

# Kansas Emergency Medical Services Education Instructional Guidelines

## ADVANCED EMERGENCY MEDICAL TECHNICIAN

# Preparatory EMS Systems

Applies fundamental knowledge of the EMS system, safety/well-being of the AEMT, medical/legal and ethical issues to the provision of emergency care.

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

## I. Quality Improvement

- A. System for Continually Evaluating and Improving Care
- B. Continuous Quality Improvement (CQI)
- C. Dynamic Process

## II. 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

### III. Education

- A. Levels of EMS licensure
- B. National EMS Education Agenda for the Future: A Systems Approach

### IV. Authorization to Practice

- A. Legislative Decisions on Scope of Practice
- B. State EMS Office Oversight
- C. Medical Oversight
  - 1. Clinical
    - a. Offline Protocols
    - b. Online Protocols
    - c. Standing orders
  - 2. Quality improvement
  - 3. Administrative
- D. Local Credentialing
- E. Employer Policies and Procedures

### V. Integration with Other Professionals and Continuity of Care

- A. Medical Personnel
- B. Law Enforcement
- C. Emergency Management
- D. Home Healthcare Providers
- E. Other Responders

### VI. Maintenance of Certification and Licensure

- A. Personal Responsibility
- B. Continuing Education
- C. Skill Competency Verification
- D. Criminal Implications
- E. Fees

# Preparatory Research

Applies fundamental knowledge of the EMS system, safety/well-being of the AEMT, medical/legal and ethical issues to the provision of emergency care.

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

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# Preparatory Workforce Safety and Wellness

Applies fundamental knowledge of the EMS system, safety/well-being of the AEMT, medical/legal and ethical issues to the provision of emergency care.

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

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# Preparatory Documentation

Applies fundamental knowledge of the EMS system, safety/well-being of the AEMT, medical/legal and ethical issues to the provision of emergency care.

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

## I. Principles of Medical Documentation and Report Writing

### A. Minimum Data Set

1. Patient information
  - a. Chief complaint
  - b. Initial assessment
  - c. Vital signs
  - d. Patient Demographics
2. Administrative information
  - a. Time incident reported
  - b. Time unit notified
  - c. Time of arrival at patient
  - d. Time unit left scene
  - e. Time of arrival at destination
  - f. Time of transfer of care
3. Accurate and synchronous clocks

### B. Prehospital Care Report

1. Functions
  - a. Continuity of care
  - b. Legal document
  - c. Educational
  - d. Administrative
    - i. billing
    - ii. service statistics
  - e. Research
  - f. Evaluation and continuous quality improvement
2. Uses
  - a. Types
    - i. traditional written form with check boxes and a section for narrative
    - ii. electronic - information is filled in by means of a device or over the Internet
  - b. Sections
    - i. run data
    - ii. patient data
    - iii. check boxes
    - iv. narrative section
      - a) systems documentation
      - b) SOAPE format

- c. Confidentiality
  - d. Distribution
  - e. Health Information Portability and Accountability Act of 1996 (HIPAA)
3. Falsification Issues

C. Documentation of Patient Refusal

- 1. Before leaving the scene
  - a. Document patient's able to make a rational, informed decision
  - b. Inform the patient why he should go and what may happen to him if he does not
  - c. Consult medical direction as directed by local protocol
  - d. Document any assessment
  - e. Obtain appropriate witness signature
  - f. Complete the prehospital care report
    - i. care patient refused
    - ii. statement that EMT explained to patient possible consequences of failure to accept care, including potential death
    - iii. offer alternative methods of gaining care
    - iv. state willingness to return

D. Special Situations/Reports/Incident Reporting

- 1. Correction of errors
  - a. Errors discovered while the report form is being hand written
  - b. Errors discovered after a hand written report form is submitted
  - c. Errors discovered while/after completing an electronic report
- 2. Multiple Casualty Incidents (MCI)
  - a. When there is not enough time to complete form before next call, EMT will need to fill out the report later
  - b. The local MCI plan should have some means of recording important medical information temporarily
  - c. The standard for completing the form in an MCI is not the same as for a typical call
- 3. Special situation reports
  - a. Used to document events that should be reported to local authorities, or to amplify and supplement primary report
  - b. Should be submitted in timely manner and should include the names of all agencies, people, and facilities involved
  - c. The report, and copies if appropriate, should be submitted to the authority described by local protocol
  - d. Exposure
  - e. Injury
  - f. Goal should be to provide a report prior to departing from the hospital
  - g. EMT should keep a copy of transfer report for use as a reference during primary prehospital care report and should submit copy with final prehospital care report

# Preparatory

## EMS System Communication

Applies fundamental knowledge of the EMS system, safety/well-being of the AEMT, medical/legal and ethical issues to the provision of emergency care.

The AEMT Instructional Guidelines in this section include all the topics and material at the EMR and EMT 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 to 15 miles over average terrain
3. Portable radios (transmitter/receivers)
  - a. Handheld device
  - b. Typically have power output of 1 to 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
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
6. Arrival for service after patient transfer

### 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. AEMTs may need to contact medical control for consultation and to get orders for administration of medications
3. AEMTs 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 AEMT



## B. Communication with Receiving Facilities

1. AEMT having right room, equipment and personnel prepared or allow facility to plan for the patient

2. Patient reporting concepts

a. When speaking on the radio, keep these principles in mind:

- i. make sure the radio is on and volume is properly adjusted
- ii. listen to the frequency and ensure it is clear before beginning a transmission
- iii. press the “press to talk” button on radio and wait for one second before speaking
- iv. speak with lips about 2 to 3 inches from the microphone
- v. address the unit being called, and then give the name of the unit
- vi. the unit being called will signal that the transmission should start
- vii. speak clearly, calmly, and slowly in a monotone voice
- viii. keep transmissions brief
- ix. use clear text
- x. avoid codes or agency specific terms
- xi. avoid meaningless phrases like “be advised”
- xii. courtesy is assumed, one should limit saying “please,” “thank you,” and “you’re welcome”
- xiii. when transmitting a number that might be confused (e.g. a number in the teens), give the number, then give the individual digits
- xiv. the airwaves are public and scanners are popular
- xv. remain objective and impartial in describing patients
- xvi. do not use profanity on the air
- xvii. avoid words that are difficult to hear like “yes” and “no”; use “affirmative” and “negative”
- xviii. use the standard format for transmission of information
- xix. when the transmission is finished, indicate this by saying “over”
- xx. avoid offering a diagnosis of the patient’s problem
- xxi. use EMS frequencies only for EMS communication
- xxii. reduce background noise

b. Notify the dispatcher when the unit leaves the scene

c. When communicating with medical direction or receiving facility, a verbal report should be given that includes essential elements of a report, in an order that is efficient and effective, are:

- i. identify unit and level of provider (can utilize the name of the provider giving the report as well as the unit identification)
- ii. estimated time of arrival
- iii. current patient condition
- iv. patient’s age and sex
- v. mental status
- vi. chief complaint
- vii. brief, pertinent history of the present illness
- viii. major past illnesses
- ix. baseline vital signs
- x. pertinent findings of the physical exam
- xi. emergency medical care given
- xii. response to emergency medical care

d. After giving this information, the AEMT will continue to assess the patient

- e. Arrival at the hospital
  - i. the dispatcher must be notified
  - ii. in some systems, the hospital should also be notified
- f. Leaving the hospital for the station
- g. Arrival at the station

#### C. System Maintenance

1. Communication equipment needs to be checked to ensure that a radio is not drifting from its assigned frequency
2. As technology changes, new equipment becomes available that may have a role in EMS systems
3. AEMTs need to be able to consult on-line medical direction, and EMS system must provide back-up

#### D. Phone/Cellular Communications

1. Should be treated similar to radio communications when it comes to content and strategies for delivery of pertinent information
2. The AEMT should be familiar with important and commonly utilized telephone numbers, such as medical control, local hospital Emergency Departments, dispatch centers
3. The AEMT should also have a familiarity with cellular technologies and knowledge of the location of cellular dead spots in the area
4. There should be another plan for when a cellular transmission fail during a report or communication with another agency

### III. Team Communication and Dynamics

# Preparatory Therapeutic Communication

Applies fundamental knowledge of the EMS system, safety/well-being of the AEMT, medical/legal and ethical issues to the provision of emergency care.

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

## I. Principles of Communicating With Patients in a Manner That Achieves a Positive Relationship

### A. Dealing with Difficult Patients

### B. Most Patients Are More Than Willing to Talk

1. Difficult interviews
2. Techniques to use
  - a. Start the interview in the normal manner.
  - b. Attempt to use open-ended questions
  - c. Provide positive feedback
  - d. Make sure the patient understands the questions
  - e. Continue to ask questions
3. Interviewing a hostile patient
4. Hearing impaired patients
5. Patients under the influence of street drugs or alcohol
6. Sexually aggressive patients

# Preparatory Medical/Legal and Ethics

Applies fundamental knowledge of the EMS system, safety/well-being of the AEMT, medical/legal and ethical issues to the provision of emergency care.

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

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# Anatomy and Physiology

## Anatomy and Physiology

Integrates complex knowledge of the anatomy and physiology of the airway, respiratory and circulatory systems to the practice of EMS.

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

### I. Anatomy and Body Functions

#### A. Anatomical Planes

1. Frontal or coronal plane
2. Sagittal or lateral plane
3. Transverse or axial plane

#### B. Standard Anatomic Terms

#### C. Body Systems

##### 1. Skeletal

##### a. Components

- i. skull
- ii. face
- iii. vertebral column
- iv. thorax
- v. pelvis
- vi. upper extremities
- vii. lower extremities

##### b. Joints

##### c. Function

##### 2. Muscular

##### a. Types

- i. skeletal
- ii. smooth
- iii. cardiac

##### b. Function

#### D. Respiratory System

##### 1. General function of the respiratory system

- a. Upper respiratory tract
- b. Lower respiratory tract

##### 2. Structure and functions of the nasal cavities and pharynx

##### a. Nasal cavities

- i. nose
- ii. nasal cavities
- iii. nasal septum
- iv. nasal mucosa

- v. olfactory receptors
- vi. paranasal sinuses
- b. Pharynx
  - i. nasopharynx
  - ii. soft palate
  - iii. oropharynx
  - iv. laryngopharynx
- 3. Structure and function of the larynx and the speaking mechanism
  - a. Voice box
  - b. Thyroid cartilage
  - c. Epiglottis
  - d. Vocal cords
  - e. Glottis
- 4. Structure and functions of the trachea and bronchial tree
  - a. Trachea
  - b. Primary bronchi
  - c. Bronchial tree
  - d. Right and left main-stem bronchi
  - e. Bronchioles
- 5. Lungs
  - a. Location and function
  - b. Pleural membranes
    - i. parietal pleura
    - ii. visceral pleura
    - iii. serous fluid
  - c. Hilus
- 6. Structure and function of the alveoli and pulmonary capillaries
- 7. Mechanism of breathing
  - a. Mechanical ventilation
    - i. mechanism of inhalation
      - a) inspiration
      - b) phrenic nerve
      - c) intercostal nerves
      - d) respiration
      - e) ventilation/perfusion disturbance
      - f) diaphragm
      - g) external intercostal muscles
      - h) internal intercostal muscles
      - i) pressures
    - ii. changes in air pressure that occur within the thoracic cavity during respiration
      - a) atmospheric
      - b) intrapleural
      - c) intrapulmonic
  - b. Role of the visceral and parietal pleura in respiration
  - c. Mechanics of exhalation
- 8. Explain the diffusion of gases in external and internal respiration
- 9. Discuss pulmonary volumes
  - a. Tidal volume
  - b. Minute respiratory volume (MRV)

- c. Vital capacity
- 10. Physiological dead space and lung compliance
- 11. Oxygen and carbon dioxide transport in the blood
- 12. Nervous and chemical mechanisms that regulate respiration
- 13. Respiration and acid-base balance
  - a. Respiratory acidosis and alkalosis
  - b. Metabolic acidosis and alkalosis

## E. Circulatory

### 1. Blood

- a. Composition and function of blood
- b. Composition and function of blood plasma
  - i. amount
  - ii. color
  - iii. pH
  - iv. viscosity
  - v. plasma
- c. Primary hemopoietic tissue
- d. Function of red blood cells
- e. Red blood cell production in hypoxic state
- f. Red blood cell and hemoglobin destruction
- g. ABO group and Rh factor blood types
- h. Function of white blood cells (leukocytes)
- i. Platelets

### 2. The heart

- a. Location and features of the heart
  - i. mediastinum
  - ii. pericardial membranes
  - iii. fibrous pericardium
  - iv. parietal pericardium
  - v. epicardium
- b. Chambers of the heart
  - i. myocardium
  - ii. endocardium
  - iii. right and left atria
  - iv. right and left ventricles
- c. Valves of the heart and their function
  - i. tricuspid valve
  - ii. bicuspid valve (mitral valve)
  - iii. aortic valve
  - iv. pulmonary semilunar valve
- d. Cardiac cycle
- e. Coronary Arteries
- f. Major blood vessels
- g. Stroke volume, cardiac output, and Starling's law of the heart
- h. Nervous system regulation of the function of the heart

### 3. Blood vessels and circulation

- a. Structure and function of the blood vessels, arteries, veins and capillaries
- b. Arterial and venous anastomosis

- c. Structure of capillaries
- d. Exchange of gases that occurs at the capillary level
- e. Mechanism that regulate blood flow through arteries, capillaries, and veins
- f. Pathway and purpose of the pulmonary circulation
- g. Pathway of the systemic circulation
- h. Pathway and purpose of the hepatic portal circulation
- i. Branches of the aorta and their distributions
- j. Major systemic arteries and the parts of the body they nourish
- k. Major systemic veins and the parts of the body they drain of blood
- l. Hemodynamics
  - i. blood pressure
    - a) venous return
    - b) pulse pressure
    - c) peripheral resistance
  - ii. factors that maintain systemic blood pressure
    - a) heart rate and force of contraction
    - b) vessel elasticity
    - c) blood viscosity
    - d) hormones
    - e) peripheral resistance
  - iii. osmosis
  - iv. diffusion
  - v. facilitated diffusion
  - vi. active transport
  - vii. hydrostatic pressure
  - viii. oncotic pressure
- m. Regulation of blood pressure by the heart and kidneys
- n. Medulla and autonomic nervous system regulation of the diameter of the blood vessels
- o. Coordination of cardiac, vasomotor, and respiratory centers to control blood flow through the tissues

