EMT INTERMEDIATE

Version 1.04

SEPTEMBER 2008

SPECIAL THANK YOU

Committee Members
Peggy Andrews, EMT P, Chairman
Chemeketa Community College

Donna Wilson, EMT-P, Co-Chairman
DHS/EMS MTU Coordinator
Crooked River Ranch RFPD

Adam Glaser,
Emanuel Hospital, Life Flight

Rose Howe, EMT-I
Monument Volunteer Ambulance

Leslie Huntington, NREMT – P
DHS-EMS MTU Coordinator

Shane Moore, EMT-I
Portland Community College

Reta Warner, EMT-I
Wallowa Memorial Hospital

Reviewers
Ben Bowers, EMT I
Cal-Or Ambulance

Linda Thompson, EMT I
Waldport

Carol DeYoung, EMT I
Alsea RFPD

Jane McLaughlin, NREMTP,
Chiloquin Volunteer Ambulance

Jessica Darling, EMT I
Lane Rural Fire District

Dr. Jon Jui, MD.
OHSU

Dr. Joe Goldman D.O
Supervising Physician Central Coast Area

Item Writers
Cameron Helikson, EMT-I
Newberg EMS

Leslie Terrell, EMT-P, LPN
St. Charles Medical Center

PREREQUISITE

OREGON EMT-BASIC CERTIFICATION
AGENCY REFERRAL**
EXAM – ADVISORY ONLY*

*Study guide handed out the first night of class; exam within 2 weeks of class starting
**Letter of sponsorship from Supervising Physician or designee.

**NOTE: On 9/5/08, DHS-EMS and Trauma Systems Director Robert Leopold and DHS-EMS and Trauma Systems Medical Director Dr. Ritu Sahni determined that agency affiliation is no longer required as an entry requirement for the EMT Intermediate course. The EMT-I Curriculum Committee strongly recommends that the course participants have prehospital experience as an EMT-Basic. Past EMT-I courses have shown that an experienced EMT Basic has been able to grasp the material in the course more quickly and is likely to be more successful with the course than an EMT with little or no experience. Therefore, the EMT-I course director should be prepared to add more time to the course for review and remediation for courses with non-affiliated EMTs or EMTs with limited prehospital experience.

CLINICAL/FIELD

A minimum of 8 hours in a clinic or emergency department setting – observation only is acceptable
A minimum of 20 patient contacts

Invasive skills to be performed under direct supervision by clinical staff or instructor

PRE-REQUISITE

EXAM

Includes:

Scope of practice questions

On-line medical control

Off-line medical control

Supervising physician role/responsibilities

Continuing education requirements

Safety in laboratory

Universal precautions

Prehospital care reports and documentation requirements

EMT-Basic questions

Medical and Trauma scenario based questions

Skills pretest- Proficiency must be shown:

BVM, naso/oropharyngeal airways, suctioning

C-spine immobilization; standing, sitting, lying

An organized initial and detailed patient assessment

CLINICAL/FIELD

Objectives include:

Complete comprehensive patient assessment including history taking, physical examination and assessment of vital signs, evaluation of patient medications

Perform patient interventions as allowed by EMT-Intermediate scope of practice

Note: clinical field experience my be observational

**NOTE: On 9/5/08, DHS-EMS and Trauma Systems Director Robert Leopold and DHS-EMS and Trauma Systems Medical Director Dr. Ritu Sahni determined that agency affiliation is no longer required as an entry requirement for the EMT Intermediate course. The EMT-I Curriculum Committee strongly recommends that the course participants have prehospital experience as an EMT-Basic. Past EMT-I courses have shown that an experienced EMT Basic has been able to grasp the material in the course more quickly and is likely to be more successful with the course than an EMT with little or no experience. Therefore, the EMT-I course director should be prepared to add more time to the course for review and remediation for courses with non-affiliated EMTs or EMTs with limited prehospital experience.

I am recommending _____ for acceptance into the upcoming EMT-Intermediate course. I know this individual to be in good standing within the system in which he/she works and has proven to perform competently at the basic level. I understand that the course will begin with a written and practical pre-test that will cover EMT-Basic didactic material as well as EMT-Basic skills. I believe that this individual is capable of performing the following skills at the minimum level established by the National Registry of EMT's and observed by the State of Oregon.

The skills, which will be tested, are as follows:

- C-spine immobilization Supine
- Airway management (BVM)
- Trauma Patient Assessment
- Traction Splint

This form is to be reviewed and signed by the Supervising Physician or his/her designee as recorded by the Oregon EMS office.

Signature _____-

Print: _____

Title:_____

PREPARATORY
- Roles & Responsibilities
- Emergency Pharmacology
- Venous Access and Medication Administration
- EKG Monitoring and Management of Dysrhythmias
- AIRWAY MANAGEMENT & VENTILATION

MEDICAL
- Respiratory Emergencies
- Cardiovascular Emergencies
- Altered Mental Status
- Diabetic Emergencies
- Neurological Emergencies

TRAUMA
- Trauma systems/Mechanism of Injury
- Hemorrhage and Shock
- Burns
- Head
- Thoracic Trauma

SPECIAL CONSIDERATIONS
- Environmental Emergencies
- Pediatrics
- Geriatrics
- Clinical Decision Making

CASE-BASED SCENARIOS

RECOMMENDED MINIMUM COURSE HOURS

	Recommended Didactic Hours	Recommended Practical Laboratory hours
Preparatory		
Roles & Responsibilities	4	0
Emergency Pharmacology	14	6
Venous Access & Medication Administration	4	10
EKG Monitoring & Management of Dysrhythmias	10	8
Airway Management & Ventilation		
Airway & Ventilation	2	2
Advanced Airway techniques	4	4
Medical		
Respiratory Emergencies	4	2
Cardiovascular Emergencies	6	6
Altered Mental Status Diabetic Emergencies Neurological Emergencies	5	3
Trauma		
Trauma Systems/Mechanism of Injury	2	4
Hemorrhage & Shock	2	
Burns	1	
Head Injury	1	
Thoracic Trauma	3	
Special Considerations		
Environmental Emergencies	1	0
Pediatrics	6	2
Geriatrics	6	2
Clinical Decision Making	2	4
Case-Based Scenarios	2	4
Total, didactic and lab	79	57
Clinical experience	8	
Total hours	144*	

*Many community colleges are either teaching a separate A & P course or increasing course to approximately 200 hours.

Domains of Learning

Cognitive Domain

Level 1 – Knowledge

- Recall; automatic
- Example – rote memorization of the steps of a procedure

Teaching Strategies

- 3 steps: proper encoding (use of mnemonics), immediate retrieval (i.e. in-class review), regular retrieval episodes (repetition

Level 2 – Comprehension

- Understanding of the principles of a concept
- Ability to process and alter stored information
    - Understanding of the what, why, and why-not
- THIS IS THE MOST IMPORTANT LEVEL – IT IS THE GATEWAY TO HIGHER THINKING

Teaching Strategies

- Break complex theories down and explain them in the most simplistic ways
- View the theories from different angles – draw analogies and comparisons
- Have the student explain the concept in their own words as if they are teaching another person

Level 3 – Application

- Use stored information to arrive at a solution to a specific problem.
- The student begins to pull concepts together and apply them to particular issues by trial-and-error
    - The student must go through bad judgment-decisions before they can progress to achieve good solutions

Teaching Strategies

- Provide unknown scenarios to the student and allow the student to explore options and solutions to the problem
    - Ask “what-if” questions at the end of scenarios to maximize their experience with problem-solving
- Judgment cannot be taught - it must be developed through experience; maximize problem-solving time at this level of learning!
    - Use the consequences of slow decisions and changes in patient conditions to direct the discussion towards good decision-making
    - Have the students explain what they are doing and their reasoning for it while they are doing it

Level 4 – Analysis

- Retroactive, "post-game" analysis
- Take the big picture and break it down
- Example – "how did the individual treatment help the patient/situation as a whole?"
    - This will provide a view of how each step interacted with each other to achieve the end result

Teaching Strategy

- After a patient assessment scenario, break the scenario apart and explain how all of the treatments/assessment questions fit together to achieve the correct field impression or treatment

Level 5 – Synthesis

- Contemplation phase
- This takes will established concepts and applying them in a different context
    - The student must first have a good understanding of how a process works
    - This will cause deep thinking and contemplation!
- Example: IV fluid challenge for trauma is a well-accepted practice; explore how IV fluid challenges could be just as beneficial for a patient suffering from sepsis or right ventricular MI
- Example: determining whether the vasodilation properties of nitroglycerin would work with a patient suffering from a hypertensive crisis
- Example: Use of the KED for pediatric full-body immobilization

Level 6 – Evaluation

- The student will make a decision whether a particular solution or treatment is correct and then defends the decision

Teaching Strategies

- Case reviews
- Self-evaluation after scenarios
- Evaluate the decisions of others (video taped scenarios) and discuss the rationale of those decisions

Psychomotor Domain

Level 1 – Imitation

- Modeling of good practice
- "See, then do."

Teaching Strategy

- Allow time for informal practice at this stage
- Have students use skill sheets

Level 2 – Manipulation

- Hands-on practice with the start of adaptation

Teaching Strategies

- After the student can perform a rote memorization of the skill, then begin to incorporate questions the "when" and "how" of the skill

Level 3 – Precision

- Reproduction of the skill without mistakes
- Requires a tremendous amount of practice!

Level 4 – Articulation

- The student is able to perform the skill and is able to discuss the "why" and "when" of applying the skill.
- Integration of indications and contraindications into the application of the skill

Level 5 – Naturalization

- The student is able to perform the skill while concurrently performing other tasks
    - Example: the student can conduct a focused history while starting an IV without having to stop

Affective Domain

Level 1 – Receiving

- The student is aware of it, is willing to spend some time looking at it and give it some attention as a top priority (at least temporarily)
    - Example: the student reviews the course syllabus and agrees to accept the rules of the course
- The student will comply because they have to or because someone else (the instructor) believes it is important
    - The student may not have personal buy-in at this point

Teaching Strategies

- Let the students know what to expect
- Put the emphasis where it belongs and make the material relevant

Level 2 – Responding

- The student acts upon the message
- This is the start of the student attaching the emotion (good or bad!) to the information
    - This is also the beginning of self-esteem development
- Three levels:
    - #1 – Comply. This is the simple textbook response; the student will act upon something or answer the question right without fully understanding the reasons or the real meaning yet
    - #2 – Willing Response. The student answers the question or performs the task and knows the rationale for it
    - #3 – Satisfaction Response. The student is happy to answer or perform the task!

Teaching Strategies

- Creating a safe classroom environment is very important at this level. The student will not move on if they do not feel comfortable.
- Motivation will increase or decrease at this level
- Use respect tact, and honesty with feedback!

Level 3 – Valuing

- The student attaches worth to the concept, which is an internal act
    - This is a slow process
- Three levels:
    - #1 – Acceptance of the Value. Inconsistent behavior, even though the student can explain why the value is important. The student thought may be, " the instructor thinks it's important and I can see/appreciate that." The student doesn't possess a strong desire to always follow the value.
    - #2 – Preference for the Value. When faced with the choice, the student will choose the value. They accept the value and is willing to identify with it.
    - #3 – Commitment to the Value. The value becomes the basis for their behavior. They accept the value and upholds it without reservation. The student does it without thinking and they also defend the value.

Teaching Strategies

- Give the student the chance to explore and even argue (constructively) the value through analysis and synthesis
- Be a consistent role model for the values you want them to have
- Use a lot of personal interaction with guidance, encouragement and reinforcement
- Get the student out of a rut!

Level 4 – Organization

- The student is able to prioritize values in specific situations and is able to defend them
- This is the beginning of the work ethic or philosophies regarding patient care

- This level will also bring the context of the didactic information into the experience.
- The student is able to set treatment priorities on a scene and defend them with medical rationale

Teaching Strategies

- Use "point-counterpoint" questioning and have the student provide medical reasoning in order to defend their priorities.
- Put the student in situations that will allow them to evaluate their priorities

Level 5 – Characterization

- Ingrained behavior; this becomes the "natural style" of the EMT practice
    - This can be good or bad!
- This impact comes directly from peers, life events and from role models

Teaching Strategies

- This level may not be achieved during the initial education phase of the EMT
- However, early experiences with positive role models with strong positive values can set an early foundation for the EMT
- Other strategies
    - What values do you want the student to emulate?
    - Use effective presentation styles
    - Use relevance and context frequently
    - Keep the student in the self-evaluation and improvement mode


This page intentionally left blank

Roles And Responsibilities

Cognitive Objective:

1) Explain the term “ethics”. (C-2)
2) Explain the term “Professional”. (C-2)
3) Give an example of a “health care professional”. (C-2)
4) Describe the role of the Oregon Department of Human Services EMS and Trauma Section. (C-2)
5) Describe the differences between ethical behavior and legal requirements and how they pertain to EMT-Intermediates on and off duty. (C-2)
6) Identify whether a particular activity is unethical and/or illegal. (C-1)
7) Describe the importance of EMT-Intermediate involvement in public education. (C-1)
8) Describe continuing education requirements for EMT-Intermediates. (C-1)

Affective Objectives:

None identified for this section

Psychomotor Objectives:

None identified for this section

Declarative

*History of EMS in Oregon Power Point presentation


This page intentionally left blank

Emergency Pharmacology

Cognitive Objectives:

1) Identify the common sources of drug information. (C-1)
2) Discuss the standardization of drugs and how they are classified. (C-2)
3) Differentiate among the chemical, generic, and trade names of a drug. (C-2)
4) List the four main sources of drug products. (C-2)
5) Explain the special consideration in drug treatment with regard to pregnant, pediatric and geriatric patients. (C-3)
6) Discuss the EMT-Intermediate's responsibilities and scope of management pertinent to the administration of medications. (C-2)
7) List and describe liquid, solid, and gas drug forms. (C-2)
8) List and differentiate routes of drug administration. (C-2)
9) Differentiate between enteral and parenteral routes of drug administration. (C-3)
10) Review the specific anatomy and physiology relevant to pharmacology. (C-3)
11) Describe mechanisms of drug action, drug-response relationship, factors altering drug responses, drug interactions, predictable and unpredictable drug responses. (C-2)
12) Discuss considerations for storing drugs. (C-2)
13) List and describe the drugs which an EMT-Intermediate may administer. (C-2)
14) Explain procedures and measures to ensure security of controlled substances. (C-2)
15) In a given scenario formulate a pharmacologic management plan including medication administration. (C-5)

Affective Objectives:

1) Defend medication administration by an EMT-Intermediate to effect positive therapeutic affect. (A-3)

Psychomotor Objectives:

None identified for this module

Declarative

1)Drugs

a) Chemical agents used in the diagnosis, treatment, or prevention of disease.
b) Pharmacology – the study of drugs and their actions in the body.
c) General principles
    i) Drugs do not confer any new functions on a tissue or organ in the body; they only modify existing functions.
    ii) Drugs in general exert multiple actions rather than a single effect
    iii) Once administered, drugs go through four stages
        (1) Absorption
        (2) Distribution
        (3) Metabolism
        (4) Excretion

2) Sources of drug information
    a) AMA Drug Evaluation
    b) PDR – Physicians Desk Reference
    c) Hospital Formulary
    d) Drug Inserts
    e) Other texts, sources
3) Discuss the standardization of drugs and how they are classified.
    a) Standardization is a necessity
    b) Techniques for measuring a drug's strength and purity
    c) Classified by
        i) body system
        ii) class of agent
        iii) mechanism of actions
4) Differentiate among the chemical, generic, and trade names of a drug.
    a) Chemical name – a precise description of the drugs chemical composition and molecular structure
    b) Generic name or non-proprietary name

c) Official name approved by the FDA
   i) Usually suggested by the first manufacturer
d) Trade or proprietary name
   i) Brand name registered to a specific manufacturer or owner

5) List the four main sources of drug products.
   a) Plants
      i) Alkaloids
      ii) Glycosides
      iii) Gums
      iv) Oils
   b) Animals and humans
   c) Minerals or mineral products
   d) Chemical substances made in the laboratory
6) Discuss special consideration in drug treatment with regard to pregnant, pediatric and geriatric patients
   a) Pregnant patients
      i) Before using any drugs during pregnancy, the expected benefits should be considered against the possible risks
      ii) Many drugs are unknown to caused problems in animals or humans during pregnancy
      iii) Pregnancy causes a number of anatomical and physiological changes
   b) Pediatric patients
      i) Based on the child's weight or body surface area
      ii) Special consideration for neonates
   c) Geriatric patients
      i) The physiological effects of aging can lead to altered metabolism and effect of drugs

7) Discuss the EMT-Intermediate's responsibilities and scope of management pertinent to the administration of medications
   a) EMT-Intermediates are held responsible for safe and therapeutically effective drug administration
      i) Use correct precautions
      ii) Observe and document the effects of drugs
      iii) Keep their knowledge base current to changes and trends in pharmacology
      iv) Establish and maintain professional relationships
      v) Understand pharmacology
      vi) Perform evaluation to identify drug indications and contraindications
      vii) Seek drug reference literature
      viii) Take a drug history from their patients including
         (1) Prescribed medications
         (2) Over-the-counter (OTC) medications
         (3) Vitamins/herbal supplements
         (4) Drug reactions
         (5) Recreational drugs/alcohol
   b) Consult with medical direction
   c) EMT-Intermediates are personally responsible – legally, morally, and ethically – for each drug they administer
8) List and describe liquid, solid, and gas drug forms
   a) Liquid
   b) Solutions
   c) Tinctures
   d) Suspensions
   e) Spirits
   f) Emulsions
   g) Elixirs
   h) Syrups
   i) Solid drug forms
   j) Pills powders

k) Tablets
l) Suppositories
m) Capsules
n) Gas forms

9) List and differentiate routes of drug administration
   a) The mode of drug administration affects the onset of action and may affect the therapeutic response that results
   b) The choice of the route of administration is crucial in determining the suitability of a drug
   c) Routes of drug administration
      i) Enteral
         (1) Sublingual
         (2) Buccal
         (3) Oral
         (4) Rectal
         (5) Nasogastric
      ii) Parenteral
         (1) Inhalation
         (2) Nebulized medications
         (3) Subcutaneous
         (4) Intramuscular
         (5) Intravenous
         (6) Intrathecal
         (7) Pulmonary
         (8) Intralingual
         (9) Intradermal
         (10) Transdermal
         (11) Umbilical
         (12) Intraosseous
         (13) Nasal
         (14) Endotracheal

10) Differentiate between enteral and parenteral routes of drug administration.

11) Nervous system components

- a) Central nervous system
- b) Peripheral nervous system
  - i) Peripheral nervous system characteristics
    - (1) Somatic system
    - (2) Autonomic nervous system
      - (a) Autonomic nervous system characteristics
        - (i) Parasympathetic and sympathetic characteristics
        - (ii) Autonomic antagonists
        - (iii) Physiological antagonism between sympathetic and parasympathetic discharge-organ response
        - (iv) Sympathetic branch of autonomic nervous system
        - (v) Parasympathetic branch of autonomic nervous system
        - (vi) Direction of sympathetic influences
        - (vii) Altering neurotransmission with drugs
        - (viii) Receptor location and selective drug action
        - (ix) Autonomic neurotransmitters
          1. acetylcholine (cholinergic) receptor locations
          2. norepinephrine (adrenergic) receptor locations
             a. Alpha receptors
             b. Beta receptors
             c. Dopaminergic receptors
          3. receptor structure
          4. synaptic control mechanisms

12) Describe mechanisms of drug action.

- a) Concentration of the drug at its site of action is influenced by various processes, which are divided into three phases of drug activity.
  - i) Pharmaceutical Phase
    - (1) Disintegration of dosage forms
    - (2) Dissolution of drug

ii) Pharmacokinetic Phase
  (1) Absorption
  (2) Distribution
  (3) Metabolism
  (4) Excretion

iii) Pharmacodynamic Phase
  (1) To produce optimal desired or therapeutic effects. A drug must reach appropriate concentrations at its site of action.
  (2) Molecules of the chemical compound must proceed from point of entry into the body to the target tissues.
  (3) The magnitude of the response depends on the dosage and the time course of the drug in the body.

b) Pharmacokinetics
  i) Absorption
    (1) Variables that affect drug absorption
      (a) Nature of the absorbing surface
      (b) Blood flow to the site of administration
      (c) Solubility of the drug
      (d) PH
      (e) Drug concentration
      (f) Dosage form
      (g) Routes of drug administration
      (h) Bioavailability
  ii) Mechanisms involved in cellular absorption
    (1) Diffusion
    (2) Osmosis
    (3) Filtration
    (4) Passive transport
    (5) Active transport distribution

(6) Drug reservoirs
(a) Plasma protein binding
(b) Tissue binding
(7) Barriers to drug distribution
(a) Blood-brain barrier
(b) Placental barrier
(8) Factors altering distribution
(a) Age
(b) Body mass
(c) Gender
(d) Environmental
(e) Time of administration
(f) Pathologic state
(g) Genetic factors
(h) Psychologic factors

iii) Biotransformation
(1) Active metabolites
(2) Inactive metabolites

iv) Excretion
(1) Organs of excretion
(a) Kidneys
(b) Intestine
(c) Lungs
(d) Sweat and salivary glands
(e) Mammary glands

13) Pharmacodynamics: describe theories of drug action, drug-response relationship, factors altering drug responses, predictable and unpredictable drug responses.

a) Drug-receptor interaction
i) Agonists
(1) Drugs that interact with a receptor to stimulate a response

ii) Antagonists
  (1) Drugs that attach to a receptor but do not cause a response
  (2) Drugs that interact with a receptor to stimulate a response but inhibit other responses are called partial antagonists
iii) Affinity
iv) Efficacy
v) Types of receptors
  (1) Adrenergic
  (2) Cholinergic
  (3) Opioid
  (4) Others

b) Drug-response relationship
  i) Plasma level profile of a drug
  ii) Biologic half-life
  iii) Therapeutic threshold or minimum effective concentration
c) Predictable responses
  i) Desired action
  ii) Side effects
d) Unpredictable adverse responses
  i) Drug allergy
  ii) Anaphylactic reaction
  iii) Delayed reaction
  iv) Hypersensitivity
  v) Idiosyncrasy
  vi) Tolerance
  vii) Cumulative effect
  viii) Drug dependence
  ix) Drug interaction
  x) Synergism
  xi) Potentiation

e) Drug interactions
   i) Variables influencing drug interaction
      (1) Intestinal absorption
      (2) Competition for plasma protein binding
      (3) Drug metabolism or biotransformation
      (4) Action at the receptor site
      (5) Renal excretion
      (6) Alteration of electrolyte balance
   ii) Drug-drug interactions
   iii) Other drug interactions
   iv) Alcohol consumption
   v) Cigarette smoking

14) Discuss considerations for storing drugs.
   a) Refer to local protocol
      i) Moisture
      ii) Light sensitivity
      iii) Temperature
      iv) Shelf life

15) List and describe the drugs, which an EMT-Intermediate may administer.
   a) Acetylsalicylic acid
   b) Activated charcoal
   c) Amiodarone
   d) Analgesics
      i) Narcotic
         (1) Fentanyl
         (2) Morphine Sulfate
         (3) Nubain
      ii) Non-narcotic
         (1) Toradol
   e) Atropine sulfate
   f) Bronchodilators

   i) Albuterol
   ii) Ipratropium
   iii) Combivent
g) Dextrose, 50%
h) Diphenhydramine
i) Epinephrine, 1:1,000
j) Epinephrine, 1:10,000
k) Glucagon
l) Glucose, oral
m) Lasix
n) Lidocaine
o) Naloxone
p) Nitroglycerine
q) Nubain
r) Toradol
s) Vasopressin

16) Discuss procedures and measures to ensure security of controlled substances.
   a) Security of controlled substances
      i) Procedures and measures to ensure the security of controlled substances
      ii) Requirements for locking
      iii) Signing for/counting drugs
      iv) “Wasting” a controlled substance
      v) Security of DEA order forms
   b) Reporting a violation


This page intentionally left blank

Venous Access And Medication Administration

Terminal Objectives

The EMT-Intermediate will be able to safely and precisely access the venous circulation and administer medications.

