - a. Epidemiology
    - b. Anatomic and physiologic differences in children
  - 2. Pathophysiology (compensated vs. decompensated)
    - a. Hypovolemic
    - b. Distributive (septic, neurogenic, anaphylactic)
  - 3. Assessment
    - a. History (fever, vomiting, diarrhea, urine output, fluid intake, blood loss, allergic symptoms, burns, accidental ingestion)
    - b. Physical findings (heart rate, blood pressure, capillary refill, color, petechiae, mental status, mucous membranes, skin turgor, face/lip/tongue swelling)
  - 4. Management
    - a. Intravenous isotonic crystalloid for all types
    - b. Septic: in-hospital antibiotics for presumed bacterial sepsis
    - c. Anaphylactic: subcutaneous epinephrine, intravenous antihistamines (diphenhydramine, ranitidine), and intravenous steroids
    - d. Consider pressors for ongoing decompensated shock
- C. Cardiac
  - 1. Introduction
    - a. Epidemiology
    - b. Anatomic and physiologic differences in children
  - 2. Pathophysiology
    - a. Shock in children (compensated vs. decompensated)
    - b. Cardiogenic vs. noncardiogenic shock
  - 3. Assessment
    - a. History (age, sweating while feeding, cyanotic episodes, difficulty breathing, syncope, prior cardiac surgery, poor weight gain)

- b. Physical findings (heart rate, blood pressure, capillary refill, color, mental status, cardiac murmurs/rubs/gallops, pulse oximetry, 4 extremity blood pressures)
    - c. Bedside testing (rhythm strip)
  - 4. Congestive heart failure
    - a. Myocarditis
    - b. Cardiomyopathy
    - c. Congenital heart disease as underlying cause
  - 5. Congenital heart disease
    - a. Cyanotic Disease (brief overview)
      - i. Hypoplastic left heart syndrome (HLHS)
      - ii. Tricuspid atresia
      - iii. Transposition of the great arteries (TGA)
      - iv. Tetralogy of Fallot (ToF)
      - v. Total anomalous pulmonary venous return (TAPVR)
      - vi. Truncus arteriosus
    - b. Noncyanotic Disease (brief overview)
      - i. Coarctation of the aorta (CoA)
      - ii. Atrial septal defect (ASD)
      - iii. Ventricular septal defect (VSD)
      - iv. Patent ductus arteriosus (PDA)
  - 6. Arrhythmias
    - a. Fast pulse
      - i. Sinus tachycardia
      - ii. Supraventricular tachycardia (SVT)
      - iii. Ventricular tachycardia, with a pulse
    - b. Slow pulse
      - i. Sinus bradycardia
      - ii. 2<sup>nd</sup> or 3<sup>rd</sup> degree heart block
    - c. Absent pulse
      - i. Asystole
      - ii. Ventricular fibrillation/Pulseless ventricular tachycardia
      - iii. Pulseless electrical activity (PEA)
  - 7. Management
    - a. Congestive Heart Failure and Congenital Heart Disease
      - i. Oxygen (caution with ductal dependent systemic flow due to pulmonary steal)
      - ii. Use of prostaglandin for ductal dependent cardiac lesions
      - iii. Use of furosemide diuretic for fluid overload
      - iv. Cautious use of IV fluids if cardiogenic shock suspected
    - b. Arrhythmias
    - c. Vagal maneuvers for SVT (recommended vs. unacceptable)
    - d. Pharmacologic indications
    - e. Chest compressions
    - f. Defibrillation, synchronized cardioversion, and transcutaneous pacing
    - g. Interventions for other causes of PEA

- D. Neurologic
  - 1. Introduction
    - a. Epidemiology
    - b. Anatomic and physiologic differences in children
  - 2. Pathophysiology
    - a. Causes of altered mental status in children (trauma, toxins, infection, electrolyte or glycemic imbalance, intussusception, seizure, uremia, intracranial bleed, intracranial mass)
    - b. Hydrocephalus
    - c. Epidural and subdural hematomas
    - d. Pathophysiology of seizures
    - e. Increased intracranial pressure and cerebral perfusion pressure
  - 3. Assessment
    - a. History (age, fever, vomiting, photophobia, headache, prior seizures, extremity shaking, staring episodes, trauma, ataxia, ingestions, oral intake, bloody stool, urine output, baseline developmental level)
    - b. Physical findings (vital signs, photophobia, nuchal rigidity, GCS, palpation of ventricular shunt, full neurologic exam)
  - 4. Meningitis
  - 5. Seizures
    - a. Afebrile
    - b. Febrile
    - c. Status epilepticus
  - 6. Hydrocephalus
  - 7. Closed head injury
    - a. Epidural hematoma
    - b. Subdural hematoma
    - c. Fractures
  - 8. Ventricular shunts
    - a. Infection
    - b. Malfunction
  - 9. Management
    - a. Seizures
      - i. Oxygen for prevention of brain hypoxia
      - ii. Benzodiazepines
      - iii. Other antiepileptic drugs (fosphenytoin, phenobarbital, pentobarbital)
    - b. Altered Mental Status
      - i. Assess for need to protect airway
      - ii. Consider reversal agents for toxin ingestion
      - iii. Assess and intervene for increased intracranial pressure
    - c. Increased Intracranial Pressure
      - i. Medications for intubation (thiopental, etomidate, lidocaine, non-depolarizing muscle relaxants)

- ii. ICP lowering medications (benzodiazepines, barbiturates, mannitol)
  - iii. Other ICP lowering techniques (mannitol, elevation of head, hyperventilation)
- E. Endocrinology
  - 1. Introduction
    - a. Epidemiology
    - b. Anatomic and physiologic differences in children
  - 2. Pathophysiology
    - a. Glucose metabolism
    - b. Diabetic ketoacidosis and cerebral edema in children
    - c. Cortisol deficiency
  - 3. Assessment
    - a. History (polyuria, polydipsia, weight loss, visual changes, poor feeding, abnormal odors, growth delays)
    - b. Physical findings (heart rate, blood pressure, mucous membranes, mental status, virilization, frontal bossing, blindness)
    - c. Bedside testing (blood sugar)
  - 4. Hyperglycemia
  - 5. Hypoglycemia
    - a. Congenital adrenal hyperplasia
    - b. Panhypopituitarism
    - c. Inborn errors of metabolism
  - 6. Management
    - a. Hyperglycemia
      - i. Cautious fluid resuscitation due to risk of cerebral edema
      - ii. Insulin administration
    - b. Hypoglycemia
      - i. Dextrose dosing in children
      - ii. Use of D10 in children with metabolic disease
      - iii. Administration of stress dose steroids for cortisol deficiency
- F. Hematologic/Oncologic/Immunologic
  - 1. Introduction
    - a. Epidemiology
    - b. Anatomic and physiologic differences in children
  - 2. Pathophysiology
    - a. Hemoglobin and disrupted oxygen carrying capacity
    - b. Blood clotting (platelets, coagulation factors)
    - c. Tumor lysis syndrome (basic overview)
    - d. Immune dysfunction and infection risk
  - 3. Assessment
    - a. History (chest pain, weakness, abdominal pain, extremity pain, trauma, bleeding, swollen joints, swollen glands, fever, bruising)

- b. Physical findings (all vital signs, lung sounds, extremity tenderness, signs of active bleeding, bruises, joint swelling, lymphadenopathy, capillary refill)
    - c. Bedside testing (blood sugar)
    - d. Inspection of indwelling catheters for possible infection
  - 4. Sick cell disease
    - a. Acute chest syndrome
    - b. Splenic sequestration
    - c. Stroke
    - d. Vaso-occlusive crises
    - e. Priapism
  - 5. Bleeding disorders
    - a. Thrombocytopenia
    - b. Hemophilia
    - c. Von Willebrand's Disease
  - 6. Leukemia/Lymphoma
  - 7. Immunocompromised
    - a. Neutropenia
    - b. Immunosuppressive medication
  - 8. Management
    - a. Sick cell disease
      - i. IV hydration (caution with fluid sensitivity)
      - ii. Pain control with NSAIDs and opiates
    - b. Bleeding disorders
      - i. Isotonic fluid resuscitation for blood loss
      - ii. Maneuvers to control active bleeding
    - c. Leukemia/Lymphoma
      - i. Hydration with  $\text{NaHCO}_3$  for possible tumor lysis syndrome
    - d. Immunocompromise
      - i. Isotonic fluid resuscitation for possible sepsis
      - ii. Antibiotics for possible sepsis
- G. Gastrointestinal
  - 1. Introduction
    - a. Epidemiology
    - b. Anatomic and physiologic differences in children
  - 2. Pathophysiology
    - a. Embryology of the GI tract
    - b. Vomiting mechanism
    - c. Electrolyte complications of gastroenteritis and pyloric stenosis
    - d. GI bleeding
  - 3. Assessment
    - a. History (blood or bile in emesis, diarrhea, age, gender, constipation, fever, medications, tolerance of gastrostomy tube feeds, prematurity, blood type incompatibility, epistaxis, liver disease)