## F. Nervous System

- 1. Structural division
  - a. Central nervous system (CNS)
    - i. brain
    - ii. spinal cord
  - b. Peripheral nervous system (PNS)
- 2. Functional
  - a. Autonomic
    - i. sympathetic
    - ii. parasympathetic
- 3. Functions of the nervous system
  - a. Consciousness
    - i. cerebral hemispheres
    - ii. reticular activating system (center of consciousness)
  - b. Sensory function
  - c. Motor function
  - d. Fight-or-flight response



## G. Integumentary (Skin)

1. Structures
  - a. Epidermis
  - b. Dermis
  - c. Subcutaneous layer
2. Functions of the skin
  - a. Protection
  - b. Temperature control

## H. Digestive System

1. Structures
  - a. Esophagus
  - b. Stomach
  - c. Intestines
  - d. Liver
  - e. Pancreas

## I. Endocrine System

1. Structures
  - a. Pancreas
  - b. Adrenal glands
    - i. epinephrine
    - ii. norepinephrine
2. Function
  - a. Control of blood glucose level
  - b. Stimulate sympathetic nervous system

## J. Renal System

1. Structures
  - a. Kidneys
  - b. Bladder
  - c. Urethra
2. Function
  - a. Blood filtration
  - b. Fluid balance
  - c. Buffer

## K. Reproductive System

1. Male
  - a. Structures
    - i. testicles
    - ii. penis
  - b. Functions
    - i. reproduction
    - ii. urination
    - iii. hormones
2. Female
  - a. Structures
    - i. ovaries

- ii. fallopian tubes
- iii. uterus
- iv. vagina
- b. Functions
  - i. reproduction
  - ii. hormones

## II. Life Support Chain

### A. Fundamental Elements

1. Oxygenation
  - a. Alveolar/capillary gas exchange
  - b. Cell/capillary gas exchange
2. Perfusion
  - a. Oxygen
  - b. Glucose
  - c. Removal of carbon dioxide and other waste products
3. Cell environment
  - a. Aerobic metabolism
    - i. high ATP (energy) production
    - ii. byproduct of water and carbon dioxide
  - b. Anaerobic metabolism
    - i. low ATP (energy) production
    - ii. byproduct of lactic acid

### B. Issues Affecting Fundamental Elements

1. Composition of ambient air
2. Patency of the airway
3. Mechanics of ventilation
4. Regulation of respiration
5. Ventilation/perfusion ratio
6. Transport of gases
7. Blood volume
8. Effectiveness of the heart as a pump
9. Vessel size and resistance (systemic vascular resistance)
10. Effects of acid on cells and organs

## III. Age-Related Variations for Pediatrics and Geriatrics

### A. See Special Patient Populations

# Medical Terminology

## Medical Terminology

Uses foundational anatomical and medical terms and abbreviations in written and oral communication with colleagues and other health care professional.

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

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# Pathophysiology

## Pathophysiology

Applies comprehensive knowledge of the pathophysiology of respiration and perfusion to patient assessment and management.

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

### I. Introduction

#### A. Correlation Of Pathophysiology With Disease Process

1. Cells and the multi-cellular organism
2. Cellular communication

### II. Basic Cellular Review

#### A. Major Classes of Cells

#### B. Chief Cellular Functions

#### C. Cellular Components

1. Structure
2. Function

### III. Alteration in Cells and Tissues

### IV. Cellular Injury

#### A. Hypoxic Injury - Causes

1. Decreased oxygenation
2. Loss of hemoglobin or hemoglobin function
3. Decreased red blood cells
4. Respiratory or cardiovascular system disease

### V. Hypoperfusion

#### A. Pathogenesis

1. Decreased cardiac output
2. Compensatory mechanisms
  - a. Catecholamine release
    - i. epinephrine
    - ii. norepinephrine
    - iii. increase in systemic vascular resistance
      - a) increased blood volume
      - b) vasoconstriction
    - iv. increased stroke volume

- v. increased heart rate
- vi. increased preload
- 3. Oxygen impairment
  - a. Anaerobic metabolism
  - b. Increased lactate
  - c. Metabolic acidosis
    - i. decreased oxygen affinity for hemoglobin
    - ii. decreased atp
    - iii. changes in cellular electrolytes
    - iv. cellular edema
    - v. release of lysosomal enzymes
  - d. Impaired glucose use

## 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

# Life Span Development

## Life Span Development

Applies fundamental knowledge of life span development to patient assessment and management.

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

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# Public Health

## Public Health

Uses simple knowledge of the principles of the role of EMS during public health emergencies.

The AEMT Instructional Guidelines in this section include all the topics and material at the EMR and EMT 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 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
- c. Injury surveillance

D. Role of EMS in Public Health Emergencies

1. Types of public health emergencies
2. EMS response

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# Pharmacology

## Principles of Pharmacology

Applies (to patient assessment and management) fundamental knowledge of the medications carried by AEMTs that may be administered to a patient during an emergency.

The AEMT Instructional Guidelines in this section include all the topics and material at the EMR and EMT 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

G. Drug Forms

1. Liquids
2. Solids
3. Gases

### 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 Affected

B. Class of Agent

C. Body System

D. Class of Agent

E. 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

F. Classifications by Body System

1. Central nervous system
  - a. Autonomic pharmacology
    - i. cholinergics
    - ii. anticholinergic drug definitions
    - iii. adrenergics
    - iv. antiadrenergic
      - a) alpha – adrenergic blockers
      - b) beta – adrenergic blockers
  - b. Analgesics
    - i. opioid agonists

- ii. opioid antagonists
      - iii. non steroidal anti – inflammatory drugs
    - c. Sedative/hypnotic
      - i. benzodiazepines
      - ii. barbiturates
    - d. Anticonvulsants
    - e. Stimulants
  - 2. Cardiovascular drug definitions
    - a. Anti-dysrhythmics
    - 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 -- drugs affecting the pancreas
    - 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. Antihelminthic 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
  - a. Potential Implications
    - i. interaction with pharmaceuticals
    - ii. idiosyncratic reactions
    - iii. manufacturing error
    - iv. contamination
    - v. substitution
  - b. Adulteration
    - i. incorrect preparation
    - ii. incorrect labeling
- 15. Over the counter (OTC) medications
  - a. Drugs affecting the central nervous system
    - i. sedatives
    - ii. stimulants

- iii. hallucinogenic (dextromethorphan)
- b. Drugs affecting the respiratory system
  - i. asthma treatment products
  - ii. cold and allergy products
- c. Supplements
  - i. herbs
  - ii. vitamins
  - iii. minerals
  - iv. other

## V. Storage and Security

### A. Factors Affecting Drug Potency

1. Temperature
2. Light
3. Moisture
4. Shelf Life

### B. Locking and Double Locking of Medications

1. Controlled Substances
  - a. Storage
  - b. Accountability

## VI. 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

## VII. 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

## VIII. Pharmacological Concepts

A. Pharmacokinetics

1. Absorption

a. Mechanism of Absorption

i. diffusion

ii. osmosis

iii. filtration

2. Solubility

3. Distribution

a. Drug Reservoirs

i. plasma protein binding

ii. tissue binding

b. Barriers to Drug Distribution

i. blood Brain Barrier

ii. placental Barrier

4. Bioavailability

5. Biotransformation

a. First Pass Metabolism

b. Active Metabolites

c. Inactive Metabolites

6. 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

## IX. Medication Interactions

A. Intestinal Absorption

B. Competition for Plasma Protein Binding

C. Biotransformation

D. Drug Metabolism

E. Renal Excretion

F. Drug – Drug Interaction

## X. Toxicity



# Pharmacology

## Medication Administration

Applies (to patient assessment and management) fundamental knowledge of the medications carried by AEMTs that may be administered to a patient during an emergency.

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

### I. Routes of Administration

#### A. Enteral - Alimentary Tract

1. Oral
2. Sublingual
3. Rectal

#### B. Parenteral

1. Subcutaneous
2. Intramuscular
3. Intravenous
  - a. bolus
  - b. piggyback
4. Intraosseous
  - a. bolus
  - b. piggyback
5. Inhalational
6. Endotracheal
7. 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. Rectal
12. Topical

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

Applies (to patient assessment and management) fundamental knowledge of the medications carried by AEMTs that may be administered to a patient during an emergency.

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

The AEMT must know (fundamental 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.

### I. Specific Medications

- A. Activated Charcoal
- B. Adenosine
- C. Albuterol
- D. Amiodarone
- E. Aspirin
- F. Dextrose (50%, 25%)
- G. Diazepam
- H. Diltiazem
- I. Diphenhydramine HCl
- J. Dopamine
- K. Epinephrine (Intramuscular or Subcutaneous)
- L. Glucagon
- M. Glucose
- N. Intravenous Fluids
  - 1. Dextrose 5% in Water
  - 2. Normal Saline
  - 3. Lactated Ringer's
- O. Lidocaine

P. Lorazepam

Q. Midazolam

R. Morphine

S. Naloxone

T. Nitroglycerin

1. Paste
2. Spray
3. Tablets

U. Nitrous Oxide

V. Oxygen

## II. Special Considerations in Pediatrics and Geriatrics

A. Routes of Administration

B. Dosages

C. Dilutions

D. Pharmacokinetic Alterations

# Airway Management, Respiration, and Artificial Ventilation

## Airway Management

Applies knowledge (fundamental depth, foundational breadth) of upper airway anatomy and physiology to patient assessment and management in order to assure a patent airway, adequate mechanical ventilation, and respiration for patients of all ages.

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

### I. Airway Anatomy

#### A. Sinuses

#### B. Upper Airway Tract

##### 1. Nose

- a. Warm and humidify air
- b. Turbinate

##### 2. Mouth and Oral Cavity

- a. Lips
- b. Teeth
- c. Tongue
- d. Soft Palate -- Uvula
- e. Tonsils and Adenoids

##### 3. Jaw

- a. Facial Bones
  - i. maxilla
  - ii. mandible

##### 4. Pharynx

- a. Nasopharynx
- b. Oropharynx
- c. Hypopharynx
- d. Laryngopharynx

##### 5. Larynx

- a. Cartilages
  - i. epiglottis
  - ii. arytenoid cartilages
  - iii. vocal cords
  - iv. thyroid cartilage
  - v. cricoid ring
- b. Bone

#### C. Jugular Notch

#### D. Lower Airway Tract

- 1. Trachea
- 2. Carina

3. Bronchi
4. Lungs
  - a. Bronchioles
    - i. bronchial smooth muscle
    - ii. beta 2 adrenergic receptors
  - b. Pulmonary cilia
  - c. Alveoli

#### 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

## 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 Magill forceps without direct laryngoscopy

- a. Purpose
  - b. Indications
  - c. Contraindications
  - d. Complications
  - e. Procedure
  - f. Limitation
3. Airway suctioning
- a. Review and elaborate on upper airway suctioning information from EMR and EMT
  - b. Tracheobronchial Suctioning
    - i. purpose
    - ii. indications
    - iii. contraindications
    - iv. complications
    - v. procedure
    - vi. limitation

#### D. Upper Airway Suctioning

- 1. Review and elaborate on the upper airway suctioning information from EMR and EMT
- 2. Procedure for lower airway suctioning of the previously intubated patient
  - a. Purpose
  - b. Indications
  - c. Contraindications
  - d. Complications
  - e. Procedure
  - f. Limitation

#### E. Blind Insertion Airway Devices

- 1. Esophageal obturation (e.g., Combitube, PTL, Easytube, King LTD)
  - a. Purpose
  - b. Indications
  - c. Contraindications
  - d. Complications
  - e. Procedure (including confirmation techniques)
- 2. Supraglottic devices (e.g., LMA, COBRA)
  - a. Purpose
  - b. Indications
  - c. Contraindications
  - d. Complications
  - e. Procedure (including confirmation techniques)

#### E. Endotracheal intubation

- 1. Direct laryngoscopy (visualized)
  - a. Purpose
  - b. Indications
  - c. Contraindications
  - d. Complications
  - e. Procedure (including confirmation techniques)
  - f. Limitations

#### IV. Consider Age-Related Variations in Pediatric and Geriatric Patients

# Airway Management, Respiration, and Artificial Ventilation

## Respiration

Applies knowledge (fundamental depth, foundational breadth) of upper airway anatomy and physiology to patient assessment and management in order to assure a patent airway, adequate mechanical ventilation, and respiration for patients of all ages.

The AMT Instructional Guidelines in this section include all the topics and material at the EMR and EMT 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

C. Chest Cage

1. Ribs
2. Muscles of respiration
  - a. Intercostal muscles
  - b. Diaphragm
3. Pleura
  - a. Parietal pleura
  - b. Visceral pleura

D. Phrenic Nerve

E. Mediastinum

### II. Physiology of Respiration

A. Mechanics of Respiration

1. Pulmonary ventilation
  - a. Movement of the thoracic wall
  - b. Intrathoracic pressure gradients
  - c. Phases of ventilation
    - i. active phase
    - ii. passive phase
  - d. Lung volumes and capacities
    - i. volumes
      - a) tidal volume
      - b) minute volume
      - c) residual volume
      - d) dead space volume
    - ii. capacities
      - a) vital capacity
    - iii. maximum inspiratory force



- iv. maximum expiratory force
- v. significance of pulmonary volumes and capacities
- 2. Gas exchange
- 3. Oxygenation
- 4. Respiration
  - a. External
  - b. Internal
  - c. Cellular
- 5. Lung compliance

### III. Pathophysiology of Respiration

#### A. Pulmonary Ventilation

- 1. Interruption of nervous control
  - a. Drugs
  - b. Trauma
  - c. Muscular dystrophy
- 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 muscle tone)

#### B. Oxygenation

#### C. Respiration

- 1. External
  - a. Deficiencies due to altitude
  - b. Deficiencies due to closed environments
  - c. Deficiencies due to toxic or poisonous environments
- 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

### IV. Assessment of Adequate and Inadequate Respiration

### V. Management of Adequate and Inadequate Respiration

#### A. Respiratory Compromise

- 1. Assure an adequate airway

2. Review supplemental oxygen therapy
3. Assisted positive pressure ventilations
  - a. Purpose/definition
  - b. Indications
  - c. Contraindications
  - d. Complications
  - e. Procedure

## VI. Supplemental Oxygen Therapy

### A. Review of Oxygen Delivery Devices Used by EMTs

1. Purpose
2. Indications
3. Contraindications
4. Complications
5. Procedures

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

# Airway Management, Respiration, and Artificial Ventilation

## Artificial Ventilation

Applies knowledge (fundamental depth, foundational breadth) of upper airway anatomy and physiology to patient assessment and management in order to assure a patent airway, adequate mechanical ventilation, and respiration for patients of all ages.