Cognitive Objectives

1) Review the relevant peripheral vascular anatomy. (C-1)
2) Calculate basic mathematical problems utilized in pharmacology (C-3)
3) Apply formulas as a basis for performing drug calculations. (C-3)
4) Calculate oral and parenteral drug dosages for all emergency medications administered to adults, infants, and children. (C-3)
5) Discuss the role of medical direction in medication administration. (C-2)
6) Discuss legal aspects affecting medication administration. (C-2)
7) List the Rights of Medication Administration. (C-1)
8) Describe medical asepsis and the differences between clean and sterile techniques. (C-2)
9) Describe use of antiseptics and disinfectants. (C-2)
10) Explain the use of universal precautions and body substance isolation (BSI) procedures when administering a medication.
11) Explain the indications, contraindications, equipment needed, technique utilized, precautions and general principles of peripheral venous cannulation and intraosseous needle placement and infusion. (C-3)
12) Discuss the advantages and disadvantages for the various commercial intraosseous devices (FAST, EZ-IO). (C-2) – Enhanced objective
13) Explain the indications, contraindications, equipment needed, techniques utilized, precautions, and general principles of administering medications by the inhalation route, and oral route. (C-3)
14) Explain the equipment used and the procedure for the administration of parenteral medications. (C-3)
15) Define the different forms and measurements of oral medications. (C-1)
16) Compare and contrast each parenteral route of medication administration. (C-6)

17) Explain the procedure for the administration of medications through the subcutaneous, intramuscular and intravenous routes. (C-2)
18) Describe the equipment needed, techniques utilized, precautions, and general principles for obtaining a blood sample. (C-2)
19) Describe disposal of contaminated items and sharps. (C-2)
20) Integrate pathophysiological principles of medication administration with patient management. (C-4)

Affective Objectives

1) Defend a pharmacologic management plan for medication administration. (A-3)
2) Appreciate the necessity of universal precautions and body substance isolation (BSI) (A-1).
3) Comply with EMT-Intermediate standards of medication administration. (A-2)

Psychomotor Objectives

1) Use universal precautions and body substance isolation (BSI) procedures during medication administration. (P-2)
2) Demonstrate cannulation of peripheral veins, intraosseous needle placement and infusion. (P-3)
3) Demonstrate the placement of the various commercial IO devices. (P-2) – Enhanced objective
4) Demonstrate clean technique during medication administration of parenteral medications.(P-3)
5) Demonstrate administration of medications by inhalation and oral routes. (P-3)
6) Demonstrate preparation and techniques for obtaining a blood sample and appropriate disposal of contaminated items and sharps. (P-3)
7) Given various scenarios: (P-4)
   a) Follow correct procedures in preparing a medication for administration.
   b) Verbalizes the understanding the Rights of Medication Administration.
   c) Follow the procedure of administering an IV/IO bolus medication.
   d) Demonstrate the procedure of administering an intramuscular medication.

e) Demonstrate the procedure of administering a nebulized medication.
f) Demonstrate the procedure of administering a sublingual medication.
g) Demonstrate the correct care and disposal of a contaminated needle/syringe.
h) Demonstrate accurate record-keeping for controlled substances.
i) Demonstrate correct technique for “wasting” a controlled substance.

Declarative

1) Review the relevant peripheral vascular anatomy
   a) Location of veins
      i) Dorsum of the hand
      ii) Lower arm
      iii) Antecubital fossa
      iv) Dorsum of the foot
      v) Neck
2) Calculate basic mathematical principles utilized in pharmacology
   a) Basic mathematical principles
      i) Multiplication and division
      ii) Decimals
      iii) Fractions
   b) Mathematical equivalents used in pharmacology
      (1) The metric system
      (2) Conversion from U.S. to metric (lb – kg, inches – cm)
   c) Parenteral medications
      i) Quantity (typically weight)
         (1) Grams
         (2) Milligrams
         (3) Micrograms
      ii) Volume
         (1) Liter
         (2) Milliliter
      iii) Units (i.e., insulin)

3) Apply formulas as a basis for performing drug calculations
    a) Calculation methods
        i) Fraction method
        ii) Ratio method
        iii) Desired dose over available concentration method
    b) Calculating dosages
        i) Oral medication
        ii) Capsules and tablets
        iii) Liquids
    c) Calculate intravenous infusions
        i) Medication flow rates
        ii) Medication flow rates for infants and children
4) Calculate intravenous medication administration for adults, infants, and children.
    a) Body weight
    b) Use of tablets, charts, and other adjuncts
    c) Length-based resuscitation tapes
5) Discuss the legal aspects affecting medication administration
    a) Medical Direction
        i) Role of the medical director
        ii) Off-line medical direction
            (1) Patient management protocols
            (2) Written standing orders
        iii) On-line medical direction
    b) Other legal considerations
        i) System and agency policies and procedures
        ii) State and federal regulations
6) The Rights of Medication Administration
    a) Right patient
    b) Right drug
    c) Right dose
    d) Right route

e) Right time
f) Right documentation
g) Right to refuse

7) Describe medical asepsis and the differences between clean and sterile techniques
   a) Medical asepsis
      i) Definition
      ii) Description and application to the prehospital environment
   b) Clean technique versus sterile technique
   c) Sterilization
8) Describe the use of antiseptics and disinfectants
   a) General indications for their use
      i) Routine cleaning
      ii) Contaminated equipment
9) Explain the use of universal precautions and body substance isolation (BSI) when administering a medication
   a) Handling of sharps
   b) Use of gloves
10) Explain the indications, contraindications, equipment needed, techniques utilized, precautions and general principles of peripheral venous cannulation and intraosseous needle placement and infusion
   a) Intravenous cannulation of the extremities
      i) General principles
      ii) Indications
      iii) Contraindications
      iv) Precautions
      v) Equipment
      vi) Procedure
   b) Intravenous cannulation of the external jugular
      i) Indications
      ii) Precautions

iii) Equipment
(1) IV catheters
(a) Sizes and indications
(b) Butterfly needles
(c) Angiocaths
(2) Intravenous (IV) administration sets
(a) Types
(i) Macrodrip chamber type
(ii) Microdrip chamber type
(iii) Extension sets
(iv) Locks
(v) Volume control intravenous sets
1. Types
a. Solu-sets
b. Buretrol
(b) Indications for use
(c) Intravenous (IV) solutions
(i) Types of containers
(ii) Typical volumes
(iii) Types of solution
1. Isotonic
2. Hypotonic
iv) Procedure

c) Intraosseous needle placement and infusion
i) Indications
(1) Adult
(2) Pediatric
ii) Precautions
iii) Equipment
(1) Jamshidi IO needles (Pediatric)
(2) FAST IO (Adult) - Enhanced

(3) EZ-IO - Enhanced

(a) Adult

(b) Pediatric

iv) Procedure

(1) Pediatric

(2) Adult

11) Explain the indications, contraindications, equipment needed, techniques utilized, precautions and general principles of administering medications by the inhalation route and oral route

a) Medications administered by the inhalation route

i) Indications

(1) Bronchoconstriction

(2) Use of bronchodilators

ii) Precautions and contraindications

iii) Equipment utilized

(1) Oxygen or compressed air source

(2) Small volume nebulizer device

(3) Other inhaler equipment

(4) Adapters for bag-valve mask devices

iv) Technique

(1) Assembly of the nebulizer

(2) Medication placement

(3) Oxygen flow

(4) Patient instructions

b) Oral medication administration

i) Indications

ii) Precautions and contraindications

iii) Equipment utilized

(1) Medicine cup

(2) Medicine dropper

(3) Teaspoons

(4) Oral syringes

(5) Nipples

c) General principles

(1) Airway patency

(2) Absorption factors

12) Define the different measurements and forms of oral medications

a) Capsules and time-released capsules

b) Lozenges

c) Pills

d) Tablets

e) Elixirs

f) Emulsions

g) Suspensions

h) Syrups

13) Compare and contrast each parenteral route of medication administration

a) Routes of parenteral medications used by EMT-Intermediates

i) Intramuscular (IM)

ii) Intravenous (IV) bolus

iii) Intravenous infusion

iv) Intraosseous (IO)

v) Sublingual (SL)

b) Rates of absorption for each route listed above

c) Scenarios

i) Discussion of cost versus benefit for parenteral routes for the following patient conditions:

(1) Circulatory compromise

(2) Anaphylaxis

(3) Hypothermia

(4) Elderly

14) Explain the equipment used and the procedure for the administration of parenteral medications
    a) Equipment utilized
        i) Syringes
            (1) Calibration of the syringe
            (2) Prefilled syringe
        ii) Needles
            (1) Parts of the needle
            (2) Filter needle
            (3) Sizes
                (a) Selection for IM, IV, SQ routes
        iii) Packaging of parenteral medications
            (1) Ampules
            (2) Vials
            (3) Prefilled syringes
            (4) Other
    b) Standard procedures for preparing all parenteral medications
    c) Removal of medications
        i) Prefilled syringes
        ii) Ampule
        iii) Multi-dose vial
        iv) Mix-o-vial
15) Explain the procedure for the administration of a medication through the subcutaneous, intramuscular and intravenous routes
    a) Subcutaneous route
        i) Anatomical sites
            (1) Upper arm
            (2) Anterior thigh
            (3) Abdomen
        ii) Precautions
            (1) Up to 1mL may be administered

iii) Procedure

(1) Cleanse the area

(2) Pinch the skin

(3) Insert syringe at a 45-degree angle

(4) Draw back on plunger to confirm placement

(5) Administer medication

(6) Remove syringe

b) Intramuscular route

i) Anatomical sites

(1) Vastus lateralis muscle

(2) Rectus femoris muscle

(3) Gluteal area

(4) Deltoid muscle

ii) Precautions

(1) Placement of needle on a nerve

(2) Placement of needle into a blood vessel

iii) Procedure

(a) Cleanse the area

(b) Insert syringe at a 90-degree angle

(c) Draw back on plunger to confirm placement

(d) Administer medication

(e) Remove syringe

c) Intravenous route

i) Administration sites

(1) Peripheral IV lines

(a) Intravenous

(b) Intraosseous

(2) Medication is placed directly into the bloodstream

ii) Precautions/Complications

(1) Rapid administration and adverse effects

(2) Extravasation of the medication into the tissue

(3) Allergic reaction

(4) Phlebitis

(5) Potential introduction of an air embolus

d) Procedure

16) Describe the equipment needed, techniques utilized, precautions and general principles for obtaining a blood sample

a) Indication

b) Equipment

c) Anatomical sites

i) From the established intravenous catheter

ii) Antecubital fossa

d) Procedure

e) Precautions

17) Describe the disposal of contaminated items and sharps


This page intentionally left blank

AIRWAY MANAGEMENT

Cognitive Objectives

1) Identify the anatomy and physiology of the upper and lower airways. (C-1)
2) Discuss the role of the medulla and chemoreceptors in the control of ventilation. (C-2)
3) Describe the normal arterial partial pressures of PaO_2, $PaCO_2$, and pH, explaining their significance and relationship to respiratory compromise and/or disease. (C-3)
4) Associate respiratory volumes and capacities in relationship to the need for assisted ventilations in the following medical presentations. (C-3)
   a) Asthma
   b) Pulmonary edema
   c) COPD
5) Discuss the specific observations and physical findings to be evaluated in patients with respiratory complaints. (C-3)
6) Summarize specific observations and physical findings commonly found in patients presenting in respiratory and/or cardiac arrest. (C-5)
7) Discuss the basic principles of airway management. (C-5)
8) Describe the indications for suctioning and identify rigid and flexible suction catheters and the indications for their use. (C-3)
9) Determine the indications and contraindications for the use of the pharyngeal/esophageal airway device (PEAD) (C-4)
10) Determine the advantages and disadvantages of using the pharyngeal/esophageal airway device (PEAD). (C-4)
11) Explain under what situations the PEADs may be removed in the prehospital setting. (C-3)
12) List the indications and contraindications for the use of the Supralaryngeal Airway Device (e.g King Airway) (C-1) – Enhanced Objective
13) Determine the advantages and disadvantages of using the Supralaryngeal Airway Device (e.g. King Airway) (C-2)
14) Explain under what situations the Supralaryngeal Airway may be removed in the prehospital setting. (C-3) – Enhanced Objective

Affective Objectives

Upon completion of this unit, the student will have:

1) Compassion for the patient in respiratory distress. (A-3)
   a) Appreciation for the feeling of distress a patient manifests who finds themselves being ventilated by an EMT (A-3)
   b) Acknowledge the need for rapid assessment and management of the patient in respiratory distress. (A-3)

Psychomotor Objectives

1) Demonstrate placement of the PEAD pharyngeal esophageal airway device. (P-5)
2) Demonstrate the method of assuring and maintaining correct placement of the PEAD and re-ventilation for missed placement of the PEAD. (P-4)
3) Demonstrate correct removal techniques for the PEAD device in the patient regaining consciousness and not tolerating the device. (P-4)
4) Demonstrate placement of the Supralaryngeal Airway Device (e.g. King Airway). (P-2) – Enhanced Objective
5) Demonstrate the method of assuring and maintaining correct placement of the Supralaryngeal Airway Device (e.g. King Airway). (P-2) – Enhanced Objective
6) Demonstrate correct removal technique for the Supralaryngeal Airway Device (e.g. King Airway). (P-2) – Enhanced Objective

Declarative

1) Anatomy and physiology
   a) The upper airway
      i) General function
         (1) Remove carbon dioxide from the blood
         (2) Transfer oxygen into the blood
      ii) Structures
         (1) Nose
         (2) Nasopharynx
         (3) Mouth
         (4) Oropharynx
         (5) Hypopharynx

(6) Larynx

(7) Epiglottis

iii) Functions

(1) Passage for air

(2) Warms

(3) Humidifies

(4) Filters protection

(a) Gag reflex

(b) Cough

(5) Speech

b) The lower airway

i) Function

(1) Air passage

(2) Gas exchange

(3) Warm

(4) Humidify

ii) Structures

(1) Trachea

(2) Main stem bronchi

(3) Secondary bronchi

(4) Bronchioles

(5) Alveoli

c) The lungs

i) Structure

(1) Location within the thoracic cavity

(2) Lobes of each lung

(3) Pleura

(4) Blood supply

(5) Musculoskeletal system

d) Mechanics of respiration/ventilation

i) Definitions

(1) Respiration

(a) Exchange of air between atmosphere and cells

(b) Gas exchange facilitated by diffusion

(2) Ventilation

(a) Exchange of air between atmosphere and lungs

(b) Mechanical process

ii) Respiratory cycle

(1) Inspiration

(a) Active phase

(i) Muscles contract

(ii) Chest expands

(iii) Lowers internal pressure

(iv) Atmospheric pressure forces air to enter

(v) Lasts approximately 1 – 2 seconds

(2) Expiration

(a) Passive phase

(i) Chest relaxes

(ii) Pressure increases

(iii) Air expelled

(iv) Recoil of alveoli

(v) Lasts approximately 5 seconds

iii) Control of respiration

(1) Brain stem

(a) Receives input from central and peripheral chemoreceptors

(i) pH, carbon dioxide and oxygen

(b) Output performed by the medulla

(2) Diaphragm and intercostal muscles

(a) Mechanical assistance

(b) Controlled by the medulla

(c) Role of stretch receptors in regulation

(3) Voluntary vs. involuntary control

(4) Regulation of respiration by chemoreceptors

(a) Location

(i) Central

1. Medulla
2. Cerebrospinal fluid

(ii) Peripheral

1. Carotid bodies
2. Aortic arch

(b) Function

(i) Monitor carbon dioxide levels in the blood

(ii) Monitor pH levels in cerebrospinal fluid (CSF)

(iii) High CO_2 increases respiratory activity

(iv) Low CO_2 decreases respiratory activity

(c) Response to oxygen levels when the CO_2 receptors fail

(i) Drop of arterial oxygen saturation below 85% will stimulate respiratory activity

(ii) Long-term smoking desensitizes CO_2 receptors

1. Hypoxic drive in emphysema

2) Oxygen and carbon dioxide measurements

a) Oxygen saturation

i) Measurable with pulse oximeter measurement

(1) An assessment tool only

(2) May provide false readings

(3) Gives the percent of hemoglobin saturated

(4) Should be close to 100%

(5) If below 90%, may require intervention with oxygen and ventilation

b) Partial pressure of oxygen in an artery (PaO_2)

i) Measured in hospital blood gases

ii) Partial pressure based on total atmospheric pressure being 760 mm/Hg; oxygen is 21% of atmosphere or 160mmHg

iii) Oxygen in artery this is part of the total of 760 mmHg

iv) Normal range is 80-100 mmHg

v) Readings below indicate hypoxemia

c) The hypoxic drive in COPD patients
   i) The importance of the hypoxic drive
   ii) Review of conditions predisposing the patient to reliance on hypoxic drive
      (1) COPD
      (2) Smoking
d) Partial pressure of carbon dioxide in an artery ($PaCO_2$)
   i) Another blood gas measurement
   ii) Normal range is 35-45 mmHg
   iii) High CO_2 means hypoventilation and requires intervention
   iv) Low CO_2 means hyperventilation and may also require intervention
   v) End-tidal CO_2 detector
      (1) Types of detectors
         (a) Capnometry
            (i) Measures the quantity of exhaled CO_2 at the alveoli
               1. Color-based devices (“Easy Cap”)
            (ii) Typically used for confirmation of PEAD or tracheal tube placement
         (b) Capnography
            (i) Measures the quantity of exhaled CO_2 and graphs the removal of CO_2 during the stages of exhalation
               1. Hand-held capnography or in-line devices (Lifepak 12, Zoll, etc.)
            (ii) Uses
               1. Confirmation of PEAD or tracheal tube placement
               2. Monitoring device for bronchoconstriction
                  a. Graphs severity
                  b. Graphs changes to bronchoconstriction
      (2) Measures CO_2 levels delivered to the alveoli
      (3) A more accurate measurement of respiration than pulse oximetry
e) pH

3) Respiratory volume and management
   a) Respiratory rates, volume, and capacities
      i) Measures of respiratory function

(1) Normal ventilatory rates

(a) Adults, 12-20 times per minute

(b) Children, approximately 18-24 times per minute

(c) Infants, may be 22-36 times per minute

(d) Newborns, 40-60 times per minute

ii) Factors affecting respiratory rate

(1) Fever – increases

(2) Anxiety – increases

(3) Insufficient oxygen – increases

(4) Depressant drugs – decreases

(5) Sleep - decreases

iii) Volumes (adult males)

(1) Lung capacity of 6 liters

(2) Tidal volume

(a) One breathing cycle

(b) About 500 ml of air at rest

(3) Dead air space

(4) Approximately 150 ml

(a) Increased dead air space in emphysema and asthma

(5) Alveolar air approximately 350 ml reach alveoli for gas exchange

(6) Minute volume (mv)

(a) Total air moved per minute

(b) Rate x volume – mv

(c) Important assessment item

(7) Factors affecting minute volume

(a) Head, neck and chest injuries

(b) Shock states

(c) Diabetic conditions

(d) Pulmonary edema

(e) Respiratory disease

(i) COPD and asthma

1. Increase in rate as compensation in respiratory distress
2. Distended alveoli will not allow for increase in tidal volume

(f) Any condition in which CO_2/O_2 are increasing or decreasing markedly

4) Assisting ventilation and oxygenation
   a) Airway control and management
   b) Suctioning
   c) Patient positioning
   d) Supplemental oxygen
   e) Mechanical assistance

Assessing respiratory problems

1) General assessment
   a) Scene Size Up
      i) Environmental causes
      ii) Clues to the potential cause and severity of the dyspnea
         (1) Oxygen equipment
         (2) Inhalers, cold medicines, tissues
         (3) # of pillows on bed, recliner
         (4) Cigarette packs and ashtrays
         (5) Industrial sites
   b) General Impression
      i) Level of consciousness
      ii) Patient position
      iii) Skin color
      iv) Body type
      v) Effort with breathing and speaking
      vi) Audible lung sounds
   c) Initial Assessment
      i) Level of consciousness
         (1) Need for ventilatory support
      ii) Adequacy of airway and breathing

(1) Minute volume
(2) Pursed-lip breathing

iii) Need for ventilatory support

d) Adequacy of circulation
   i) Pulse quality and rate

e) Focused History
   i) SAMPLE history
   ii) Chief complaint (dyspnea, orthopnea)
   iii) Chest pain related to breathing (pleuritic)
   iv) Cough history, color of sputum
   v) Edema

f) Vital signs

g) Focused Physical: Inspection
   i) Confusion, agitation, orientation
   ii) Cyanosis
   iii) Diaphoresis
   iv) Retractions (suprasternal, intercostals, subcostal)
   v) Use of accessory muscles
   vi) Jugular venous distention
   vii) Nasal flaring
   viii) Tracheal tugging
   ix) Signs of trauma or scars on chest
   x) Pedal edema
   xi) Dehydration (furrowed tongue, sunken eyes, skin tenting, dry mucous membranes)

h) Focused Physical: Palpation
   i) Skin turgor, color, temperature, diaphoresis
   ii) Pulse rate, rhythm, quality
   iii) Chest wall pain, symmetry
   iv) Tracheal deviation

i) Focused Physical: Auscultation of lungs
   i) Breath sounds

(1) Present
(2) Equal
(3) Abnormal sounds
(a) Crackles
(b) Wheezes
(c) Correlate with history if possible

j) Assessment of Patient Medications
i) Respiratory medications
(1) Short-term inhalers
(2) Long-term inhalers
(3) Oral respiratory medications
(a) Reveals the need for long-term control of the disease
(i) Steroid anti-inflammatories
(ii) Theophylline-type drugs
(4) Antibiotics
(5) Cardiac medications
(a) May suggest CHF as the cause for the dyspnea
(i) Nitrate drugs
(ii) Anti-hypertensive drugs
(iii) Digoxin

Airway Procedures in Respiratory and Cardiac Arrest

1) Respiratory and cardiac arrest
a) Observations/physical findings
i) Quickly becomes unconscious
ii) May appear to have seizure initially
iii) No air movement at nose or mouth, or agonal respirations
iv) Skin color worsens quickly
v) No chest movement except if conscious with foreign body in the airway
vi) No carotid pulse if in cardiac arrest
b) Protocol introduction
i) Cardiac arrest is the most common indication for the PEAD

ii) Integration in
iii) CPR is indicated when pulse is absent
iv) The defibrillator should be attached as soon as possible if patient is pulseless
v) Start an IV as soon as possible
vi) Administer appropriate medication
vii) Continually reassess airway and breathing
viii) Keep high flow oxygen going as you ventilate the patient
ix) Suction as needed

2) Review of the basic principles of airway management
   a) Manual maneuvers
      i) Advantages, disadvantages and indications
         (1) Head-tilt, chin lift
         (2) Jaw lift
         (3) Jaw thrust
      ii) Mechanical airways
         (1) Nasal airways (nasopharyngeal)
         (2) Oral airways (oropharyngeal)
   b) Ventilation methods and devices
      i) Advantages, disadvantages and methods of use
         (1) Mouth-to-mask devices
         (2) Bag-valve mask resuscitator
      ii) Evaluation of effectiveness
         (1) Chest movement
         (2) Lung sounds
         (3) Stomach noises/distention
         (4) Patient response
   c) Suctioning
      i) Indications for suction
         (1) Vomitus and food
            (a) Contents
               (i) Partially digested food

(ii) Protein-dissolving enzymes

1. Stomach acid (hydrochloric acid)

(b) Mechanism of damage

(i) Damage to alveolar walls

(ii) Fluid shifts into the alveoli

(iii) Contents of vomit may cause infection

(c) Results

(i) May obstruct airways at any level

(ii) Can cause severe pneumonia

(iii) Impaired gas exchange and hypoxia

(2) Saliva

(a) Contents – digestive enzymes, bacteria

(b) Results

(i) Fills alveoli

(ii) Interferes with ventilation by blocking small airways

(i) Pneumonia

(3) Blood

(a) Contents

(i) Protein

(ii) Fibrin

(iii) Water

(iv) Electrolytes

(b) Results

(i) Clogs small airways

(ii) Irritates mucous membranes

(iii) Causes chemical reactions that cause airway damage

ii) Suction catheters

(1) Rigid or Yankaur suction

(2) Review of advantages, disadvantages and methods of use

Pharyngeal/Esophageal Airway Device – PEAD – adult and small adult size

1) Pharyngeal/Esophageal Airway Devices (PEAD)
   a) Description of devices
      i) PEAD SA
      ii) PEAD
   b) Indications for use
      i) Respiratory arrest
      ii) Cardiac arrest
      iii) Unconscious, without a gag reflex
   c) Contraindications
      i) Gag reflex
      ii) Conscious
      iii) Breathing adequately
      iv) Caustic ingestions
      v) Known esophageal disease or varices
      vi) Under 16 years of age
      vii) Under 5 feet or over 6 feet 8 inches for adult size PEAD
      viii) Under 5 feet or over 5 feet 6 inches for small adult PEAD
   d) Advantages
      i) Rapid insertion
      ii) Limits regurgitation, aspiration, and stomach distention
      iii) “blind” insertion
      iv) Permits delivery of high O_2 concentration
      v) Requires less training than endotracheal intubation
      vi) Can be inserted with neck in neutral position
   e) Disadvantages
      i) Patient must be unresponsive without a gag reflex
      ii) Not recommended for use in children under 16 years old
      iii) Most responsive patients will vomit when airway is removed.
      iv) May damage the esophagus
   f) Maintaining patency of PEAD

i) Flexible suctioning
   (1) Advantages
   (2) Disadvantages
      (a) Smaller bore
   (3) Indications
   (4) Contraindications
   (5) Methods of use

2) Indications for removal of PEAD
   a) Failure of airway device
   b) Patient regains consciousness and begins breathing adequately with an intact gag reflex
   c) Patient regains consciousness and gag reflex, is not breathing adequately but is unable to tolerate device