- b. Physical findings (heart rate, blood pressure, mucous membranes, icterus, capillary refill, blood in nares, abdominal distention or mass, hepatomegaly, pallor, anal fissure)
    - c. Inspection of gastrostomy tube
  - 4. Vomiting
    - a. Gastroenteritis
    - b. Malrotation
    - c. Pyloric stenosis
  - 5. GI Bleeding
    - a. Upper GI bleed ((swallowed maternal blood, Mallory-Weiss tear, swallowed nasopharyngeal blood, gastritis, gastric ulcer, esophageal varices)
    - b. Lower GI bleed (
    - c. Neonatal (swallowed maternal blood, anal fissure, necrotizing enterocolitis, malrotation, Hirschsprung's disease, coagulopathy)
      - i. Infants/Toddlers (allergic colitis, infectious enteritis, intussusception, Meckel's diverticulum, GI duplication)
      - ii. School age (infectious enteritis, juvenile polyps, hemolytic uremic syndrome, Henoch Schonlein purpura)
      - iii. Adolescents (infectious diarrhea, juvenile polyps, inflammatory bowel disease)
    - d. Gastrostomy tube dysfunction
  - 6. Neonatal Jaundice
    - a. Physiologic
    - b. Pathologic
  - 7. Management
    - a. Bowel rest (for vomiting and GI bleed)
    - b. IV hydration
    - c. Replacement of G-tube if dislodged or dysfunctional
- H. Toxicologic
  - 1. Introduction
    - a. Epidemiology
    - b. Nontoxic exposures
    - c. Role of the Poison Control Center
  - 2. Assessment
    - a. History (time of ingestion/exposure, amount ingested, abnormal symptoms, bottles/containers available)
    - b. Physical findings (all vitals, airway/breathing/circulation)
  - 3. Ingestion
    - a. Specific toxidromes (anticholinergics, cholinergics, opiates, benzodiazepines, sympathomimetics, beta-blockers, calcium channel blockers, salicylate, tricyclic antidepressants)
    - b. Caustic substances
  - 4. Inhalation
  - 5. Management
    - a. Decontamination

- b. topical irrigation for skin and eye exposures
- c. dilution
- d. gastric emptying (no role for ipecac; indications for gastric lavage)
- e. inert binding (activated charcoal; single and multi-dose)
- f. catharsis (sorbitol or magnesium citrate)
- g. whole bowel irrigation
- h. antidotes
- i. diuresis (mannitol and sodium bicarbonate)
- j. dialysis and hemoperfusion
- k. oxygen and bronchodilators for inhalation injuries

#### IV. Abuse and Neglect

##### A. Introduction

- 1. Epidemiology
- 2. Definitions of abuse (physical, emotional, sexual) and neglect

##### B. Assessment

- 1. Elements in the history or scene concerning for abuse or neglect
- 2. Assessing the caregiver's behavior
- 3. Physical findings concerning for abuse or neglect
- 4. Benign findings often confused for physical or sexual abuse

##### C. Management

- 1. Role of the Prehospital Professional (scene assessment, assessment of the caregiver, communication with the caregiver, documentation, reporting suspected abuse/neglect, safely transporting one or more injured children)
- 2. Role of Child Protective Services (CPS)
- 3. Role of Medical Examiner and law enforcement

#### V. Sudden Infant Death Syndrome

##### A. Introduction

- 1. Definition of SIDS
- 2. Definition of ALTE
- 3. Epidemiology and Risk Factors

##### B. Assessment

- 1. Cardiopulmonary status
- 2. Clinical signs of death
- 3. Evaluation for other signs of abuse

##### C. Management

- 1. Local EMS criteria for death in the field
- 2. Notification of appropriate authorities
- 3. Controversy over transport after failed advanced life support
- 4. Caregiver support



# Special Patient Population

## Geriatrics

### Paramedic Education Standard

Integrates assessment findings with principles of pathophysiology and knowledge of psychosocial needs to formulate a field impression and implement a comprehensive treatment/disposition plan for patients with special needs.

### Paramedic-Level Instructional Guideline

The Paramedic Instructional Guidelines in this section include all the topics and material at the AEMT level PLUS the following material:

- I. Normal and Abnormal Changes associated with aging
  - A. Normal changes associated with aging primarily occur due to deterioration of organ systems;
  - B. Pathological changes in the elderly are sometimes difficult to discern from normal aging changes.
  - C. Cardiovascular
    - 1. Inability to tolerate cardiovascular dysfunction of any kind
    - 2. Inability to increase rate and cardiac output
    - 3. Degeneration of valves
    - 4. Degeneration of conduction system
    - 5. More likely to have dysrhythmias
    - 6. Stroke volume decreases
    - 7. Vessel walls loose elasticity and are less flexible
  - D. Respiratory
    - 1. Loss of elastic recoil in the chest wall
    - 2. Diminished respiratory muscle strength and endurance
    - 3. Loss of alveoli
    - 4. Reduction in oxygen and carbon dioxide exchange
    - 5. Inability to increase rate of respiratory effort
    - 6. Decreased cough reflex
    - 7. Decreased ability of cilia to move mucus upward
  - E. Neurovascular
    - 1. Atrophy of the brain tissue
      - a. Cognitive and short-term memory effects
      - b. Delayed verbal response
    - 2. Deterioration of the nervous system function in controlling
      - a. Rate and depth of breathing
      - b. Heart rate
      - c. Blood pressure
      - d. Hunger and thirst

- e. Temperature
  - f. Sensory perception – including audio, visual, olfactory, touch and pain
- 3. Delayed reflexes and response times
- 4. Impaired balance
- F. Gastrointestinal
  - 1. Dental problems
  - 2. Decrease in saliva
  - 3. Poor sphincter muscle tone
  - 4. heartburn, and acid reflux
  - 5. Decrease in hydrochloric acid in the stomach
  - 6. Alterations in absorption of nutrients
  - 7. Slowing peristalsis causing constipation
  - 8. Rectal sphincter weakens with increased incidence of fecal incontinence
  - 9. Liver function decreases with increased potential for drug toxicity
- G. Genitourinary
  - 1. Reduction in renal function due to decreased blood flow and tubule degeneration
  - 2. Decreased bladder capacity
  - 3. Decline in sphincter muscle control causing incontinence
  - 4. Decline in voiding senses and nighttime voiding
  - 5. In males benign prostatic hypertrophy
- H. Endocrine
  - 1. Increase in incidence of diabetes
  - 2. Increase in secretion of antidiuretic hormone causing fluid imbalance
  - 3. Decreased production of estrogen causing osteoporosis
- I. Musculoskeletal
  - 1. Atrophy of muscles
  - 2. Degenerative changes and loss of bone
  - 3. Loss of strength
  - 4. Degenerative changes in joints
  - 5. Loss of elasticity in ligaments and tendons
  - 6. Thinning of cartilage and thickening of synovial fluid
- J. Integumentary
  - 1. Atrophy of the epidermis, hair follicles, and sweat glands
  - 2. Lessened skin turgor
  - 3. Tenting present even when patient is hydrated
  - 4. Nails become thin and brittle
  - 5. Increased healing time
  - 6. Pigment changes
  - 7. Decreased elasticity
  - 8. Hair loss
  - 9. Reduction of subcutaneous tissue
  - 10. Skin easily torn

- II. Sensory changes
  - A. Vision
    - 1. Decreased visual acuity -- inability to accommodate
    - 2. Inability to differentiate colors
    - 3. Decreased night vision
    - 4. Decreased tear production
    - 5. Development of cataracts
    - 6. Disease processes
      - a. Glaucoma
      - b. Macular degeneration
      - c. Retinal detachment
  - B. Hearing
    - 1. Presbycusis
    - 2. Inability to hear high frequency sounds
    - 3. Use of hearing aids
  - C. Pain Perception -- inability to differentiate hot from cold
- III. Pharmacokinetic change
  - A. Physiological changes that impact pharmacokinetics
    - 1. Decrease in amount of body water
    - 2. Decrease in muscle mass
    - 3. increase in body fat
    - 4. Renal function deterioration
    - 5. Liver function deterioration
    - 6. Altered distribution of drugs
  - B. Implications of altered pharmacokinetics
    - 1. Increased drug sensitivity
    - 2. Increased adverse drug reactions
    - 3. Increased drug toxicity
    - 4. Dosages should possibly be decreased
  - C. Difficulty in compliance of drug therapy
    - 1. Lack of money to purchase
    - 2. Complicated drug regime
    - 3. Forgetfulness “did I take it or not”
    - 4. Difficulty opening containers
    - 5. Directions for use not understood
    - 6. Other
- IV. Polypharmacy
  - A. Multiple chronic diseases mean multiple medications
  - B. Drug dosages may not have been adjusted for multiple meds
  - C. Drug interactions may cause problems
  - D. Consider polypharmacy as a reason for problems
- V. Psychosocial and economic aspects
  - A. Demographics and “graying of America”

- B. Psychosocial issues
  - 1. Living environments
  - 2. Financial issues
  - 3. Social services
- VI. Specific conditions that occur more frequently in the elderly
  - A. Myocardial infarction
    - 1. Patient will usually have atypical chest pain or NO pain
    - 2. May present with only dyspnea, acute confusion (delirium), syncope, weakness or nausea and vomiting
  - B. Congestive Heart Failure
    - 1. A frequent condition of elderly
    - 2. May present with dyspnea, orthopnea, or mental status alteration
    - 3. Peripheral edema is frequently present in elderly patients with or without failure and may signify a variety of conditions
    - 4. Fluid balances are sometimes difficult to achieve
  - C. Aortic Dissection
  - D. Syncope
    - 1. May have a variety of causes, usually cardiac or neurological
    - 2. Causes to consider
      - a. Vasopressor use
      - b. Orthostatic hypotension
      - c. Transient reduction in blood flow to the brain due to cardiac output drop for any reason
      - d. TIA
      - e. Vasovagal syncope
  - E. Hypertension
  - F. Pneumonia
    - a. Presentation can include dyspnea, congestion, altered mental status, or abdominal pain.
    - b. Fever may be absent
  - G. Pulmonary Embolism
    - a. Should be considered in any elderly patient with acute dyspnea
    - b. Common after hip fracture
  - H. Asthma
  - I. Emphysema and chronic bronchitis
  - J. Stroke.
  - K. Transient Ischemic Attacks (TIA)
  - L. Alzheimer's Disease
    - 1. Definition
      - a. Stages
      - b. Diagnosis
      - c. Prognosis
    - 2. Epidemiology
      - a. Population
      - b. early onset