The AMT Instructional Guidelines in this section include all the topics and material at the EMR and EMT 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

### II. The Management of Inadequate Ventilation

- A. Assure an Adequate Airway
- B. Supplemental Oxygen Therapy
- C. Artificial Ventilation Devices
  - 1. Bag-valve-mask with reservoir
    - a. Advantages
    - b. Disadvantages
  - 2. Manually triggered ventilation device
    - a. Advantages
      - i. single rescuer able to use both hands to maintain mask seal while providing positive pressure ventilation to a patient.
      - ii. reduces rescuer fatigue during extended transport times
    - b. Disadvantages
      - i. difficult to maintain adequate ventilation without assistance

- ii. requires oxygen however, typical adult ventilation consumes 5 liters per minute  $O_2$  versus 15 –25 liters per minute for a bag-valve-mask.
- iii. typically used on adult patients only
- iv. requires special unit and additional training for use in pediatric patients
- v. the rescuer is unable to easily assess lung compliance.
- vi. high ventilatory pressures may damage lung tissue.

### 3. Automatic Transport Ventilator/Resuscitator

#### a. Advantages

#### b. Disadvantages

- i. requires oxygen however, typical adult ventilation consumes 5 liters per minute  $O_2$  versus 15 –25 liters per minute for a bag-valve-mask.
- ii. may require an external power source
- iii. must have bag-valve-mask device available
- iv. may interfere with timing of chest compressions during CPR
- v. must monitor to assure full exhalation
- vi. barotrauma

### D. Ventilation of an Apneic Patient

1. Purpose
2. Indications
3. Contraindications
4. Procedure

### E. Ventilation of the Protected Airway

1. Purpose
2. Indications
3. Contraindications
4. Complications
5. Procedure

## III. The Differences Between Normal and Positive Pressure Ventilation

### A. Air Movement

1. Normal ventilation
  - a. Negative intrathoracic pressure
  - b. Air is sucked into lungs
2. Positive pressure ventilation

### B. Blood Movement

1. Normal ventilation
  - a. Blood return from the body happens naturally
  - b. Blood is pulled back to the heart during normal breathing
2. Positive pressure ventilation
  - a. Venous return is decreased during lung inflation
  - b. Amount of blood pumped out of the heart is reduced.

### C. Airway Wall Pressure

1. Normal ventilation
2. Positive pressure ventilation

- a. Walls are pushed out of normal anatomical shape
- b. More volume is required to have the same effect as normal breathing

D. Esophageal Opening Pressure

- 1. Normal ventilation
- 2. Positive pressure ventilation
  - a. Air is pushed into the stomach during ventilation
  - b. Gastric distention may lead to vomiting

E. Over Ventilation (Either by Rate or Volume) Can Be Detrimental to the Patient

- 1. Hypotension
- 2. Gastric distention
- 3. Other unintended consequences

IV. Consider Age-Related Variations in Pediatric and Geriatric Patients

# Patient Assessment

## Scene Size-Up

Applies scene information and patient assessment findings (scene size-up, primary and secondary assessment, patient history, reassessment) to guide emergency management.

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

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# Patient Assessment

## Primary Assessment

Applies scene information and patient assessment findings (scene size-up, primary and secondary assessment, patient history, reassessment) to guide emergency management.

The AEMT Instructional Guidelines in this section include all the topics and material at the EMR and EMT 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
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. Identify Life Threats

G. 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

Applies scene information and patient assessment findings (scene size-up, primary and secondary assessment, patient history, reassessment) to guide emergency management.

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

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# Patient Assessment

## Secondary Assessment

Applies scene information and patient assessment findings (scene size-up, primary and secondary assessment, patient history, reassessment) to guide emergency management.

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

### I. Assessment of Lung Sounds

#### A. Expose the Chest as Appropriate for the Environment

#### B. Auscultation

1. Technique
  - a. Medical versus trauma
  - b. Anterior chest
2. Lung sounds
  - a. Vesicular
  - b. Bronchovesicular
  - c. Bronchial sounds
  - d. Adventitious sounds
  - e. Absence of breath sounds
3. Inspiratory versus expiratory phase

### II. Special Considerations for Pediatric and Geriatric Patients

#### A. Normal Vital Signs by Age

#### B. See Special Patient Populations section

# Patient Assessment Monitoring Devices

Applies scene information and patient assessment findings (scene size-up, primary and secondary assessment, patient history, reassessment) to guide emergency management.

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

## I. Blood Glucose Determination

### A. Purpose

1. Assess blood glucose level
2. Assess impact of interventions

### B. Indications

1. Decreased level of consciousness in the suspected diabetic
2. Decreased level of consciousness of unknown origin

### C. Procedure

1. Cleaning the site
2. Refer to manufacturer's instructions for device being used
3. Disposal of sharps

### D. Limitations

1. Lack of calibration
2. Venous versus Capillary sampling

### E. Interpretation (see Medical Emergencies: Endocrine)

## II. Continuous ECG monitoring

### A. Purpose

### B. Indication

1. Patient's presenting with cardiac-related signs/symptoms or potential signs/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)

## III. 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)

IV. 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

# Patient Assessment Reassessment

Applies scene information and patient assessment findings (scene size-up, primary and secondary assessment, patient history, reassessment) to guide emergency management.

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

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# Medicine

## Medical Overview

Applies fundamental knowledge to provide basic and selected advanced emergency care and transportation based on assessment findings for an acutely ill patient.

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

### II. Major Components of the Patient Assessment

- A. Standard Precautions
- B. Scene Size-Up
- C. General Impression
- D. Initial Assessment
- 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
  - b. May be obtained by family members or 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: what were you doing when the problem began?
  - b. **P** – Provoke
    - i. focuses on what might provoke the problem for the patient.
    - ii. question: 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 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 1 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. questions: 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 signs/symptoms of illness not revealed during initial assessment.
  - a. Head/scalp

- i. pain
  - ii. symmetry
- 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

1. When practical, transport the patient in the recovery position to help ensure a patent airway
2. Consider the need for ALS backup

# Medicine

## Neurology

Applies fundamental knowledge to provide basic and selected advanced emergency care and transportation based on assessment findings for an acutely ill patient.

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

### I. Stroke/TIA

#### A. Causes

1. Hemorrhage
2. Clot

#### B. Review of Anatomy and Function of the Brain and Cerebral Blood Vessels

#### C. Assessment Findings and Symptoms

1. Confused, dizzy, weak
2. Decreasing or increasing level of consciousness
3. Combative or uncooperative or restless
4. Facial drooping, inability to swallow, tongue deviation
5. Double vision or blurred vision
6. Difficulty speaking or absence speech
7. Decreased or absent movement of one or more extremities
8. Headache
9. Decreased or absent sensation in one or more extremities or other areas of body
10. Coma

#### D. Stroke Alert Criteria

1. Cincinnati Prehospital Stroke Scale
2. Other stroke scales

#### E. Management of Patient With Stroke Assessment Findings or Symptoms

#### F. Scene Safety and Standard Precautions

1. ABCs /position
2. Oxygen/suction
3. Pulse oximetry
4. Emotional support
5. Rapid transport

#### G. Transient Ischemic Attack (TIA)

### II. Seizures

#### A. Incidence

## B. Caused by Hypoglycemia

1. Pathophysiology
2. Assessment
3. Management

## C. Types of Seizures

1. Generalized tonic-clonic
  - a. Aura
  - b. Tonic
  - c. Clonic
  - d. Postictal
2. Partial seizures
3. Status epilepticus

## D. Assessment Findings

1. Spasms, muscle contractions
2. Bite tongue, increased secretions
3. Sweating
4. Cyanosis
5. Unconscious gradually increasing level of consciousness
6. May shaking or tremors and no loss of consciousness
7. Incontinent
8. Amnesia of event

## E. Management

1. Safety of patient/position
2. ABCs, consider nasopharyngeal airway
3. Oxygen/suction
4. Pulse oximetry
5. Emotional support

## III. Headache

### A. As a Symptom

### B. As a Neurological Condition

### C. Assessment Findings and Symptoms

### D. Management

## IV. Age-Related Variations for Pediatric and Geriatric Assessment and Management

### 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. Seizures
- 8. Altered mental status
- 9. Management

B. Geriatrics - Stroke Common in This Age Group

V. Communication and Documentation

VI. Transport Decisions—Rapid Transport to Appropriate Facility

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# Medicine

## Abdominal and Gastrointestinal Disorders

Applies fundamental knowledge to provide basic and selected advanced emergency care and transportation based on assessment findings for an acutely ill patient.

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

### I. Define Acute Abdomen

### II. Anatomy of the Organs of the Abdominopelvic Cavity

- A. Stomach
- B. Intestines
- C. Esophagus
- D. Spleen
- E. Urinary Bladder
- F. Liver
- G. Gall Bladder
- H. Pancreas
- I. Kidney
- J. Reproductive Organs

### III. Assessment and Symptoms

- A. Techniques
  - 1. Inspection
  - 2. Palpation
- B. Normal Findings—Soft Non-Tender
- C. Abnormal Findings
  - 1. Nausea/vomiting
    - a. Excessive
    - b. Hematemesis
  - 2. Change in bowel habits/stool
    - a. Constipation

- b. Diarrhea
- c. Dark tarry stool
- 3. Urination
  - a. Pain
  - b. Frequency
  - c. Color
  - d. Odor
- 4. Weight loss
- 5. Belching/flatulence
- 6. Concurrent chest pain
- 7. Pain, tenderness, guarding, distension
- 8. Other

#### IV. General Management for Patients With an Acute Abdomen

- A. Scene Safety and Standard Precautions
- B. Airway, Ventilatory and Circulation
- C. Position
- D. Emotional Support

#### V. Specific Acute Abdominal Conditions—Definition, Causes, Assessment Findings and Symptoms, Complications, and Specific Prehospital Management.

- A. Acute and Chronic Gastrointestinal Hemorrhage
- B. Peritonitis
- C. Ulcerative Diseases

#### VI. Consider Age-Related Variations for Pediatric and Geriatric Assessment and Management

#### VII. Pediatrics

- A. Anatomic and Physiologic Differences in Children
- B. Pathophysiology
- C. Assessment
  - 1. History
  - 2. Physical findings
    - a. Vomiting causes dehydration
    - b. Appendicitis common in children
    - c. Abdominal pain from constipation
    - d. Vomiting
    - e. GI Bleeding
  - 3. Management

D. Geriatric

1. May not exhibit rigidity or guarding
2. Abdominal pain related to cardiac conditions

VIII. Communication and Documentation for Patients With an Abdominal or Gastrointestinal Condition or Emergency

IX. Transport Decisions

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# Medicine

## Immunology

Applies fundamental knowledge to provide basic and selected advanced emergency care and transportation based on assessment findings for an acutely ill patient.

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

### I. Introduction

#### A. Definition of Terms

1. Allergic reaction
2. Anaphylaxis

#### B. Risk Factors and Common Allergens

### II. Basic Immune System's Response to Allergens

#### A. The Purpose of the Response

#### B. The Type of Response (Local versus Systemic)

#### C. The Speed of the Response

### III. Pathophysiology

#### A. Allergic Reaction

1. Antigens
2. Antibodies
3. Mast cells and basophils
4. Histamine, leukotrienes, and other mediators
5. Local reactions
6. Reactions

### IV. 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

## V. Managing Anaphylaxis

- A. Provide Treatment Specific to Assessment Findings and Severity of Reaction
- B. Remove Allergen If Possible
- C. Protect the Airway –consider intubation
- D. Oxygenate the Patient
- E. Ventilate If Needed
  1. Apneic patient
  2. Dyspneic patient
  3. Patient with airway edema
- F. Medication Administration
  1. Epinephrine administration
  2. Bronchodilation
- G. Fluid Administration

## VI. Age-Related Considerations

- A. Pediatric Epinephrine Dosing
- B. Use of Epinephrine in the Geriatric Patient

# Medicine

## Infectious Disease

Applies fundamental knowledge to provide basic and selected advanced emergency care and transportation based on assessment findings for an acutely ill patient.

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

### I. Causes of Infectious Disease

#### A. Infectious Agents

1. Bacteria
2. Viruses
3. Fungi
4. Protozoa
5. Helminthes (worms)

### II. Standard Precautions, Personal Protective Equipment, and Cleaning and Disposing of Equipment and Supplies

#### A. Principles of Standard Precautions

#### B. Hand Washing Guidelines

#### C. Recommendations for Personal Protective Equipment

#### D. Recommendations for Cleaning or Sterilization of Equipment

#### E. Recommendations for Disposing of Contaminated Linens and Supplies Including Sharps

#### F. Recommendations for Decontaminating the Ambulance

### III. 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

## IV. Consider Age-Related Variations in Pediatric and Geriatric Patients as They Relate Assessment and Managements of Patients with a Gastrointestinal Condition or Emergency

## V. Communication and Documentation for a Patient with a Communicable or Infectious Disease

## VI. Transport Decisions Including Special Infection Control Procedures

## VII. 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

Applies fundamental knowledge to provide basic and selected advanced emergency care and transportation based on assessment findings for an acutely ill patient.