Supralaryngeal Airway Device (e.g. King Airway) – Enhanced

1) Description of device
   a) Oropharyngeal airway device
      i) Single-lumen, 2-cuff device
      ii) Not designed for esophageal placement
   b) 3 sizes based upon patient's height
   c) Indications for use
      i) Patients over 4' in height
      ii) Unconscious, without a gag reflex
      iii) Respiratory and/or cardiac arrest
   d) Contraindications
      i) Opiate overdose that may be reversed with naloxone
      ii) Gag reflex
      iii) Conscious
      iv) Breathing adequately
   e) Advantages
      i) Rapid insertion

ii) "blind" insertion

iii) Permits delivery of high O_2 concentration

iv) Requires less training than endotracheal intubation

v) Cuffs require less air than the PEAD – reduced potential for airway trauma

f) Disadvantages

i) Does not protect the airway from regurgitation or aspiration

ii) High airway pressures may divert air into the stomach

iii) Patient must be unresponsive without a gag reflex

g) Procedure for insertion

i) Pre-oxygenate the patient

ii) Select the appropriate size for the patient

iii) Test the patency of the cuffs prior to placement

iv) Apply lubricant to the distal end of the device

v) Place the head in the neutral or "sniffing" position

vi) Hold the Supralaryngeal Airway with the dominant hand and use the other hand to perform a chin lift and to hold the mouth open

vii) With the Supralaryngeal Airway rotated 45-90 degrees, insert the device at the corner of the mouth and advance it to the base of the tongue

viii) Rotate the tube back to midline as the tip reaches the posterior wall of the pharynx

ix) Gently advance the tube until the base of the BVM connecter is aligned with the teeth or gums

x) Inflate the cuffs

xi) Attach the BVM and begin ventilation

xii) While ventilating the patient, simultaneously withdraw the tube until ventilation is easy and free-flowing

xiii) Note the reference mark on the tube on that aligns with the teeth

xiv) Confirm placement by auscultation, adequate chest rise and end-tidal CO_2 monitoring

xv) Secure the Supralaryngeal Airway with tape or a bite block

h) Removal of the Supralaryngeal Airway

i) Have suction available and suction the mouth as needed prior to removal

ii) Fully deflate the cuffs

iii) Remove the Supralaryngeal Airway, avoiding the teeth

AIRWAY DISEASE

Cognitive Objectives

1) Discuss the physiology of ventilation and respiration as it pertains to airway disease. (C-5)
2) Identify common pathological events that affect the pulmonary system. (C-2)
3) Explain how effective assessment is critical to clinical decision-making in the airway management of the respiratory distress patient. (C-5)
4) Explain how hypoxic patients affect assessment and decision-making. (C-4)
5) Determine the general approach, patient assessment, and management priorities for patients who are complaining of dyspnea. (C-4)
6) Discuss normal and abnormal assessment findings associated with airway disease. (C-4)
7) Compare various airway and ventilation techniques used in the management of airway disease. (C-4)
8) Discuss the pharmacological preparations that EMT-Intermediates use for the management of airway disease. (C-4)
   a) Albuterol
   b) Atrovent
   c) Epi 1:1000
   d) Combi-vent
   e) Lasix
9) Review the equipment used during the physical examination of patients with complaints associated with airway diseases and conditions. (C-1)
10) Describe the epidemiology, pathophysiology, assessment findings and management for the following respiratory diseases and conditions. (C-5)
   a) Asthma
   b) Chronic bronchitis
   c) Pneumonia
   d) Pulmonary edema
   e) Pleural effusion
   f) Congestive heart failure (covered in greater extent in cardiac section).
   g) ARDS

11) Differentiate between critical life threatening, potentially life-threatening, and non life-threatening patient presentations. (C-3)

Affective Objectives

1) Realize the critical nature of accurate field impressions of patients with respiratory diseases and conditions. (A-3)
2) Appreciate the use of scenarios to develop a high level of clinical decision-making. (A-3)
3) Practice the process of complete patient assessment in respiratory distress patients. (A-4)
4) Recognize, assess and treat the patient in respiratory distress from airway disease. (A-3)

Psychomotor Objectives

1) Demonstrate and record pertinent assessment findings associated with airway diseases and other pulmonary diseases and conditions. (P-4)
2) Demonstrate proper use of airway, ventilation and nebulizer devices. (P-5)
3) Demonstrate the placement and operation of a CPAP device (P-2) - Enhanced
4) Conduct a simulated history and patient assessment, record the findings and appropriately manage patients with airway diseases, other pulmonary diseases and conditions. (P-4)

Declarative

1) Application of respiration and ventilation to airway disease
   a) Interruption or interference of ventilation and respiration may be caused by a variety of mechanisms
   b) Examples of interference
      i) Thickening of the alveoli membranes can decrease diffusion of gases
      ii) Fluid accumulation in the alveoli will decrease diffusion of gases
      iii) Bronchoconstriction will interfere with removal of carbon dioxide
      iv) Mucus accumulation in the lower airway will decrease delivery of oxygen to the alveoli
      v) Infection can cause obstruction of the airway

vi) Trauma to the thoracic area may impair ventilation

c) Implications of interference

i) Reduction of oxygen delivery to the body cells

ii) Hypoperfusion and shock

2) Common pathological causes that affect the pulmonary system

a) Genetic causes

i) Asthma, COPD, cardiac-related

b) Smoking

c) Exposure to environmental elements

i) Black Lung disease, Asbestos, dust

3) Signs of potentially life-threatening presentations in respiratory disease

a) Change in LOC

b) Cyanosis

c) Absent or noisy breath sounds

d) Tripod positioning

e) Use of accessory muscles

4) Hypoxia

a) The brain is particularly sensitive to decreased supply of oxygen

b) Significant deprivation of oxygen causes marked decrease in mentation

c) Changes in mentation can cause the patient to underestimate their degree of illness

d) Changes in mentation may affect the patient's ability to think rationally

5) General assessment for dyspnea

a) Scene size up

i) Clues to the cause and severity of the dyspnea

ii) Cause may relate to environmental or hazardous environments

(1) EMT safety considerations

b) General impression

i) Patient's LOC

ii) Patient position

iii) Pallor of the skin

iv) Effort required for breathing and/or speech

v) Audible lung sounds

c) Initial assessment

i) Focus on recognizing and treating immediate life threats (Airway, airway, airway!)

d) Focused history

i) Led by the chief complaint

ii) SAMPLE and OPQRST history.

iii) History should lead up to the physical exam of patient

e) Focused Physical

i) Vitals,

ii) Lung sounds,

iii) Exam of chest wall for injury, surgical scars and use of accessory muscles

iv) Presence of pedal edema

f) Management considerations

i) Oxygen administration

ii) Transportation decisions (load and go v. stay and play)

iii) Patient positioning

iv) Medication administration

6) Review of normal respiratory rates and breath sounds.

7) Abnormal assessment findings in airway disease

a) Altered LOC

b) Abnormal rates and types of breathing

i) Kussmaul

ii) Cheyne-Stokes

iii) Ataxic (Biot's)

iv) Apneustic

v) Apnea or Eupnea

vi) Central neurogenic hyperventilation

c) Abnormal breath sounds

i) Stridor

ii) Snoring respirations

iii) Wheezing

iv) Crackles (rales)
v) Rhonchi (rattling)
vi) Pleural rub

d) Use of accessory muscles, retractions, tracheal tugging
e) Cyanosis
f) Carpopedal spasm of fingers or toes indicating hyperventilation
g) Clubbing of the fingers
h) Pulsus Paradoxus

8) Airway and ventilation techniques used in the management of airway disease
a) Oxygen delivery devices
i) OXYGEN SHOULD NEVER BE WITHHELD FROM A PATIENT IN RESPIRATORY DISTRESS REGARDLESS OF THE UNDERLYING DISEASE CONDITION
ii) Nasal cannula
(1) Well tolerated
(2) Contraindicated for patients in respiratory distress
iii) Non-rebreather mask:
(1) High concentration of oxygen delivery at 10-15L/min delivery of O2
(2) Contraindications
(a) Apneic patients
(b) Severe hypoxia or poor respiratory effort
iv) Humidified oxygen
b) Ventilation devices
i) Mouth to mask
(1) Provides greater degree of effective ventilation over BVM device
ii) Ventilation by bag-valve mask (BVM)
(1) Indicated for apneic patients or those with compromised respiratory rates/efforts
(2) Provides positive pressure to the patient
(3) Provides a sense of compliance of the patient's lungs
(4) Precaution
(a) Can be very distressing when used on a conscious patient

iii) Continuous Positive Airway Pressure Device (CPAP)
  (1) Non-invasive airway device
  (2) Allows positive pressure ventilation to be delivered to a conscious patient
    (a) Keeps bronchi and bronchioles open for easier ventilation by the patient
    (b) Able to push fluid out of the bronchi, bronchioles and alveoli
  (3) May be used for acute pulmonary edema associated with volume overload, asthma and COPD, Near Drowning
    (a) Relative contraindications
      (i) Decreased LOC
      (ii) Claustrophobia
      (iii) Patient intolerance
    (b) Absolute contraindications
      (i) Imminent or absolute respiratory arrest
      (ii) Cardiogenic shock
      (iii) Pneumothorax
      (iv) Facial trauma or anomalies that interfere with mask seal
    (c) Clinical considerations
      (i) Gastric distension
      (ii) Corneal drying
      (iii) Hypotension
      (iv) Pneumothorax
    (d) Consult local protocols for specific applications
  (4) Precautions
    (a) Requires a spontaneously breathing patient
    (b) Potential for over-inflation of the lungs and pneumothorax in COPD and asthma
    (c) Not effective with lung injuries (pulmonary contusion, pneumothorax)
iv) Dual lumen ventilation device or oropharyngeal airway device
  (1) PEAD or Supralaryngeal Airway (King airway)
    (a) Indications
    (b) Contraindications

9) Prehospital medications for the management of airway disease
   a) Classification, actions, indications, contraindications, side effects, precautions, dosage, and route for the following
      i) Albuterol (Proventil, Ventolin)
      ii) Ipratropium (Atrovent, Combi-vent)
      iii) Epinephrine 1:1000
      iv) Epinephrine 1:10,000
      v) Furosemide (Lasix)

10) Equipment used during the physical examination of the patient with complaints associated with airway disease
   a) The EMT-INTERMEDIATE! Your eyes, ears, sense of touch etc.
   b) Stethoscope for auscultation of the lungs
   c) Blood pressure cuff
   d) Pulse Oximeter
   e) Capnography (end tidal CO_2 monitor)

Airway Disease Profiles

11) Chronic obstructive pulmonary disease (COPD)
   a) Emphysema and chronic bronchitis
   b) Emphysema; permanent damage to the alveoli
      i) Loss of elasticity and resultant loss of recoil
      ii) Loss of alveolar surface area and thickened walls
      iii) Decreased efficiency for gas exchange
   c) Chronic bronchitis
      i) Increased number of mucus-secreting cells in the respiratory tree
      ii) Chronic infection of bronchioles cause thickening of walls
         (1) Narrowed diameter and mucus decreases oxygen delivery to the alveoli
   d) Assessment and management
      i) Moderate versus severe stages of chronic COPD
         (1) Home oxygen
         (2) Medications
         (3) Baseline findings and changes

ii) Decompensation potential with respiratory infections

iii) Lung sounds

(1) Diminished

(2) Wheezes

(3) Rhonchi

iv) Oxygen therapy

(1) Begin with low-flow oxygen (unless cyanotic)

(2) Consider humidified oxygen

v) Medication nebulizer with albuterol, Atrovent.

vi) Position of comfort, IV, transport

12) Adult Respiratory Distress Syndrome (ARDS)

a) Form of pulmonary edema

i) Fluid accumulation in the interstitial spaces and alveoli in the lung

b) Causes

i) Severe infection or injury

(1) Pneumonia

(2) inhalation injury

(3) Burns

(4) Aspiration of foreign substance

(5) High altitude sickness

(6) Hypothermia

(7) Post-resuscitation of cardiac arrest

ii) Development of ARDS is typically delayed in its onset

c) Assessment

i) Respiratory distress

(1) Tachypnea and dyspnea

(2) Tachycardia

ii) Lung sounds

(1) Crackles

(2) Wheezes

iii) Other signs may appear from the underlying cause of ARDS

d) Management
   i) High-flow oxygen
   ii) Consider the need for assisted ventilations
   iii) IV therapy
      (1) Caution with rate of fluids
      (2) Pulmonary edema may worsen
   iv) Position of comfort
   v) Transport

13) Asthma

a) Pathophysiology
   i) Irritation of the bronchioles
   ii) Bronchiole constriction
   iii) Mucus production
      (1) Mucus plugs

b) Assessment findings
   i) Expiratory wheezing
   ii) Dyspnea
   iii) Chest tightness
      (1) Usually bilateral
      (2) Results from the constriction of the bronchioles
   iv) History of asthma
   v) Medications
      (1) Inhalers
      (2) Long-term asthma inhibitors
   vi) Management
      (1) Humidified oxygen
         (a) Flow of oxygen should correspond with severity of the respiratory distress
      (2) Medication nebulizer
         (a) Albuterol and Atrovent.
      (3) IV therapy
      (4) Position of comfort

(5) Transport

14) Status asthmaticus

a) Patients at risk
   i) Prior history of respiratory failure
   ii) Steroid-dependent asthma patients
   iii) Rapid fluctuations in the severity of previous attacks

b) Assessment findings
   i) High work of breathing with minimal air movement
   ii) Wheezing
      (1) Inspiratory and expiratory
      (2) Diminished or silent in the bases
   iii) Severe anxiety or lethargy
   iv) Cyanosis
   v) Pulsus paradoxus

c) Management
   i) Call for ALS intercept
   ii) Bag-valve mask ventilations
   iii) Continuous nebulized bronchodilators
   iv) Other medications per standing orders

15) Pneumonia

a) Pathophysiology
   i) Infection
   ii) Production of mucus and bronchoconstriction
   iii) Edema
   iv) Young and old patients most susceptible

b) Assessment
   i) Level of respiratory distress dependent upon the severity of the infection and the presence of chronic respiratory or cardiac disease
   ii) Fever (not always present in older patients)
   iii) Sputum
      (1) Thick

(2) Color change

iv) Looks ill

v) May have signs of dehydration

c) Management

i) Supplemental oxygen

ii) Position of comfort

iii) IV therapy

(1) Isotonic fluids

(2) Fluid bolus if signs of dehydration

iv) Transport

16) Pulmonary edema (CHF)

a) Pathophysiology

i) Failure of the left ventricle

ii) Inability to pump fluid out of the heart

iii) Backup of fluid into the lungs

b) Assessment

i) History of heart problems

ii) Acute onset of dyspnea

iii) Signs of severe respiratory distress may be present

iv) Audible rales or wheezing

v) Recent history of orthopnea, or paroxysmal nocturnal dyspnea

vi) Medications

(1) Antihypertensives

(2) Diuretics

(3) Nitrates

(4) Digoxin

vii) Lung sounds

(1) Wheezing

(2) Crackles

(3) Diminished or absent in the bases

viii) Management

(1) Oxygen therapy
  (a) Base the flow of oxygen on the severity of the respiratory distress
  (b) Consider assisted ventilations with severe respiratory distress
(2) IV therapy
  (a) Consider the use of a microdrip IV administration set
  (b) Restrict fluid administration to a keep-open rate
(3) Pharmacological and mechanical interventions
  (a) Use caution with use of bronchodilators
    (i) Opening the bronchioles may encourage more fluid shifts into the lungs
    (ii) May worsen the patient's condition
  (b) Nitroglycerin
  (c) Furosemide
  (d) Use of CPAP
  (e) Morphine
    (i) Current controversies for the use of morphine
    (ii) ACLS recommendation: use after nitroglycerin and furosemide
    (iii) Local standing orders may use a different sequence
(4) Position of comfort
(5) Transport

17) Pleural Effusion
  a) Collection
  b) of blood or fluid in the pleural space
    i) Hemothorax
      (1) May also be associated with pneumothorax
    ii) Massive inflammation
  c) Assessment
    i) Respiratory distress and tachypnea
    ii) Tachycardia
    iii) Pleuritic chest pain
    iv) Decreased breath sounds
  d) Management

i) Supplemental oxygen

ii) Position of comfort

iii) IV therapy

iv) Transport

This page intentionally left blank

Cardiac Emergencies

Cognitive Objectives

1) The blood
   a) List the 5 functions of blood. (C-1)
   b) Describe the physical characteristics of blood, including the composition and function of plasma, erythrocytes, hemoglobin, leukocytes, and platelets. (C-2)
   c) Summarize the process of blood clotting. (C-3)
   d) Distinguish the factors that limit clot formation and prevent clotting. (C-3)
   e) Cite examples of clotting disorders. Give reasons for each condition.
      i) Thrombotic and embolic conditions (C-2)
      ii) Thrombocytopenia (petechiae) (C-2)
      iii) Hemophilia (C-2)
2) The blood vessels
   a) Describe the structure of blood vessel walls. (C-2)
   b) Describe the structure and function of the arterial system. (C-2)
   c) Describe the structure and function of a capillary bed. (C-2)
   d) Describe the structure and function of the venous system. (C-2)
   e) Trace the pathway of a drop of blood through the body. (C-3)
   f) Name and give the location of the major arteries and veins in the systemic circulation. (C-1)
3) The heart
   a) Describe the size and shape of the heart and indicate its location and orientation in the thorax. (C-1)
   b) Name the covering of the heart. (C-1)
   c) Describe the structure of the heart wall. (C-1)
   d) List the structure and function of the four heart chambers. Name each chamber and provide the name and general route of its associated great vessel(s). (C-1)
   e) Name the heart valves and describe their location, function, and mechanism of operation. (C-2)
   f) Name the major branches of the coronary arteries and describe their distribution. (C-2)

g) Differentiate between cardiac and skeletal muscle in terms of their intrinsic properties and tissue structure. (C-3)
h) Name the components of the conduction system of the heart and trace the conduction pathway. (C-1)
i) Summarize the electrophysiology of membrane potential, sodium channels, potassium channels, calcium channels, depolarization, repolarization, refractory periods, and electrolyte roles in cardiac function. (C-2)
j) Describe the timing and mechanical events of the cardiac cycle. (C-2)
k) Discuss how ions, nerves and hormones influence the electrophysiology and mechanics of the cardiac cycle. (C-2)
l) Explain how the body regulates stroke volume, cardiac output, heart rate, preload, afterload, and blood pressure. (C-2)

4) Physiology of Circulation and Perfusion
   a) Define blood flow, blood pressure and resistance. (C-1)
   b) List and describe the factors that influence blood flow in the body. (C-2)
   c) Describe how blood pressure is regulated. (C-3)
   d) Explain the role of cardiac cell feedback loops; baroreceptors, chemoreceptors, sympathetic and parasympathetic innervation and response in the regulation of cardiac output and blood pressure. (C-3)
   e) Explain how capillary sphincters control local blood flow and nutrient exchange at the cell. (C-2)
   f) Explain the relationship between vasoconstriction, vasodilation, and blood pressure. (C-3)
   g) List examples of shock and identify which mechanisms of cardiac output and blood pressure are impaired or impacted. (C-2)
5) Assessment of chest pain
   a) Identify the cardiac and non-cardiac causes of chest pain. (C-1)
   b) Identify the traumatic and non-traumatic causes of chest pain (C-1)
   c) Outline the specific elements to include in the following aspects of a cardiovascular assessment: (C-3)
      i) Scene assessment

ii) Initial assessment
iii) Focused history
(1) OPQRST
(2) Associated symptoms
(3) Dyspnea
(a) Exertional
(b) Orthopnea
(c) Cough
iv) Past medical history
(1) Baseline assessment
(2) Medications
(3) Risk factors
v) Physical Assessment
(1) Inspection
(2) Auscultation
(3) Palpation

d) Describe the components of the focused history as it relates to the patient with cardiovascular compromise. (C-3)
e) Identify the elements of the SHOPS mnemonic as part of a chest pain assessment. (C-1)

6) EKG interpretation
a) Explain the purpose of EKG monitoring and its limitations. (C-2)
b) Specify patient situations when monitoring is indicated. (C-2)
c) Identify the operational aspects of EKG monitoring and defibrillator devices. (C-2)
d) Describe correct electrode placement for monitoring. (C-2)
e) Correlate EKG graph lines with the heart rate. (C-3)
f) Define the common terms used in EKG analysis including isoelectric line, duration, segment, complex and interval. (C-1)
g) Given a diagram of a normal electrocardiogram tracing, name the individual waves and intervals represented. (C-1)

h) Discuss the normal findings of each wave and interval of a typical EKG and indicate the events represented by each element of the EKG. (C-2)
i) Describe a systematic approach to the analysis and interpretation of cardiac rhythms. (C-3)
j) Interpret various rhythms found within the following categories of dysrhythmias
    i) Narrow complex bradyrhythmias (C-4)
    ii) Wide complex bradyrhythmias (C-4)
    iii) Narrow complex tachyrhythmias (C-4
    iv) Wide complex tachyrhythmias (C-4)
    v) Premature complexes (C-4)
    vi) Cardiac arrest (C-4)
k) Identify the primary mechanisms responsible for producing cardiac dysrhythmias. (C-1)
l) Outline the assessment for dysrhythmias and discuss the general treatment approach to dysrhythmias per ACLS guidelines. (C-2)

7) Cardiac Chest Pain Profiles
a) Describe the pathophysiology of angina pectoris. (C-3)
b) Differentiate between the signs and symptoms of stable angina and unstable angina. (C-3)
c) Describe the pathophysiology of myocardial infarction. (C-3)
d) Differentiate the characteristics of angina pectoris and acute myocardial infarction. (C-3)
e) Identify the most common complications of an acute myocardial infarction. (C-3)
f) Identify atypical presentations possible (particularly in females) in a patient having and acute myocardial infarction. (C-2)
g) Identify the primary hemodynamic changes and the anticipated clinical presentation of a patient with a suspected acute myocardial infarction. (C-4)
h) Describe the causes of and pathophysiology associated with congestive heart failure. (C-3)
i) Define pulmonary edema and describe its relationship to left ventricular failure. (C-3)
j) Define and explain the significance of pulmonary edema and dependent edema. (C-3)

k) Differentiate between the chronic and acute clinical presentation of a patient with congestive heart failure. (C-3)
l) Formulate a patient treatment plan for the patient in acute congestive heart failure. (C-5)
m) Determine the most commonly used physician-prescribed drugs classes in the management of chronic congestive heart failure. (C-2)
n) Based on the pathophysiology and evaluation of the patient with chest pain, list the anticipated clinical problems according to their life-threatening potential. (C-6)
o) Correlate abnormal findings in assessment with clinical significance in the patient with cardiovascular presentations. (C-3)
p) Interpret the signs and symptoms of the patient with chest pain, CHF, MI, angina, acute aortic aneurysm, hypertensive emergency, and cardiac arrest. (C-2)
q) Differentiate between critical life threatening, potentially life threatening and non-life threatening patient presentations with the use of critical thinking scenarios. (C-3)

8) Emergency cardiovascular care
   a) Outline the drug profiles for the prehospital treatment of cardiac chest pain including their mechanism of action, indications, precautions, side effects, contraindications, and dosing regimen. (C-2)
   b) Specify the measures that may be taken to prevent or minimize complications in the patient suspected of myocardial infarction. (C-3)
   c) Explain the current ACLS algorithms for bradycardia and acute pulmonary edema (C-3)
   d) Explain the “window of opportunity” as it pertains to reperfusion of a myocardial injury or infarction and list the characteristics of an eligible patient. (C-2)
9) Cardiac arrest
   a) Distinguish the unique characteristics of manual, automatic, semi-automatic and internal defibrillators. (C-1)
   b) Define and explain the importance of defibrillation. (C-3)
   c) Summarize the contraindications and precautions for defibrillation. (C-1)
   d) Identify the signs of cardiac arrest and describe the importance of confirming cardiac arrest prior to initiating defibrillation. (C-2)

e) Describe the safety considerations involved in defibrillation. (C-2)
f) Describe correct pad /paddle placement for analysis and defibrillation. (C-2)
g) Define and describe the pathophysiology of cardiac arrest. (C-2)
h) Outline the sequence for the ACLS universal algorithm for cardiac arrest. (C-1)
i) Describe the dysrhythmias seen in cardiac arrest. (C-2)
j) Explain the current ACLS algorithms for the following:
    i) VF/pulseless VT (C-3)
    ii) PEA (C-3)
    iii) Asystole (C-3)
k) Determine the following drug choices for cardiac arrest including their indications, contraindications, side effects, route of administration, and dosages: (C-4)
    i) Antiarrhythmic (e.g., Amiodarone, Lidocaine)
    ii) Anticholinergic (e.g. Atropine)
    iii) Sympathomimetics (e.g. Epinephrine)
    iv) Antidiuretic, antihemorrhagic (e.g. Vasopressin)
l) Explain the steps involved in the confirmation of asystole. (C-1)
m) Identify circumstances and situations where resuscitation efforts would not be initiated. (C-3)
n) Identify communication and documentation protocols with medical direction and law enforcement used for termination of resuscitation efforts. (C-3)

10) Special considerations in cardiac arrest
a) Identify causes of sudden cardiac arrest in children. (C-1)
b) Explain the use of defibrillation with children. (C-2)
c) Identify the differences between adult and child defibrillation. (C-2)
d) Indicate the joules used in pediatric defibrillation. (C-1)
e) Explain the current ACLS guidelines for recognition and management of the following: (C-3)
    i) Hypothermia
    ii) Trauma
    iii) Recreational drug use

11)Vascular Disorders

a) Explain the pathophysiology and risk factors of an arterial aneurysm. (C-1)
b) Recognize and describe the signs and symptoms of dissecting thoracic or abdominal aneurysm. (C-3)
c) Describe the significance of unequal blood pressure readings in the arms. (C-2)
d) State the symptoms and consequences of chronic hypertension. (C-2)
e) Identify the risk factors and precipitating causes of a hypertensive emergency. (C-1)
f) Explain the signs and symptoms of a hypertensive emergency. (C-3)
g) Determine the drugs of choice for hypertensive emergencies including their indications, precautions, contraindications, side effects, route of administration and dosages. (C-3)