3. Pathophysiology
    - a. Plaques
    - b. Tangles
  4. Signs and Symptoms
    - a. Memory
    - b. Learning
    - c. Judgment
    - d. Language
    - e. Tasks
  5. Personality changes
    - a. Apathy
    - b. Irritability
    - c. Depression
    - d. Agitation
    - e. Psychosis
  6. Normal day-to day living
    - a. Problems associated with management
    - b. Patient violence
    - c. Patient verbal abuse
    - d. Fearful patient
  7. Management
    - a. Communication
    - b. Slow clear instructions
    - c. Distraction from agitation
    - d. Other
    - e. Treat symptomatically
    - f. Consider co-illnesses
    - g. Consider medication reactions
  8. Alzheimer's treatment
    - a. Cholinesterase inhibitors
    - b. Antipsychotics
    - c. Antidepressants
- M. Dementia
1. Definition
  2. Causes of dementia
    - a. Alzheimer's disease
    - b. Multi-infarct dementia
    - c. Drug toxicity
    - d. Emotional disorders
    - e. Metabolic and endocrine disorders
    - f. Brain tumor
    - g. Brain trauma
    - h. Infections
    - i. Major depression Parkinson's disease
    - j. Huntington's chorea

- k. Alzheimer's Disease—most common form of dementia
      - i. Pathophysiology
      - ii. Stages
      - iii. Paramedic assessment and interactions
  - 3. Associated signs and symptoms
    - a. Progressive loss of cognitive function; short and long-term memory problems
    - b. Loss of attention span
    - c. Loss of communication skills
    - d. Inability to perform daily routines
    - e. Easily lost
    - f. Angers easily
  - 4. Problems associated with management of patient with dementia
    - a. Poor historian; impaired judgment
    - b. Inability to vocalize areas of pain and current symptoms
    - c. Unable to follow commands
    - d. Anxiety over movement out of home or current establishment
    - e. Anxiety and fear of treatment of current medical problems
- N. Delirium- a sudden change in behavior, consciousness, or cognitive processes generally due to a reversible physical ailment.
  - 1. Mortality rates
  - 2. Evaluation of pathophysiology through history, possible risk factors, and current medications
    - a. Intoxication or withdrawal from alcohol
    - b. Withdrawal from sedatives
    - c. Vitamin deficiencies
    - d. Urinary tract infections/ bowel obstructions
    - e. Cardiovascular disease
    - f. Hyper/hypoglycemia
    - g. Psychiatric disorders
    - h. Malnutrition
    - i. Dehydration
    - j. Environmental emergencies
    - k. Depression
    - l. Fever
    - m. Current medications: anticholinergic medications
  - 3. Associated signs and symptoms
    - a. Onset of minutes, hours, days
    - b. Disorganized thoughts: inattention, memory loss, disorientation
    - c. Hallucinations
    - d. Delusions
    - e. Reduced level of consciousness
  - 4. Possible changes in physical assessment
    - a. Changes in peripheral, core and neurovascular perfusion
    - b. Changes in response of pupils
    - c. Changes in response to motor tests

- d. Dysrhythmias
  - e. Adventitious breath sounds
- 5. Assessment tools
  - a. Neurological examination of cranial nerves, motor and sensory function
  - b. Blood pressures
  - c. Evaluation of limb lead ECG
  - d. Interpretation of 12 lead ECG for signs of ischemia, injury or anomalies
  - e. Auscultation of heart to detect irregular, muffled, or extra heart tones
  - f. Auscultation of breath sounds to detect adventitious noises
  - g. Capnography
  - h. Evaluation of glucose
- 6. Treatment
  - a. Airway, ventilatory and circulatory support
  - b. Oxygen with adjuncts appropriate to patient condition
  - c. Venous access
  - d. ECG monitoring
  - e. Treatment to correct reversible causes: Hypoglycemia D50 IV or glucagons, or possible drug overdose with Narcan
  - f. Evaluation of patient treatment through reassessment
- O. GI Gastrointestinal bleeding- is caused by disease processes, inflammation, infection and obstruction of the upper and lower gastrointestinal tract.
  - 1. Evaluation of pathophysiology through history, possible risk factors, and current medications.
    - a. Peptic ulcer disease
    - b. Esophageal varices
    - c. Stomach cancer
    - d. Esophageal cancer
    - e. Diverticulitis
    - f. Bowel obstruction
    - g. Smoking
    - h. Alcohol/ Cirrhosis of the Liver
    - i. Medications in use: nonsteroidal anti-inflammatory drugs, warfarin
  - 2. Associated signs and symptoms
    - a. Hematemesis
    - b. Bilious vomitus
    - c. Melena
    - d. Dyspepsia
    - e. Hepatomegaly
    - f. Jaundice
    - g. Constipation, diarrhea
    - h. Agitation, inability to find a comfortable position
    - i. Dizziness

3. Possible changes in physical assessment
  - a. Changes in peripheral, core and neurovascular perfusion
  - b. Pale or yellow, thin skin, frail musculoskeletal system
  - c. Peripheral, sacral and periorbital edema
  - d. Hypertension
  - e. Fever
  - f. Tachycardia
  - g. Dyspnea
4. Assessment tools
  - a. Evaluation of limb lead ECG
  - b. Interpretation of 12 lead ECG for signs of ischemia, injury or anomalies
  - c. Blood pressures
  - d. Auscultation of heart to detect irregular, muffled, or extra tones
  - e. Auscultation of breath sounds to detect adventitious noises
  - f. Auscultation of bowel sounds; palpation of abdomen
5. Treatment:
  - a. Airway, ventilatory and circulatory support
  - b. Oxygen with adjuncts appropriate to patient condition
  - c. Venous access- care should be taken to avoid use of indwelling fistulas or shunt unless necessary in cardiac events.
  - d. Dysrhythmia management according to current ACLS standards or area protocol
  - e. Evaluation of patient treatment through reassessment
  - f. Definitive care of renal patients is dialysis.
  - g. Fever
  - h. Tachycardia
  - i. Tachypnea
  - j. Diffuse tenderness on palpation of abdomen, with distention, guarding, or masses; upon auscultation high pitched noises
  - k. Hypovolemia
6. Assessment tools
  - a. Evaluation of limb lead ECG
  - b. Interpretation of 12 lead ECG for signs of ischemia, injury or anomalies
  - c. Blood pressures, lying, sitting, and standing noting any change of 10 mm/Hg or more lower as the patient moves to an upright position
  - d. Pulses, lying, sitting, and standing noting any change of 10 beats per minute more higher as the patient moves to an upright position
  - e. Auscultation of heart to detect irregular, muffled, or extra tones
  - f. Auscultation of breath sounds to detect adventitious noises, or foreign bodies
  - g. Auscultation of bowel sounds; palpation of abdomen



7. Treatment:
  - a. Management of Upper GI bleeds is not dependent upon the identifying the underlying cause; however, assessment and history are the key to successful treatment of this emergent life threatening illness.
  - b. Airway, ventilatory and circulatory support
  - c. Oxygen with adjuncts appropriate to patient condition
  - d. Venous access- depending on patient presentation it may be necessary to place two large bore IVs
  - e. Dysrhythmia management according to current ACLS standards or area protocol
  - f. Evaluation of patient treatment through reassessment
- P. Biliary disease is disorders of the liver and gallbladder.
  1. Evaluation of pathophysiology through history, possible risk factors, and current medications.
    - a. Liver disease
    - b. Congestive heart failure
    - c. Gallstones
    - d. Cholecystitis
    - e. Medications that cause adverse affects on the liver
  2. Associated signs and symptoms
    - a. Jaundice
    - b. Fever
    - c. Right upper quadrant pain, radiating to upper back and shoulder
    - d. Vomiting
  3. Possible changes in physical assessment
    - a. Changes in peripheral, core and neurovascular perfusion
    - b. Pale or yellow, warm skin
    - c. Fever
    - d. Tachycardia
    - e. Tachypnea due to pain in the abdomen
    - f. Diffuse tenderness in right upper quadrant on palpation of abdomen, guarding
  4. Assessment tools
    - a. Evaluation of limb lead ECG
    - b. Interpretation of 12 lead ECG for signs of ischemia, injury or anomalies
    - c. Blood pressures
    - d. Auscultation of heart to detect irregular, muffled, or extra tones
    - e. Auscultation of breath sounds to detect adventitious noises
    - f. Auscultation of bowel sounds; palpation of abdomen
  5. Treatment:
    - a. Airway, ventilatory and circulatory support
    - b. Oxygen with adjuncts appropriate to patient condition
    - c. Venous access