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

### I. Diabetic Emergencies

A. Related Anatomy of the Pancreas and Organs Supporting Blood Sugar Regulation

B. Physiology of the Pancreas

C. Hormones Related to Blood Sugar Regulation

D. Pathophysiology of Diabetes Mellitus

1. Long-term complications
2. Types of diabetes
  - a. Type I
  - b. Type II
  - c. Gestational

E. Drugs to Manage Diabetes

1. Insulins
  - a. types
  - b. delivery methods
2. Oral antihyperglycemics

### II. Assessment

A. Impact of Disease on Prehospital Assessment

B. Alterations of Findings in Long-Term Diabetics

C. Hypoglycemia

1. Physical findings
2. Blood sugar level
3. Causes

D. Hyperglycemia/DKA

1. Physical findings
2. Blood sugar level
3. Causes

#### E. Treatment

1. Oxygenation and ventilation requirements
2. Blood glucose determination
3. Oral glucose
4. Glucagon administration
5. IV placement and fluid therapy for
  - a. hyperglycemia
  - b. hypoglycemia
6. D50 administration

#### F. Reassessment and Evaluation for Other Underlying Acute Illness in the Hyperglycemic Patient

### III. Age-Related Considerations

1. Pediatric patients
2. Usually type I diabetes
3. Late stages of hyperglycemia may have cerebral edema
4. Prone to seizures
5. Prone to dehydration in hyperglycemia
6. Geriatric patients
7. Masking of illness through changes in pain perception
8. Prone to dehydration and sepsis

### IV. Communication and Documentation

# Medicine

## Psychiatric

Applies fundamental knowledge to provide basic and selected advanced emergency care and transportation based on assessment findings for an acutely ill patient.

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

### I. Define

- A. Behavior
- B. Psychiatric Disorder
- C. Behavioral Emergency

### II. Epidemiology of Psychiatric Disorders

### III. Assessment

- A. General Appearance
- B. Speech
- C. Skin
- D. Posture/Gait
- E. Mental Status
- F. Mood, Thought, Perception, Judgment, Memory, and Attention

### IV. Behavioral Change

- A. Factors That May Alter Patient's Behavior
  1. Situational Stresses
  2. Medical Illnesses
  3. Psychiatric Problems
  4. Alcohol or Drugs
- B. Common Causes of Behavioral Alteration
  1. Low blood sugar
  2. Lack of oxygen
  3. Hypoperfusion
  4. Head trauma
  5. Mind altering substances

6. Psychogenic – resulting in psychotic thinking, depression or panic
7. Excessive cold
8. Excessive heat
9. Meningitis
10. Seizure disorders
11. Toxic ingestions—overdose
12. Withdrawal of drugs or alcohol

## V. Psychiatric Emergencies

### A. Acute Psychosis

#### 1. Assessment for Suicide Risk

##### a. Depression

##### b. Risk Factors/signs or symptoms

- i. ideation or defined lethal plan of action-verbalized and/or written.
- ii. alcohol and substance abuse
- iii. purposelessness
- iv. anxiety, agitation, unable to sleep or sleeping all the time
- v. feeling trapped, no way out
- vi. hopelessness
- vii. withdrawal from friends, family and society
- viii. anger and/or aggressive tendencies
- ix. recklessness or engaging in risky activities
- x. dramatic mood changes
- xi. history of trauma or abuse
- xii. some major physical illness (cancer, CHF, etc.)
- xiii. previous suicide attempt
- xiv. job or financial loss
- xv. relational or social loss
- xvi. easy access to lethal means
- xvii. lack of social support and sense of isolation
- xviii. certain cultural and religious beliefs

#### 2. Important questions

- a. How does the patient feel?
- b. Determine suicidal tendencies
- c. Is patient threat to self or others?
- d. Is there a medical problem?
- e. Is there trauma involved?
- f. Interventions?

### B. Agitated Delirium

#### 1. Emergency medical care

- a. Scene size-up, personal safety
- b. Establish rapport

##### i. utilize therapeutic interviewing techniques

- a) engage in active listening
- b) supportive and empathetic
- c) limit interruptions
- d) respect patient's territory, limit physical touch

- ii. avoid threatening actions, statements and questions
- iii. approach slowly and purposefully
- c. Patient assessment
  - i. intellectual functioning
  - ii. orientation
  - iii. memory
  - iv. concentration
  - v. judgment
  - vi. thought content
    - a) disordered thoughts
    - b) delusions, hallucinations
    - c) unusual worries, fears
  - vii. language
    - a) speech pattern and content
    - b) garbled or unintelligible
  - viii. mood
    - a) anxiety, depression, elation, agitation
    - b) level of alertness, distractibility
      - i) appearance, hygiene, dress
      - ii) psychomotor activity
- d. Calm patient – do not leave patient alone, unless unsafe situation; consider need for law enforcement
- e. Restrain if necessary
- f. Transport
- g. If overdose, bring medications or drugs found to medical facility.

## VI. Medical-Legal Considerations

### A. Types of Restraints

### B. Transport Against Patient Will

## VII. Consider Age-Related Variations for Pediatric and Geriatric Assessment and Management

### A. Pediatric Behavioral Emergencies

1. Teenage suicide concerns
2. Aggressive behavior may be a symptom of an underlying disorder or disability

### B. Geriatrics



# Medicine

## Cardiovascular

Applies fundamental knowledge to provide basic and selected advanced emergency care and transportation based on assessment findings for an acutely ill patient.

The AEMT Instructional Guidelines in this section include all the topics and material at the EMR and EMT 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. Electrical and conduction system

a. Myocardial muscle cells

b. Specialized electrical cells

- i. Sinoatrial node
- ii. Atrioventricular node
- iii. Atrioventricular bundle (Bundle of His)
- iv. Bundle branches
  - a) left anterior fascicle
  - b) left posterior fascicle
  - c) right
- v. Purkinje network
- vi. Internodal and interatrial pathways
  - a) Atrioventricular node
  - b) Left Atrium (Bachmann's bundle)
  - c) Middle internodal tract (Wenckebach's tract)
  - d) Posterior internodal tract (Thorel's tract)
- vii. Anatomical tracts that bypass the atrioventricular node
  - a) considered possible conduction routes that account for anomalous atrioventricular conduction

c. Automaticity

d. Autonomic Control

- i. sympathetic
- ii. parasympathetic

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 Veins

- i. Venous return (preload)
  - a) skeletal muscle pump
  - b) thoracoabdominal pump
  - c) respiratory cycle
  - d) gravity
  - e) effects of IPPB, PEEP, CPAP and BiPAP on venous return
- ii. Systemic vascular resistance and capacitance (afterload)
- iii. Pulmonary veins

## B. Blood

1. Red blood cells
2. White blood cells
3. Platelets
4. Plasma

## 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. Pulses

1. Peripheral pulses
2. Central pulses

### C. Blood Pressure

1. Systolic
2. Diastolic

### D. Blood Circulation through a Double Pump

1. Respiratory system
  - a. Deoxygenated blood to lungs
  - b. Oxygenated blood back to heart
2. Body

## E. Cardiac output

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

## F. Perfusion

1. Function of red blood cells in oxygen delivery
2. Factors governing adequate perfusion
  - a. Rate
  - b. Pump
  - c. Volume

## G. Oxygenation of Tissues

1. Delivery of oxygenated blood
2. Removal of tissue wastes

## 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 recognition 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. **O**nset/ origin
    - i. pertinent past history
    - ii. time of onset
  - b. **P**rovocation
    - i. exertional
    - ii. non-exertional
  - c. **Q**uality
  - d. **R**egion/ radiation
  - e. **S**everity
  - f. **T**iming

- 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. 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. 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. 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. Relationship of P waves to QRS complexes
    - i. consistent
    - ii. progressive prolongation
    - iii. no relationship
  - f. T 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 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) vary intensity of first heart tone
      - b) beat to beat changes in blood pressure
    - ii. Other considerations
      - a) Pitfalls
        - i) age is not a differential
        - ii) slower rates may present with stable hemodynamic
      - c) Regularity
        - i) monomorphic V-tach and SVT are usually 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. ECG changes in hypothermia

## IX. Management of the patient with an arrhythmia

### A. Incidence

1. Prevalence of cardiac death outside of a hospital

## B. 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

## 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. Defibrillation
  - b. 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

#### 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. Brief discomfort, predictable characteristics, relieved promptly - no change in 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

#### 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
    - ii. changes in skin temperature

iii. changes in skin moisture

#### E. History of the Present Illness/Sample History

1. Chief complaint
  - a. Typical - sudden onset of discomfort, usually of brief duration, lasting 3-5 minutes, maybe 5-15 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

#### G. Management

1. Refer to American Heart Association guidelines
2. Rapid transport
  - a. Sense of urgency for reperfusion
  - b. No relief with medications
  - c. Hypotension/ hypoperfusion with CNS involvement

### XI. Acute Myocardial Infarction

#### A. Epidemiology

#### B. Precipitating Causes (as With Angina)

1. Atherosclerosis
2. Persistent angina
3. Occlusion
4. Non-traumatic
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 color
    - ii. changes in skin temperature
    - iii. changes in skin 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

#### G. Management

1. Refer to American Heart Association guidelines
  - a. Scope of practice includes
    - i. oxygen
    - ii. aspirin
    - iii. nitroglycerin
    - iv. nitrous oxide
2. Transport
  - a. Criteria for rapid transport
    - i. no relief with medications
    - ii. hypotension/ hypoperfusion

#### XII. Irregularity of Pulse

# Medicine

## Toxicology

Applies fundamental knowledge to provide basic and selected advanced emergency care and transportation based on assessment findings for an acutely ill patient.

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

### I. Introduction

A. Define Toxicology, Poisoning, Overdose

B. National Poison Control Center

C. Routes of Absorption

1. Ingestion
2. Inhalation
3. Injection
4. Absorption

### II. Poisoning by Ingestion

A. Examples

B. Assessment Findings

C. General Management Considerations

### III. Poisoning by Inhalation

A. Examples

B. Assessment Findings

C. General Management Considerations

### IV. Poisoning by Injection

A. Examples

B. Assessment Findings

C. General Management Considerations

### V. Poisoning by Absorption



A. Examples

B. Assessment Findings

C. General Management Considerations

## VI. Drugs of Abuse

A. Opiates/Narcotics

1. Common causative agents
2. Assessment findings and symptoms
  - a. Decreased level of consciousness, sedation
  - b. Hypotension
  - c. Respiratory depression/ arrest
  - d. Nausea, Pinpoint pupils
  - e. Seizures and Coma
3. Management for a patient using opiates

B. Alcohol

1. Overview of alcoholism including long term effects
2. Alcohol abuse
  - a. CNS changes—agitation to sedation to altered level of consciousness
  - b. Respiratory depression
  - c. Nausea and vomiting
  - d. Uncoordination
3. Alcohol withdrawal
  - a. Tremors, sweating, weakness
  - b. Hallucinations and seizures
4. Assessment findings and symptoms for patients with alcohol abuse and alcohol withdrawal
5. Management for a patient using alcohol or withdrawing from alcohol

C. Common Causative Agents, Assessment Findings and Symptoms, Management

1. Cannabis
2. Hallucinogens
3. Stimulants
4. Barbiturates/sedatives/ hypnotics

## VII. Poisonings and Exposures

A. Scene Safety Issues

B. Common causative agents, assessment findings and symptoms, management

1. Pesticides
2. Chemicals
3. Household Cleaning poisonings
4. Poisonous Plants

## VIII. Medication Overdose

- A. Common Causes of Overdoses (Other Than Drugs of Abuse)
  - 1. Cardiac medications
  - 2. Psychiatric medications
  - 3. Non-prescription pain medications including Salicylates and Acetaminophen
  - 4. Other

B. Assessment Findings and Symptoms for Patients With Medication Overdose

C. Management for a Patient With Medication Overdose

## IX. General Treatment Modalities for Poisonings

A. Scene Safety

B. Standard Precautions and Decontamination

C. Airway Control

D. Ventilation and Oxygenation

E. Circulation

F. Use of Activated Charcoal

- 1. Indications/contraindications/side effects
- 2. Physician order
- 3. Dose

## X. Toxic Syndromes

A. Introduction

- 1. Definition of a toxic syndrome (toxidrome)
- 2. Incidence of opiate abuse

B. Opiate Intoxication/Poisoning

- 1. Common causative agents
  - a. heroin, morphine, methadone
  - b. codeine, meperidine, propoxyphene
  - c. fentanyl, lortab, oxycontin
  - d. other
- 2. Assessment findings specific to opiate intoxication/poisoning
  - a. CNS -- Level of consciousness/behavior
    - i. euphoria
    - ii. decreased level of consciousness
    - iii. sedation
    - iv. pin-point pupils
    - v. seizures
    - vi. coma
  - b. Respiratory
    - i. decreased respiratory rate and effort

- ii. apnea
  - c. Gastrointestinal
    - i. nausea
    - ii. vomiting
- 3. Management specific to opiate intoxication/poisoning
  - a. Airway/Breathing support
    - i. oxygenation requirements
    - ii. ventilatory requirements
      - a) considerations in use of oral pharyngeal airways
      - b) bag-valve mask
      - c) considerations of use of the advanced airway in the opiate overdose patient
  - b. Circulatory Support
    - i. causes of hypotension in the opiate overdose
    - ii. IV access
  - c. Pharmaceutical interventions
  - d. Other considerations in the care of the opiate overdose
    - i. underlying chronic illness
      - a) HIV/AIDS
      - b) hepatitis
      - c) malnutrition
      - d) sepsis
    - ii. family interaction and social issues
    - iii. chronic pain patients
      - a) drug dependency
      - b) consequences of narcotic antagonist use in the chronic pain patient

## XI. Consider Age-Related Variations for Pediatric and Geriatric Assessment and Management

### A. Pediatric

1. Toddler-age prone to ingestions of toxic substance
2. Adolescent prone to experimentation with drugs of abuse

### B. Geriatric

1. Alcoholism is common in elderly
2. Drug dependency
3. Consequences of narcotic antagonist use in the chronic pain patient

## XII. Documentation and Communication

### A. Documentation of the Opiate Overdose Specific Patient

### B. Communication

1. Hospital personnel
2. Family
3. Law enforcement personnel

### C. Transport Decisions

# Medicine

## Respiratory

Applies fundamental knowledge to provide basic and selected advanced emergency care and transportation based on assessment findings for an acutely ill patient.