Affective Objectives

2) Ability to demonstrate effective leadership attributes when communicating with team members and presenting treatment options in cardiac arrest scenarios. (A-2)
3) Value and defend the possibility of termination of resuscitative efforts in the prehospital setting. (A-3)
4) Value and defend the sense of urgency in recognizing signs of aortic aneurysm, acute myocardial infarction and clinical compromise in congestive heart failure. (A-3)
5) Value and defend the sense of urgency necessary to protect the "window of opportunity" for reperfusion in the patient with suspected myocardial infarction. (A-3)

Psychomotor Objectives

6) Perform, document and communicate a cardiovascular assessment. (P-3
7) Demonstrate the placement, recording and interpretation of an EKG in various patient scenarios. (P-2)
8) Demonstrate the appropriate operation of a monitor/defibrillator according to the specific manufacturer's instruction. (P-3)
9) Demonstrate the ability to troubleshoot problems with the monitor/defibrillator without compromising patient and rescuer safety. (P-2
10) Demonstrate the safe and appropriate application of defibrillation in cardiac arrest. (P-3)
11) Demonstrate the appropriate selection of treatment options in patient scenarios presenting with chest pain or cardiac arrest. (P-2)

Declarative

Introduction

1) Epidemiology
   a) Incidence
      i) Prevalence of cardiac death outside of a hospital
         (1) Supportive statistics
      ii) Prevalence of warning signs and symptoms for cardiac emergencies
         (1) Supportive statistics
      iii) Increased recognition of need for early reperfusion
   b) Morbidity / mortality
      i) Reduced with early recognition
      ii) Reduced with early access to EMS system

Cardiovascular Anatomy and Physiology: The Blood

1) Functions of blood
   a) Transportation of dissolved gases, nutrients, hormones and waste
   b) Regulation of pH and electrolyte concentrations in the body
   c) Response to vessel injury through blood clotting
   d) Defend against toxins and pathogens
   e) Assist in the regulation of temperature
2) Physical characteristics and composition of whole blood
   a) Plasma
      i) Composition
         (1) Dissolved solutes
         (2) Proteins
      ii) Function
         (1) Distribution
            (a) Glucose
            (b) Oxygen
            (c) Metabolic waste
            (d) Hormones

(2) Regulation

(a) Heat

(b) Fluid volume

(c) pH

(3) Coagulation

b) Erythrocytes

i) Composition

(1) Hemoglobin

ii) Function

(1) Transport oxygen and carbon dioxide

iii) Origin

(1) Bone marrow

c) Leukocytes

i) Composition

(1) Complete cells

ii) Function

(1) Responds to injury or inflammation

(2) Destroys bacteria, viruses, parasites, toxins, tumor cells

d) Platelets

i) Composition

(1) Disk-shaped cell fragments

(2) Contain enzymes to assist with blood clotting

ii) Function

(1) Form temporary plugs to stop bleeding

(2) Control the release of clotting factors and enzymes

3) Injury Response and Bleeding Control (Hemostasis)

a) Vascular spasm

i) Immediate response to a cut in the blood vessel wall

ii) Lasts approximately 30 minutes

iii) Allows time for platelet plug formation and blood clotting

b) Platelets form plug on wall of damaged vessel
   i) "Sticky" surfaces cause platelets to stick together
   ii) Temporary phase of blood clotting
   iii) Activated platelets stimulate coagulation and repair
c) Coagulation (blood clotting)
   i) Enzyme release from platelets stimulate clotting factors in plasma
   ii) Thrombin is formed and stimulates the development of fibrin
   iii) Fibrin grows a net and covers the platelet plug
   iv) Permanent repair continues
   v) Clotting time
d) Fibrinolysis
   i) Eventual formation of plasmin
   ii) Plasmin causes the dismantling of the clot
   iii) Clot breakdown lasts hours-days

4) Factors that limit clot formation
   a) Medications
      i) Aspirin
         (1) Prevents platelets from becoming "sticky"
         (2) Alters the platelet enzymes' ability to stimulate clotting
      ii) Heparin
         (1) Naturally occurring anticoagulant
         (2) Inactivates thrombin
      iii) Coumadin
         (1) Blocks the development of clotting factors in the blood
         (2) Prevents the development of thrombin and fibrin
      iv) Streptokinase, Urokinase, t-PA (Tissue Plasminogen Activator)
         (1) "Clot busters" used in acute MI
         (2) Stimulate the development of plasmin
         (3) Rapid breakdown of clots in the body
5) Clotting disorders
   a) Thrombotic and embolic disorders

6) Thrombus
    a) Cerebral thrombosis (CVA)
    b) Coronary artery thrombosis (MI)
7) Embolus
    a) Pulmonary emboli
    b) Cerebral emboli (CVA)
8) Causes
    a) Conditions that roughen the vessel walls
        i) Arteriosclerosis
        ii) Severe burns
        iii) Inflammation
    b) Blood stasis
        i) Bedridden or wheelchair-bound patients
        ii) Clotting factors accumulate
9) Preventative treatments
    a) Aspirin
    b) Heparin
    c) Warfarin (Coumadin)
    d) Hemophilia
        i) Inadequate production of clotting factors
        ii) Spontaneous bleeding likely
    e) Thrombocytopenia (purpura)
        i) Abnormally low levels of circulating platelets
        ii) Characteristics
            (1) Patient bruises easily
                (a) Minor trauma
                (b) Prolonged bleeding with trauma
            (2) Purpura and/or petechiae
                (a) Purple patches on the skin
                (b) Non-blanching

iii) Causes

(1) Drug-induced

(a) Chronic heparin therapy

(b) Chronic alcoholism

(2) Immune disorders

(a) HIV

(b) Leukemia

(3) Other

(a) Massive bloodborne bacterial infection

(b) Blood transfusions

Cardiovascular Anatomy And Physiology: The Blood Vessels

1) Structure of the blood vessel

a) Walls

i) Inner layer

ii) Middle layer

(1) Circumferential muscle

(2) Vasoconstriction

iii) Outermost layer

b) Lumen

2) Arterial System

a) Conduction arteries

i) The aorta

(1) Diameter

(2) Wall structure

(3) Elasticity

(a) Continuous blood flow

(4) arteriosclerosis

ii) Distributing arteries

(1) Diameter

(2) Wall structure

(3) Elasticity

iii) Arterioles
(1) Diameter
(2) Wall structure
(3) Elasticity

3) Capillaries
   a) Diameter
   b) Wall structure
   c) Length
4) Capillary bed
   a) Site of gas exchange
   b) Capillary sphincters
      i) Muscular bands at entrance and exit points of the capillary bed
      ii) Regulates local blood flow to the cells by contraction and relaxation
5) The Venous System
   a) Venules
      i) Diameter
      ii) Wall structure
   b) Veins
      i) Diameter
      ii) Wall structure
      iii) Blood reservoirs
      iv) Resistance to blood flow
      v) Venous valves
   c) Vascular Anastomoses
      i) Collateral circulation
6) Blood flow through the body
   a) Heart
   b) Major Arteries
      i) Ascending aorta, aortic arch, thoracic aorta, abdominal aorta
      ii) Brachiocephalic artery
      iii) External carotid arteries

iv) Pulmonary artery

v) Axillary artery, brachial artery, radial artery, ulnar artery

vi) Femoral arteries, popliteal artery, anterior and posterior tibial arteries

c) Capillary circulation

i) Arterioles

ii) Capillaries

iii) Capillary bed

iv) Venules

d) Major veins

i) Superior vena cava, inferior vena cava

ii) External jugular veins

iii) Pulmonary vein

iv) Brachiocephalic veins

v) Axillary vein, brachial vein, basilica vein, median cubital vein, ulnar vein, radial vein, digital veins

vi) Femoral vein, great saphenous vein, popliteal vein, posterior and anterior tibial vein

Cardiovascular Anatomy And Physiology: The Heart

7) General Anatomy

a) Size

b) Location

c) Orientation

d) Heart wall

i) Pericardium

ii) Epicardium

iii) Pericardial sac

iv) Myocardium

v) Endocardium

e) Chambers of the heart
   i) Atria
      (1) Thin muscular walls
      (2) Expandable auricles
      (3) Receiving blood supply
         (a) Inferior vena cava
         (b) Superior vena cava
   ii) Ventricles
      (1) Structural differences from the atria
      (2) Structural and functional differences between the right and left ventricles
      (3) Blood flow out of the ventricles
         (a) Right ventricle – pulmonary arteries
         (b) Left ventricle - aorta
   iii) Interatrial and interventricular septum
      (1) Structure
      (2) Function
f) Heart Valves
   i) Names and locations
      (1) Atrioventricular valves
         (a) Tricuspid valve
         (b) Mitral or bicuspid valve
      (2) Semilunar valves
         (a) Aortic
         (b) Pulmonary
   ii) Function
      (1) Prevent backflow of blood
   iii) Mechanism of operation
      (1) Papillary muscles
      (2) Chordae tendineae
g) Coronary Arteries
   i) Right coronary artery

(1) Branches from the base of the ascending aorta

(2) Distribution

(a) Right atrium

(b) Conduction system of the heart

(c) Right ventricle

(d) Portions of left ventricle

ii) Left coronary artery

(1) Branches from the base of the ascending aorta

(2) Distribution

(a) Left atrium

(b) Portions of left ventricle

8) Contrasts between cardiac and skeletal muscle

a) Skeletal muscle

i) Structure

ii) Function and properties

b) Cardiac cell types

i) Auto-rhythmic

ii) Myocardial (contraction) cells

c) Properties of cardiac cells

i) Automaticity

ii) Excitability

iii) Conductivity

(1) Syncytium

(a) Muscle cells branch and intertwine

(b) Efficiency with nerve conduction and muscle contraction

(i) Intercalated discs

(ii) Gap junctions

iv) Contraction

(1) Syncytium

d) Muscular structure of cardiac cells
   i) Striated
   ii) Short

9) Electrophysiology
   a) Cardiac conduction system
      i) Sinoatrial (SA) node
         (1) Pacemaker
         (2) Sinus rhythm
      ii) Atrial internodal pathways
      iii) Atrioventricular (AV) node
         (1) Impulse delayed
         (2) Allows for ventricular filling
      iv) Atrioventricular (AV) junction
         (1) AV node
         (2) Bundle of His
      v) His-Purkinje system
         (1) Bundle branches
            (a) Right
            (b) Left
      vi) Purkinje fibers
   b) Electrical potential of myocardial cells
      i) Action potential
         (1) Resting membrane potential
            (a) Relative polarity (charges)
            (b) Membrane channels and ion movement
               (i) Sodium
               (ii) Potassium
               (iii) Calcium
         (2) Depolarization and the action potential
            (a) Initial movement of sodium and potassium
            (b) Plateau phase and the role of calcium

(c) Absolute refractory period

(3) Repolarization

(a) Movement of sodium, potassium and calcium

(b) Relative refractory period

10) Mechanical Events of The Cardiac Cycle

a) Phases

i) Systole

(1) Contraction phase of a chamber

ii) Diastole

(1) Relaxation phase

(2) Filling of the chamber

b) Cardiac output

i) Definition

(1) Amount of blood ejected from the ventricle in one cardiac cycle

(2) Cardiac output (CO) dependent on heart rate (HR) and stroke volume (SV)

(3) CO (ml/min) = HR (beats/min) x SV (ml/beat)

ii) Heart Rate (HR): beats per minute

(1) Tachycardia

(2) Bradycardia

iii) Stroke volume (SV)

(1) Preload

(a) Dependent upon venous return of blood

(b) Frank-Starling Law

(2) Contractility

(3) Afterload

c) Factors affecting the cardiac cycle

i) Cardiac feedback loops

(1) Communication between the periphery and the medulla

(2) Chemoreceptors

(a) Sensitivity to pH, PaO_2 and $PaCO_2$

(3) Baroreceptors

(a) Location

(b) Sensitivity to changes in arterial pressure

ii) Medullary response

(1) Stimulation of the autonomic nervous system

(2) Sympathetic nervous system

(a) Fibers extensively innervate the SA node and ventricular cells

(b) Increases heart rate and force of contractions

(3) Parasympathetic nervous system

(a) Sends impulses via branches of the vagus nerve

(b) Innervation of the SA and AV nodes

(i) Slows rate

(ii) Slows conduction of impulses at the AV node

iii) Chemical Factors

(1) Hormones: epinephrine

(a) Stimulation of beta receptors in the myocardium

(b) Increase in contractility and rate

(2) Ions: electrolyte imbalances

(a) Calcium derangements

(i) Hypocalcemia and hypercalcemia

(ii) Impacts the strength of myocardial contractions

(iii) Hypercalcemia may cause irritability of the electrical cells

(b) Potassium derangements

(i) Impacts the rates of firing and recovery of all cardiac cells

(ii) Hyperkalemia

1. Caused by kidney failure
2. May cause dysrhythmias
3. Potential for ventricular fibrillation

(iii) Hypokalemia

1. May be caused by diuretic use
2. Bradycardia and hypotension

11) Physiology of Circulation and Perfusion
    a) Definitions
        i) Blood flow
        ii) Resistance
        iii) Blood pressure
            (1) BP = Cardiac Output x Peripheral Resistance
            (2) Average pressures for arteries, veins and capillaries
    b) Factors influencing blood flow
        i) Cardiac output
            (1) Preload
            (2) Contractility
            (3) Afterload
                (a) Diameter of vessels
                    (i) Aorta v. arterioles
                    (ii) Hypertension v. hypotension
                    (iii) Length of vessels
        ii) Resistance to blood flow
            (1) Turbulence
                (a) Pressure exerted against the blood by vessel walls
                (b) Presence of arteriosclerosis
            (2) Viscosity of blood
                (a) Dehydration
    c) Capillary Dynamics
        i) Capillary sphincters
            (1) Function
                (a) Control fluid movement and diffusion of gases at the cells
                (b) Opening and closing of sphincters will change the pressure between the capillaries and cells
                (c) Pressure gradients will facilitate the movement of oxygen and metabolic wastes across the cell membrane

(2) Control of capillary sphincters
(a) Changes in oxygen and carbon dioxide levels
(b) Changes in pH
(c) Stimulation by the sympathetic nervous system

d) Regulation of Blood Pressure
i) Feedback loops
(1) Similar function of baroreceptors and chemoreceptors to regulation of cardiac output
(a) Medulla stimulated
(b) Medulla activates several processes to control vasoconstriction or vasodilation
ii) Primary processes involved in regulation
(1) Sympathetic Nervous System
(a) Alpha receptor sites
(b) Pre-capillary sphincter
(2) Parasympathetic Nervous System
(3) Chemical Controls
(a) Adrenal hormones
(i) Norepinephrine
(ii) Epinephrine
(b) Other hormones
(i) Anti-diuretic hormone
1. vasopressin

e) Application of Blood Flow and Perfusion
i) Shock examples and impacted mechanisms of cardiac output and blood flow
(1) Hypovolemia
(a) Impacts to resistance and blood flow
(b) Detection of changes by feedback loops
(c) Response of the sympathetic nervous system
(d) Changes to cardiac output and vessel diameter

(2) Cardiogenic shock

(a) Failure of contractility

(b) Detection by baroreceptors

(c) Response by the sympathetic nervous system

(d) Changes to cardiac output and vessel diameter

f) Hypertension

i) Signs and symptoms of chronic hypertension

ii) Consequences

(1) CVA

(2) CHF

(3) Aneurysm

(4) Other

Assessment Of Chest Pain

12)Causes of chest pain

a) Non-cardiac causes

i) Cholecystitis

ii) Aneurysm

iii) Aortic dissection

iv) Esophageal spasm

v) Pulmonary embolism

vi) Respiratory infections

vii) Pneumothorax

viii) Blunt trauma

(1) Chest wall

(2) Pulmonary injuries

b) Cardiac causes
   i) Angina
      (1) Stable
      (2) Unstable
   ii) Myocardial infarction
   iii) Congestive heart failure
   iv) Cardiac infection
   v) Cardiac trauma

13) Components of a cardiovascular assessment
   a) Initial assessment
      (1) Level of consciousness
      (2) Signs/Symptoms and physiological cause for each finding
         (a) AVPU
         (b) Dizziness
         (c) Unresponsive
   ii) Airway
      (1) Signs/Symptoms and physiological cause for each finding
         (a) Patent
         (b) Debris, blood
         (c) Frothy sputum
   iii) Breathing
      (1) Signs/Symptoms and physiological cause for each finding
         (a) Absent
         (b) Present
            (i) Rate and depth
               1. Effort
                  a. Number of word-sentences
               2. Breath sounds
                  a. Characteristics
                  b. Significance

iv) Circulation

(1) Signs/Symptoms and physiological cause for each finding

(a) Pulse

(i) Absent

(ii) Present

1. Rate and quality
2. Pulse deficit
3. Peripheral

(iii) Skin

1. Color
2. Temperature
3. Moisture
4. Turgor
5. Mobility
6. Edema

(iv) Blood pressure

14) Focused history

a) SAMPLE history

i) Chief complaint

ii) Pain (Signs/Symptoms and physiological cause for each finding)

(1) OPQRST

(a) Onset/origin

(i) Pertinent past history

(ii) Time of onset

(b) Provocation

(i) Exertional

(ii) Non-exertional

(c) Quality

(i) Patient's narrative description

1. For example: sharp, tearing, pressure, heaviness

(ii) Region/radiation

1. For example: arms, neck, back

(iii) Severity

1. Scale of 1 to 10

(iv) Timing

1. Duration
2. Worsening or improving
3. Continuous or intermittent
4. At rest of with activity

iii) Dyspnea (Signs/Symptoms and physiological cause for each finding)

(1) Continuous or intermittent

(2) Exertional

(3) Non-exertional

(4) Orthopneic

(5) Paroxysmal nocturnal dyspnea (PND)

(6) Cough

(a) Dry

(b) Productive

(c) Frothy

(d) Bloody

iv) Related signs and symptoms (and physiological cause for each finding)

(1) Feeling of impending doom

(2) Nausea/vomiting

(3) Fatigue

(4) Palpitations

(5) Edema
(a) Extremities
(b) Sacral
(6) Headache
(7) Syncope
(8) Activity limitations
(9) Trauma

b) Past medical history
i) Coronary artery disease (CAD)
ii) Atherosclerotic heart disease
(1) Angina
(2) Previous MI
(3) Hypertension
(4) Congestive heart failure (CHF)
iii) Valvular disease
iv) Aneurysm
v) Pulmonary disease
vi) Diabetes
vii) Renal disease
viii) Vascular disease
ix) Previous cardiac surgery

c) Current/past medications
(1) SHOPS
(a) Street drugs
(b) Herbal
(c) Over the counter
(d) Prescribed
(e) Sexual enhancement
(i) Viagra
(ii) Levitra
(iii) Cialis

d) Allergies

15) Detailed physical examination

a) Inspection

i) Tracheal position

(1) Neck veins

(a) Appearance

(b) Pressure

(c) Clinical significance

(2) Thorax

(a) Configuration

(i) A-P diameter

(ii) Movement with respirations

(b) Clinical significance

(3) Epigastrium

(a) Pulsation

(b) Distention

(c) Clinical significance

(4) Extremities

(a) Color changes

b) Auscultation

i) Breath sounds

(1) Depth

(2) Equality

(3) Adventitious sounds

(a) Crackles

(b) Wheezes

(i) Gurgling

(ii) Frothing (mouth and nose)

1. Blood-tinged
2. Foamy

c) Palpation
   i) Areas of crepitus or tenderness
   ii) Thorax
   iii) Epigastrium
      (1) Pulsation
      (2) Distention
   iv) Extremities
      (1) Pitting edema
      (2) Temperature changes

EKG Interpretation

16) Electrocardiogram (EKG or ECG) monitoring
   a) Value
      i) Graphic representation of the heart's electrical activity
      ii) Assessment tool for cardiac complaints
   b) Limitations
      i) Does not record mechanical activity
      ii) Interpretation must accompany a clinical correlation
   c) Indications
   d) Operational aspects of EKG monitoring device
      i) Lead placement
         (1) 3-lead
         (2) 4-lead
         (3) 12 lead – Enhanced
   e) Surfaces of heart and lead systems.
      i) Lead 1,2, and 3
      ii) 12 lead - Enhanced
   f) EKG graph paper
      i) Horizontal axis represents time
         (1) Small box measurements
         (2) Large box measurements
         (3) Other horizontal markers

(4) Calculation of rate

(a) “300” method

(b) Horizontal measures

ii) Vertical axis measures amplitude

(1) Small box measurements

(2) Large box measurements

iii) Methods of measuring rhythm

(1) Paper and pencil

(2) Calipers

g) EKG Interpretation Terminology

i) Isoelectric line

ii) Positive deflection

iii) Negative deflection

iv) Duration

v) Segment

vi) Complex

vii) Interval

h) EKG Analysis: sinus rhythm

i) P waves

(1) Location: first round positive deflection of the complex

(2) Configuration: usually rounded and upright

(3) Deflection: positive or upright in Leads I, II; usually positive but vary in lead III

(4) Representation

(a) Atrial depolarization

(i) Conduction of an electrical impulse through the atria

(ii) Atria contract after P wave begins

ii) PR Interval

(1) Location: from the beginning of the P wave to the beginning of the QRS complex

(2) Configuration and deflection: isoelectric line

(3) Amplitude: none

(4) Duration: 0.12 to 0.20 s

(5) Representation

(a) The “pause” of electrical activity at the AV node and AV junction

(b) Allows time for ventricular filling

(c) Minimal electrical movement is recorded as a flat line

iii) QRS complex

(1) Location: follows the PR interval

(2) Configuration (Lead II): combination of 3 deflections

(a) Q wave (the first negative deflection or deflection above the baseline, after the P wave)

(b) R wave (the first positive deflection after the Q wave)

(c) S wave (the first negative deflection after the R wave)

(d) Not all waves may be seen

(e) Waves may look different in each Lead

(3) Deflection: positive in leads I, II, III

(4) Amplitude: 5 to 30 mm high, but different for each lead used

(5) Duration: 0.04 to 0.12 second

(a) Duration is measured from the beginning of the Q wave to the end of the S wave or from the beginning of the R wave if the Q wave is absent

(6) Representation

(a) Impulse conduction through the ventricles

(b) Immediately after the ventricles depolarize, they contract

iv) ST Segment

(1) Location: extends from the S wave to the beginning of the T wave

(2) Configuration

(3) Deflection: usually isoelectric

(a) May vary from -0.5 to +1 mm

(b) J Point

(i) Reference for the start of the ST segment

(ii) Distinct turning point or change of electrical direction from the S wave

(4) Amplitude

(a) None in a normal EKG

(b) May be altered with abnormal conduction of the QRS or during cardiac ischemia

(5) Representation

(a) The transition between ventricular depolarization and repolarization

v) T wave

(1) Location: follows the S wave or ST segment

(2) Configuration: typically round and smooth

(3) Deflection: usually upright in Leads I, II; variable in lead III

(4) Representation

(a) Ventricular recovery or repolarization

i) Systematic approach to ECG analysis and interpretation

i) Ventricular Rate

ii) Atrial Rate

iii) Regular or Irregular

iv) P Wave

(1) Location

(2) Amplitude

(3) Duration

(4) Configuration

(5) Deflection

(6) Ratio of P waves to each QRS

v) PR interval

(1) Duration

(2) Significance of interpretation

(a) Changes in PR interval indicate an altered impulse formation or a conduction delay

(b) Short PR intervals (less than 0.12 seconds) indicate that the impulse originated somewhere other than the SA node.