- d. Dysrhythmia management according to current ACLS standards or area protocol
  - e. Evaluation of patient treatment through reassessment
- Q. Chronic Renal Failure- is the inability of the kidneys to excrete waste, concentrate urine, or control electrolyte balance in the body.
  - 1. Evaluation of pathophysiology through history, possible risk factors, and current medications.
    - a. Diabetes
    - b. Congenital disorders
    - c. Pyelonephritis
    - d. Hypertension
    - e. Autoimmune disorders
    - f. Glomerulonephritis
    - g. Medications that damage the kidneys: antibiotics, nonsteroidal anti-inflammatory drugs, anticancer drugs
  - 2. Associated signs and symptoms
    - a. Hypertension
    - b. Headache
    - c. Anxiety
    - d. Fatigue
    - e. Anorexia
    - f. Vomiting
    - g. Increased voiding of brown colored urine
    - h. Confusion
    - i. Seizures
    - j. Musculoskeletal pain
  - 3. Possible changes in physical assessment
    - a. Changes in peripheral, core and neurovascular perfusion
    - b. Pale or yellow, thin skin, frail musculoskeletal system
    - c. peripheral, sacral and periorbital edema
    - d. Hypertension
    - e. Fever
    - f. Tachycardia
    - g. Dyspnea
  - 4. Assessment tools
    - a. Evaluation of limb lead ECG
    - b. Interpretation of 12 lead ECG for signs of ischemia, injury or anomalies
    - c. Blood pressures
    - d. Auscultation of heart to detect irregular, muffled, or extra tones
    - e. Auscultation of breath sounds to detect adventitious noises
    - f. Auscultation of bowel sounds; palpation of abdomen
  - 5. Treatment:
    - a. Airway, ventilatory and circulatory support
    - b. Oxygen with adjuncts appropriate to patient condition

- c. Venous access- care should be taken to avoid use of indwelling fistulas or shunt unless necessary in cardiac events.
  - d. Dysrhythmia management according to current ACLS standards or area protocol
  - e. Evaluation of patient treatment through reassessment
  - f. Definitive care of renal patients is dialysis.
- R. Urinary Tract Infection
1. Evaluation of pathophysiology through history, possible risk factors, and current medications.
    - a. Diabetes
    - b. Prostatitis
    - c. Cystocele
    - d. Urethrocele
    - e. Kidney obstruction
    - f. Indwelling foley catheters
    - g. Medications used- immunosuppressive and chemotherapy
  2. Associated signs and symptoms
    - a. Urinary frequency and urgency
    - b. Dysuria
    - c. Hematuria
    - d. Nausea, vomiting, and diarrhea
    - e. Anorexia
    - f. Shortness of breath
    - g. Fever
    - h. Hypothermia
  3. Possible changes in physical assessment
    - a. Changes in peripheral, core and neurovascular perfusion
    - b. Diaphoresis, pale, cool, skin
    - c. Hypotension
    - d. Fever
    - e. Tachycardia
  4. Assessment tools
    - a. Evaluation of limb lead ECG
    - b. Interpretation of 12 lead ECG for signs of ischemia, injury or anomalies
    - c. Blood pressures
    - d. Auscultation of heart to detect irregular, muffled, or extra tones
    - e. Auscultation of breath sounds to detect adventitious noises
    - f. Auscultation of bowel sounds; palpation of abdomen
  5. Treatment:
    - a. Airway, ventilatory and circulatory support
    - b. Oxygen with adjuncts appropriate to patient condition
    - c. Venous access
    - d. Supportive care
    - e. Evaluation of patient treatment through reassessment of disease

S. Endocrine

1. Diabetes Mellitus- an inability of the pancreas to produce a sufficient amount of insulin causing hyperglycemia.
  - a. Classification:
    - i. Type I diabetes is insulin dependent (IDDM)
    - ii. Type II diabetes is non-insulin dependent (NIDDM)
  - b. Evaluation of pathophysiology through history, possible risk factors, and current medications.
    - i. Insulin deficiency
    - ii. Hyperglycemia: plasma levels greater than 200 mg/dl, fasting levels of greater than 126 mg/dl
    - iii. Ketoacidosis
    - iv. Medications used: short-acting and long-acting insulin
  - c. Associated signs and symptoms
    - i. Polyuria
    - ii. Polydipsia
    - iii. Polyphagia
    - iv. Anorexia
    - v. Nausea, vomiting
    - vi. Neuropathy and paresthesia
  - d. Possible changes in physical assessment
    - i. Changes in peripheral, core and neurovascular perfusion
    - ii. Diaphoresis, pale skin, poor skin turgor; pale, dry, oral mucosa, furrowed tongue
    - iii. Hypotension
    - iv. Hypoglycemia/Hyperglycemia
    - v. Tachycardia
    - vi. Fever
  - e. Assessment tools
    - i. Evaluation of limb lead ECG
    - ii. Interpretation of 12 lead ECG for signs of ischemia, injury or anomalies
    - iii. Blood pressures
    - iv. Blood glucose levels
    - v. Distal pulses
    - vi. Auscultation of heart to detect irregular, muffled, or extra tones
    - vii. Auscultation of breath sounds to detect adventitious noises
    - viii. Temperature
    - ix. Capnography
  - f. Treatment
    - i. Airway, ventilatory, and circulatory support
    - ii. Oxygen with adjuncts appropriate to patient condition
    - iii. Venous access
    - iv. Correction of hypoglycemia with D50 IV
    - v. Treatment of hyperglycemia with fluids
    - vi. Evaluation of patient treatment through reassessment

2. Diabetic Ketoacidosis-is a diabetic complication of IDDM that occurs when the patient become hyperglycemic. This causes the cells to burn fat, which causes the body to create ketones and ketoacids.
  - a. Evaluation of pathophysiology through history, possible risk factors, and current medications.
    - i. Non-compliance in medication use
    - ii. Recent myocardial infarction, stroke, infection, or anorexia
    - iii. Insulin pump use
    - iv. Medications used: short-acting insulin, long-acting insulin, metformin
  - b. Associated signs and symptom
    - i. Altered level of consciousness
    - ii. Visual disturbances
    - iii. Fruity or foul odor to breath (acetone halitosis)
    - iv. Weight loss
    - v. Polyuria
    - vi. Polydypsia
    - vii. Polyphagia
    - viii. Abdominal pain
    - ix. Nausea and vomiting
  - c. Possible changes in physical assessment
    - i. Changes in peripheral, core and neurovascular perfusion
    - ii. Warm, flushed skin, (even though the patient can be hypothermic) poor skin turgor; pale, dry, oral mucosa, furrowed tongue
    - iii. Kussmaul respirations
    - iv. Hyperglycemia
    - v. Tachycardia
  - d. Assessment tools
    - i. Evaluation of limb lead ECG
    - ii. Interpretation of 12 lead ECG for signs of ischemia, injury or anomalies
    - iii. Blood pressures
    - iv. Blood glucose levels
    - v. Distal pulses
    - vi. Auscultation of heart to detect irregular, muffled, or extra tones
    - vii. Auscultation of breath sounds to detect adventitious noises
    - viii. Temperature
    - ix. Capnography
  - e. Treatment
    - i. Airway, ventilatory, and circulatory support
    - ii. Oxygen with adjuncts appropriate to patient condition
    - iii. Venous access
    - iv. Treatment of hyperglycemia with fluids
    - v. Evaluation of patient treatment through reassessment

3. Nonketotic Hyperglycemic-Hyperosmolar Coma –is a diabetic complication of NIDDM in the elderly. Unlike DKA the resulting high blood glucose levels do not cause ketosis, but rather lead to osmotic diuresis, and shift of fluid to the intravascular space, resulting in dehydration.
  - a. Evaluation of pathophysiology through history, possible risk factors, and current medications.
    - i. Type II diabetes (NIDDM)
    - ii. Non-compliance of medicines
    - iii. Hypothermia
    - iv. Heat Stroke
    - v. Infections
    - vi. Cardiac disease
    - vii. Pancreatitis
    - viii. Stroke
    - ix. Medications
  - b. Associated signs and symptoms
    - i. Hyperglycemia
    - ii. Polydipsia
    - iii. Dizziness
    - iv. Confusion
    - v. Altered mental status
    - vi. Seizures
  - c. Possible changes in physical assessment
    - i. Changes in peripheral, core and neurovascular perfusion
    - ii. Warm, flushed skin, poor skin turgor; pale, dry, oral mucosa, furrowed tongue
    - iii. Hypotension and shock
    - iv. Tachycardia
    - v. Blood glucose levels greater than 500 mg/dl
  - d. Assessment tools
    - i. Evaluation of limb lead ECG
    - ii. Interpretation of 12 lead ECG for signs of ischemia, injury or anomalies
    - iii. Blood pressures
    - iv. Blood glucose levels
    - v. Distal pulses
    - vi. Auscultation of heart to detect irregular, muffled, or extra tones
    - vii. Auscultation of breath sounds to detect adventitious noises
    - viii. Temperature
    - ix. Capnography
  - e. Treatment
    - i. Airway, ventilatory, and circulatory support
    - ii. Oxygen with adjuncts appropriate to patient condition
    - iii. Venous access may necessitate 2 large bore IVs