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

### I. Anatomy and Physiology

#### A. Anatomy of the Pulmonary System

1. Upper airway
  - a. Function
  - b. Structures and functions of:
    - i. nose and nasopharynx
    - ii. pharynx
    - iii. hypopharynx
    - iv. larynx
2. Lower airway
  - a. Function
  - b. Structures and functions of:
    - i. trachea
    - ii. bronchi
    - iii. bronchioles
    - iv. cilia
3. Gas exchange
  - a. Function
  - b. Structures and functions of;
    - i. alveoli
    - ii. interstitial space
    - iii. pulmonary capillary bed
4. Chest wall
  - a. Function
  - b. Structures and function of:
    - i. diaphragm
    - ii. intercostal muscles
    - iii. accessory muscles
    - iv. pleural space
5. Neurological control of breathing
  - a. Function
  - b. Structures and functions:
    - i. medulla
    - ii. phrenic nerve
    - iii. spinal nerves
    - iv. Hering-Breuer reflex

## II. Pathophysiology

### A. Obstructive/Restrictive Lung Diseases

1. Emphysema
  - a. changes in respiratory tract
  - b. changes in gas exchange
  - c. long term effects
  - d. decompensated states
2. Chronic Bronchitis
  - a. changes in respiratory tract
  - b. changes in gas exchange
  - c. long term effects
  - d. decompensated states
3. Asthma
  - a. changes in respiratory tract
  - b. changes in gas exchange
  - c. long term effects
  - d. decompensated states

### B. Infectious Lung Disease

1. Pneumonia

## III. Assessment

### A. Impact of Disease on Prehospital Assessment

1. Pertinent historical questions – history of previous intubation
2. Pertinent physical findings
  - a. Breath sounds
    - i. coarse crackles
    - ii. fine crackles
    - iii. ronchi
    - iv. wheezes
      - a) diffuse
      - b) continuous
    - v. stridor
    - vi. pleural rub
  - b. Inspiratory vs. Expiratory ratios

### B. Finding Associated With Specific Diseases

1. Emphysema
2. Chronic Bronchitis
3. Asthma
4. Pneumonia

### C. Age-Related Considerations

1. Pediatrics
  - a. variations in symptomatology
  - b. variations in physical presentation
    - i. asthma

ii. types of pneumonia

2. Geriatrics

- a. variations in symptomatology
- b. variations in physical presentation

IV. Treatment

A. Oxygenation and Ventilation Requirements

B. Use of Inhaled Beta-Agonists

C. IV Fluid Therapy in Respiratory Illness

D. Age-Related Considerations

1. Pediatrics

- a. dosage considerations
- b. fluid considerations

2. Geriatrics

- a. drug interaction considerations
- b. fluid considerations

V. Communication and documentation

# Medicine

## Hematology

Applies fundamental knowledge to provide basic and selected advanced emergency care and transportation based on assessment findings for an acutely ill patient.

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

### I. Introduction

#### A. Epidemiology of Blood Disorders

1. Incidence
2. Morbidity/mortality

#### B. Anatomy And Physiology

1. Blood
2. Plasma
3. Blood forming organs
4. Normal red cell production, function, destruction

### II. 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
  - c. Maintain normothermic
  - d. Rest
  - e. Pain management

### III. Assessment

#### A. Types of Presentation

B. Specific Signs and Symptoms

IV. Management

A. Airway and Oxygenation Requirements

B. IV Access

V. Age-Related Considerations

A. Types of Crisis Specific to the Pediatric Patient

B. Special Considerations in Treatment

VI. Documentation and Communication

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# Medicine

## Genitourinary/Renal

Applies fundamental knowledge to provide basic and selected advanced emergency care and transportation based on assessment findings for an acutely ill patient.

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

### I. Anatomy and Physiology

#### A. Urinary System

1. Structures
2. Functions

#### B. Pathophysiology

1. Renal Calculi (kidney stones)
  - a. Calculi formation
  - b. Consequences of renal calculi
2. Types of renal failure
  - a. Acute
  - b. Chronic
3. End-stage renal disease
  - a. Definition
  - b. Causes

#### C. Dialysis

1. Definition of dialysis
2. Process of dialysis
3. Types of dialysis
4. Complications/adverse effects of dialysis
  - a. Hypotension
  - b. Muscle cramps
  - c. Nausea/vomiting
  - d. Altered mentation, loss of consciousness
  - e. Hemorrhage from shunt
  - f. Air embolism
  - g. Myocardial ischemia
  - h. Infection
  - i. Electrolyte imbalance
5. Consequences of missed dialysis treatment
  - a. Electrolyte excesses
  - b. Weakness
  - c. Pulmonary edema

#### D. Assessment

1. Findings in renal calculi

2. Findings in renal failure
  - a. Acute
  - b. Chronic
  - c. End-stage

#### E. Management

1. Renal calculi patient
  - a. Oxygen requirements
  - b. IV access
  - c. Fluid administration considerations
2. Renal failure patients
  - a. Oxygen and ventilation requirements
  - b. IV access
    - i. hypotensive patient
    - ii. pulmonary edema patient

#### F. Documentation

1. Documentation of the renal calculi patient
2. Documentation of dialysis complication patient

# Medicine

## Gynecology

Applies fundamental knowledge to provide basic and selected advanced emergency care and transportation based on assessment findings for an acutely ill patient.

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

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# Medicine

## Non-Traumatic Musculoskeletal Disorders

Applies fundamental knowledge to provide basic and selected advanced emergency care and transportation based on assessment findings for an acutely ill patient.

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

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# Medicine

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

Applies fundamental knowledge to provide basic and selected advanced emergency care and transportation based on assessment findings for an acutely ill patient.

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

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# Shock and Resuscitation

## Shock and Resuscitation

Applies fundamental knowledge to provide basic and selected advanced emergency care and transportation based on assessment findings for a patient in shock, respiratory failure or arrest, cardiac failure or arrest and post resuscitation management.

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

### I. Ethical Issues in Resuscitation

- A. Withholding Resuscitation Attempts
  - 1. Irreversible death
  - 2. Do Not Resuscitate (DNR) orders
- B. Provide Emotional Support for Family
- C. Organ and Tissue Donation

### II. Anatomy and Physiology Review

- A. Respiratory System
- B. Cardiovascular System

### III. Cardiac Arrest

- A. 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. Cardio-pulmonary resuscitation (CPR)
    - a. Artificial ventilation
    - b. External chest compressions
    - c. Oxygenated blood is circulated to the brain and other vital organs
- B. General Reasons for the Heart to Stop Beating
  - 1. Sudden death and heart disease
  - 2. Breathing stops, especially in infants and children
  - 3. Medical emergencies
  - 4. Trauma

## IV. 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
5. Alternative CPR techniques -- Interposed abdominal compression

### C. 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
    - i. reduces blood return to the right side of the heart
    - ii. reduces the overall blood flow that can be generated with CPR
  - b. Devices to assist ventilation

### D. Chest Compressions

1. Factors which decrease 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

## V. Automated External Defibrillation (AED) -- (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 patients
3. Transdermal medication patches

## VI. Advanced Life Support - Refer to the Current American Heart Association Guidelines

## VII. Post-Resuscitation Support - Refer to the Current American Heart Association Guidelines

### A. Return of Spontaneous Circulation (ROSC)

1. Temperature regulation
  - a. Induced hypothermia
2. Glucose control
3. Organ specific support
  - a. Respiratory system
    - i. ventilation rates
  - b. Cardiovascular system
    - i. monitor
    - ii. leave AED pads in place
  - c. Central nervous system

## VIII. Shock

### A. Definition

1. Perfusion is the passage of blood and oxygen and other essential nutrients to the body's cells
2. While delivering essentials to body's cells, circulatory system is also removing waste such as carbon dioxide from the cells
3. Shock is a state of hypoperfusion, or inadequate perfusion of blood through body tissues
4. Hypoperfusion can lead to death if not corrected

### B. Anatomy and Physiology Review

1. Heart/blood vessels
2. Physiology of respiration
  - a. Gas exchange
    - i. alveolar level
    - ii. tissue level
  - b. Circulation
    - i. pulmonary
    - ii. systemic
3. Essential components for normal perfusion
  - a. Functioning pump/heart



- i. stroke volume
  - ii. cardiac output
  - iii. blood pressure
    - a) mean arterial pressure
    - b) pulse pressure
  - iv. baroreceptors
  - v. nervous control of heart
    - a) sympathetic nervous system
    - b) parasympathetic nervous system
- b. Adequate volume
  - i. formed elements
  - ii. plasma
- c. Intact container/vessels
  - i. arteries
  - ii. arterioles
  - iii. capillary beds
  - iv. sphincters
  - v. venules
  - vi. veins
  - vii. capacity of each vessel
  - viii. sympathetic nervous system control of each vessel
  - ix. blood flow controlled by cellular tissue demands
  - x. sphincter control

### C. Tissue Hypoperfusion

- 1. Inadequate fluid volume
- 2. Inadequate pump
- 3. Inadequate container size

### D. Physiologic Response to Shock

- 1. Cellular
  - a. Fick principle
  - b. Waste removal
  - c. Aerobic metabolism/glycolysis
  - d. Anaerobic metabolism
- 2. Sympathetic nervous system and endocrine implications

### E. Categories of Shock

- 1. Compensated shock
- 2. Decompensated shock
- 3. Irreversible shock

### F. Specific Types of Shock

- 1. Hypovolemic
  - a. Hemorrhage classifications
    - i. hemostasis
    - ii. vascular phase
    - iii. platelet phase
    - iv. coagulation phase

- v. tension lines
      - vi. 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 -- heart muscle damage
      - i. physiology
      - ii. signs/symptoms
      - iii. assessment
      - iv. management
    - b. Extrinsic causes
      - i. cardiac tamponade
      - ii. tension pneumothorax
  - 4. Respiratory
- G. Complications of Shock
  - 1. Multiple Organ Dysfunction Syndrome (MODS)
    - a. Sepsis
    - b. Death of organs
    - c. Death of organism
  - 2. Acute Respiratory Distress Syndrome (ARDS)
- H. Patient Assessment
  - 1. Scene size-up
  - 2. Perform a primary assessment
  - 3. Obtains a relevant history
  - 4. Perform a secondary assessment
  - 5. Perform a reassessment
- I. 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 positioning
    - 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. Begin transport at the earliest possible moment
10. Treat any additional injuries that might be present

#### J. Devices to Assist Circulation

### IX. Age-Related Variations

#### A. Pediatrics

1. Common causes of shock
  - a. Trauma
  - b. Fluid loss
  - c. Neurological injury
  - d. Anaphylaxis
  - e. Heart disease
  - f. Infection
2. Presentation
  - a. Cardiovascular
  - b. Skin signs
  - c. Mental status
  - d. Decreased fluid output
  - e. Vital signs
3. Anatomic and physiologic implications
  - a. Unreliable indicators
  - b. Indicators of shock
    - i. tachycardia for age
    - ii. weak distal pulses
    - iii. delayed capillary refill time
    - iv. cool mottled extremities
    - v. altered mental status
4. Management
  - a. Inline spinal stabilization
  - 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 sign variations
  - 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

Applies fundamental knowledge to provide basic and selected advanced emergency care and transportation based on assessment findings for an acutely injured patient.

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

### 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.

# Trauma

## Bleeding

Applies fundamental knowledge to provide basic and selected advanced emergency care and transportation based on assessment findings for an acutely injured patient.

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

### I. Fluid Resuscitation in Bleeding and Shock

#### A. Pathophysiology of Shock

1. Cardiac control in homeostasis of blood pressure
  - a. Changes in function in hemorrhagic shock
    - i. rate
    - ii. volume circulated
    - iii. preload
    - iv. afterload
    - v. Starling's law
    - vi. cardiac output
  - b. Loss of ability to compensate
2. Neurological/Autonomic control in homeostasis
  - a. Vasoconstriction
    - i. peripheral
    - ii. central
    - iii. chemoreceptors
    - iv. baroreceptors
  - b. Loss of ability to compensate
3. Blood vessels in homeostasis of blood
  - a. Neurovascular control
    - i. chemoreceptors
    - ii. baroreceptors
  - b. Clotting
  - c. Loss of ability to compensate

#### B. Blood Volume and Shock Stages

1. Class I
  - a. Definition
  - b. Estimated blood loss
  - c. Assessment findings
2. Class II
  - a. Definition
  - b. Estimated blood loss
  - c. Assessment findings
3. Class III
  - a. Definition
  - b. Estimated blood loss

- c. Assessment findings
- 4. Class IV
  - a. Definition
  - b. Estimated blood loss
  - c. Assessment findings

### C. Management of Bleeding and Shock Using Fluid Resuscitation

1. Review of fluid physiology and special considerations in shock
  - a. Oncotic pressure
  - b. Hydrostatic pressure
  - c. Osmosis
  - d. Diffusion
2. Review of IV skills and special considerations in shock
  - a. Vascular anatomy
  - b. Catheter selection
    - i. diameter impact
    - ii. length impact
  - c. Other considerations
    - i. tubing length and extension tubing
    - ii. impact of saline locks on IV flow
3. General principles of shock management
  - a. Scene safety
  - b. Body substance isolation
  - c. Rapid transport without unnecessary scene delays
  - d. Airway
  - e. Breathing
    - i. hyperventilation is contraindicated
    - ii. monitor oxygen saturation to maintain above 90%
  - f. Circulation
    - i. control the external bleeding
      - a) start two large-bore IV's enroute
      - b) fluid replacement with warmed isotonic solution up to 30 ml/kg in 250 - 500 ml increments with frequent reassessments
      - c) monitor response to therapy
    - ii. internal bleeding and non-compressible bleeding
      - a) position the patient to maximize perfusion
      - b) consider PASG by protocol
      - c) start two large-bore IV's enroute
      - d) fluid replacement with warmed isotonic solution up to 20-30 ml/kg in boluses of 250-500 ml
      - e) maintain blood pressure between 70mm/hg and 90 mm/hg
4. Reassessment of fluid therapy after initial treatment
  - a. Rapid return to normal vitals and vitals remain normal
    - i. slow IV to TKO rate
    - ii. reassess often
  - b. Inconsistent response to initial treatment with initial improvement followed by slow deterioration
    - i. indicates ongoing uncontrolled blood loss
    - ii. maintain blood pressure between 70-90mm/Hg depending on local protocol

## II. Special Considerations in Fluid Resuscitation

### A. Permissive Hypotension

### B. Reperfusion Injury

### C. Pediatrics

1. Temperature control is critical in maintaining perfusion
2. Use of IV is for known required fluid replacement
3. Consider use of IO if peripheral vein is not accessible and patient is in immediate need of fluid
  - a. Keep normal vital signs by age on hand
  - b. Infuse up to 20cc/kg of warmed isotonic solution
  - c. Consider a second infusion of 20cc/kg if there is no response to first
  - d. Second infusion should be initiated based on patient's need of rapid restoration of red blood cells while awaiting definitive care if shock is due to non-compressible hemorrhage
  - e. A third infusion of 20cc/kg may be considered in patients with controlled hemorrhage
  - f. Use of continuous infusion in uncontrolled hemorrhage should be done to maintain adequate perfusion levels of critical organs enroute to the hospital

### D. Geriatrics

1. Patients with chronic hypertension may have higher blood pressure value needs to achieve the same level of end organ perfusion than other patients
  - a. Patient may be in shock with blood pressure above 100
  - b. Modest amounts of blood loss can lead to shock
    - i. reduced blood volume
    - ii. possible anemia
  - c. Patient is less able to tolerate excessive fluids
    - i. possible anemia
    - ii. possible electrolyte alterations

### E. Obstetrical Patients

1. Shock states lead to shunting of blood away from fetus
2. The closer the maternal blood pressure is to normal, the better the fetal perfusion



# Trauma

## Chest Trauma

Applies fundamental knowledge to provide basic and selected advanced emergency care and transportation based on assessment findings for an acutely injured patient.