1. Associated with junctional arrhythmias

(c) Prolonged PR intervals (greater than 0.20 s) may represent a conduction delay through the atria or AV node

(d) Variations in PR interval durations may indicate the presence of an AV block

vi) QRS

(1) Location

(2) Amplitude

(3) Duration

(4) Configuration

(a) Uniformity

(5) Deflection

vii) ST Segment

(1) Deflection

(2) Significance in interpretation

(a) Elevation or depression of the ST segment may indicate myocardial ischemia or injury

viii) T wave

(1) Location

(2) Deflection

ix) Ectopic Beats/ Irregularities

j) Cardiac dysrhythmias

i) Dysrhythmias originating in the sinus node

(1) Sinus bradycardia

(2) Sinus tachycardia

(3) Sinus dysrhythmia Enhanced

ii) Dysrhythmias originating in the atria

(1) Premature atrial complex - Enhanced

(2) Supraventricular tachycardia (SVT)

(3) Atrial flutter - Enhanced

(4) Atrial fibrillation

iii) Dysrhythmias originating within the AV junction

(1) First degree AV block

(2) Second degree AV block

(a) Narrow-complex QRS

(b) Wide-complex QRS

(3) Complete AV block (third degree block)

(a) Narrow-complex QRS

(b) Wide-complex QRS

iv) Dysrhythmias sustained or originating in the AV junction - Enhanced

(1) Junctional rhythm

(2) Accelerated junctional rhythm

(3) Premature junctional complex

(4) Junctional tachycardia

v) Dysrhythmias originating in the ventricles

(1) Idioventricular rhythm

(2) Accelerated idioventricular rhythm

(3) Premature ventricular complex (PVC)

(a) Paired couplets

(b) Focus

(i) Multifocal

(ii) Unifocal

(4) Ventricular tachycardia

(5) Ventricular fibrillation

(6) Asystole

(a) Confirmation using at least two EKG leads

vi) Other rhythms

(1) Artifact

(2) Paced rhythms

17) Management of the patient with dysrhythmias

a) Assessment

i) Symptoms

(1) Palpitations

(2) Syncope or near-syncope

(3) Dizziness or lightheadedness

(4) Chest pain

(5) Dyspnea

ii) Signs

(1) Hypotension or orthostatic hypotension

(2) Skin signs

(3) Level of consciousness

b) Treatment

i) Consider causes and tailor treatments accordingly

(1) Illicit drug use

(2) Myocardial ischemia

(a) Chronic

(b) Acute

(c) Trauma

(3) Stress

(4) New-onset dysrhythmias or tachycardias

ii) ACLS treatment algorithms

iii) PHTLS treatment considerations

iv) Transport considerations

v) Psychological support/communications strategies

(1) Explanation for patient, family, significant others

(2) Communication and transfer of data to the physician

18) Cardiac Chest Pain Profiles

a) Angina pectoris

i) Definition

ii) Causes

(1) Atherosclerotic coronary artery disease

(2) Cardiac hypoxia during periods of physical or emotional stress

(3) Arterial spasm

iii) Stable angina
(1) Onset and occurrence
(2) Signs and symptoms
(3) Relief of symptoms

iv) Unstable angina
(1) May be a precursor of myocardial infarction
(2) Changes in pathology
(a) Rupture of atherosclerotic plaque
(b) Formation of thrombosis
(c) Reduced oxygen delivery to the myocardium
(3) Differences from stable angina
(a) Onset and occurrence
(b) Signs and symptoms
(c) Relief of symptoms

b) Myocardial infarction
i) Morbidity/mortality
(1) Not a self-limiting disease
(2) Chest pain may dissipate, but myocardial ischemia & injury can continue
(3) A single anginal episode may be a precursor to myocardial infarction
(4) May not be cardiac in origin

ii) Causes
(1) Similar causes as angina
(2) Sudden occlusion
(3) Non-traumatic causes
(a) Use of stimulant drugs
(4) Trauma

iii) Signs/Symptoms
(1) Typical symptoms
(a) Dull, crushing pain or pressure
(b) Radiation of pain

(2) Atypical presentations possible

(a) Females

(b) Advanced diabetes

iv) Need for intervention

(1) Damage to heart tissue

(a) 30 minutes after occlusion, some heart muscle cells begin to die

(b) 2 hours after occlusion, half of the cells in the area of infarct are dead

(c) 4 to 6 hours after occlusion, 90% of cells are dead

v) Potential complications of AMI and hemodynamic changes

(1) Reduction of cardiac output

(a) Reduction of heart rate

(i) Bradycardia

1. Stimulation of the vagus nerve
2. Protective mechanism
3. Heart rates between 50-60 common

(ii) Heart blocks

1. Thrombus in the coronary artery
2. Significantly lowered rate possible

(b) Reduction of stroke volume

(i) PVCs

(ii) Damaged myocardium and reduction of contractility

(iii) Poor contractility may result in pulmonary edema

(c) Clinical significance

(i) Reduced cardiac output may occur

(ii) Reduced oxygen delivery to peripheral tissues

(iii) Signs of hypoperfusion and shock may be present

c) Congestive heart failure (CHF)

i) Causes of CHF

(1) Left-sided heart failure

(a) Atherosclerosis

(b) Persistent, uncontrolled hypertension (#1 cause)

(c) Myocardial infarction (acute or chronic)

(d) Cardiomyopathy

(2) Right-sided heart failure

(a) Left-sided failure (#1 cause)

(b) Chronic bronchitis/COPD

ii) Pathophysiology of CHF

(1) Reduction of contractility

(a) Chronic high afterload placed on the ventricle

(b) Consequence

(i) Fluid overload on the ventricle

(ii) Backup of fluid from the ventricle

1. Atria
2. Systemic circulation – right ventricle
3. Lungs – left ventricle

(2) Cardiac output and perfusion

(a) Heart may be unable to meet tissue demands

(i) Exertional dyspnea and chest pain

(ii) Chronic dyspnea and chest pain

1. Later stages
2. May progress to unstable angina and/or AMI

iii) Pulmonary congestion

(1) Ultimate consequence of left ventricular failure

(2) Left ventricle unable to eject the entire volume of blood from the chamber

(a) Volume and pressure builds in the ventricle

(b) Pressure and volume wave moves backward to the left atrium

(c) Pressure wave and volume continue to moves backward into the pulmonary veins and circulation

(d) Pulmonary vessels engorge

(e) Pressure on the arteries and capillaries pushes fluid out into the interstitial fluid and eventually into the alveoli

iv) Peripheral congestion
(1) Similar progression to the left ventricle
(2) Pressure wave progression
(a) Right ventricle
(b) Right atrium
(c) Venous system
(d) Engorgement of veins and capillaries
(e) Pressure in vessels push fluid into the interstitial spaces
(3) Location of fluid accumulation dependent upon gravity
(a) Feet and legs for seated or standing patients
(b) Lower back for supine patients

v) Assessment & physical findings for CHF
(1) Chronic findings
(a) May be asymptomatic at rest
(b) May be on home oxygen
(c) Dyspnea or chest pain
(i) With exertion
(ii) When supine (orthopnea)
(iii) Paroxysmal nocturnal dyspnea (PND)
(d) Chronic dysrhythmias
(i) Atrial fibrillation
(ii) PVCs
(e) Medications
(i) Antihypertensives
(ii) Digoxin
(iii) Nitrates
(iv) Diuretics
(f) Chronic edema
(i) Lung sounds
1. Crackles or wheezing or diminished

2. Typically adventitious sounds are located in the bases of the lung fields

(ii) Peripheral edema

1. Pedal edema may worsen in summer months
2. Ascites

(2) Acute findings

(a) Chest pain

(i) Worse than previous episodes

(ii) Non-responsive to treatment regimen

(b) Dyspnea

(i) Labored respirations

(ii) Audible sounds

(iii) Paroxysmal nocturnal dyspnea (PND)

(iv) Tripod position

(v) Frothy sputum

(vi) Retraction of chest muscles

(c) Lung sounds

(i) Wheezing, rales

(ii) Higher locations in the lung fields

(3) Circulation

(a) Cyanosis

(b) Rapid pulse

(c) Any tachycardia with ectopy

(d) Any bradycardia with ectopy

(4) History and detailed physical

(a) Weight gain over short period of time

(b) Progression of edema in the extremities

(i) Localized in ankles

(ii) to the mid calf

(iii) to the knees

(iv) obliteration of pulses

(c) Recent change in sleep patterns

(i) More frequent trips to the bathroom

(ii) Need to sleep on more pillows

(iii) Need to sleep on the recliner

(iv) New episodes of PND

vi) CHF management

(1) Position of comfort

(2) Pharmacological and mechanical interventions

(a) Oxygen

(b) Nitroglycerin

(c) Lasix

(d) CPAP

(e) Morphine

(3) Transport considerations

(4) Psychological support/communications strategies

(a) Explanation for patient, family, significant others

Emergency Cardiovascular Care

18) Prehospital Medications for cardiovascular emergencies

a) Medications used for cardiac chest pain

i) Mechanism of action, indications, contraindications, precautions and dosing

(1) Oxygen

(2) Aspirin

(3) Nitroglycerin

(4) Morphine

b) Pharmacological interventions for cardiac complications

i) Mechanism of action, indications, contraindications, precautions and dosing

(1) Antidysrhythmics

(a) Lidocaine

(b) Amiodarone

(2) Furosemide

(3) Atropine

19)ACLS Algorithms

a) Introduction

i) Algorithms are modified for the EMT-I scope of practice

ii) Internationally recognized standards for cardiac care

(1) Based on research

(2) Standards will change with new research studies

(3) Current knowledge with algorithm changes is necessary

iii) Algorithms are patient-focused

(1) The EMT-I must decide if the treatment algorithm is appropriate for the patient's condition

(2) Causes for the dysrhythmia should always be explored

b) Algorithms in detail

i) Bradycardia

ii) Acute pulmonary edema

20) Management of MI

a) Hospital strategies

i) Cardiac catheterization labs

(1) Indications

(a) "STEMI" candidates

(i) "ST Elevation MI"

1. Rise in the ST segment that is associated with cardiac chest pain
2. Diagnosis can only be determined with a 12-lead ECG

(ii) Prehospital considerations

1. "STEMI" protocols developed to reduce delays in MI recognition and treatment
2. Inclusion and exclusion criteria
3. Use of the 12-lead by the EMT-Intermediate
   a. Placement
   b. Transmission of the ECG to the ED for diagnosis
   c. Efficient transport to the nearest cardiac cath lab

i. Ground transport versus helicopter

ii) Fibrinolytic therapy

(1) May be used if a cath lab is not available

(2) Indications of fibrinolytic therapy

(3) Fibrinolytic drug names

(a) Ateplace

(b) Retaplace

(c) t-PA

iii) Fibrinolytic drug actions

(1) Systemic dissolution of clots

(2) Significant complications (bleeding)

b) Candidate Screening

i) Local standing orders

ii) Criteria for inclusion and exclusion

c) Procedures for inclusion

i) Local standing orders

ii) Communication with on-line medical direction

d) Transfer considerations

Cardiac Arrest

21) Defibrillators
   a) Characteristics
      i) Manual
      ii) Automated external defibrillator (AED)
      iii) Semi-automatic external defibrillator (SAD)
      iv) Internal
      v) Monophasic versus biphasic defibrillators
         (1) Biphasic defibrillators measure resistance and deliver an energy equivalency in 2 directions
         (2) Less joules required for defibrillation

22) Defibrillation
   a) Indications
      i) Pulseless ventricular tachycardia
      ii) Ventricular fibrillation
   b) Contraindications and precautions
      i) Perfusing rhythms
         (1) Recognition of artifact v. ventricular fibrillation
         (2) Ventricular tachycardia with a pulse
         (3) Any patient with a pulse or blood pressure
      ii) Slow ventricular rhythms
         (1) Associated with a pulse
         (2) Cardiac arrest
      iii) Moving ambulances
      iv) Hazardous environments
         (1) Water
         (2) Metal surfaces
         (3) Presence of explosives
         (4) Nitroglycerin patches
         (5) Internal defibrillators and pacemakers
   c) Integration of defibrillation in cardiac arrest

i) Confirmation of cardiac arrest
(1) Signs
(a) Unconscious
(b) Lack of a carotid pulse
(c) Agonal or no respiratory effort
(d) Poor skin signs
(2) EKG findings
(a) Ventricular fibrillation
(b) Ventricular tachycardia
(3) Safety considerations
(a) Defibrillation pads
(i) Inspect for drying of gel
(ii) Assure a adequate contact with skin
(b) Rescuer safety during defibrillation
(i) Clear all contact with the patient
(ii) Clear all contact with equipment touching the patient
(iii) Visual contact with team members and auditory signals prior to defibrillation

d) Correct pad/paddle placement
i) Anterior positioning
ii) Smooth contact between pads and patient skin
(1) Need for clean, dry chest
(2) Chest hair
(3) Obese patients
iii) Paddles
(1) Gel
(2) Pressure
(a) 25lb
(3) position
(4) safety

e) Cardiac arrest

i) Causes and pathophysiology
  (1) Ischemic or infarcted myocardial tissue
    (a) Irritable cardiac cells
      (i) PVCs, R on T phenomenon may lead to VF
      (ii) Heart blocks may occur from ischemic sinus or AV nodes
      (iii) Asystole may occur with prolonged ischemia or infarction
  (2) Trauma
    (a) Heart muscle intact
    (b) Loss of circulating volume and red blood cells
    (c) Systemic hypoxia and dying tissue
    (d) Organized rhythms usually seen (tachycardias)

ii) Medications use in cardiac arrest
  (1) Mechanism of action, indications, precautions, contraindications
    (a) Epinephrine
    (b) Vasopressin
    (c) Amiodarone
    (d) Lidocaine
  (2) Integration

iii) ACLS algorithms in cardiac arrest
  (1) Universal algorithm for cardiac arrest
    (a) Primary and Secondary ABCDs
    (b) Selection of algorithms
    (c) Consideration of Causes: 5Hs and 5Ts
  (2) Ventricular fibrillation, pulseless ventricular tachycardia
    (a) Only 2 shockable rhythms in cardiac arrest
    (b) Description of algorithm sequence for ventricular fibrillation
    (c) Incorporation of skills in the algorithm
      (i) CPR
      (ii) Airway management
      (iii) Defibrillation

(iv) Drug choices and selection

1. ACLS research and local standing orders
2. Epinephrine v. vasopressin
3. Amiodarone v. lidocaine

(3) Pulseless Electrical Activity (PEA)

(i) Non-shockable rhythm

(ii) Rhythms included in the PEA algorithm

1. Bradycardic rhythms and causes
2. Tachycardic rhythms and causes

(iii) Mechanical impairments to pulsations/cardiac output

(iv) High priority on determination of causes

(v) ACLS algorithm sequence for PEA

(vi) Drug choices and selection

1. Epinephrine
2. Vasopressin
3. Atropine

(4) Asystole

(a) Algorithm focus on termination of care

(b) Review of standing orders for death in the field

(i) ACLS algorithm sequence for asystole

(ii) Initial confirmation of asystole in 2 leads

(iii) Circumstances where resuscitation efforts would not be initiated

(iv) Communication with family, law enforcement and medical control

iv) Documentation

(1) Event Summary from the defibrillator

(2) Essential components for the narrative

(a) Initial rhythm and change in rhythms

(b) Treatment and responses

(c) Focused history directed towards potential causes

(d) Documentation of communication with medical control

(e) Documentation of family wishes or DNR orders

(f) Transfer of care: law enforcement or funeral home contacts

Special Considerations in Cardiac Arrest

23) Pediatrics

- a) Causes of sudden cardiac arrest in children
  - i) Respiratory arrest
  - ii) History of congenital abnormalities
  - iii) Traumatic injury from accidents
    - (1) Head injury
    - (2) Blunt thoracic or abdominal injury
- b) Defibrillation for children
  - i) Joules used in pediatric defibrillation
  - ii) 2j/kg & 4j/kg
  - iii) Pads must not touch
  - iv) Manufacturer-specific
- c) Additional treatments
  - i) Aggressive management of airway and ventilations
  - ii) ACLS algorithms
    - (1) Adjust doses for children
    - (2) High priority on correcting the underlying cause

24) Hypothermia

- a) Hypothermia classifications
  - i) Classified by core temperature
    - (1) Mild
    - (2) Moderate
    - (3) Severe
- b) General management
  - i) ACLS algorithm for hypothermia
  - ii) Gentle handling of patients
    - (1) Moderate-to-severe hypothermia
    - (2) Low threshold for ventricular fibrillation

iii) Removal of wet clothing

iv) Drying

v) Warm IV fluids and oxygen

vi) Remove from cold environment

vii) Ambulance heater, warm packs

c) Considerations in cardiac arrest

i) CPR

ii) Consider only first line, rhythm-specific ACLS drugs until the patient is rewarmed

iii) Consult with medical direction regarding transport times and patient temperatures prior to cessation of efforts

Vascular Disorders

25)Aortic Aneurysm

a) Definition and causes

i) Abnormal ballooning of the aorta

ii) Weakness in the vessel wall

iii) Contributing factors

(1) Atherosclerosis

(2) Hypertension

(3) Congenital weakening of the connective tissue of the arterial wall

(4) Trauma

b) Signs and symptoms of aortic aneurysm

i) There are often no symptoms

ii) May develop slowly over many years

c) Aortic dissection

i) Tear in inner layer of arterial wall

ii) Blood accumulation between the arterial wall layers

iii) Tear or rupture of the middle and outer arterial walls

d) Symptoms of aortic tear or rupture
   i) Initial assessment
      (1) Pale, clammy skin
      (2) Tachycardia
      (3) Diaphoresis
   ii) Abdominal signs and symptoms
      (1) Pulsating sensation
      (2) Abdominal Pain
         (a) Severe, sudden, persistent or constant
            (i) Tearing sensation common
            (ii) Stabbing pain
         (b) May radiate to groin, buttocks, legs, lower back
      (3) Abdominal rigidity
      (4) Nausea and vomiting
   iii) Associated symptoms
      (1) Fainting or near-syncope
      (2) Orthostatic changes
         (a) Vital signs
         (b) Unequal blood pressure readings in extremities
         (c) Intensity or change in symptoms
e) Management
   i) BLS treatment
   ii) IV and fluid administration
      (1) Titrate to level of consciousness
      (2) Titrate to systolic BP of 90-100mm Hg
f) Psychological support/communications strategies
   i) Explanation for patient, family, significant others

26) Hypertensive Emergencies

a) Precipitating causes
   i) History of hypertension
   ii) Non-compliance with medications
   iii) Toxemia of pregnancy

b) Morbidity/mortality
   i) Hypertensive encephalopathy
   ii) Stroke

c) Assessment and physical findings of acute HTN
   i) Blood pressure
      (1) Systolic greater than 160 mmHg
      (2) Diastolic greater than 94 mmHg
      (3) Other criteria as defined by standing order
   ii) Neurological signs
      (1) Signs and symptoms are typically bilateral
      (2) Unilateral symptoms and signs may indicate a TIA or CVA
      (3) Slurred speech
      (4) Blurred vision
      (5) Generalized weakness
      (6) Weak grip strength

d) Management
   i) Consideration should be given to the cause of the hypertension before treatment is administered
      (1) Acute congestive heart failure
      (2) CVA
      (3) Intracranial bleeding
   ii) Oxygen
   iii) Position of comfort
   iv) Airway and ventilation

v) Pharmacological interventions

(1) Nitroglycerin

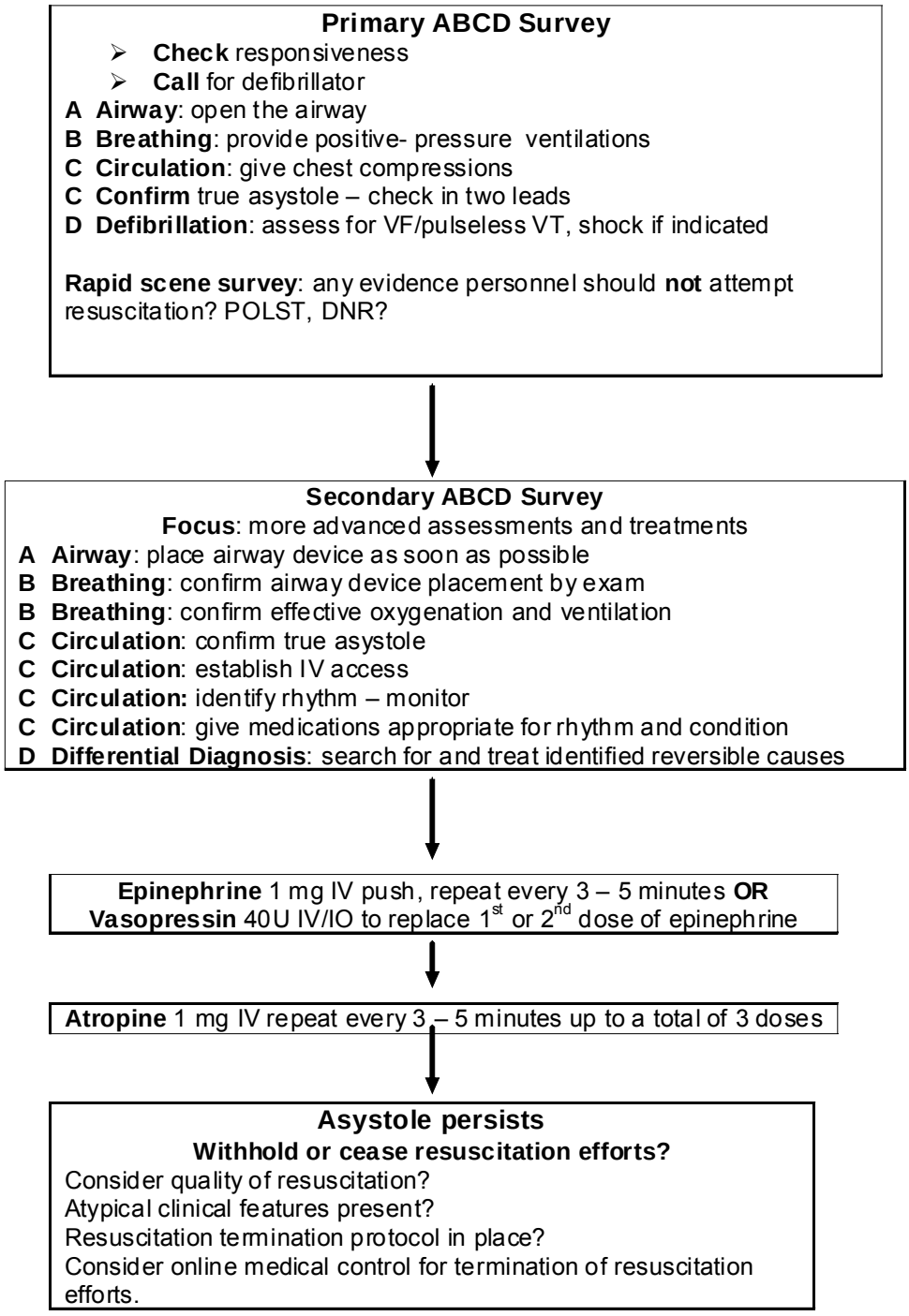
(2) Morphine

vi) Transport considerations

vii) Psychological support/communications strategies

(1) Explanation for patient, family, significant others

Asystole Algorithm
EMT-Intermediate



Bradycardia Algorithm
EMT-Intermediate

Bradycardia
- Slow rate of <60 bpm) and inadequate for clinical condition.

Primary ABCD Survey
- Assess ABCs
- Secure Airway noninvasively
- Ensure monitor/defibrillator is available

Secondary ABCD Survey
- Assess secondary ABCs (invasive airway management needed?
- Oxygen-IV access-monitor-fluids
- Vital signs, pulse oximeter, monitor BP
- Problem-focused history
- Problem-focused physical examination
- Consider causes (differential diagnosis)

Signs or Symptoms of poor perfusion caused by the bradycardia?
(eg. Acute altered mentation, ongoing chest pain, hypotension or other signs of shock

Adequate perfusion → Observe/ Monitor

Poor perfusion → Consider Atropine 0.5 – 1.0 mg

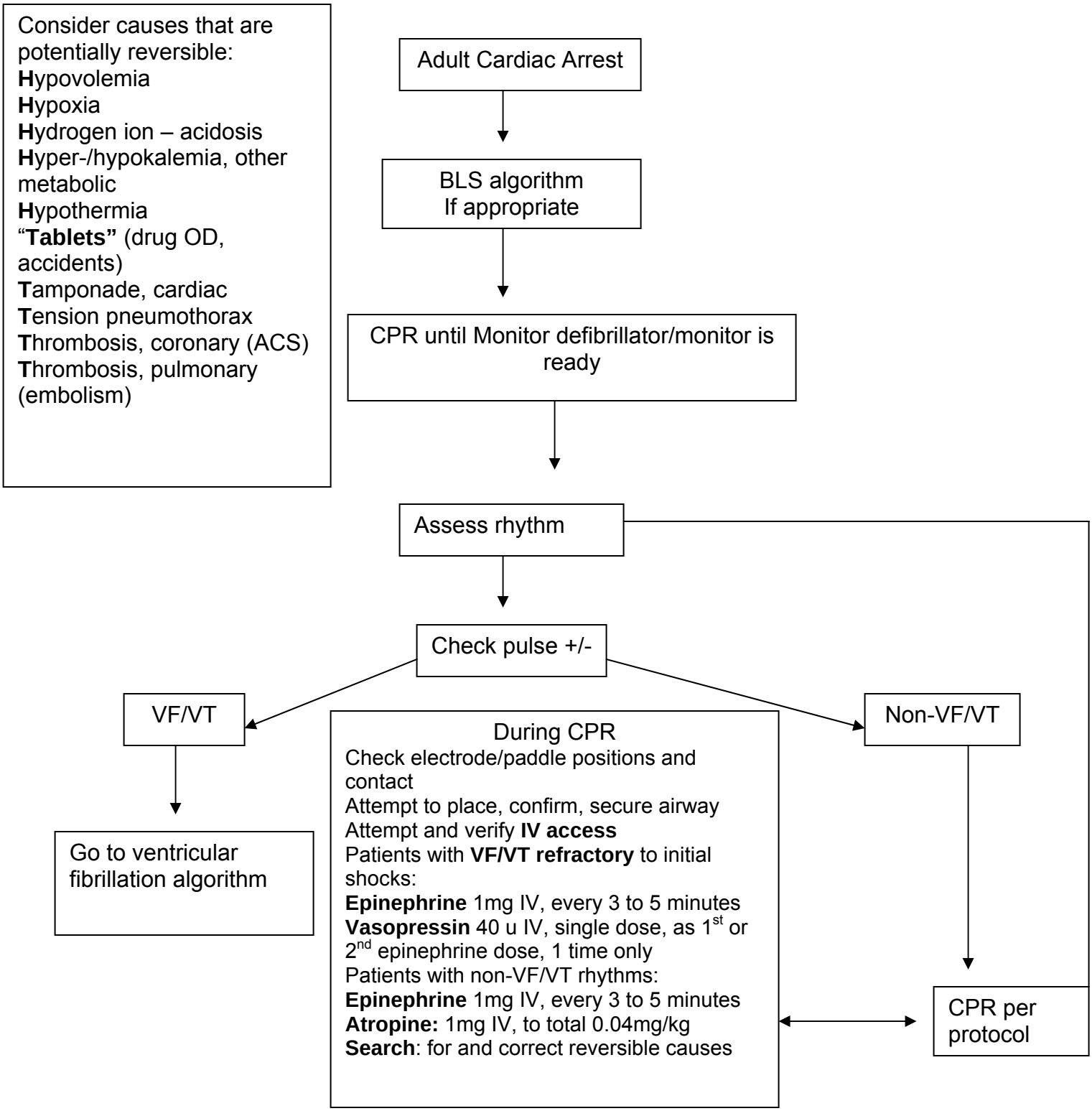
Reminders

- If pulseless arrest develops, go to Pulseless Arrest algorithm
- Search or and treat possible contributing factors:

Hypovolemia	Toxins
Hypoxia	Tamponade, cardiac
Hydrogen ion (acidosis)	Tension pneumothorax
Hypo/hyperkalemia	Thombosis (coronary or pulmonary)
Hypoglycemia	Trauma (Hypovolemia, increased ICP)
Hypothermia	

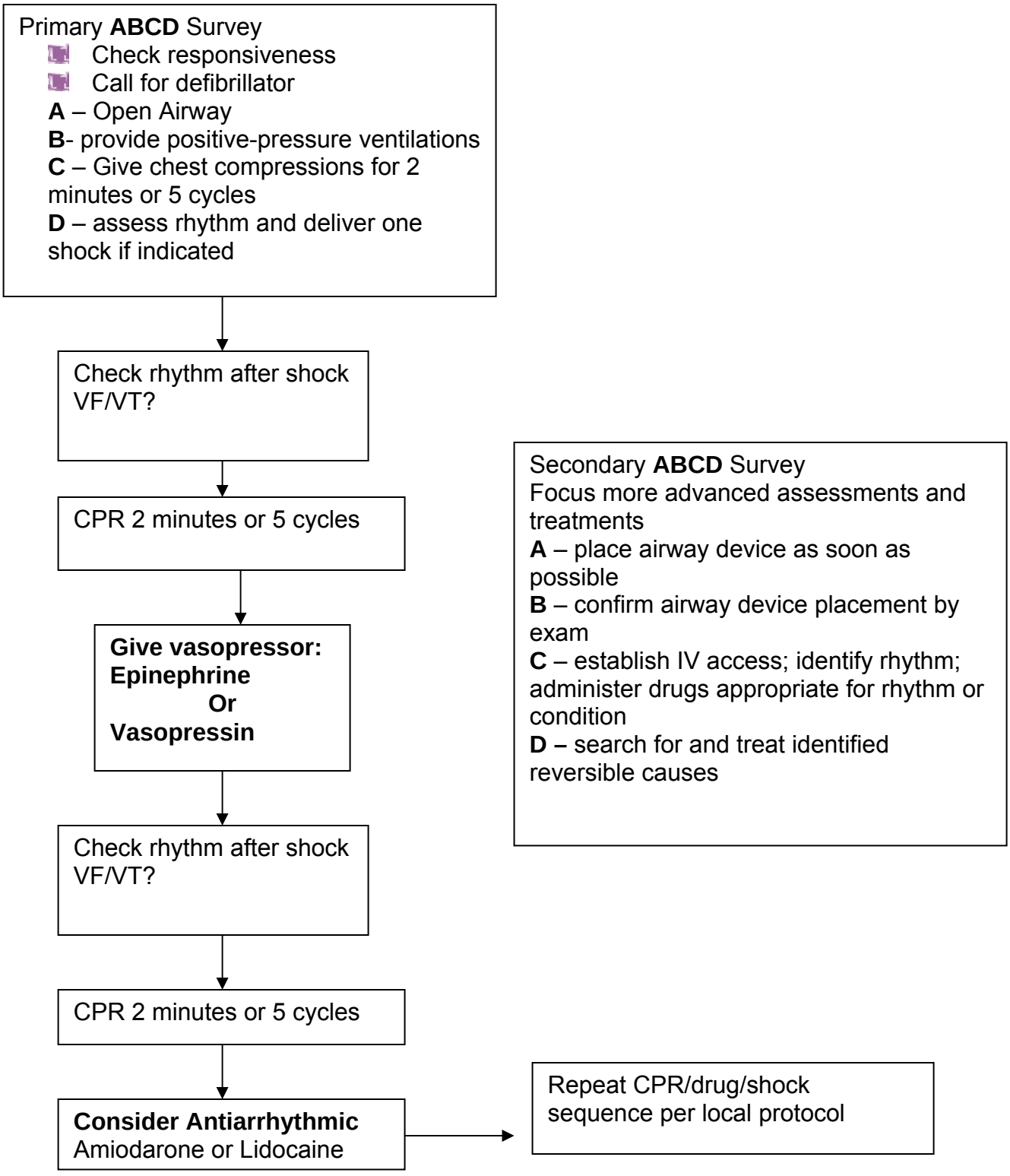
Universal / International ACLS Algorithm

EMT-Intermediate



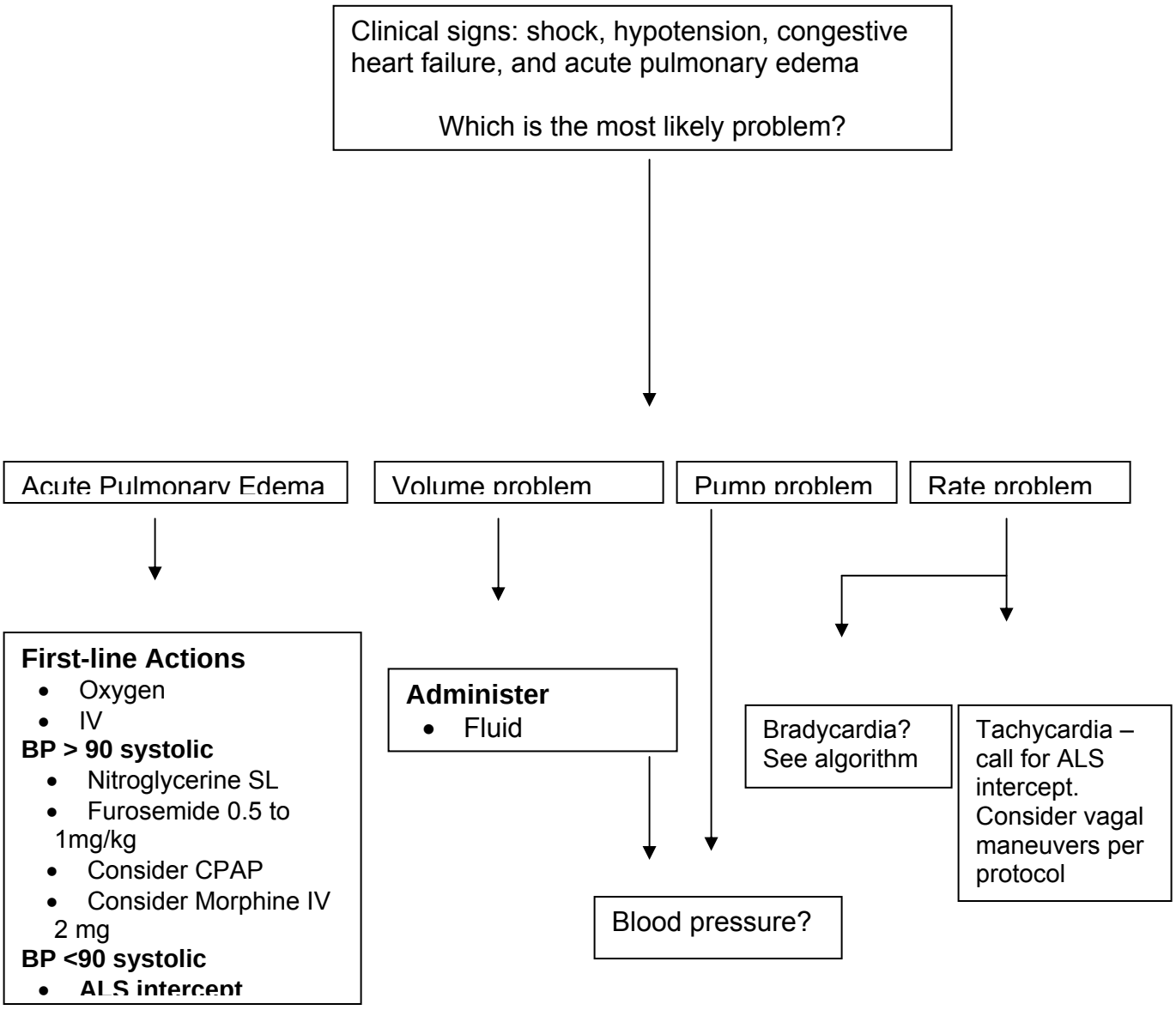
Ventricular Fibrillation/Pulseless Ventricular Tachycardia Algorithm

EMT Intermediate



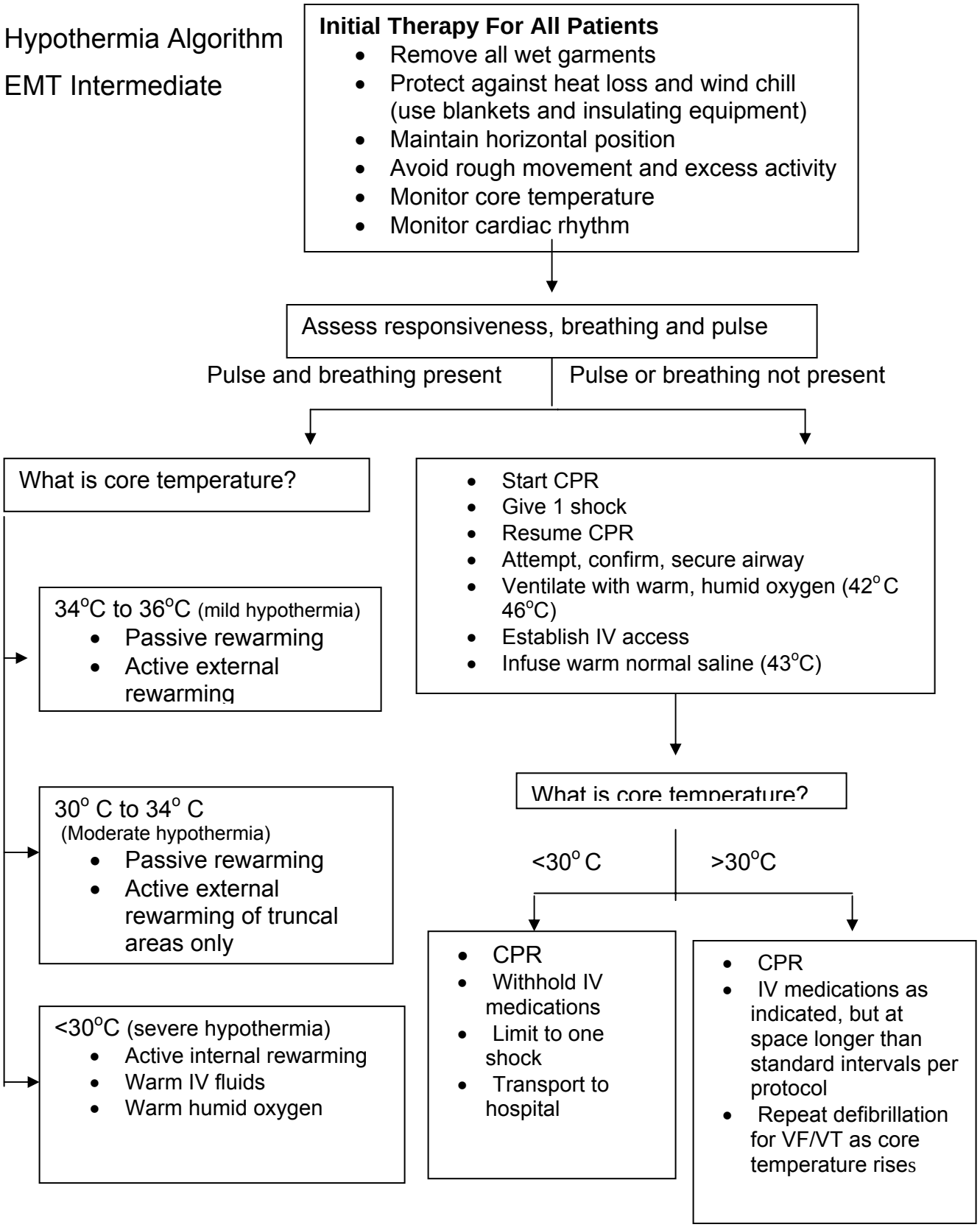
Acute Pulmonary Edema, Hypotension, Shock

EMT Intermediate



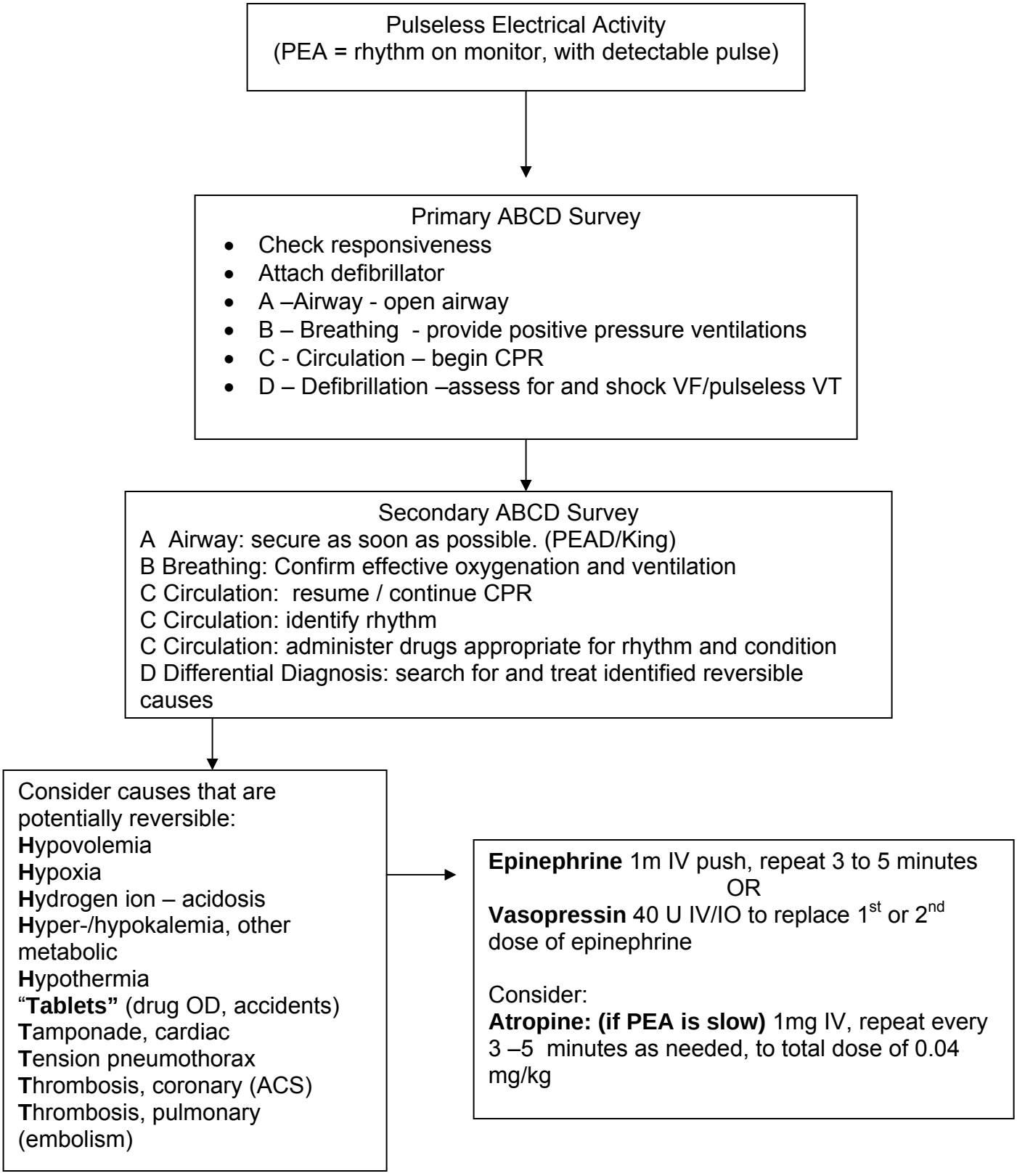
Hypothermia Algorithm

EMT Intermediate



Pulseless Electrical Activity Algorithm

Intermediate




This page intentionally left blank

Altered Mental Status

Terminal Objectives

1) To understand the basic anatomy and physiology of the nervous system and endocrine system and how they relate to altered mentation.
2) To utilize the assessment findings to formulate a field impression and implement a treatment plan for the patient with an altered mentation.

Cognitive Objectives

1) Identify the following structures in the brain: (C-1)
   a) Medulla
   b) Pons
   c) Midbrain
   d) Brain stem
2) State the functions of the nervous system. (C-1)
3) Name the divisions of the nervous system. (C-1)
4) Describe the types of nerves. (C-1)
5) Describe the role of polarization, depolarization, and repolarization in nerve impulse transmission. (C-2)
6) Identify the components of the central nervous system. (C-1)
7) Describe the role of the central nervous system. (C-1)
8) Define the Reticular Activating System. (RAS) (C-1)
9) Describe the role of the Reticular Activating System as it pertains to AMS. (C-1)
10) State the function of the meninges and cerebrospinal fluid. (C-1)
11) Identify the divisions of the autonomic nervous system and define their functions. (C-1)
12) State the function of the hormones of the pancreas. (C-1)
13) Describe how glucose is converted to energy during cellular respiration. (C-1)
14) Describe the response of insulin and glucagon to altered levels of glucose. (C-2)
15) Describe the pathophysiology of diabetes mellitus. (C-2)
16) Describe the mechanism of ketone body formation and its relationship to ketoacidosis. (C-2)

17) Correlate abnormal findings in assessment with clinical significance in the patient with a diabetic emergency. (C-2)
18) Generalize the pathophysiology of non-traumatic neurologic emergencies. (C-3)
19) Explain the pathophysiology, epidemiology, assessment findings and management of the following: (C-2)
    a) Stroke, intracranial hemorrhage
        i) CVA – brain attack
            (1) Occlusive
                (a) Embolic stroke
                (b) Thrombotic stroke
            (2) Hemorrhagic
    b) TIA and RIND
    c) Seizures
        i) Generalized – tonic/clonic
        ii) Partial
        iii) Others
    d) Diabetes
        i) Hypoglycemia
        ii) Hyperglycemia
        iii) DKA
            (1) Differences from HHNK
    e) Drugs
        i) Barbiturates
        ii) Narcotics
        iii) Hallucinogens
        iv) Depressants (including alcohol)
    f) Non-specific coma
    g) Altered level of conscious/syncope/weakness/headache
    h) Infections
        i) Meningitis
        ii) Encephalitis

20) Correlate abnormal findings in assessment with clinical significance in the patient with CVA/TIA/RIND, diabetes, drug overdose, seizures, and infections. (C-3)
21) Interpret the signs and symptoms of the patient with CVA//TIA/RIND, diabetes, drug overdose, seizures, and infection. (C-2)
22) Demonstrate the management of CVA/TIA/RIND, diabetes, drug overdose, epilepsy, and infections. (C-2)
23) Apply the pathophysiological principles and the assessment findings to formulate a field impression and implement a treatment plan for the patient with altered mentation. (C-3)
24) Develop a patient management plan based on field impression in the patient with altered mentation. (C-3)
25) Determine the need for rapid intervention and transport of the patient with non-traumatic emergencies. (C-3)
26) Determine the class, mechanism of action, contraindications/cautions, interactions, adverse reactions of the following: (C-4)
    a) Naloxone hydrochloride
    b) Hypertonic glucose
    c) Glucagon

Affective Objectives

1) Characterize the feelings of a patient who regains consciousness among strangers. (A-2)
2) Formulate means of conveying empathy to patients whose ability to communicate is limited by their condition. (A-3)

Psychomotor Objectives

1) In given scenarios, properly identify and treat causes of altered mentation. (P-3)

Declarative

1) General system pathophysiology
    a) Causes
        i) Alterations in cognitive systems
            (1) Hypoxia
        ii) Alterations in cerebral homeostasis
        iii) Alterations in motor control
        iv) Central nervous system disorders
        v) Medications/drugs
        vi) Trauma
        vii) Cerebrovascular disorders
        viii) Tumors
        ix) Infection
        x) Inflammation
        xi) Degenerative disease
2) Nervous system anatomy and physiology
        i) Divisions
            (1) Central nervous system (CNS)
                (a) Components
                    (i) Brain
                    (ii) Spinal cord
                (b) Function
                    (i) Coordinate sensory and motor activities
                    (ii) Control voluntary and involuntary activities
            (2) Peripheral nervous system
                (a) Components
                    (i) Somatic nervous system
                    (ii) Autonomic nervous system
                (b) Function
                    (i) Transmit impulses to and from the CNS

ii) Neurons
  (1) Structure
    (a) Cell body
    (b) Dendrites
    (c) Axons
  (2) Types of neurons
    (a) Sensory neurons
    (b) Receptors
    (c) Motor neurons
  (3) The nerve impulse
    (a) Polarization
    (b) Depolarization
    (c) Repolarization

iii) Basic location and function of central nervous system components
  (1) The spinal cord
  (2) Brain
    (a) Meninges and cerebrospinal fluid
      (i) Function
        1. Role in maintaining cerebral perfusion
        2. Impacts from changes in intracranial pressure (ICP)
    (b) Cerebrum
    (c) Mesencephalon
      (i) Reticular activating system (reticular formation)
        1. Regulation of consciousness
    (d) Brain stem
      (i) Pons
      (ii) Medulla

3) General assessment and management for all patients with altered mentation
    a) Scene assessment
        i) Clues regarding the cause
        ii) Safety considerations
            (1) Toxic environment
            (2) Syringes and needles
        iii) General impression
            (1) Level of responsiveness
            (2) Interaction with EMS crews
            (3) Potential for violence
                (a) Body language
                (b) Verbal threats
        iv) Initial assessment
            (1) Snoring respirations
            (2) Breathing rate and quality
            (3) Skin signs
            (4) Level of consciousness
                (a) AVPU
                (b) GCS
        v) Focused history
            (1) Events
                (a) Seizure activity
                (b) Syncope
                (c) Bizarre movements
                (d) Progression of the event
                (e) Previous experience with complaint
            (2) OPQRST
                (a) Abrupt or gradual onset
                (b) Changes from baseline conditions

(3) Medications

(a) Barbiturates

(b) Narcotics

(c) Hallucinogens

(d) Depressants (including alcohol)

(e) Prescription medications

(i) Blood thinners

(ii) Hypoglycemics

(iii) Anticonvulsants

(iv) Cardiac medications

b) Focused physical

i) The Mental Status Exam

(1) General appearance

(a) Hygiene and dress

(2) Orientation to current events

(3) Memory

(4) Concentration

(a) Ability to track with the conversation

(5) Judgment

(a) Able to think rationally

(b) Able to make rational decisions

(6) Mood and affect

(a) What they are feeling

(b) How they are presenting

(c) Continuity between the two

(7) Thought content

(a) Delusions or hallucinations

(8) Speech

(a) Pattern

(i) Rapid

(ii) Slow

(9) Motor activity

(a) Posture

(b) Gait

(c) Rapid movements of hands or body

ii) The Cincinnati Stroke Scale

(1) Smile

(2) Speech

(3) Arm drift

iii) Head and neck

(1) Facial expression

(2) Eyes

(a) Position and alignment

(b) Pupils

(3) Mouth

(a) Odors on mouth

(b) Facial droop

iv) Thorax and lungs

(1) Auscultation

v) Nervous system

(1) Motor system

(a) Muscle tone

(b) Muscle strength

(c) Coordination

vi) Skin

(1) Diaphoresis

(2) Flushed

(3) Fever

vii) Vital signs

(1) Blood pressure

(a) Hypertension

(b) Hypotension

(2) Heart rate

(a) Tachycardia

(b) Bradycardia

(c) EKG monitoring

(i) Dysrhythmias

(3) Blood glucose

c) Ongoing assessment

i) Changes from treatment

ii) Documentation

d) Management

i) Airway and ventilatory support

(1) Indicators for rapid intervention

ii) Oxygen

iii) Assisted ventilation

iv) Suction

v) Advanced airway device

vi) Positioning

e) Circulatory support

i) Venous access

(1) Indicators for fluid challenge

f) Check glucose

g) Pharmacological interventions

i) Dextrose 50%

ii) Glucagon

iii) Naloxone

h) Non-pharmacological interventions

i) Spinal immobilization

ii) Transport considerations

(1) Appropriate mode

(2) Appropriate facility

iii) Psychological support/communication strategies

Specific injuries/illnesses

4) Stroke and intracranial hemorrhage
   a) Epidemiology
   b) Mortality/morbidity
   c) Definition
      i) Ischemic – 85 % of all strokes
         (1) Thrombotic
         (2) Embolic
         (3) Transient ischemic attack (TIA)
         (4) Reversible ischemic attack (RIND)
         (5) Hypoperfusion stroke
      ii) Hemorrhagic 15% of all strokes
         (1) Intracerebral
         (2) Subarachnoid
   d) Risk factors
      i) Modifiable
         (1) Hypertension
         (2) Cigarette smoking
         (3) Heart disease
         (4) Diabetes mellitus
         (5) Hypercoagulopathy
         (6) High red blood cell count and sickle cell anemia
         (7) Carotid bruit
      ii) Non-modifiable
         (1) Age
         (2) Gender
         (3) Race
         (4) Prior stroke
         (5) Heredity
   e) Pathophysiology of regional disruption of cerebral blood flow
      i) Thrombus

(1) Signs and symptoms develop gradually

(2) Often occur at night

(a) Patient wakes with decreased mental status, loss of speech, and decrease of sensation or motor function.

ii) Embolus

(1) History of atrial fibrillation

(2) Sudden onset of headache

iii) Transient ischemia attack

(1) Resolve in less than one hour usually in minutes

iv) Reversible ischemic neurological deficit

(1) Resolve in 1 -24 hours

(2) 60% of all TIA/RIND show signs of brain infarction

v) Hypoperfusion stroke

(1) Post cardiac arrest or severe loss of pump function

vi) Hemorrhage

(1) Intracerebral

(a) History of hypertension

(b) Among the elderly amyloid angiopathy plays a major role in intracerebral hemorrhage

(2) Subarachnoid hemorrhagic stroke

(a) Aneurysms

f) Assessment findings

i) Scene size up

(1) Possible environmental causes

(2) Clues to potential causes

ii) General impression

(1) Patient posture

iii) Initial assessment

(1) Potential for choking

iv) Focused assessment

(1) SAMPLE

(a) History

(b) General health

(c) Previous medical conditions

(d) Medications

(i) Barbiturates

(ii) Narcotics

(iii) Hallucinogens

(iv) Depressants (including alcohol)

(v) Blood thinners

(vi) Antihypertensives

(vii) Digoxin

(e) Previous experience with complaint

(f) Time of onset

(2) Seizure activity

(3) Headache

(4) Nose bleed

(5) Others

v) Physical

(1) Standard physical exam for the patient with potential neurological event

(2) Cincinnati stroke scale (see AHA Handbook for Emergency Cardiovascular care)

(a) Facial droop

(i) Smile to show teeth

(ii) Abnormal – one side does not move

(b) Arm Drift

(i) Patient closes eyes holds arms out straight for 10 seconds

(ii) Abnormal one arm drifts down

(c) Speech

(i) Ask the patient to say, “You can’t teach old dogs new tricks”.