- iv. Treatment of hyperglycemia with judicious use of fluid boluses
  - v. Evaluation of patient treatment through reassessment
- 4. Hypothyroidism-is destruction of the thyroid tissue over time that causes an insufficient amount of thyroid hormone in the blood. Myxedema coma is a premorbid consequence of hypothyroidism in the elderly caused by a recent history of surgery, hypothermia, infection, hypoglycemia, and sedative use.
  - a. Evaluation of pathophysiology through history, possible risk factors, and current medications.
    - i. Anemia
    - ii. Congestive heart failure
    - iii. Hyponatremia
    - iv. Medications used: Levothyroxines
  - b. Associated signs and symptoms
    - i. Cold intolerance
    - ii. Fatigue
    - iii. Weight gain
    - iv. Poor cognitive function
    - v. Scaly dry skin and hair loss
    - vi. Peripheral and facial edema
    - vii. Altered mentation
    - viii. Depression, paranoia
  - c. Possible changes in physical assessment
    - i. Changes in peripheral, core and neurovascular perfusion
    - ii. Bradycardia
    - iii. Respiratory failure or arrest
    - iv. Hypercarbia
    - v. Changes in blood glucose levels
    - vi. Non-pitting or pitting edema
  - d. Assessment tools
    - i. Evaluation of limb lead ECG
    - ii. Interpretation of 12 lead ECG for signs of ischemia, injury or anomalies
    - iii. Blood pressures
    - iv. Blood glucose levels
    - v. Auscultation of heart to detect irregular, muffled, or extra tones
    - vi. Capnography and pulse oximetry
  - e. Treatment
    - i. Airway, ventilatory, and circulatory support
    - ii. Oxygen with adjuncts appropriate to patient condition; may necessitate aggressive management
    - iii. Venous access
    - iv. Correction of hypoglycemic levels with D50

- v. \*Dysrhythmia management according to current ACLS standards or area protocol
    - vi. Evaluation of patient treatment through reassessment
  - T. Inflammatory arthritis
  - U. Osteo
    - 1. Osteoporosis-is a bone disease that decreases bone density.
      - a. Type I osteoporosis is seen in post menopausal women due to the decline in estrogen and most commonly causes radial and hip fractures. Type II occurs in both men and women over fifty and causes hip and vertebral fractures that can eventually result in dorsal kyphosis.
      - b. Evaluation of pathophysiology through history, possible risk factors, and current medications.
        - i. Genetics
        - ii. Smoking
        - iii. Exercise habits
        - iv. Diets poor in calcium and vitamin D
        - v. Gastrointestinal disorders
        - vi. Hormones
        - vii. Body type and weight
        - viii. Steroids
        - ix. Anticonvulsants
        - x. Alcohol
    - 2. Osteoarthritis- is a progressive disease from repetitive trauma to the joints causing destruction of the cartilage. Commonly strikes the hands, knees, hips, and spine.
    - 3. Rheumatoid Arthritis is an autoimmune disorder that affects the joints of the body. Rheumatoid causes inflammation of the joints, resulting in pain and instability of the joints.
- V. Immunological system anatomical and physiological changes, and pathophysiology
  - 1. Immunological changes in the elderly
    - a. Aging of the thymus and reduction of T-cells
    - b. Reduced leukocyte activity
    - c. Increased production of autoantibodies
  - 2. The changes in the immunological system of the elderly make them more prone to infections and exacerbations of chronic disease processes. These infections compounded by an inability, due to ageing of the hypothalamus, may not produce a fever in the face of an immunological insult such as a viral, bacterial, or occult infection.
- W. Pressure Ulcers- is the decay of body tissue due to pressure on a site. This results in a lack of blood supply and oxygen to the tissues.
  - 1. Evaluation of pathophysiology through history and possible risk factors
    - a. Brain or spinal cord injury
    - b. Neuromuscular disorders
    - c. Acute illness that results in loss of mobility



- d. Nutritional problems
    - e. Fecal or urinary incontinence
  - 2. Areas of concern
    - a. Lower legs
    - b. Sacrum
    - c. Greater trochanter
    - d. Buttocks
  - 3. Stages of Ulcer
    - a. Nonblanching erythema
    - b. Blisters
    - c. Ulcer exposing fat and fascia
    - d. Ulcer exposing muscle or bone
  - 4. Management is at the BLS level
- X. Herpes Zoster- a highly contagious virus that is manifested by a painful rash that affects the ganglion of a nerve and appears along the affected nerve pathway.

# Special Patient Population

## Patients with Special Challenges

### Paramedic Education Standard

Integrates assessment findings with principles of pathophysiology and knowledge of psychosocial needs to formulate a field impression and implement a comprehensive treatment/disposition plan for patients with special needs.

### Paramedic-Level Instructional Guideline

The Paramedic Instructional Guidelines in this section include all the topics and material at the AEMT level PLUS the following material:

- I. Abuse and neglect
  - A. Introduction
    - 1. Epidemiology
    - 2. Definitions of abuse (physical, emotional, sexual) and neglect
  - B. History
    - 1. Social
    - 2. Financial
    - 3. Ethical
    - 4. Other
  - C. Assessment
    - 1. Elements in the history or scene concerning for abuse or neglect
    - 2. Assessing the caregiver's behavior
    - 3. Physical findings concerning for abuse or neglect
    - 4. Benign findings often confused for physical or sexual abuse
  - D. Management
    - 1. Role of the Prehospital Professional (scene assessment, assessment of the caregiver, communication with the caregiver, documentation, reporting suspected abuse/neglect, safely transporting one or more injured children)
    - 2. Role of Child/Adult Protective Services
    - 3. Role of Medical Examiner and law enforcement
  - E. Legal aspects
    - 1. Abuse
    - 2. Neglect
    - 3. Assault
    - 4. Sexual assault
  - F. Risk profile of abuse victim
  - G. Risk profile of the abuser/assailant
  - H. Documentation
    - 1. Empirical -- Non judgmental
    - 2. Subjective --Patient/other description

- a. Use quotes
  - b. Identify the resource
  - c. Avoid judgment of potential abuser/ assailant
- 3. Objective
  - a. Observations
  - b. Descriptions
  - c. Time frame

## II. Homelessness/Poverty

- A. Advocate for patient rights and appropriate care
- B. Identify facilities that will treat regardless of payment
- C. Prevention strategies will likely be absent, increasing the probability of disease
- D. Familiarity with assistance resources offered in community
- E. It is estimated that 41 million Americans and one-third of people living in poverty have no health insurance, and insurance coverage held by many others would not carry them through a catastrophic illness
- F. Financial challenges for health care can quickly result from loss of a job and depletion of savings
- G. Financial challenges combined with medical conditions that require uninterrupted treatment (e.g., TB, HIV/AIDS, diabetes, hypertension, mental disorders) or that occur in the presence of unexpected illness or injury, can deprive the patient of basic health care services
- H. In addition, poor health is closely associated with homelessness, where rates of chronic or acute health problems are extremely high
- I. Special considerations
  - 1. People with financial challenges are often apprehensive about seeking medical care
  - 2. When caring for a patient with financial challenges who is concerned about the cost of receiving needed health care, explain the following:
    - a. Patient's ability to pay should never be a factor in obtaining emergency health care
    - b. Federal law mandates that quality, emergency health care be provided, regardless of the patient's ability to pay
    - c. Payment programs for health care services are available in most hospitals
    - d. Government services are available to assist patients in paying for health care
    - e. Free (or near-free) health care services are available through local, state, and federally-funded organizations
  - 3. In cases where no life-threatening condition exists, counsel the patient with financial challenges about alternative facilities for health care that do not require ambulance transport for emergency department evaluation
  - 4. Consider providing an approved list of alternative health care sites (e.g., a minor-emergency center or health clinic) that can provide medical care at less cost than those charged by emergency departments

- III. Bariatric Patients
  - A. Definition
  - B. Risk factors:
    - 1. Caloric intake that exceeds calories burned
    - 2. Low basal metabolic rate
    - 3. Genetic predisposition for obesity
  - C. Associated with an increased risk for the following:
    - 1. Hypertension
    - 2. Stroke
    - 3. Heart disease
    - 4. Diabetes
    - 5. Some cancers
    - 6. Injury
  - D. Long-term health effects
  - E. Special considerations
  - F. Patient handling issues
    - 1. to prevent back injuries
    - 2. to position the patient to breathe
- IV. Technology Assisted/Dependent
  - A. Ventilation devices
  - B. Apnea monitoring/Pulse Oximetry
  - C. Long term vascular access devices
  - D. Dialysis shunts
  - E. Nutritional support (i.e. gastric tubes)
  - F. Elimination diversion
- V. Hospice Care and Terminally Ill
  - A. What is hospice?
    - 1. Comfort care vs. curative care
    - 2. Terminally ill as verified by physician
    - 3. Typically cancer, heart failure, Alzheimer's disease, AIDS
  - B. EMS Intervention
  - C. DNR (do not resuscitate) orders
- VI. Tracheostomy care/Dysfunction
  - A. Tracheostomy: surgical opening from the anterior neck into the trachea
  - B. Consists of
    - 1. Stoma
    - 2. Outer cannula
    - 3. Inner cannula
  - C. Routine care
    - 1. Keep stoma clean and dry
    - 2. Change outer cannula as needed
    - 3. Suction as needed
  - D. Acute care

VII. Technology Assisted Patients

- A. Profile of patients requiring adaptive devices
- B. Adaptive devices
  - 1. Positive pressure ventilation devices
    - a. CPAP/BiLevel
    - b. Ventilators
    - c. other
  - 2. Negative pressure ventilation devices
    - a. Ventilators
    - b. Phrenic nerve stimulators
    - c. Diaphragm pacers
  - 3. Apnea monitoring/Pulse Oximetry
  - 4. Airways -- Tracheostomy tubes
  - 5. Long term vascular access devices
    - a. Midlines
    - b. PICC lines
    - c. Central lines
    - d. Implanted ports
    - e. Other
  - 6. Medication administration systems
  - 7. Ventricular assist devices
  - 8. CerebroSpinal Fluid (CFS) shunts
  - 9. Hemodialysis
  - 10. Peritoneal dialysis
  - 11. Nutritional support
    - a. Gastric
    - b. Jejunum
  - 12. Elimination
    - a. Intestinal diversion
    - b. Urinary diversion
  - 13. Braces
  - 14. Mobility
  - 15. Wounds
    - a. Closures
    - b. Drains
  - 16. Other
- C. Assessment
- D. Management approach