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

### I. Traumatic Aortic Disruption

#### A. Pathophysiology

1. Role of deceleration and speed as MOI
2. Partial tear
3. Complete tear

#### B. Assessment

1. Mechanism of injury
2. High percent have no signs of external chest trauma
3. Hypotension
4. Signs of Shock
5. Chest pain – tearing in nature
6. Suspicion raises with chest wall injury
7. Unusual pulses or blood pressure in upper extremities
8. Voice changes
  - a. Hoarseness
  - b. Stridor
9. Difficulty swallowing

#### C. Management

1. Review knowledge from previous levels
2. AVO management
3. High index of suspicion based upon MOI
4. Do not over-hydrate

### II. Pulmonary Contusion

#### A. Pathophysiology

1. Blunt trauma with associated injuries (rib fractures)
2. Capillary leakage into alveoli prevents gas exchange
3. Decrease lung compliance
4. Slowly developing process
5. Diffuse vs localized

#### B. Assessment

1. Respiratory distress symptoms
2. Hemoptysis

3. Chest pain from blunt trauma
4. Cough
5. Lung sounds
  - a. vesicular
  - b. bronchovesicular
  - c. bronchial sounds
  - d. adventitious sounds
6. Hypoxia
7. High index of suspicion based on MOI

#### C. Management

1. AVO management
2. IV fluid administration – over hydration is contraindicated (see Trauma: Bleeding)

### III. Blunt Cardiac Injury

#### A. Pathophysiology

1. Cardiac arrhythmias sometimes occur
2. Heart failure may occur
  - a. Review of right sided heart failure
  - b. Review of left-sided heart failure

#### B. Assessment

1. High index of suspicion with anterior blunt chest trauma
2. Clinical signs vary due to injury location in heart – vessels, muscle mass or conduction system
3. Tachycardia
4. May not exhibit external chest discoloration
5. Chest pain – retrosternal (MI type pain)

#### C. Management

1. High index of suspicion
2. AVO management
3. Limit fluids if signs of heart failure are present
  - a. lung crackles
  - b. Jugular venous distension
4. Be prepared for deteriorations in patients with rapid or irregular pulses

### IV. Hemothorax

#### A. Pathophysiology

1. Review knowledge from previous levels
2. Penetrating wounds
  - a. Tears in lung parenchyma
  - b. Puncture great vessels or heart
3. Clotting in the chest may release fibrolyns – continue bleeding process
4. Loss of circulating blood in vessels

#### B. Assessment

1. Review knowledge from previous levels

2. Shock
3. Unequal breath sounds
4. Dullness on percussion
5. Jugular venous distention assessment
  - a. Proper patient positioning for jugular venous assessment
  - b. Flat with hypovolemia
  - c. Distended if increased intrathoracic pressure

### C. Management

1. Review knowledge from previous levels
2. AVO management
3. Fluid bolus and continued hypovolemia assessment (see Trauma: Bleeding)
4. Rapid transport to appropriate facility

## V. Pneumothorax

### A. Open

1. Pathophysiology
  - a. Review knowledge from previous levels
  - b. Open wound to the chest wall
  - c. Fracture of chest wall structure
  - d. Hypoxia
  - e. Loss of lung adhesion to chest wall due to loss of surface tension collapse of lung
2. Assessment
  - 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. Cardiac dysrhythmia
3. Management
  - a. Review knowledge from previous levels
  - b. Airway, respiration and ventilation management
  - c. Inspect chest
    - i. cover open wounds with non-porous dressing
    - ii. excessive pressure ventilation can cause tension pneumothorax
  - d. Pneumothorax complications
  - e. Dysrhythmia treatment

### B. Simple

1. Pathophysiology
  - a. Review knowledge from previous levels
  - b. Defect in chest wall allow air to enter pleural space
  - c. Some low velocity wounds self-seal
  - d. Chest wall hole 2/3 size of trachea, air enters from atmosphere—sucking sound heard
  - e. With large holes air enters both the trachea and the hole rapidly collapsing the lung

- f. Delayed or improper treatment will lead to tension pneumothorax
- 2. Assessment
  - a. Review knowledge from previous levels
  - b. AVO assessment
  - c. Chest Assessment
    - i. inspection
      - a) immediately cover open wounds with nonporous dressings
    - ii. auscultation
      - a) unequal breath sounds
    - iii. percussion
  - d. Subcutaneous emphysema
  - e. Hypovolemia signs
  - f. Cardiac dysrhythmia
- 3. Management
  - a. Review knowledge from previous levels
  - b. Airway, respiration and ventilation management
  - c. Inspect chest
    - i. cover open wounds with non-porous dressing
    - ii. excessive pressure ventilation can cause tension pneumothorax
  - d. Pneumothorax complications
  - e. Dysrhythmia treatment

### 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 – mediastinal shift 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. Assessment
  - a. Review knowledge of previous levels
  - b. Severe respiratory distress
  - c. Jugular vein distention
  - d. Deviation of the trachea
    - i. almost never seen in the prehospital environment
    - ii. more easily seen on x-ray.
  - e. Tachycardia
  - f. Narrow pulse pressure
  - g. Absent breath sounds on affected side
  - h. Unequal chest rise
- 3. Management
  - a. Review knowledge from previous levels
  - b. Airway, respiration and ventilation management
  - c. Inspect chest
    - i. cover open wounds with non-porous dressing
    - ii. excessive pressure ventilation can cause tension pneumothorax
  - d. Pneumothorax complications
  - e. Dysrhythmia treatment

## VI. Cardiac Tamponade

### A. Pathophysiology

1. Review knowledge from previous levels
2. Mechanism of injury
  - a. Penetrating trauma
  - b. Much more rare in blunt trauma
3. Blood in the pericardial sac
  - a. Perforation of heart muscle
  - b. Amount of blood dependent in where blood originates
  - c. Sac is not elastic – no stretching
  - d. Small amounts (55cc) can cause reduction in cardiac output
  - e. Increased sac pressure puts pressure on coronary arteries

### B. Assessment

1. Jugular vein distention – increase in CVP
2. Increased diastolic pressure
3. Narrowed pulse pressure

### C. Management

- a. Review knowledge from previous levels
- b. Airway, respiration and ventilation management
- c. Inspect chest
  - i. cover open wounds with non-porous dressing
  - ii. excessive pressure ventilation can cause tension pneumothorax
- d. Rapid IV fluid bolus
- e. Dysrhythmia treatment

## VII. Rib Fractures

### A. Pathophysiology

### B. Assessment

### C. Management

## VIII. Flail Chest

### A. Pathophysiology

### B. Assessment

### C. Management

## IX. Commotio Cordis

### A. Pathophysiology

### B. Assessment

### C. Management

# Trauma

## Abdominal and Genitourinary Trauma

Applies fundamental knowledge to provide basic and selected advanced emergency care and transportation based on assessment findings for an acutely injured patient.

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

### I. Incidence

#### A. Morbidity/Mortality

### II. Anatomy

#### A. Quadrants and Boundaries of the Abdomen

#### B. Surface Anatomy of the Abdomen

#### C. Intraperitoneal Structures

#### D. Retroperitoneal Structures

#### E. Reproductive Organs

### III. Physiology

#### A. Solid Organs

#### B. Hollow Organs

#### C. Vascular Structures

### IV. Specific Injuries

#### A. Closed Abdominal Trauma

##### 1. Mechanism of injury

- a. Compression
- b. Deceleration
- c. MVA
- d. Motorcycle collisions
- e. Pedestrian injuries
- f. Falls
- g. Assault
- h. Blast injuries

##### 2. Signs and Symptoms

- a. Pain

- b. Guarding
  - c. Distention – rise in abdomen between pubis and xiphoid process
  - d. Discoloration of abdominal wall
  - e. Tenderness – on movement
  - f. Lower rib fractures
  - g. May be overlooked in multi-system injuries
  - h. Suspicion based on mechanism of injury
3. Assessment
- a. Inspection
  - b. Noting position of the patient
  - c. Noting pain with movement
  - d. Auscultation – little value
  - e. Blood loss through rectum or vomit
4. Management
- a. Oxygen
  - b. Transport in position of comfort if indicated
  - c. Treat for shock – internal bleeding

#### B. Penetrating/Open Abdominal Trauma

- 1. Low velocity injury – knife wound, abdominal wall tear, consider underlying organ injury
- 2. Medium velocity penetration – shot gun wound
- 3. High-velocity penetration – gunshot wound
- 4. Signs and Symptoms of penetrating abdominal trauma
  - a. Bleeding
  - b. Puncture wounds – entrance and exits
  - c. Signs/symptoms of closed abdominal wounds may be present with puncture wound
- 5. Assessment
  - a. Clothing removal
  - b. Inspection – look for exit wounds including posterior
  - c. Noting position of patient
- 6. Management
  - a. Cover wounds
  - b. Use non-porous dressing if chest may be involved
  - c. Treat for shock
  - d. Oxygen
  - e. Transport decision

#### C. Considerations in Abdominal Trauma

- 1. Hollow organs injuries
  - a. Stomach
  - b. Small bowel
  - c. Large bowel
  - d. Gallbladders
  - e. Urinary bladder
  - f. Considerations of signs and symptoms of hollow organ injuries
    - i. pain – may be intense with open wounds to the stomach or small bowel
    - ii. infection – delayed complication which may be fatal
    - iii. air in peritoneal cavity
- 2. Solid organ injuries

- a. Blood in the abdomen does not acutely produce abdominal pain
- b. Abdominal pain from solid organ penetration or rupture is of slow onset
- c. Liver
  - i. largest organ
  - ii. very vascular leading to hypo-perfusion
  - iii. injured with lower right rib fractures or penetrating trauma
- d. Spleen
  - i. injured in auto crashes, falls, bicycle accidents, motorcycles
  - ii. injured with lower left rib fractures or penetrating trauma
  - iii. left shoulder pain
- e. Pancreas
- f. Kidney
  - i. vascular
  - ii. blood in urine
- g. Diaphragm
  - i. abnormal respiratory sounds
  - ii. shortness of breath
- h. Retroperitoneal structures

## V. General Assessment

- A. High Index of Suspicion
- B. Pain with Abdominal Trauma Is Often Masked Due to Other Injuries
- C. Airway Patency
- D. External and Internal Hemorrhage
- E. Identification and Management of Life Threats
- F. Spinal Immobilization
- G. Physical Exam
  - 1. Inspection
  - 2. Auscultation
  - 3. Palpation
- H. Associated Trauma
- I. Recognition and Prevention of Shock
- J. PASG for Pelvic Fracture Stabilization
- K. Transportation Decisions to Appropriate Facility

## VI. General Management

- A. Scene Safety/Standard Precautions



- B. Airway Management
- C. Oxygenation and Ventilation
- D. Spinal Immobilization Considerations
- E. Control External Hemorrhage
- F. Identification of Life Threatening Injury
- G. Application and Inflation of PASG for Pelvic Fracture Stabilization
- H. Abdominal Trauma May Be Masked by Other Body System Trauma
- I. Transportation to Appropriate Facility
  - 1. No transport decisions
  - 2. Transport to acute care facility
  - 3. Transport to trauma center
  - 4. ALS mutual aid
- J. Communication and Documentation

## VII. Age-Related Variations for Pediatric and Geriatric Assessment and Management

- A. Pediatric
  - 1. Mechanism of injury as pedestrian
  - 2. Use of PASG (fracture stabilization)
- B. Geriatric

## VIII. Special Considerations of Abdominal Trauma

- A. Sexual Assault
  - 1. Criminal implications and evidence management
  - 2. Patient confidentiality
  - 3. Treat wounds as other soft tissue injuries
- B. Vaginal Bleeding Due to Trauma
  - 1. May be due to penetrating or blunt trauma
  - 2. Assess to determine pregnancy
  - 3. Apply sterile absorbent vaginal pad
  - 4. Determine mechanism of injury
  - 5. Do not insert gloved fingers for instruments in vagina

# Trauma

## Orthopedic Trauma

Applies fundamental knowledge to provide basic and selected advanced emergency care and transportation based on assessment findings for an acutely injured patient.