(ii) Abnormal – can not recite phase

g) Management
  i) Airway and ventilatory support
  ii) Oxygen
  iii) Positioning
  iv) Assisted ventilation
  v) Suction
  vi) Advanced airway device
    (1) End tidal CO2
  vii) Circulatory support
    (1) Indicators for fluid administration
  viii) Check glucose
  ix) Pharmacological interventions
    (1) Indications and precautions
      (a) Dextrose
        (i) Profile
        (ii) Indications
        (iii) Contraindications
        (iv) Drug interactions
        (v) Adverse reactions
        (vi) Dosing
      (b) Narcan
        (i) Profile
        (ii) Indications
        (iii) Contraindications
        (iv) Drug interactions
        (v) Adverse reactions
        (vi) Dosing
  x) Non-pharmacological interventions
    (1) Positioning

xi) Transport considerations
(1) Appropriate mode
(2) Early notification of receiving facility
(3) Appropriate facility
(a) CT capabilities
(4) Psychological support/communication strategies
(a) Reassure patient

5) Transient Ischemic Attack and Reversible Ischemic Neurologic Deficit

a) Epidemiology
b) Mortality/morbidity
i) Resolves within 24 hours
c) Risk factors
d) Pathophysiology
i) Transient neurological deficits
(1) 60% show evidence of brain infarct
ii) Partial disruptions of blood flow
iii) May last up to 24 hours
iv) 10% will experience a complete stroke within 3 months; of these, half of those will occur within 2 days (AHA stroke guidelines, 2003)
e) Assessment findings
i) Similar presentation as a stroke
ii) Resolve of symptoms

6) Seizure

a) Epidemiology
i) Mortality/morbidity
ii) Risk factors
b) Pathophysiology
i) Unexpected electrical discharge of neuron in brain
c) Types
i) Generalized

(1) Tonic-clonic or grand mal seizure

(a) Motor seizure resulting in loss of consciousness

(2) Absence seizure or petit mal seizure

(a) Loss of consciousness lasts 10 – 30 seconds

(b) Rarely occur after age 20

(3) Pseudoseizure

(a) Emotionally caused

(b) Patient may be conscious

(c) Patient able to follow commands and control movements

(d) No postictal period

ii) Partial

(1) Simple partial seizure or focal-motor seizure

(a) No loss of consciousness

(b) Localized tonic-clonic moments

(c) Repetitive movements

(d) Document progression

(2) Complex partial seizure or temporal lobe seizure or psychomotor seizure

(a) Aura, smells, tastes or sounds precede the seizure activity

(b) Focal seizure

(i) Isolated to one area of the body

(ii) Last 1 – 2 minutes

(iii) May be confused

d) Other causes of seizure

i) Idiopathic

ii) Fever

iii) Neoplasms

iv) Infection

v) Metabolic

vi) Drug toxicity

vii) Drug withdrawal

viii) Head trauma

ix) Eclampsia

x) Cerebral degenerative disease

e) Assessment findings

i) General Impression and initial assessment

(1) Level of consciousness

(a) Awake but nonverbal

(b) Lethargic

(c) Slow to answer questions

(d) Slow movements

(2) Skin signs

(a) Flushed

(b) Diaphoretic

(c) Progression of skin color during the postictal phase

ii) Medications

(1) Changes in medications

(2) Non-compliance with medications

(3) Rapid growth (children)

iii) Previous seizures

(1) Length of seizure activity

(2) Date of last seizure

(3) Need for ALS treatments

iv) Seizure activity

(1) Duration

(2) Number of seizures

(a) Consciousness between seizures

(b) Potential for status epilepticus

v) Physical

(1) Standard physical exam for the patient with potential neurological event

(2) Pertinent findings

(a) Tongue (lacerations)

(b) Head

(i) Hemorrhage

(ii) Wounds

(c) GI/GU

(i) Incontinence of urine

(ii) Incontinence of feces

(3) Management

(a) Airway and ventilatory support

(i) Oxygen

(ii) Positioning

(iii) Assisted ventilation

(iv) Suction

(v) Advanced airway device

(b) Circulatory support

(i) Venous access

(c) Check glucose

(d) Pharmacological interventions

(i) Dextrose

(ii) Narcan

(e) Non-pharmacological interventions

(i) Protection from injury

(ii) Positioning

(iii) Spinal precautions

(iv) Transport considerations

1. Appropriate mode
2. Appropriate facility
3. Psychological support/communication strategies

4. Issues of refusals

7) Non-specific coma or altered level of consciousness/syncope/weakness/headache

a) Pathophysiology
   i) Coma
      (1) Define
   ii) Syncope
      (1) Definition
      (2) Causes
   iii) Headache
      (1) Migraine
      (2) Intracranial bleed
   iv) Drugs
      (1) Barbiturates
         (a) Profile
      (2) Narcotics
         (a) Profile
      (3) Hallucinogens
         (a) Profile
      (4) Depressants (including alcohol)
         (a) Profile

b) Assessment findings

c) Management
   i) Airway and ventilatory support
      (1) Oxygen
      (2) Positioning
      (3) Assisted ventilation
      (4) Suction
      (5) Advanced airway device
   ii) Circulatory support
      (1) Venous access
      (2) EKG monitoring

iii) Blood glucose
iv) Pharmacological interventions
(1) Dextrose
(2) Narcan
v) Non-pharmacological interventions
(1) Protection from injury
(2) Positioning
(3) Spinal precautions
vi) Transport considerations
(1) Appropriate mode
(2) Appropriate facility
vii) Psychological support/community strategies

8) Integration
a) Scenarios of altered mentation
i) Coma
ii) Stroke
iii) Seizure
b) Develop management strategies for each scenario

The Endocrine System

1) Function of pancreatic hormones
a) Insulin
b) Glucagon
2) Diabetes mellitus
a) Type 1
i) Other names
(1) Insulin dependent diabetes mellitus (IDDM)
(2) Juvenile-onset diabetes
ii) Incidence
(1) 5-10% of all diabetes diagnoses
(2) Typically diagnosed in children and young adults

iii) Morbidity/mortality
(1) Long term complications
(2) Risk factors
(a) Genetic predisposition

b) Type 2
i) Other names
(1) Non-insulin-dependent diabetes mellitus (NIDDM)
(2) Adult-onset diabetes
ii) Incidence
(1) 90-95% of all diabetes diagnoses
iii) Morbidity/mortality
(1) Long term complications
(2) Risk factors
(a) Heredity (family history)
(b) Obesity

c) Normal glucose metabolism
i) Glucose transported into the cell by insulin
ii) Aerobic metabolism
(1) The most efficient cellular energy production process
(2) High yield of ATP
(3) By-products C02 and H20
(a) Easily eliminated by lungs and kidneys

d) Glucose regulation
i) Glucagon
(1) Released in response to mismatch of glucose to insulin molecules
(a) High insulin and deceased glucose
(i) Glucagon releases stored glucose in the liver
(ii) Result increases glucose levels in the blood
1. Glucose-to-insulin ratio becomes more equal

ii) Insulin
(1) Release in response to high levels of glucose
(2) Facilitates more glucose transport into the cell
(3) Blood glucose levels normalize as a result

e) Pathophysiology of Diabetes
i) Mismatch of insulin-to-glucose molecules
(1) Low or no circulating insulin causing high blood glucose levels
(a) High concentrations of glucose are eliminated by the kidneys
(i) Fluid shifts to dilute glucose
1. Polyuria
2. Polydipsia
(ii) Dehydration potential
(2) Cells must find alternative energy source for metabolism
(a) Fats and proteins
(b) Energy production similar to normal glucose metabolism
(c) Cellular by product – Ketone
(i) Amount of ketones produced are determined by the severity of insulin deficiency
1. DKA vs. HHNK
(ii) Elimination is slow and difficult
(iii) Ketones upset pH balance and acidosis develops
1. Relatively rapid changes in DKA
2. Minimal pH changes in HHNK

3) Assessment findings – Hyperglycemia , DKA and HHNK
a) Scene assessment
i) Presence of blood glucose testing supplies

4) General impression and initial assessment
i) Altered mental status
ii) Abnormal respiratory pattern (Kussmaul's breathing)
iii) Breath has a distinct fruity odor
iv) Pale skin

5) Focused history
   a) Symptoms
      i) Abdominal pain or cramping
      ii) Weakness
      iii) Lethargy
      iv) Recent weight loss
      v) Abnormal thirst or hunger
      vi) Increase in the frequency of urination
   b) Onset and progression of symptoms
      i) DKA
      ii) HHNK
6) Medications
      i) Has the patient been diagnosed with diabetes?
      ii) Has insulin dosage changed recently?
      iii) Has the patient had a recent infection?
      iv) Recent exercise or change in routine
      v) Has the patient suffered any psychologic stress?
   a) Physical assessment
      i) Warm, dry skin
      ii) Signs of dehydration
         (1) Poor skin turgor
         (2) Dry mucous membranes
         (3) Sunken eyes
      iii) Tachycardia
      iv) Hypotension or orthostatic hypotension
      v) Blood glucose analysis
         (1) Elevation
            (a) Normal levels 80 – 120 mg/dL
            (b)
   b) Management
      i) Airway and ventilation

ii) Circulation
(1) EKG monitoring
(2) IV therapy
(a) Large bore if severe hyperglycemia
(b) Fluid bolus
iii) Treatment of abnormal glucose levels should be based on clinical presentation and local protocols
iv) Transport considerations
(1) Appropriate mode
(2) Appropriate facility
(3) Psychological support/communication strategies

7) Hypoglycemia

a) Risk factors
i) Triggers
b) Pathophysiology
i) Blood glucose levels fall below that required for normal body functioning
ii) Cellular organ death can occur if left untreated
c) Assessment findings
i) Patients may tolerate low levels of glucose differently
ii) Attempt to gain baselines on previous hypoglycemic episodes
d) Focused assessment
i) SAMPLE
ii) History
(1) Diabetes
(2) Recent history
(a) Prolonged fasting
(b) Exercise in the last 24 hours
(c) Changes in activity
(3) Alcoholism
(4) General health
(5) Previous medical conditions

e) Physical findings
   i) Weakness
   ii) Irritability
   iii) Hunger
   iv) Confusion
   v) Anxiety
   vi) Bizarre behavior
   vii) Tachycardia
   viii) Normal respiratory pattern
   ix) Cool, pale skin
   x) Diaphoresis
   xi) Blood glucose analysis
f) Management
   i) Airway and ventilation
   ii) Circulations
   iii) Pharmacological interventions
      (1) Oral glucose
         (a) Review
            (i) Profile
            (ii) Indications
            (iii) Contraindications
            (iv) Drug interactions
            (v) Adverse reactions
            (vi) Dosing
      (2) D50
         (a) Profile
         (b) Indications
         (c) Contraindications
         (d) Drug interactions
         (e) Adverse reactions
         (f) Dosing

(3) Glucagon

(a) Profile

(b) Indications

(c) Contraindications

(d) Drug interactions

(e) Adverse reactions

(f) Dosing

iv) Non-pharmacological interventions

v) Transport considerations

(1) Appropriate mode

(2) Appropriate facility

(3) Refusal

(4) Psychological support/communication strategies

8) Hyperglycemia

a) Blood glucose levels are higher than circulating insulin levels

i) Low to moderate levels of ketones are produced

ii) Signs of DKA may or may not be present

9) Diabetic ketoacidosis

a) Occurs in Type I diabetes

b) Anatomy and physiology review

i) Pathophysiology

ii) Absence of insulin results in spike in blood glucose levels

(1) Rapid rise in blood glucose

(2) Blood glucose levels typically higher than 250mg/dl

(3) See diabetes mellitus

c) Assessment findings

d) Focused assessment

i) Chief complaint

(1) Stomach pain

(2) Unconscious

(3) Near-syncope

(4) Weakness

ii) Vital signs

(1) Rapid and/or deep respirations

(2) Tachycardia

(3) Hypotension potential

iii) Recent history

(1) Infection

(2) Stress

(3) Inconsistent absorption of insulin

(4) Mismatch of insulin dose to carbohydrate intake

(5) Insulin pump failure

(6) Medication noncompliance

(7) Changes to metabolic demands

iv) Time of onset

(1) Within hours

e) Physical

i) Dehydration

ii) Hypotension

(1) Late finding

iii) Reflex tachycardia

iv) Acetone (fruity) odor on breath

(1) Severe or late finding

v) Nausea/vomiting

vi) Abdominal pain

vii) Hyperventilation

(1) Late finding

viii) Kussmaul's respiration

(1) Late finding

10) Hyperosmolar non-ketotic coma

a) Occurs in Type II diabetes

b) Characterized by severe hyperglycemia and dehydration, but no ketoacidosis

c) Differences from DKA
   i) Pathophysiology
      (1) Higher blood glucose levels will be present before obvious signs develop
         (a) Type II diabetes patients still have some circulating insulin
         (b) Ketone development is slow
            (i) Onset of HHNK rarely occurs within hours or days
            (ii) Kussmaul respirations are typically absent
      (2) High levels of blood glucose
         (a) Elimination by the kidneys with fluid shifts to dilute the glucose
         (b) Dehydration potential is similar to DKA
d) Assessment findings
   i) General impression and initial assessment
      (1) Unconsciousness
      (2) No abnormal respiratory patterns
e) Focused assessment
   i) SAMPLE
   ii) History
      (1) Infection
      (2) Stress
      (3) Medications
         (a) Steroids
      (4) Blood glucose levels typically above 1000 mg/dL
   iii) Physical findings
      (1) Hyperventilation and Kussmaul respirations seldom seen
      (2) History
         (a) Difficult to ascertain because onset of symptoms are subtle

(3) Neurologic abnormalities

(a) Altered level of consciousness

(b) Coma

(c) Dehydration

(d) Abnormal increase in urination

(i) Orthostatic hypotension may be present

f) Management of DKA and HHNK

i) Airway and ventilation

ii) Circulation

(1) IV access

(a) Rehydration

(b) Fluid challenge

(i) Check breath sounds

(c) EKG

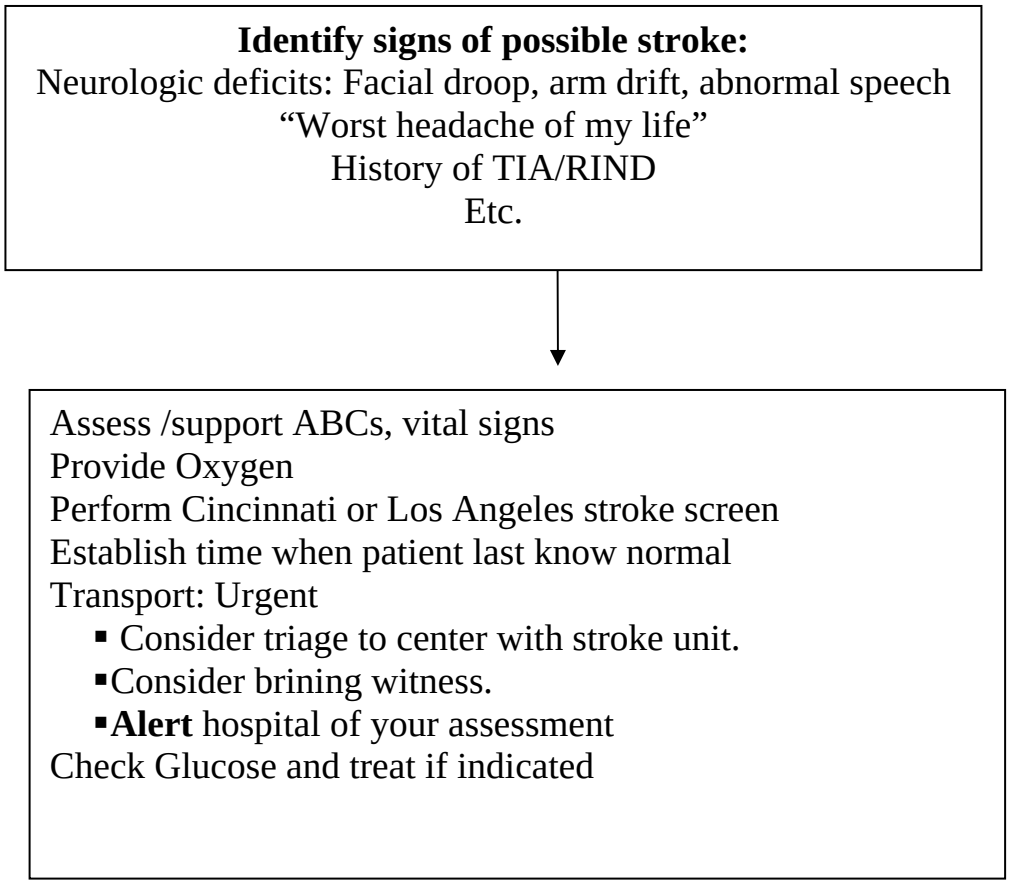
(2) Transport considerations

(a) Appropriate mode

(b) Appropriate facility

(3) Psychological support/communication strategies

Suspected Stroke Algorithm
EMT- Intermediate




This page intentionally left blank

Trauma

Terminal Objective

At the completion of this module, the EMT-Intermediate student will be able to utilize the assessment findings to formulate a field impression and implement the treatment plan for the trauma patient.

It is recommended that the EMT-Intermediate student take a nationally recognized Pre-Hospital Trauma Class. Example: NAEMT Pre-Hospital Trauma Life Support or Basic Trauma Life Support.

Trauma Systems and Mechanism of Injury

Terminal Objective

At the completion of this unit, the EMT-I student will be able to apply the principles of kinematics to enhance the patient assessment and predict the likelihood of injuries based on the patient's mechanism of injury.

Cognitive Objectives

1) List and the components of the trauma system in the State of Oregon. (C-1)
2) Explain the role of and the differences between the levels of trauma centers in Oregon. (C-2)
3) Describe the criteria for transport to a trauma center. (C-2)
4) Describe the criteria and procedure for air medical transport. (C-2)
5) Define energy and force as they relate to trauma. (C-1)
6) Define the laws of motion and energy and understand the role of increased speed has on injuries. (C-2)
7) Define the role of kinematics as an additional tool for patient assessment. (C-2)
8) Describe the organ collisions that occur in blunt trauma and vehicular collisions. (C-1)
9) Describe each type of vehicular collision and list the injuries that would potentially result from each impact. (C-1)
10) Determine the effects of various restraint systems on energy transfer and injury patterns in motor vehicle crashes. (C3) – Enhanced objective
11) Explain motion and energy considerations of mechanisms other than motor vehicle crashes. (C-2)

12)Explain the kinematics of penetrating injuries. (C-2)

13)List specific injuries and their causes as related to interior and exterior vehicle damage. (C-1)

Affective Objectives

None identified for this unit

Psychomotor Objectives

None identified for this unit

Declarative

1) Oregon trauma system
    a) Components
        i) Injury prevention
        ii) Prehospital care
            (1) Treatment
            (2) Transportation
            (3) Trauma triage guidelines
                (a) Mandatory v. discretionary
                (b) Prehospital criteria v. hospital trauma activation criteria
                (c) ATAB involvement for prehospital triage and transport
                    (i) Allows for specificity by region
                    (ii) Based upon local issues and QI data
                    (iii) Examples – 2005
                        1. ATAB 5 - Sharing trauma call between hospitals
                        2. ATAB 1 – Bypassing trauma hospitals
                        3. ATAB 3 – Specific criteria for transport to a level 2 v. level 3 hospital
            (4) Emergency Department capabilities

(5) Interfacility transportation as necessary

(a) “Critical Access Hospital”

(i) Medicare designation for funding purposes

(ii) Hospital must not have more than 25 beds

(iii) Increased likelihood for interfacility transport

(6) Definitive care

(7) Trauma critical care

(8) Rehabilitation

(9) Data collection/trauma registry

b) Trauma centers

i) Levels

ii) Qualifications

(1) Essential

(2) Desired

c) Transport considerations

i) Level of receiving facility

ii) Mode of transport

(1) Ground

(a) When the appropriate facility can be reached within reasonable time

(b) To a more accessible landing zone for air medical transport

(2) Air medical

(a) Indications

(b) Contraindications

(c) Procedure

(d) Local standing orders

2) Kinetics of Energy

a) Review the kinematics involved in blunt trauma

i) Newton’s first law of motion

(1) A body at rest or a body in motion will remain in that state until acted upon by an outside force

ii) Conservation of energy

(1) Energy cannot be created nor destroyed

(2) It can only change forms

iii) Kinetic energy (KE)

(1) $KE = \frac{Mass \times Velocity^2}{2}$

(2) Velocity influences KE more than mass

(3) Greater amounts or energy are created with higher speeds

iv) Force

(1) Force = mass x acceleration (or deceleration)

(2) Greater speeds of acceleration or deceleration will generate greater force

b) Application of kinetic energy and force to trauma assessment

i) Rates of speed and rates of acceleration/deceleration will assist with the determination of energy transfer to the patient

(1) Assessment of vehicular damage and path of energy exchange towards the interior compartment

(2) Stopping distances before impact or landing

(3) Mechanisms used to exchange energy prior to impact

(a) Braking/skids

(b) Surface of travel

(c) Air bags

ii) Greater precision likely with the prediction of internal injuries

3) Injury potentials in blunt trauma

a) Organ collisions in blunt vehicular trauma

i) Vehicle v. object

ii) Body v. vehicle

iii) Organ v. body cavity wall

b) Body organs travel at the same speed as the vehicle

c) Sudden stoppage will increase the force against organs and increase the injury potential

4) Types of vehicle collisions
   a) Frontal
   b) Lateral
   c) Rear
   d) Rotational
   e) Rollover
   f) Prediction of injuries
      i) Frontal impact
         (1) Up-and-over pathway
            (a) Injury potential
               (i) Head injury
                  a. Skull fractures
                  b. Cerebral contusion
                  c. Stretch of the brain stem
               (ii) Spinal injury
                  1. Hyperflexion
                  2. Compression injury from unrestrained occupants
               (iii) Chest injury
                  1. Rib fractures
                  2. Pneumothorax
                  3. Cardiac contusion
                  4. Myocardial rupture
                  5. Aortic shear injury
               (iv) Abdominal injury
                  1. Liver fracture (ligamentum teres)
                  2. Splenic fracture
               (v) Pelvis fracture

(2) Down-and-under

(a) Injury potential

(i) Lower extremity fractures

(ii) Posterior knee dislocation

(iii) Femur fracture

(iv) Hip dislocations

(v) Liver fracture

ii) Rear impact

(1) Seat propels the occupant forward

(2) Inadequate headrest position may increase neck injury potential

(3) Injury potential

(a) Head injury

(i) Brain impact with rear and front portions of the skull

1. "Coup-contrecoup" injury
2. Cerebral contusion or subdural bleeding

(b) Spinal injury

(i) Hyperextension

(ii) Hyperflexion

(c) Other injuries from striking other objects

(i) Head trauma

(ii) Chest trauma

(iii) Seatbelt injuries

iii) Lateral impact

(1) Lack of lateral vehicle protection increases injury potential to the occupant

(2) Injury potential

(a) Spinal injury

(i) Rotation injury

(ii) Shearing injury

(b) Head injury

(i) Shear injury to vessels

(ii) Intracranial bleeds

(c) Humerus fracture

(d) Lateral chest injury

(i) Flail chest

(ii) Pneumothorax

(iii) Hemothorax

(iv) Pulmonary contusion

(e) Splenic fracture (impact to passenger side of vehicle)