VIII. Pediatrics Developmental Disabilities

- A. Impaired or insufficient development of the brain that causes an inability to learn at the usual rate (developmental delay)
- B. Causes include the following:
  - 1. Unsatisfactory parental interaction
  - 2. Severe vision or hearing impairment
  - 3. Mental retardation

4. Brain damage
  5. Severe diseases of body organs and systems
  6. Congenital anomalies
  - C. Signs of developmental delay
    1. Walking upright
    2. Fine hand-eye coordination
    3. Listening, language, and speech
    4. Social interaction
  - D. Accommodations that may be necessary when providing patient care include allowing adequate time for obtaining a history, performing assessment and patient management procedures, and preparing the patient for transport
  - E. Down Syndrome
    1. Features of the patient with Down syndrome:
    2. Cellular etiology
      - a. Results in a triplet of chromosomes 21
      - b. Extra number 21 chromosome
      - c. Increased maternal age
      - d. Family history of Down syndrome
    3. Special considerations
      - a. Life expectancy
      - b. Caregiver interactions
      - c. Common associated disorders
      - d. Cognitive ability of the downs patient
  - F. Autism
    1. Features of the patient with Autism:
    2. Etiology
    3. Special considerations
      - a. Caregiver interactions
      - b. Cognitive ability of the autistic patient
- IX. Emotionally impaired
- A. People with emotional impairments include those with the following:
    1. Neurasthenia (nervous exhaustion)
    2. Anxiety neurosis
    3. Compulsion neurosis
    4. Hysteria
  - B. Special considerations
    1. Signs and symptoms that may result from emotional impairment
    2. Complete history and examination
    3. Prehospital Management
    4. Emotionally/mentally impaired (EMI)
      - a. IQ assessment as:
        - i. Mild (IQ 50 to 70)
        - ii. Moderate (IQ 35 to 59)
        - iii. Profound (IQ less than 20)

- b. Causes of mental retardation
  - i. Genetic conditions
    - a) Phenylketonuria
    - b) Chromosomal disorder
    - c) Fragile X syndrome
  - ii. Problems during pregnancy
    - a) Use of alcohol or other drugs by the mother
    - b) Use of tobacco
    - c) Illness and infection
  - iii. Problems at birth
    - a) Brain injury
    - b) Prematurity
    - c) Low birth weight
  - iv. Problems after birth
    - a) Childhood diseases
    - b) Injury
    - c) Exposure to lead, mercury, and other environmental toxins
  - v. Poverty and cultural deprivation
    - a) Malnutrition
    - b) Disease-producing conditions
    - c) Inadequate medical care
    - d) Environmental health hazards
    - e) Lack of stimulation
- c. Special considerations

## X. Physical Needs/Challenges

### A. Hearing Impairments

- 1. Deafness
  - a. Etiology
  - b. Types of deafness
- 2. Sensorineural deafness
- 3. Hearing impairments
  - a. Prolonged exposure to loud noise
  - b. Disease (e.g., Meniere's disease)
  - c. Tumors
  - d. Medications
  - e. Viral infections
  - f. Natural degeneration of the cochlea and/or labyrinth in old age
  - g. Auditory process deficits
  - h. Auditory dyssynchrony
  - i. Conductive hearing loss
  - j. Mixed hearing loss
  - k. Sensorineural hearing loss

4. Special considerations
  - a. Use of hearing aids
- B. Visual Impairments
  1. Normal vision
  2. Visual impairments
    - a. Cataracts
    - b. Degeneration of the eyeball, optic nerve, or nerve pathways
    - c. Disease (e.g., diabetes, hypertension)
    - d. Eye or brain injury
    - e. Infection (e.g., CMV, HSV, bacterial ulcers)
    - f. Vitamin A deficiency in children in living in poor countries
    - g. Glaucoma
    - h. Myopia
    - i. Hyperopia
    - j. Amblyopia
    - k. Optic nerve atrophy
    - l. Optic nerve hypoplasia
    - m. Retinal diseases
    - n. Retinopathy
    - o. Cortical visual impairment
    - p. Strabismus
  3. Special considerations
- C. Speech impairments
  1. Speech impairments include disorders of language, articulation, voice production, or fluency (blockage of speech), all of which can lead to an inability to communicate effectively
  2. Speech
    - a. Language disorders.
    - b. Language learning disabilities.
    - c. Language processing disorders.
    - d. Semantic-pragmatic disorders.
    - e. Articulation disorders.
    - f. Phonological process disorders.
    - g. Motor speech diso
- D. Paraplegia/Quadriplegia
  1. Define Paraplegia
  2. Define Quadriplegia
  3. Causes:
    - a. Motor vehicle crash
    - b. Sports injury
    - c. Fall
    - d. Gunshot wound
    - e. Medical illness
  4. Both paraplegia and quadriplegia are accompanied by a loss of sensation and may have loss of urinary and or bowel control



5. Special considerations
  - a. Patients with extremity and trunk paralysis may require accommodations in patient care
  - b. Assessment
    - i. Patient may have an external device to stabilize the spine
    - ii. Ostomies
      - a) Trachea
      - b) Bladder
      - c) Colon
    - iii. Priapism may be present in some male patients
  - c. Transport
  - d. Additional manpower may be needed to move special equipment and prepare patient for transport
  - e. Pressure that would be appreciated by patients with normal sensation may not be recognized in patients with these

## XI. Patients with Communicable Diseases

### A. Overview

1. Exposure to some infectious diseases can pose a significant health risk to EMS providers
2. It is important to ensure personal protection on every emergency response
3. Required precautions will depend on the mode of transmission and the pathogen's ability to create pathological processes
  - a. In some cases gloves will provide for necessary protection
  - b. In other cases, respiratory barriers will also be indicated

### B. Special considerations

1. Some infectious diseases (e.g., AIDS) will take a toll on the emotional well-being of affected patients, their families, and loved ones
2. Psychological aspects of providing care to these patients include an emphasis on the following:
  - a. Recognizing each patient as an individual with unique health care needs
  - b. Respecting each person's personal dignity
  - c. Providing considerate, respectful care focused upon the person's individual needs

## XII. Terminally Ill Patients

### A. Overview

1. Paramedics will care for terminally ill patients (patients with advanced stages of disease with an unfavorable prognosis and no known cure)
2. These will often be emotionally-charged encounters that will require a great deal of empathy and compassion for the patient and his or her loved ones

3. If EMS has been summoned to assess late stages of a patient's terminal illness or a change in the patient's condition, gather a complete history and to ask the patient or family about advance directives and the appropriateness of resuscitation procedures
4. Hospice Care-the goal of hospice care is comfort during the end of a terminal illness
- B. Special considerations
  1. Care of a terminally ill patient will often be primarily supportive and limited to calming and comfort measures, and perhaps transport for physician evaluation
  2. Pain assessment and management are important in caring for these patients
    - a. Attempt to gather a complete pain medication history
    - b. Examine the patient for the presence of transdermal drug patches or other pain-relief devices
  3. Following an assessment of the patient's vital signs, level of consciousness, and medication history, medical direction may recommend the administration of analgesics or sedatives to ensure the patient's comfort

### XIII. Mental Needs/Challenges

- A. Mental illness refers to any form of psychiatric disorder
- B. Psychose
  1. Comprises a group of mental disorders in which the individual loses contact with reality
  2. Thought to be related to complex biochemical disease that disorders brain function
  3. Examples
    - a. Schizophrenia
    - b. Bipolar disorder (manic-depressive illness)
    - c. Organic brain disease
- C. Neuroses
  1. Refers to diseases related to upbringing and personality in which the person remains "in touch" with reality
  2. Neurotic symptoms generally do not limit work or social activity and tend to fluctuate in intensity with stress
  3. Examples
    - a. Depression
    - b. Phobias
    - c. Obsessive-compulsive behavior
- D. Special considerations
  1. Recognizing a patient who is mentally challenged may be difficult, especially when caring for mildly neurotic patients whose behavior may be unaffected
  2. Patients with more serious disorders may present with signs and symptoms consistent with mental illness

3. When obtaining the patient history, do not be hesitant to ask about:
  - a. History of mental illness
  - b. Prescribed medications
  - c. Compliance with prescribed medications
  - d. Concomitant use of alcohol or other drugs
- E. If the patient appears to be paranoid or shows anxious behavior, ask the patient's permission before beginning any assessment or performing any procedure
  1. Once rapport and trust have been established, care should proceed in the same manner as for a patient who does not have mental illness (unless the call is related specifically to the mental illness)
- F. These patients experience illness and injury like all other patients

#### XIV. Specific Challenges Created by Chronic Conditions

##### A. Arthritis

1. Inflammation of a joint, characterized by pain, stiffness, swelling, and redness
2. Has many forms and varies widely in its effects
3. Two common forms:
  - a. Osteoarthritis results from cartilage loss and wear and tear of the joints (common in elderly patients)
  - b. Rheumatoid arthritis is an autoimmune disorder that damages joints and surrounding tissues
4. Special considerations
5. Assessment
  - a. Decreased range of motion/mobility may limit physical examination
  - b. Be sure to solicit current medications before considering the administration of medications
6. Management and transportation strategies
7. Consider the patient's limited mobility
8. Equipment (e.g., backboards, splints) must be adjusted to "fit the patient" (not vice versa) by supplying adequate padding to fill all voids