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

### I. Amputations

#### A. Pathophysiology

1. Tear, retraction and spasm of blood vessels
2. Amputated extremity
3. Re-implantation opportunities

#### B. Special Assessment Finding

1. Location of amputation
2. Tearing versus cutting amputations
3. Assessment of amputated part

#### C. Special Management Considerations

1. Tourniquet
2. Fluid replacement

### II. Pelvic Fractures

#### A. Anatomy of the Pelvic Girdle

#### B. Pathophysiology

1. Type I fractures
  - a. avulsion fractures
  - b. fracture of pubis or ischium
  - c. fracture of iliac wing
  - d. fracture of sacrum
  - e. fracture of coccyx
2. Type II fractures
  - a. Single fracture of pelvic ring
  - b. unilateral fractures of both pelvic rami
  - c. Subluxation of the symphysis pubis
  - d. Fracture near the sacroiliac joint
3. Type III fractures
4. Type IV fractures
5. Associated injuries
  - a. potential blood loss amounts
  - b. retroperitoneal space potential blood loss amounts
6. Significance of posterior fractures

### C. Special Assessment Findings

1. Pelvic instability
2. Pain
3. Rectal bleeding

### D. Management Considerations

1. Stabilize with PASG and longboard to minimize movement
2. Specialized pelvic immobilization devices
3. Management of blood loss

## III. 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

Applies fundamental knowledge to provide basic and selected advanced emergency care and transportation based on assessment findings for an acutely injured patient.

The AEMT Instructional Guidelines in this section include all the topics and material at the EMR and EMT 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. Closed Soft Tissue Injury

#### A. Type of Injuries

1. Contusion
2. Hematoma
3. Crush injuries

#### B. Signs and Symptoms

1. Discoloration
2. Swelling
3. Pain

#### C. Assessment

1. Mechanism of injury, suspect underlying organ trauma/injury
2. Diffuse or generalized soft tissue trauma can be critical
3. Pulse, movement, sensation

#### D. Management

1. Ice
2. Splinting if necessary

### IV. Open Soft Tissue Injury

#### A. Type of Injuries

1. Abrasions
2. Lacerations
3. Avulsions
4. Bites

5. Impaled objects
6. Amputations
7. Blast injuries/High Pressure
8. Penetrating/Punctures

#### B. Complications of Soft Tissue Injury

1. Blood loss – review bleeding and shock
2. Infection
  - a. Mechanisms of infection
  - b. Risk factors

#### C. Signs and Symptoms of Open Soft Tissue Injuries

1. Bleeding and Shock, chest trauma and other trauma sections discuss signs/symptoms of injuries to those areas that also include a soft tissue injury
2. Pain
3. Hemorrhage
4. Contaminated wounds
5. Impaled objects
6. Loss of extremity
7. Entrance and exit wounds
8. Flap of skin attached

### V. General Assessment

#### A. Safety of Environment/Standard Precautions

#### B. Airway Patency

#### C. Respiratory Distress

#### D. Concepts of Open Wound Dressings/Bandaging

1. Sterile
2. Non-sterile
3. Occlusive
4. Non-occlusive
5. Wet
6. Dry
7. Tourniquet
8. Complications of dressings/bandages

#### E. Hemorrhage Control

1. Severity of injury
2. Elevation
3. Pressure dressing
4. Pressure points
5. Tourniquets

#### F. Associated Injuries

1. Airway

2. Face
3. Neck

## VI. Management

- A. Airway Management
- B. Control Hemorrhage
- C. Prevention of Shock
- D. Prevent Infection
- E. Transportation to the Appropriate Facility
- F. Communication and Documentation
- G. Bites
  1. Control hemorrhage
  2. Cat and human bites often lead to serious infection
- H. Avulsions
  1. Never remove skin flap regardless of size
  2. Complete avulsion often has serious infection concerns
  3. Place skin in anatomic position if flat avulsion

## VII. Incidence of Burn Injury

- A. Morbidity/Mortality
- B. Risk Factors

## VIII. Anatomy and Physiology of Burns

- A. Types of Burns
  1. Thermal
  2. Inhalation
  3. Chemical
  4. Electrical
- B. Complications of Burns
  1. Thermal
    - a. Exposure time
    - b. Enclosed space vs open
    - c. Scalds with unusual history patterns may be abuse
  2. Inhalation
    - a. Airway closure due to swelling may be very rapid
    - b. Carbon monoxide inhalation
  3. Chemical
    - a. Acid and alkaline are different

- b. Solutions and powders are different
- 4. Electrical
  - a. Skin inspection may be not indicate seriousness of burn
  - b. Entrance and exit wounds
  - c. Current across chest may cause cardiac arrest
  - d. Lighting strikes may cause cardiac arrest

#### C. Depth Classification of Burns

- 1. Superficial
- 2. Partial-thickness
- 3. Full-thickness

#### D. Body Surface Area of Burns

- 1. 'rule of nines'
- 2. 'rule of ones'

#### E. Severity of Burns

- 1. Minor
- 2. Moderate
- 3. Severe

### IX. Complications of Burn Injuries

#### A. Infection

#### B. Vasoconstriction

#### C. Hypoxia

#### D. Hypothermia

#### E. Hypovolemia

#### F. Complications With Circumferential Burns

#### G. Pediatric/Geriatric Abuse

### X. General Assessment of Burn Injuries

#### A. Safety/Standard Precautions

#### B. Airway Patency

#### C. Respiratory Distress

#### D. Hemorrhage Control

#### E. Classification of Burn Depth

F. Percentage of Body Surface Area Affected

G. Severity

## XI. General Management

A. Stop the Burning

B. Airway Management

C. Respiratory Distress

D. Circulatory

E. Dry, Sterile, Non-Adherent Dressing

F. Remove Jewelry and Clothing

G. Prevent Shock

H. Prevent Hypothermia

I. Transportation to Appropriate Facility

1. ALS mutual aid
2. Criteria for burn unit

J. Pediatric Considerations

K. Geriatric Considerations

## XII. Specific Burn Injury Management Considerations

A. Thermal

1. Complete general management
2. May be associated with an inhalation injury
3. Large BSB also have hypovolemia and hypothermia
4. Cool small or those remaining hot
5. Dry dressing help prevent infection and provide comfort
6. Time in contact with heat increases damage

B. Inhalation

1. Complications are related to chemicals within inhaled air
2. Mucosal edema of airway can be rapid – need ALS backup if signs/symptoms of edema are present, such as voice change, singed nasal hairs, etc
3. Percent of oxygen in ambient air is different so hypoxia, and carbon monoxide or other chemicals may enter the blood
4. Burns in enclosed spaces without ventilation cause inhalation injuries



### C. Chemical

1. Some burns are liquid and need copious amounts of flushing with water
2. Some burns are powders and need brushed off to remove chemicals
3. Chemical burns treatments can be specific to the burning agent and labels should be read
4. Burns at industrial sites may have experts available on scene

### D. Electrical

1. The type of electric current, amperage and volts, have effect on seriousness of burns
2. No patient should be touched while in contact with current
3. Sometimes electric current crosses the chest and causes cardiac arrest or arrhythmias
4. Many underlying injuries to organs and the nervous system may be present
5. Radiation burns require special rescue techniques

## XIII. Age-Related Variations

### A. Pediatric

1. Percentage of surface area in a burn patient
2. Alteration in calculating the burned area

### B. Geriatrics

# Trauma

## Head, Facial, Neck, and Spine Trauma

Applies fundamental knowledge to provide basic and selected advanced emergency care and transportation based on assessment findings for an acutely injured patient.

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

### I. Facial Fractures

#### A. Types

1. Soft tissue injuries
2. Fractures of facial bones
3. Eye injuries
4. Oral/dental injuries
  - a. Mandibular fractures
  - b. Maxillar fractures

#### B. Unstable Facial Fractures

1. Pathophysiology
  - a. Categories of unstable facial fractures
    - i. Le Fort I - separates hard palate and lower maxilla from remainder of skull
    - ii. Le Fort II - separates nasal and lower maxilla from facial skull and remainder of cranial bones
    - iii. Le Fort III (craniofacial disjunction) - separates entire midface from cranium.
  - b. Blunt trauma to the facial area most frequent cause
2. Specific assessment considerations
  - a. Facial instability
  - b. Epistaxis
  - c. Edema
  - d. Pain
3. Specific management considerations
  - a. Simple airway maneuvers are difficult
  - b. Intubation is method of choice for airway protection
  - c. Ventilation without intubation is difficult
  - d. Manual in-line intubation
  - e. Bleeding into the oral cavity; suction
  - f. Cricothyroidotomy if indicated
  - g. Soft tissue bleeding

#### C. Signs/Symptoms

1. Soft tissue injuries are similar to others, but swelling may be more severe.
2. Facial bones may fracture causing airway and ventilation complications
3. Eye injuries suffer soft tissue type injuries, abrasions, lacerations, punctures, chemical burns, etc
4. Eye injuries may cause vision disturbances

5. Eyes injured with chemicals need flushing with copious amounts of water
6. Excessive pressure on the eye may “blow out” bones in the orbit
7. Nasal fractures may cause bleeding
8. Oral injuries may cause airway management complications

#### D. Assessment Considerations in Facial and Eye Injuries

1. Inspection
  - a. Open wounds
  - b. Swelling
  - c. Deformity of bones
  - d. Eye clarity without foreign objects
  - e. Eye symmetry
  - f. Bone alignment in anatomical position
2. Palpation
3. Eye examination
  - a. Follows finger up, down, lateral
  - b. Can read regular print
  - c. No blood visible in iris area

#### E. Management Considerations in Facial and Eye Injuries

1. Airway must remain open throughout care
2. Nasopharyngeal airways are contraindicated
3. Suctioning may be frequent
4. Broken teeth need to be brought to hospital with patient
5. Eyes with chemical burns may need to be flushed with copious amounts of water
6. Simple nose bleeds can be controlled by pinching nostrils
7. Eye injuries require patching of both eyes
8. Impaled objects in the eye must be stabilized
9. Impaled objects in cheeks may be removed
10. Patients with these injuries may be more comfortable sitting up
11. Bandaging should not occlude the mouth

## II. 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)

III. 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. Careful two man ventilation with bag/valve/mask
  - i. may multiple people to maintain effective seal
  - ii. may need frequent suctioning
  - iii. may need immediate surgical intervention at hospital do not delay transport
- c. Consider advanced airway in apnea

2. Combative patients

- i. increased intracranial pressure
- ii. hypoxia

# Trauma

## Nervous System Trauma

Applies fundamental knowledge to provide basic and selected advanced emergency care and transportation based on assessment findings for an acutely injured patient.

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

### I. Incidence of Traumatic Brain Injury

- A. Morbidity/Mortality
- B. Prevention Strategies

### II. Traumatic Brain Injury

#### A. Anatomy

- 1. Review of major structures of the brain
- 2. Review of circulation in the brain

#### B. Physiology

- 1. Review of function of brain

#### C. Pathophysiology

- 1. Normal oxygen demand of brain
  - a. Limited oxygen storing capacity
  - b. Consequences of oxygen loss
- 2. Role of gas concentrations in vascular diameter
  - a. Carbon dioxide and vasodilation
  - b. Oxygen and vasoconstriction
- 3. Brain injury categories
  - a. Primary brain injury
  - b. Secondary brain injury
  - c. Coup/contracoup pattern
- 4. Increasing intracranial pressure
  - a. Definition
  - b. Effects
  - c. Role of mean arterial pressure in maintaining perfusion
- 5. Coma
  - a. Definition
  - b. Posturing (decerebrate, decorticate)
  - c. Normal intracranial pressure (2 – 12 mmHg)
- 6. Brain herniation
  - a. Definition
  - b. Effects (i.e. Cushing's triad)
- 7. Types of brain injuries
  - a. Concussion
  - b. Diffuse axonal injury

- c. Contusion
  - d. Subdural hematoma
  - e. Epidural hematoma
  - f. Subarachnoid hemorrhage
  - g. Intracerebral hemorrhage
  - h. Penetrating brain trauma
8. Associated Injuries -- Skull fractures
- a. Linear
  - b. Depressed
  - c. Open
  - d. Basilar

#### D. Specific Assessment Considerations

- 1. Level of Consciousness
  - a. Signs of increasing intracranial pressure
  - b. Cerebral function
  - c. Cerebellar function
  - d. Cranial nerve function
    - i. pupil changes
    - ii. doll's eyes
  - e. Peripheral/Motor function
- 2. AVO
  - a. Alterations to respiratory and ventilatory effort
  - b. Spinal Concerns
- 3. Vital sign irregularities
  - a. Blood pressure changes in intracranial pressure
    - i. early
    - ii. late
- 4. Posturing
  - a. Types
  - b. Significance
- 5. CSF presence
  - a. Causes
  - b. Significance
- 6. Coma assessment
  - a. Glasgow Coma Scale
  - b. Neurological exam
    - i. pupils
    - ii. reflexes

#### E. Special Management Considerations

1. AVO with spinal precautions/immobilization
2. Ventilate/assist to maintain PaO<sub>2</sub> of 90mmHg
  - a. Cheyne-Stokes respirations
  - b. Irregular or slow respirations
3. Seizure precautions
4. Fluid management
  - a. Isolated head trauma
  - b. Multisystem trauma with hypovolemia
  - c. role of fluids in managing ICP
5. Role of hypothermia in coma

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# Trauma

## Special Considerations in Trauma

Applies fundamental knowledge to provide basic and selected advanced emergency care and transportation based on assessment findings for an acutely injured patient.