##### B. Cancer

1. A group of diseases that allow for an unrestrained growth of cells in one or more of the body organs or tissues
2. Malignant tumors most commonly develop in major organs, e.g., the lungs, breasts, intestine, skin, stomach, and pancreas, but may also occur in cell-forming tissues of the bone marrow, and in the lymphatic system, muscle, or bone
3. Special considerations
4. Signs and symptoms depend on the cancer's primary site of origin
5. Many cancer patients take anticancer drugs and pain medications through surgically implanted ports (e.g., Mediports)
6. Transdermal skin patches that contain analgesic agents are common

C. Cerebral Palsy (CP)

1. General term for nonprogressive disorders of movement and posture
2. Results from damage to the fetal brain during later months of pregnancy, during birth, during the newborn period, or in early childhood
3. Causes
  - a. Most common cause is cerebral dysgenesis (abnormal cerebral development) or cerebral malformations
  - b. Less common causes include the following:
    - i. Fetal hypoxia
    - ii. Birth trauma
    - iii. Maternal infection
    - iv. Kernicterus (excessive fetal bilirubin, associated with hemolytic disease)
    - v. Postpartum encephalitis, meningitis, or head injury
4. Produces abnormal stiffness and contraction of groups of muscles
5. Child may be categorized as having one of the following conditions:
  - a. Diplegia—affecting all four limbs, the legs more severely than the arms
  - b. Hemiplegia—affecting limbs only on one side of the body; the arm usually more severely than the leg
  - c. Quadriplegia—affecting all four limbs severely; not necessarily symmetrically
  - d. Athetosis—producing involuntary writhing movements
  - e. Ataxia—producing a loss of coordination and balance
  - f. Hearing defects, epilepsy, and other CNS disorders are commonly present with the disease
  - g. Special considerations
    - i. Weakness
    - ii. Paralysis
    - iii. developmental delay
6. Some children with mild CP attend regular schools
7. Those with more severe forms of the disease never learn to walk or effectively communicate, and require lifelong skilled nursing care

D. Cystic Fibrosis (CF) (mucoviscidosis)

1. Inherited metabolic disease of the lungs and digestive system that manifests itself in childhood
2. Caused by a defective recessive gene inherited from each parent
3. Predisposes the individual to chronic lung infections
  - a. In addition, the pancreas of a patient with CF fails to produce the enzymes required for the breakdown of fats and their absorption from the intestine
  - b. These alterations in metabolism cause classic symptoms of CF that include the following:
    - i. Pale, greasy-looking, and foul-smelling stools (often noticeable soon after birth)

- ii. Persistent cough and breathlessness
  - iii. Lung infections that often develop into pneumonia, bronchiectasis, and bronchitis
- c. Other features of the disease include stunted growth and sweat glands that produce abnormally salty sweat
- d. In some cases, the child with CF may fail to thrive
- e. Special considerations
  - i. Older patients (and parents of children) with CF are generally aware of their disease
  - ii. Some may be oxygen-dependent and will require respiratory support and suctioning to clear the airway of mucus and secretions
  - iii. Expect a lengthy history and physical exam due to the nature of the disease and associated medical problems
  - iv. Some patients will have received heart and lung transplants, and may require transfer to specialized medical facilities for treatment
  - v. If parents are unaware of the possibility of CF in the presence of signs and symptoms described above, the paramedic should advise the physician at the receiving hospital of his or her suspicions

E. Multiple Sclerosis (MS)

- 1. Progressive and incurable autoimmune disease of the CNS, in which scattered patches of myelin in the brain and spinal cord are destroyed
- 2. Cause of MS is unknown; however, it may have a heritable or viral component
- 3. Disease usually begins early in adult life. MS may develop and progress continually or it may become active for a brief time, and then resume years later
- 4. Symptoms vary with the affected areas of the CNS and may include:
  - a. Brain involvement
  - b. Fatigue
  - c. Vertigo
  - d. Clumsiness
  - e. Muscle weakness
  - f. Slurred speech
  - g. Ataxia
  - h. Blurred or double vision
  - i. Numbness, weakness or pain in the face
  - j. Tingling, numbness, or feeling of constriction in any part of the body
  - k. Extremities that feel heavy and become weak
  - l. Spasticity
  - m. Incontinence

- n. Symptoms of MS may occur singly or in combination, and may last from several weeks to several months
- o. Some patients become disabled, bedridden, and incontinent early in middle life
- p. Disabled patients also often suffer from painful muscle spasms, constipation, urinary tract infection, skin ulcerations, and mood swings
- q. Disease is managed with medications, physical therapy, and counseling
- r. Special considerations
  - i. Some patients with MS may be difficult to examine and may be unable to provide a complete medical history due to of the nature of their illness
  - ii. Allow extra time for patient assessment and to prepare the patient for transport
  - iii. Respiratory support may be indicated in severe cases

F. Muscular Dystrophy

- 1. Inherited muscle disorder that results in a slow but progressive degeneration of muscle fibers
- 2. Classified according to the following:
  - a. Age that symptoms first appear
  - b. Rate at which the disease progresses
  - c. Way in which it is inherited
- 3. Muscular dystrophy is incurable
- 4. Most common form of the disease is Duchenne muscular dystrophy
  - a. Caused by a sex-linked, recessive gene that affects only males
  - b. Rarely diagnosed before 3 years of age
  - c. Signs and symptoms include
    - i. Child slow in learning to sit up and walk
    - ii. Unusual gait
    - iii. Curvature of the spine
    - iv. Muscles that become bulky as they are replaced by fat
    - v. Eventually, most children will be unable to walk
  - d. Many do not live past their teenage years because of chronic lung infections and congestive heart failure
- 5. Special considerations
- 6. Young children will be relatively easy to examine and prepare for transport
- 7. Older patients may require additional manpower and resources to assist with moving the patient to the ambulance
- 8. Respiratory support may be indicated in severe cases

G. Poliomyelitis (polio)

- 1. Infectious disease caused by poliovirus hominis

2. Virus is spread through direct and indirect contact with infected feces and by airborne transmission
3. Incidence has declined since the Salk and Sabin vaccines were made available in the 1950s
4. Signs and symptoms of polio in both the nonparalytic and paralytic forms include the following:
  - a. Fever
  - b. Malaise
  - c. Headache
  - d. Intestinal upset
5. Often, people with the nonparalytic form of polio recover completely
6. In the paralytic form, extensive paralysis of muscles of the legs and lower trunk can occur
7. Special considerations
  - a. Caring for a patient with paralytic polio who has respiratory paralysis may require advanced airway support to ensure adequate ventilation
  - b. If the lower body is paralyzed, urinary catheterization may be indicated
  - c. Additional resources and manpower may be needed to prepare the patient for transport

#### H. Previously head-injured patients

1. Traumatic brain injury can result from many mechanisms of trauma
2. These injuries can affect many cognitive, physical, and psychological skills
  - a. Cognitive deficits of language and communication, information processing, memory, and perceptual skills are common
  - b. Physical deficit can include ambulation, balance and coordination, fine motor skills, strength, and endurance
  - c. Psychological status also is often altered
3. Special considerations
  - a. Depending on the patient's area of brain injury, obtaining a history and performing assessment and patient care procedures may be very difficult
  - b. Some patients may require restraint
  - c. Family members and other caregivers should be:
    - i. Involved in managing the patient (when appropriate)
    - ii. Interviewed to determine if the patient's actions and responses are "normal" for the patient
    - iii. Expect to spend additional time at the scene to provide care to these patients

#### I. Spina Bifida

1. Congenital defect in which part of one or more vertebrae fails to develop, leaving part of the spinal cord exposed

2. Condition ranges in severity from minimal evidence of a defect to severe disability
3. In severe cases, the legs of some children may be deformed with partial or complete paralysis and loss of sensation in all areas below the level of the defect
4. Associated abnormalities may include:
  - a. Hydrocephalus with brain damage
  - b. Cerebral palsy
  - c. Epilepsy
  - d. Mental retardation
5. Special considerations
  - a. Because of the varying degrees of spina bifida, prehospital care will need to be tailored to the patient's specific needs
  - b. Some patients will require no special accommodations
  - c. Others will need extended on-scene time for assessment and management, and perhaps additional resources and manpower to prepare the patient for transport

#### J. Myasthenia Gravis

1. Autoimmune disorder in which muscles become weak and tire easily
2. Damage occurs to muscle receptors that are responsible for transmitting nerve impulses, commonly affecting muscles of the eyes, face, throat, and extremities
3. Rare disease that can begin suddenly or gradually
4. Can occur at any age, but usually appears in women between age 20 and 30, and in men between 70 and 80 years of age
5. Classic signs and symptoms include:
  - a. Drooping eyelids, double vision
  - b. Difficulty in speaking
  - c. Difficulty in chewing and swallowing
  - d. Difficult extremity movement
  - e. Weakened respiratory muscles
6. Affected muscles become worse with use, but may recover completely with rest
7. May be exacerbated by infection, stress, medications, and menstruation
8. Can often be controlled with drug therapy to enhance the transmission of nerve impulses in the muscles
9. Special considerations
  - a. Accommodations required for care vary based on the patient's presentation
  - b. In most cases, supportive care and transport will be all that is required
  - c. In the presence of respiratory distress, measures should be taken to ensure adequate airway and ventilatory support



# EMS Operations

## Principles of Safely Operating a Ground Ambulance

### **Paramedic Education Standard**

Knowledge of operational roles and responsibilities to ensure safe patient, public, and personnel safety.