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

### I. Trauma in Pregnancy

#### A. Incidence

1. Mortality/morbidity
2. Risk factors
3. Prevention

#### B. Anatomy

1. Review of anatomical changes in pregnancy
  - a. Organ displacement
  - b. Organs of pregnancy
  - c. Stages of fetal development/size

#### C. Physiology

1. Review of physiological changes in pregnancy
  - a. Respiratory
  - b. cardiovascular

#### D. Pathophysiology

1. Shock in pregnancy
  - a. Effects on mother
    - i. shunting
    - ii. increased volume requirements
    - iii. changes in usual findings
  - b. Effects on fetus
2. Traumatic abruptio placenta
  - a. Mechanisms of injury
  - b. Effects on mother
  - c. Effects on fetus
3. Abdominal injuries
  - a. Mechanisms of injury
  - b. Effects on mother
  - c. Effects on fetus
4. Pelvic fracture
  - a. Mechanisms of injury
  - b. Effects on mother
  - c. Effects on fetus
5. Seat belt injuries



- a. Mechanisms of injury
- b. Effects on mother
- c. Effects on fetus
- 6. Sexual assault
  - a. Mechanisms of injury
  - b. Effects on mother
  - c. Effects on fetus
- E. 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. Respiratory rate less than 20 should not be considered adequate ventilation
  - 4. Loss of landmarks for chest compressions in arrest
  - 5. Signs of abruption placentae
  - 6. Estimating gestational age of fetus
    - a. Palpation of uterine fundus
    - b. Auscultation of fetal heart tones
      - i. stethoscope position
      - ii. uterine pulse
- F. Special Considerations in Management
  - 1. AVO
    - a. Restriction of diaphragm in mother
      - i. fetal size
      - ii. maternal position
  - 2. Circulation
    - a. Fetal pressure on great vessels
      - i. impact on spinal precautions
      - ii. impact on fluid replacement requirements
    - b. IV and fluid management
      - i. the closer the maternal blood pressure is to normal, the better the fetal perfusion
      - ii. normal blood pressure varies by trimester
  - 3. Traumatic arrest
    - a. Treatment decisions
    - b. Transport decisions
    - c. Alterations to CPR
      - i. increased airway pressures
      - ii. decreased diaphragm excursion
      - iii. effects on airway management
        - a) BVM management
        - b) advanced airway management

## II. Pediatric Trauma

- A. Incidence
  - 1. Mortality/morbidity
    - a. Accidental
    - b. Intentional
  - 2. Risk factors

### 3. Prevention

#### B. Anatomy

1. Review of anatomical differences by age
  - a. Newborn
  - b. Infant
  - c. Child
    - i. preschool
    - ii. school-age
    - iii. adolescent
2. Review of impact of differences on care

#### C. Physiology

1. Review of anatomical differences by age
  - a. Cardiac differences
  - b. Catecholamine regulation
  - c. Review of impact of differences on care

#### D. Pathophysiology

1. Alterations to response of shock in the child
2. Alterations to response of head injury in the newborn/child
3. Alterations to response of spine to injury in the child (i.e. Spinal cord injury without radiographic abnormality)
4. Alterations to response to chest injury in the child
  - a. Very compliant
  - b. Injury requires great force
  - c. Sudden impact of blunt force to the chest resulting in cardiac dysfunction, even death
  - d. Alterations to response to abdominal injuries in the child
  - e. Relatively larger solid organs
  - f. Less protection from ribs
  - g. Weaker abdominal muscles
5. Musculoskeletal
  - a. Damage to epiphyseal plate
  - b. Damage to bone matrix

#### E. Special Considerations in Assessment

1. Airway, Breathing, and Circulation
  - a. Review of pediatric anatomy
  - b. Review of normal ventilatory effort in the child
  - c. Review of signs of respiratory distress in child
  - d. Mainstem intubation precautions
2. Circulation
  - a. Hypotension appears late, use other signs of inadequate circulation
  - b. Capillary refill may be helpful
  - c. Inadequate oxygenation cause bradycardia
  - d. Level of Consciousness may indicate inadequate circulation
    - i. BP estimated as  $80 + 2$  times the age
    - ii. 80ml/Kg blood loss can cause shock
3. Neurological

- a. Glasgow Coma Score less than 8 means increased ICP
- b. Beware of shaken baby syndrome

#### 4. Head

- a. Very vascular, even scalp laceration can cause shock
- b. Falls less than 5 feet are significant

#### 5. Chest

- a. Significant internal injury can be present without any external signs
- b. Tension-pneumothorax is difficult to evaluate

#### 6. Abdomen

- a. Spleen most common injured
- b. Cullen's sign
- c. Kehr's sign

### F. Special Considerations in Management

#### 1. Airway, Breathing, and Circulation (improper management is the most common cause of preventable pediatric death)

- a. High-concentration oxygen and saturation
- b. Proper endotracheal tube size considerations
- c. Nasotracheal intubation is contraindicated

#### 2. Circulation

- a. IV selection in the pediatric trauma selection
  - i. site selection
  - ii. access type
    - a) peripheral
  - iii. keep normal vital signs by age on hand
  - iv. infuse up to 20cc/kg of warmed isotonic solution
  - v. consider a second infusion of 20cc/kg if there is no response to first
  - vi. second infusion should be done considering patient's need for rapid restoration of red blood cells while awaiting definitive care if shock due to non-compressible hemorrhage
  - vii. third infusion of 20cc/kg may be considered with controlled hemorrhage
  - viii. use of continuous infusion in uncontrolled hemorrhage should be done to maintain adequate perfusion levels of critical organs enroute to the hospital
  - ix. maintain body heat to prevent more rapid deterioration
- b. Fluid replacement

### III. Geriatric Trauma

#### A. Incidence

- 1. Mortality/morbidity
  - a. Accidental
  - b. Intentional
- 2. Risk factors
- 3. Prevention

#### B. Review of Anatomical Changes of Aging

#### C. Review of Physiological Changes of Aging Affecting Trauma

1. Respiratory
  - a. Chest wall less compliant
  - b. Less vital capacity
  - c. Decrease in ciliary action
2. Cardiovascular
  - a. Heart rate and stroke volume decrease
  - b. Dysrhythmia changes
3. Neurological system
  - a. Neuron mass reduction
  - b. Velocity of impulses
  - c. Mentation changes
  - d. Thermoregulation changes

#### D. Special Considerations in Assessment

1. History
  - a. Can be unreliable historian
  - b. Underlying disease can change normal baseline for patient
    - i. mentation
    - ii. vital signs

#### E. Special Considerations in Management

1. Airway, Breathing, And Circulation Review
  - a. Mask seal with toothless patient
  - b. Cervical kyphosis
  - c. Oxygen saturation can quickly deteriorate
2. Circulation
  - a. Patients with chronic hypertension may have higher blood pressure value needs to achieve the same level of end organ perfusion than other patients
  - b. Patient may be in shock with blood pressure above 100 mmHg
  - c. Modest amounts of blood loss can lead to shock
    - i. reduced blood volume
    - ii. possible anemia
  - d. Patient is less able to tolerate excessive fluids
    - i. possible anemia
    - ii. possible electrolyte alterations

### IV. Cognitively Impaired Patient Trauma

#### A. Incidence

1. Mortality/morbidity
  - a. Accidental
  - b. Intentional
2. Risk factors
3. Prevention

#### B. Types of Cognitive Impairment

#### C. Challenges With Cognitive Impaired Patients

1. Ability of individual to communicate complaints

2. Unreliable historian
3. Unusual presentation of common disorders
4. Reduced pain threshold
5. Consent to treat complications

#### D. Special Considerations in Assessment

1. Level of development
  - a. 5<sup>th</sup> 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
2. Communication ability assessment
  - a. How does patient normally communicate?
  - b. How aware are they of environment?
  - c. What are usual motor skills and level of activity?
  - d. Use a high-function concept and have them repeat it back
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.

# Trauma

## Environmental Emergencies

Applies fundamental knowledge to provide basic and selected advanced emergency care and transportation based on assessment findings for an acutely injured patient.

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

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# Trauma

## Multiple-System Trauma

Applies fundamental knowledge to provide basic and selected advanced emergency care and transportation based on assessment findings for an acutely injured patient.

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

### I. Kinematics of Trauma

#### A. Definition

1. Looking at 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 effect
    - 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, some rifles
    - iii. high energy -- military weapons
  - c. Organs struck 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. Head and spinal trauma
  - b. Chest and abdominal trauma
  - c. Chest and multiple extremity trauma
3. Multi-trauma treatment will involve a team of physicians to treat patient such as neuro-, thoracic, 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 cannot 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. Care must be adjusted depending on needs of 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. Definitive care for multi-system trauma is surgery which cannot be done in field
  - b. On scene time is critical and should not be delayed
  - c. Rapid extraction is an important consideration
  - d. Consider ALS intercept and air medical resources in a multi-trauma patient
  - 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. AEMTs are the only ones at the scene of multi-trauma patients
    - i. AEMTs are the eyes and ears of the physicians
    - ii. AEMTs need to re-create the scene
    - iii. Important kinematics and mechanisms of injury are important to trauma teams
    - iv. Report and document changes in vital signs or assessment findings while enroute
7. Personal safety
  - a. Most important when arriving on scene, and throughout care, an injured AEMT cannot 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 AEMTs 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 complaining of pain/screaming for help while quiet patients who may be hypoxic or bleeding internally cannot call for help because of decreases in level of consciousness
  - c. Sometimes an obvious injury is not the critical cause
  - d. Trauma care is leading cause of death of young people. 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. Release
    - i. blast waves
    - ii. blast winds
    - iii. ground shock
    - iv. heat
2. Pathophysiology

- a. Blast waves 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 Populations

## Obstetrics

Applies a fundamental knowledge of growth, development, aging, and assessment findings to provide basic and selected advanced emergency care and transportation for a patient with special needs.

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

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# Special Patient Populations

## Neonatal Care

Applies a fundamental knowledge of growth, development, aging, and assessment findings to provide basic and selected advanced emergency care and transportation for a patient with special needs.

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

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# Special Patient Populations

## Pediatrics

Applies a fundamental knowledge of growth, development, aging, and assessment findings to provide basic and selected advanced emergency care and transportation for a patient with special needs.

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

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# Special Patient Populations

## Geriatrics

Applies a fundamental knowledge of growth, development, aging, and assessment findings to provide basic and selected advanced emergency care and transportation for a patient with special needs.

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

### I. Fluid Resuscitation in the Elderly

A. Patients with Chronic Hypertension May Have Higher Blood Pressure Value Needs to Achieve the Same Level of End Organ Perfusion Than Other Patients

1. Patient may be in shock with blood pressure above 100
2. Modest amounts of blood loss can lead to shock
  - a. Reduced blood volume
  - b. Possible anemia
3. Patient less able to tolerate excessive fluids
  - a. Possible anemia
  - b. Possible electrolyte alterations
4. Hemodilution

# Special Patient Populations

## Patients with Special Challenges

Applies a fundamental knowledge of growth, development, aging, and assessment findings to provide basic and selected advanced emergency care and transportation for a patient with special needs.

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

### I. Abuse and Neglect

#### A. Child Abuse

1. Types of abuse
2. Epidemiology
3. Assessment
  - a. History or scene findings to concern for abuse or neglect
  - b. Caregiver's behavior
  - c. Physical findings
4. Management
  - a. Reporting
  - b. Safely transporting
  - c. Role of child/adult protective services
5. Legal aspects
6. Documentation

#### B. Elder Abuse

1. Types of abuse
2. Epidemiology
3. Assessment
4. Management
5. Legal aspects
6. Documentation

### 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

### III. Bariatric Patients

- A. Increased Risk for
  1. Diabetes

2. Hypertension
3. Heart disease
4. stroke

#### B. 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

#### F. Elimination Diversion

### V. Hospice Care and Terminally Ill

#### A. What Is Hospice?

1. Comfort care versus curative care
2. Terminally ill as verified by physician
3. Typically cancer, heart failure, Alzheimer's disease, AIDS

#### B. EMS Intervention

#### C. DNR Orders

### VI. Tracheostomy Care

#### 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. Sensory Deficits

### A. Sight

1. Service dogs
2. Allow patient to take your arm
3. Other

### B. Hearing Impaired

1. Hearing aid issues
2. Communication
  - a. face patient (so he can lip read)
  - b. lighted area
  - c. communicate by writing
  - d. obtain sign language interpreter

### C. Paralysis

1. Hemiplegia
2. Palsy
3. Paraplegia
4. Quadriplegia

## VIII. Homecare

### A. Common for Patients Over Age 65

### B. Various Reasons for Calls

## IX. Patient with Developmental Disability

### A. Treat Like Any Other Patient

### B. Family or Friends May Supply Additional Information

### C. Take Special Care to Provide Explanations

# EMS Operations

## Principles of Safely Operating a Ground Ambulance

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

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 Kansas EMS Education Instructional Guidelines and the Kansas Scope of Practice Psychomotor Skills Guidelines for each personnel level.

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

# EMS Operations

## Incident Management

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

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 Kansas EMS Education Instructional Guidelines and the Kansas Scope of Practice Psychomotor Skills 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

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

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 Kansas EMS Education Instructional Guidelines and Kansas Scope of Practice Psychomotor Skills Guidelines for each personnel level.

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

# EMS Operations

## Air Medical

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

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 Kansas EMS Education Instructional Guidelines and the Kansas Scope of Practice Psychomotor Skills Guidelines for each personnel level.

### I. Safe Air Medical Operations

#### A. Types

1. Rotorcraft
2. Fixed wing

#### B. Advantages

1. Specialized care – skills, supplies, equipment
2. Rapid transport
3. Access to remote areas
4. Helicopter hospital helipads

#### C. Disadvantages

1. Weather/environmental
2. Altitude limitations
3. Airspeed limitations
4. Aircraft cabin size
5. Terrain
6. Cost

#### D. Patient Transfer

1. Interacting with flight personnel
2. Patient preparation
3. Scene safety
  - a. Securing loose objects
  - b. Approaching the aircraft
  - c. Landing zone

#### E. Landing Zone Selection and Preparation

#### F. Approaching the Aircraft

#### G. Communication Issues

### II. Criteria for Utilizing Air Medical Response

#### A. Indications for Patient Transport

1. Medical
2. Trauma
3. Search and rescue

B. Activation

1. Local and State guidelines exist for air medical activation
  - a. State statutes
  - b. Administrative rules
  - c. City/county/district ordinance standards

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# EMS Operations

## Vehicle Extrication

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

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 Kansas EMS Education Instructional Guidelines and the Kansas Scope of Practice Psychomotor Skills 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

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# EMS Operations

## Hazardous Materials Awareness

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

Information related to the clinical management of the patient exposed to hazardous materials is found in the clinical sections of the Kansas EMS Education Instructional Guidelines and the Kansas Scope of Practice Psychomotor Skills 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

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

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 Kansas EMS Education Instructional Guidelines and the Kansas Scope of Practice Psychomotor Skills 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

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