### **Paramedic Instructional Guideline**

The Instructional Guidelines in this section include all the topics and material at the AEMT level.

The intent of this section is to give an overview of emergency response to ensure EMS personnel, patient, and other's safety during EMS operations. This does not prepare the entry-level student to be an experienced and competent driver.

Information related to the clinical management of the patient during emergency response is found in the clinical sections of the National EMS Education Standards and Instructional Guidelines for each personnel level.

The Paramedic Instructional Guidelines in this section include all the topics and material at the EMR and EMT levels.

# EMS Operations

## Incident Management

### **Paramedic Education Standard**

Knowledge of operational roles and responsibilities to ensure safe patient, public, and personnel safety.

### **Paramedic-Level Instructional Guideline**

Information related to the clinical management of the patient within components of the Incident Management System (IMS) is found in the clinical sections of the National EMS Education Standards and Instructional Guidelines for each personnel level.

- I. Establish and Work Within the Incident Management System
  - A. Entry-Level Students Need to Be Certified in
    - 1. ICS-100: Introduction to ICS, or equivalent
    - 2. FEMA IS-700: NIMS, An Introduction
  - B. This Can Be Done as a Co requisite or Prerequisite or as Part of the Entry-Level Course

# EMS Operations

## Multiple Casualty Incidents

### **Paramedic Education Standard**

Knowledge of operational roles and responsibilities to ensure safe patient, public, and personnel safety.

### **Paramedic-Level Instructional Guideline**

The intent of this section is to give an overview of operating during a multiple casualty incident when a multiple casualty incident plan is activated.

Information related to the clinical management of the patients during a multiple casualty incident is found in the clinical sections of the National EMS Education Standards and Instructional Guidelines for each personnel level.

The Paramedic Instructional Guidelines in this section include all the topics and material at the EMT and EMT levels.

# EMS Operations

## Air Medical

### Paramedic Education Standard

Knowledge of operational roles and responsibilities to ensure safe patient, public, and personnel safety.

### Paramedic-Level Instructional Guideline

The intent of this section is to give an overview of operating safely in and around a landing zone during air medical operations and transport.

Information related to the clinical management of the patients during air medical operations is found in the clinical sections of the National EMS Education Standards and Instructional Guidelines for each personnel level.

The Paramedic Instructional Guidelines in this section include all the topics and material at the AEMT level PLUS the following material:

- I. Medical Risks/Needs/Advantages
  - A. Risks
    - 1. Aircraft crash
    - 2. Usually more severe restrictions on the number of caregivers for the patient.
  - B. Needs
    - 1. Patient's condition would benefit by decreasing transport interval
    - 2. Patient requires time-sensitive assessment or intervention not available at local facility.
    - 3. Patient is located in area not accessible by ground EMS team or ambulance.
  - C. Advantages
    - 1. Decreased transport interval if transport distance is extreme
    - 2. Availability of highly trained medical crews
    - 3. Availability of specialized medical equipment

# EMS Operations

## Vehicle Extrication

### Paramedic Education Standard

Knowledge of operational roles and responsibilities to ensure safe patient, public, and personnel safety.

### Paramedic-Level Instructional Guideline

The intent of this section is to give an overview of vehicle extrication to ensure EMS personnel and patient safety during extrication operations. This does not prepare the entry-level student to become a vehicle extrication expert or technician.

Information related to the clinical management of the patient being cared for during vehicle extrication is found in the clinical sections of the National EMS Education Standards and Instructional Guidelines for each personnel level.

- I. Safe Vehicle Extrication
  - A. Role of EMS in Vehicle Extrication
    - 1. Provide patient care
    - 2. Perform simple extrication
  - B. Personal Safety
    - 1. First priority for all EMS personnel
    - 2. Appropriate personal protective equipment for conditions
    - 3. Scene size-up
  - C. Patient Safety
    - 1. Keep them informed of your actions
    - 2. Protect from further harm
  - D. Situational Safety
    - 1. Control traffic flow
      - a. Proper positioning of emergency vehicles
        - i. upwind/uphill
        - ii. protect scene
      - b. Use of lights and other warning devices
      - c. Setting up protective barrier
      - d. Designate a traffic control person
    - 2. 360-degree assessment
      - a. Downed electrical lines
      - b. Leaking fuels or fluids
      - c. Smoke or fire
      - d. Broken glass
      - e. Trapped or ejected patients
      - f. Mechanism of injury

3. Vehicle stabilization
    - a. Put vehicle in “park” or in gear
    - b. Set parking brake
    - c. Turn off vehicle ignition
    - d. Cribbing/Chocking
    - e. Move seats back and roll down windows
    - f. Disconnect battery or power source
    - g. Identify and avoid hazardous vehicle safety components
      - i. seat belt pretensioners
      - ii. undeployed air bags
      - iii. other
  4. Unique hazards
    - a. Alternative-fuel vehicles
    - b. Undeployed vehicle safety devices
    - c. HAZMAT
  5. Evaluate the need for additional resources
    - a. Extrication equipment
    - b. Fire suppression
    - c. Law enforcement
    - d. HAZMAT
    - e. Utility companies
    - f. Air medical
    - g. Others
  6. Extrication considerations
    - a. Disentanglement of vehicle from patient
    - b. Multi-step process
    - c. Rescuer-intensive
    - d. Equipment-intensive
    - e. Time-intensive
    - f. Access to patient
      - i. simple
        - a) try to open doors
        - b) ask patient to unlock doors
        - c) ask patient to lower windows
      - ii. complex
      - iii. tools
        - a) hand
        - b) pneumatic
        - c) hydraulic
        - d) other
- E. Determine Number of Patients (implement local multiple casualty incident protocols if necessary)

## II. Use of Simple Hand Tools

- A. Hammer
- B. Center Punch

- C. Pry Bar
- D. Hack Saw
- E. Come-Along

III. Special Considerations for Patient Care

- A. Removing Patient
  - 1. Maintain manual cervical spine stabilization
  - 2. Complete primary assessment
  - 3. Provide critical interventions
- B. Assist With Rapid Extrication
- C. Move Patient, Not Device
- D. Use Sufficient Personnel
- E. Use Path of Least Resistance

# EMS Operations

## Hazardous Materials Awareness

### Paramedic Education Standard

Knowledge of operational roles and responsibilities to ensure safe patient, public, and personnel safety.

### Paramedic-Level Instructional Guideline

Information related to the clinical management of the patient exposed to hazardous materials is found in the clinical sections of the National EMS Education Standards and Instructional Guidelines for each personnel level.

- I. Risks and Responsibilities of Operating in a Cold Zone at a Hazardous Material or Other Special Incident
  - A. Entry-Level Students Need to Be Certified in:
    - 1. Hazardous Waste Operations and Emergency Response (HAZWOPER) standard, 29 CFR 1910.120 (q)(6)(i) -First Responder Awareness Level
  - B. This Can Be Done as a Co requisite or Prerequisite or as Part of the Entry-Level Course



# EMS Operations

## Mass Casualty Incidents due to Terrorism and Disaster

### Paramedic Education Standard

Knowledge of operational roles and responsibilities to ensure safe patient, public, and personnel safety.

### Paramedic-Level Instructional Guideline

The intent of this section is to give an overview of operating during a terrorist event or during a natural or manmade disaster.

Information related to the clinical management of patients exposed to a terrorist event is found in the clinical sections of the National EMS Education Standards and Instructional Guidelines for each personnel level.

- I. Risks and Responsibilities of Operating on the Scene of a Natural or Man-Made Disaster
  - A. Role of EMS
    - 1. Personal safety
    - 2. Provide patient care
    - 3. Initiate/operate in an incident command system (ICS)
    - 4. Assist with operations
  - B. Safety
    - 1. Personal
      - a. First priority for all EMS personnel
      - b. Appropriate personnel protective equipment for conditions
      - c. Scene size-up
      - d. Time, distance, and shielding for self-protection
      - e. Emergency responders are targets
      - f. Dangers of the secondary attack
    - 2. Patient
      - a. Keep them informed of your actions
      - b. Protect from further harm
      - c. Signs and symptoms of biological, nuclear, incendiary, chemical and explosive (B-NICE) substances
      - d. Concept of “greater good” as it relates to any delay
      - e. Treating terrorists/criminals
    - 3. 360-degree assessment and scene size-up
      - a. Outward signs and characteristics of terrorist incidents

- b. Outward signs of a weapons of mass destruction (WMD) incident
  - c. Outward signs and protective actions of biological, nuclear, incendiary, chemical, and explosive (B-NICE) weapons
- 4. Determine number of patients (implement local multiple-casualty incident (MCI) protocols as necessary)
- 5. Evaluate need for additional resources
- 6. EMS operations during terrorist, weapons of mass destruction, disaster events
  - a. All hazards safety approach
  - b. Initially distance from scene and approach when safe
  - c. Ongoing scene assessment for potential secondary events
  - d. Communicate with law enforcement at the scene of an armed attack
  - e. Initiate or expand incident command system as needed
  - f. Perimeter use to protect rescuers and public from injury
  - g. Escape plan and a mobilization point at a terrorist incident
- 7. Care of emergency responders on scene
  - a. Safe use of an auto injector for self and peers
  - b. Safe disposal of auto injector devices after activation