(f) Liver fracture (impact to driver side of vehicle)

(g) Pelvic fracture

(h) Lower extremity fracture

iv) Rotational impacts

(1) Vehicle is struck at an oblique angle

(a) Deceleration is more gradual than other impacts

(2) Injury potential

(a) Similar to frontal and lateral impacts

(b) The major injury emphasis will depend upon the initial impact point and motion

v) Rollover

(1) Multiple points of impact

(2) Ejection from the vehicle is likely with unrestrained occupants

(3) Difficult to predict specific injuries

(4) Multi-systems trauma likely

5) Restraint systems - Enhanced

a) Purpose

i) Absorbing the energy of the impact before the occupant strikes something hard

ii) Decreases velocity in body collision by decreasing the distance the body has to travel

b) Belt restraints

i) Works in lateral impacts as well as in frontal impacts

c) Lap belts
   i) Holds the lower torso closely to the seat and away from the dash or steering column
   ii) Injury prevention
      (1) Prevents forward motion of the lower torso in frontal collisions
      (2) Moves the torso with the vehicle and away from the impact in lateral impact collisions
      (3) Prevents multiple impacts in rollover collisions
      (4) Prevents ejection of the occupants
      (5) Prevents forward motion of the pelvis by supporting the anterior part of the pelvis
   iii) Limitations
      (1) Upper torso is not supported
      (2) Improper positioning on the body will cause a crushing of the intra-abdominal organs between the belt and spine
      (3) Potential for vertebral fractures
      (4) May cause diaphragmatic rupture
d) Shoulder restraints
   i) Injury prevention
      (1) Prevents the forward motion of the upper torso in frontal impact collisions
      (2) Prevents hyperflexion of the upper torso in a frontal impact
      (3) Moves the upper torso with the vehicle in lateral impact collisions
   ii) Limitations
      (1) If worn without a lap belt, neck injuries can occur
         (a) Down-and under pathway encouraged from a frontal collision
      (2) High position can fracture or dislocate the lumbar spine
      (3) Increased intra-abdominal pressure can rupture the diaphragm
e) Airbags
   i) Benefits
      (1) Supplemental protection

ii) Limitations

(1) Minimally effective alone

(2) Can produce significant injuries if deployment is too close to occupant

(3) Projects standing children into the seat producing cervical spine fractures

f) Child safety seats

i) Age and types

ii) Proper use

iii) Injury patterns

iv) Proper use with airbags

6) Motorcycle collisions

a) Frontal impact

i) Ejection potential

ii) Occupant impacts portions of the motorcycle

(1) Face

(2) Chest

(3) Abdomen

(4) Upper legs (femur)

iii) Ejection over the bike

(1) Into another vehicle

(2) Onto the ground

(3) Into objects in the path of ejection

(a) Cervical spine fractures

(b) Injuries to the torso

(i) Solid abdominal organ fracture

(ii) Hollow organ rupture (e.g., lungs)

(iii) Shear injuries to the aorta

(c) Open fractures to the lower extremities

b) Angular motorcycle impacts

i) Collapse of bike onto vehicle

ii) Legs trapped between bike and vehicle
(1) Open fractures and/or dislocations
(2) Lateral motion of torso into vehicle
(a) Injuries similar to lateral vehicle impacts
(i) Cervical spine injury
(ii) Lateral chest injuries
(iii) Lateral abdomen
a. Aorta
b. Liver or spleen
(iv) Protection
iii) Head
(1) Helmet
(a) 300% increase in brain injury without helmet
iv) Spine
(1) Small protection
(a) No increase
v) Skin
(1) Leathers
(2) Very protective during slides on asphalt
vi) Ankles and feet
(1) Strong boots

7) Pedestrian collisions with vehicles
a) Factors in determining Injury patterns
i) Height
ii) Body area facing impact
iii) Age
(1) Adult turns away from the vehicle
(2) Child turns to face the vehicle

b) Three phases of impact
   i) Vehicle strikes pedestrian
      (1) Legs struck by bumper
      (2) Pelvis crushed by the front of the vehicle
      (3) Lumbar and thoracic spine fractures
   ii) Pedestrian rotates onto hood
      (a) Compression injuries and/or shear injuries to chest/abdomen
      (b) Cervical spine fractures or dislocations
   iii) Pedestrian thrown to the ground
      (1) Impact into the ground similar to a fall from a height
         (a) Asphalt
         (b) Facial fractures and head trauma potential
      (2) Secondary injuries
         (a) Run over by the vehicle
         (b) Dragged by the vehicle

8) Falls
   a) Prediction of severity
      i) Height of fall
      ii) Type of landing surface
      iii) Objects struck during fall
      iv) Body part of first impact
   b) Mechanisms of falls - landings
      i) Feet first
         (1) Impact onto the heels of the feet
         (2) Linear travel of kinetic energy
            (a) Ankles, knees, femur
            (b) Acetabulum, pelvis

(c) Vertebral fractures

1. Lumbar vertebrae
2. Thoracic vertebrae

(d) Deceleration injuries to the chest and abdomen

(i) Liver

(ii) Kidney

(iii) Spleen

(iv) Aorta

ii) Head first

(1) Compression injuries

(a) Skull fracture

(b) Brain injury

(c) Spine

(d) Deceleration (shear) injuries

(i) aorta

(ii) kidney

(iii) other

iii) Parallel to ground

(1) Compression injuries

(a) All parts of the impact

(b) Injuries may be similar to lateral vehicular collisions

9) Blast Injuries

i) Five phases

(1) Primary phase

(2) Secondary phase

(3) Tertiary phase

(4) Quaternary phase

(5) Quinary phase

(6) Each phase has a different energy pattern

ii) Primary phase
  (1) Pressure wave of the blast
    (a) Major effect on gas-containing organs
    (b) Rupture or air emboli injury potential
      (i) Lungs
      (ii) Intestinal tract
  (2) Heat wave from the blast
    (a) Burns on unprotected parts of the body
    (b) Skin and eyes
iii) Secondary phase
  (1) Injuries sustained by flying particles
    (a) Glass
    (b) Brick
    (c) Wood
    (d) Metal
  (2) Injury potential
    (a) Internal organ compression injuries
    (b) Lacerations
    (c) Skeletal fractures
iv) Tertiary phase
  (1) Patient becomes flying object
    (a) Injury mechanism similar to a fall
v) Quaternary phase
  (1) Injuries produced by heat and fumes from the explosion
  (2) Injury potential
vi) Quinary phase
  (1) Bomb-related injuries
  (2) Causes
    (a) “Dirty bombs”
      (i) Radiation, bacteria, chemicals
    (b) Fragments of human remains

(i) Suicide bomber

10) Penetrating Trauma

a) Review of kinetic energy

i) $KE = \frac{\text{mass x velocity}^2}{2}$

ii) Force = mass x acceleration (or deceleration)

b) Energy exchange in the body
   i) Intensity of energy exchange is based upon the density of the tissue
      (1) Gas
         (a) Lung
         (b) Gastrointestinal tract
      (2) Liquid
         (a) Blood vessels
         (b) Muscle
         (c) Solid organs
            (i) Spleen
            (ii) Liver
            (iii) Kidney
      (3) Solid
         (a) Bone
   ii) Area of interaction and energy exchange
      (1) Deformation of bullet
      (2) Tumble
      (3) Fragmentation
c) Energy exchange and injury potential
   i) The energy used to place the mass in motion must be completely exchanged into the body tissues in order to stop the travel of the mass
   ii) Higher speeds and force of a projectile upon impact with the body will require a higher absorption of energy by the body
      (1) Cavitation
         (a) Definition
         (b) Temporary cavitation
            (i) Compression wave of tissue particles away from the path of the projectile
            (ii) Tissue damage produced by stretching of the tissues

(c) Permanent cavitation

(i) Visible when examined

(ii) Crushed tissue

iii) Weapon characteristics

(1) Low velocity, low energy exchange

(a) Examples

(i) Knife

(ii) Ice pick

(iii) Axe

(iv) Other

(b) Minimal cavitation

(c) Damage pathway is limited by the cutting edge of the object

(2) Medium velocity, medium energy exchange

(a) Muzzle velocities less than 1500 feet/ second

(b) Examples

(i) Handguns

(ii) Low-power rifles

(c) Small projectiles

(d) Cavitation is 6-10 times the frontal area of the bullet

(3) High velocity, high energy exchange

(a) Muzzle velocity greater than 1500 feet/ second

(b) Examples

(i) High velocity, small caliber weapons

(ii) M16, AK 47/74

(iii) Other

(c) Cavitation 20-30 times frontal area of the bullet

d) Implications of soft body armor

i) Anatomy

ii) Organs injured

iii) Pathway of missile

e) Profile of a bullet wound
   i) Entrance wound
      (1) Hole is crushed inward
         (a) Round or oval shaped
         (b) Rim
            (i) Dark
            (ii) 1-2 mm width
            (iii) Produced by grease and other substance on the bullet
         (c) Minimal bleeding present
      (2) Abrasion
         (a) Produced by the spinning of the bullet
         (b) Largest with greatest contact of skin
         (c) Larger area when bullet impact is at an angle
      (3) Burn
         (a) Produced by the flame from the barrel
            (i) Indicates close contact with the muzzle of the weapon
            (ii) End of the weapon likely to be 4-6 inches from the skin
         (b) Expect a high level of energy exchange inside the body
            (i) Large area of cavitation
            (ii) Higher compression of tissues
   ii) Exit wound
      (1) Pushed outward
      (2) Stellate or slit in appearance
      (3) Bleeding potential


This page intentionally left blank

Hemorrhage and Shock

Unit Terminal Objective

At the completion of this unit, the EMT-Intermediate student will be able to utilize the assessment findings to formulate a field impression and implement the treatment plan for the patient with hemorrhage or shock.

Cognitive Objectives

1. List the causes of hemorrhage and state examples of medical and traumatic causes for hemorrhage. (C-1)
2. Review the various types of hemorrhage. (C-2)
3. Generalize the body's response to various stages of blood loss. (C-3)
4. Explain how pediatric and geriatric patients tolerate varying stages of hemorrhage differently. (C-2)
5. Review the components of perfusion including cardiac output, blood pressure regulation and capillary dynamics. (C-2)
6. Outline the differences between aerobic and anaerobic metabolism as they relate to the amount of energy production and the production of waste products. (C-1)
7. Categorize traumatic and medical causes of shock by the impaired mechanism(s) of perfusion. (C-2)
8. Describe the body's physiologic response to changes in perfusion. (C-2)
9. Differentiate between the pathophysiology of compensated and decompensated shock. (C-2)
10. Describe the effects of decreased perfusion at the capillary level. (C-2)
11. Discuss the cellular ischemic phase related to hypovolemic shock. (C-2)
12. Discuss the capillary stagnation phase of hypovolemic shock. (C-2)
13. Discuss the capillary washout phase related to hypovolemic shock. (C-2)
14. Differentiate between the assessment findings of compensated and decompensated shock. (C-3)
15. Differentiate the assessment findings for hypovolemic, cardiogenic, distributive, obstructive and neurogenic shock. (C-3)
16. Explain the general principles involved in shock management. (C-2)

17. Discuss the physiologic changes associated with the pneumatic anti-shock garment (PASG). (C-2)
18. Discuss the indications and contraindications for application and inflation of the PASG. (C-2)
19. Integrate the principles of pathophysiology into the assessment of hemorrhage or shock. (C-5)
20. Synthesize assessment findings and patient history information to form a field impression for the patient with hemorrhage or shock. (C-5)
21. Develop, execute, and evaluate a treatment plan based on the field impression for the hemorrhage or shock patient. (C-5)
22. Differentiate between the treatment strategies for hypovolemic, cardiogenic, distributive, obstructive, neurogenic and hypovolemic shock. (C-3)

Affective Objectives

At the completion of this unit, the EMT intermediate student will be able to:

1. Demonstrate the rapid recognition of compensated shock and initiate the appropriate treatment plan for the patient. (A-3)

Psychomotor Objectives

At the completion of this unit, the EMT intermediate student will be able to:

1. Demonstrate the assessment and management of a patient with signs and symptoms of compensated hypovolemic shock. (P-2)
2. Demonstrate the assessment and management of a patient with signs and symptoms of decompensated hypovolemic shock. (P-2)

Hemorrhage and Shock Declarative

1) Causes of Hemorrhage
   a) External
   b) Internal
      i) Traumatic causes

ii) Non-traumatic causes
(1) Examples

2) Types of Hemorrhage
a) Controlled versus uncontrolled
i) External
ii) Internal
b) Arterial
c) Venous
d) Capillary

3) Severity of Hemorrhage
a) Stages of intravascular fluid loss
i) Stage 1
(1) Up to 15% intravascular loss
(2) Minimal response by the body
(3) Compensated by constriction of blood vessels
(a) Vital signs remain stable
(b) Patient may not show obvious signs
ii) Stage 2
(1) 15-25% intravascular loss
(2) Compensated phase of shock
(a) Compensation by the sympathetic nervous system
(b) The patient may show signs of an adrenaline response
(i) Elevation in heart rate
(ii) Elevation in respiratory rate
(3) Body cells begin to starve for oxygen
(a) Anxiousness and pale skin may be the only signs seen by the EMT
iii) Stage 3
(1) 25-35% intravascular loss
(2) Body cells suffer from profound hypoxia
(3) The sympathetic nervous system cannot maintain perfusion
(4) Decompensated phase of shock

(5) Classic signs of hypovolemic shock displayed by the patient
(a) Marked tachycardia and tachypnea
(b) Cold and clammy skin
(c) Decreased blood pressure
(d) Obvious alteration in mental status

iv) Stage 4
(1) Intravascular loss of greater than 35%
(2) Low blood volume reduces cardiac preload
(a) Low cardiac output
(b) Loss of peripheral pulses
(c) Very low blood pressure
(3) Irreversible stage of shock
(a) Body cells die
(b) Confusion and lethargy ➔ unconsciousness
(c) Very poor skin signs

b) Tolerance to blood and fluid loss
(1) Adults
(2) Pediatrics
(3) Geriatrics

4) Pathophysiology of shock
a) Review of perfusion
i) Cardiac output = stroke volume x heart rate
ii) BP = cardiac output x peripheral vascular resistance
iii) Roles of capillary sphincters
(1) Pre- and post-capillary sphincters
(a) Control blood flow at the capillary bed
(2) Controlled by several mechanisms
(a) Direct stimulation by the sympathetic nervous system
(b) Presence of carbon dioxide and lactic acid
(c) Cellular demand for oxygen
iv) Cellular metabolism

(1) Connections between oxygen supply and energy production

(a) Aerobic metabolism

(i) Preferred choice for the cell

(ii) Requires the presence of oxygen

(iii) Net production of 36 energy molecules (ATP)

(iv) Sufficient to meet the energy demands of the cell

(v) Production of waste products that are easy to eliminate

1. Carbon dioxide
2. Water

(b) Anaerobic metabolism

(i) Temporary process utilized when oxygen is not present

(ii) Net production of 2 energy molecules (ATP)

(iii) Production of waste products that are difficult to eliminate

1. Lactic acid

b) Causes of decreased perfusion (hypoperfusion)

i) Hypovolemia

(1) Uncontrolled hemorrhage

(2) Dehydration

(3) Vomiting or diarrhea

(4) Gastrointestinal bleeds

ii) Inadequate cardiac output

iii) May develop into cardiogenic shock

(1) Extreme tachycardia or bradycardia

(2) Acute myocardial infarction

(3) Cardiac contusion

iv) Decreased peripheral vascular resistance

(1) Vasodilation and/or increased vessel permeability

(2) Shock types

(a) Distributive shock

(i) Massive bloodborne bacterial infections

(ii) Anaphylaxis

(b) Neurogenic shock

(i) "Spinal shock"

(ii) Systemic dilation of arteries

v) Inability of red blood cells to deliver oxygen to tissues

(1) Uncontrolled bleeding

(2) Pulmonary contusion

(3) Hemothorax

(4) Obstructive shock

(a) Tension pneumothorax

(b) Cardiac tamponade

c) Compensation for decreased perfusion

i) Feedback loops to the medulla

(1) Stimulated by baroreceptors

(a) Low pressure in the arteries

(2) Stimulated by chemoreceptors

(a) Decrease in PaO_2 and increase in $PaCO_2$ levels in the arteries

ii) Response of the medulla

(1) Stimulation of adrenal glands

(2) Stimulation of the sympathetic nervous system

(3) Effects

(i) Increase in heart rate and contractility

(ii) Increase in blood pressure

(iii) Increase in respiratory rate and depth

(iv) Increased fluid retention in the vessels

d) Shock

i) Definition

ii) Stages of shock

(1) Compensated

(2) Decompensated

(3) Irreversible

iii) Compensated shock

(1) Stimulation of the sympathetic nervous system
  (a) Increase in heart rate and respiratory rate
  (b) Diaphoresis and pale skin
  (c) Arteriole constriction and closure of the pre-capillary sphincter
    (i) Blood shunted to the core
    (ii) Reduction of oxygen delivery to the peripheral tissues

(2) Cellular ischemic phase
  (a) Reduced oxygen delivery cause the cells to transition from aerobic to anaerobic metabolism in the periphery
    (i) Cells begin to build up lactic acid
    (ii) Cellular activity begins to slow
  (b) Elevated levels of acid stimulate chemoreceptors
    (i) Stimulation of the medulla
    (ii) Increase in respiratory rate
  (c) Closure of the pre-capillary sphincter causes stagnation of blood
    (i) Blood begins to coagulate

iv) Decompensated shock

(1) Capillary stagnation phase
  (a) Loss of fluid and oxygen delivery begin to impact more of the body
    (i) Organs and cells in the core begin to transition to anaerobic metabolism
  (b) Lactic acid levels build and leak into the capillaries
    (i) Stimulates the opening of the pre-capillary sphincter
    (ii) Stagnated and clotted blood moves into the capillaries
  (c) Post-capillary sphincter remains closed
    (i) Pressure changes cause fluid shifts into the capillaries
    (ii) Drop in circulating blood volume
      1. Cardiac output begins to fail
      2. Blood pressure begins to fall

v) Irreversible shock
(1) Capillary washout phase
(a) Cells begin to die from lack of oxygen
(i) Cell membranes lose their selectivity
1. Acid, potassium flood into capillaries
(b) Large concentrations of acid in the capillaries stimulate both capillary sphincters to open
(c) Clots and acid circulate to all body tissues
(d) Organ function fails from profound acidosis and hypoxia
(i) Control centers in the medulla fail
1. Drop in heart rate
2. Drop in respiratory rate
3. Loss of vascular constriction

5) Assessment findings of shock
a) Compensated shock
i) Signs and symptoms of early shock
(1) Anxiousness, restlessness or anxiety
(2) Normal or elevated respiratory rate
(3) Tachycardia
(4) Pale, cool and clammy skin
(5) Dry mucosa
(6) Complaint of thirst
(7) Complaint of weakness
ii) Arterial blood pressure is normal or high
iii) Treatment will typically result in recovery

b) Decompensated shock
   i) Signs and symptoms of late shock
      (1) Significant decrease in mentation
      (2) Elevated respiratory rate
      (3) Significant elevation of heart rate
      (4) Weak pulse quality
      (5) Pale, cold and diaphoretic skin
   ii) Arterial blood pressure is abnormally low
   iii) Treatment will sometimes result in recovery
c) Irreversible
   i) Signs and symptoms of late shock
      (1) Unconsciousness
      (2) Slowing of heart rate
      (3) Slowing of respiratory rate
      (4) Waxen, mottled cold skin
   ii) Arterial blood pressure is extremely low
   iii) Even aggressive treatment does not result in recovery

6) Differential shock assessment findings
   a) Medical cause of hypovolemic shock
      i) Bright red blood from wound, mouth, rectum or other orifice
      ii) Coffee ground appearance of vomitus
      iii) Melena
      iv) Hematochezia
      v) Dizziness or syncope on sitting or standing
      vi) Orthostatic hypotension
   b) Signs and symptoms of hypovolemic shock

c) Cardiogenic shock
   i) Chief complaint of chest pain, dyspnea, tachycardia
   ii) Abnormal heart rhythms and/or rate
      (1) Bradycardia
      (2) Excessive tachycardia
      (3) Dysrhythmias
   iii) Signs of acute congestive heart failure
      (1) Pulmonary edema
      (2) Orthopnea
      (3) Jugular venous distention
d) Distributive shock
   i) Mechanism that suggests vasodilation
      (1) Drug overdose
      (2) Sepsis or infection
      (3) Anaphylaxis
   ii) Warm flushed skin, especially in dependent areas
   iii) Hives
e) Obstructive shock
   i) Mechanism suggesting significant chest trauma
      (1) Rib and sternal fractures
      (2) Tension pneumothorax
      (3) Pericardial tamponade
   ii) Medical cause
      (1) Pulmonary embolus
   iii) Signs
      (1) Extreme shortness of breath and poor skin signs
      (2) Tachycardia

f) Spinal, or neurogenic shock
   i) Rare occurrence
   ii) Mechanism that suggests spinal trauma
      (1) Falls on feet or head
      (2) Penetrating trauma to the back with neurological deficits
   iii) Loss of function below the site of spinal cord injury
      (1) Flaccid paralysis distal to injury site
      (2) Loss of sympathetic nervous system function
         (a) Relative bradycardia
         (b) Hypotension
            (i) Systolic blood pressure 80-100mm Hg
         (c) Vasodilation
            (i) Warm, pink and dry skin
         (d) Loss of bladder and bowel control
         (e) Priapism

7) General principles of shock management
   a) Airway and ventilatory support
      i) Ventilate and suction as necessary
      ii) Administer high concentration oxygen
   b) Circulatory support
      i) Bleeding from nose or ears after head trauma
         (1) Refrain from applying pressure
         (2) Apply loose sterile dressing to protect from infection
      ii) External bleeding control
         (1) Direct pressure
         (2) Elevation if appropriate
         (3) Tourniquet
         (4) Pressure points
         (5) May be used in conjunction with the above techniques
         (6) Use of sterile dressing and pressure bandage
         (7) Splinting

(8) PASG

(9) Transport considerations

(10) Psychological support and communication strategies

iii) EKG

iv) Intravenous fluid therapy

(1) Isotonic fluid

(2) Selection of administration set

(a) Macrodrip administration tubing

(b) Blood-Y administration tubing

(c) Others

(3) Rate of administration

(a) Fluid challenge

(i) 1-2 liters of rapid infusion for shock classes II, III and IV

(ii) Warm fluid is preferred (102 degrees)

(iii) Titration of fluid to achievement of perfusion

1. Level of consciousness
2. Systolic blood pressure between 85-90mm Hg

(b) Indications

(i) Uncontrolled v. controlled bleeding

(ii) Shock in head trauma

1. Deliver fluids that will maintain a systolic blood pressure of 90mm Hg

v) Pneumatic anti-shock garment (PASG)

(1) Effects

(a) Increased arterial blood pressure above garment

(b) Increased systemic vascular resistance

(c) Immobilization of pelvis and possibly lower extremities

(d) Increased intra-abdominal pressure

(2) Mechanism

(a) Increases systemic vascular resistance through direct compression of tissues and blood vessels

(b) Negligible autotransfusion effect

(3) Indications
(a) Hypoperfusion with unstable pelvis
(b) Conditions of decreased SVR not corrected by other means
(c) Local standing orders
(d) Research studies
(4) Contraindications
(a) Pulmonary edema
(5) Precautions
(a) Advanced pregnancy (no inflation of abdominal compartment)
(b) Object impaled in abdomen or evisceration (no inflation of abdominal compartment)
(c) Ruptured diaphragm
(d) Cardiogenic shock

c) Transport considerations
i) Indications for rapid transport
ii) Indications for transport to a trauma center
iii) Considerations for air medical transportation
iv) Psychological support/communication strategies

8) Specific shock interventions
a) Hypovolemic shock
i) Isotonic fluid only
b) Cardiogenic shock
i) Caution with volume expanders and fluid
ii) Rate-altering medications
iii) Rationale for treatments
c) Distributive shock
i) Volume expanders
ii) PASG
iii) Rationale for treatments
d) Obstructive shock
i) Volume expanders

e) Spinal shock
   i) Volume expanders
   ii) PASG

This page intentionally left blank

Burns

Unit Terminal Objective

At the completion of this unit, the EMT-Intermediate student will be able to utilize the assessment findings to formulate a field impression and implement the management plan for the patient with a burn injury.

Cognitive Objectives

At the completion of this unit, the EMT-Intermediate student will be able to:

1. Describe the epidemiology, including incidence, morbidity/mortality, risk factors, and prevention strategies for the patient with a burn injury. (C-2)
2. Describe the anatomy and physiology pertinent to burn injuries. (C-2)
3. Describe the local and systemic complications of a burn injury. (C-2)
4. Identify and describe the depth classification of burn injuries, including the superficial burn, a partial thickness burn, a full thickness burn, and other depth classifications described by local standing orders. (C-2)
5. Identify and describe methods for determining body surface area percentage of a burn injury including the “Rule of Nines,” the “Rule of Palms,” and other methods described by local standing orders. (C-3)
6. Identify and describe the severity of a burn including a minor burn, a moderate burn, a severe burn, and other severity classifications described by local standing orders. (C-2)
7. Differentiate criteria for determining the severity of a burn between a pediatric patient and an adult patient. (C-3)
8. Discuss the factors that impact the determination of burn severity. (C-2)
9. Outline the general assessment and management of a thermal burn injury. (C-1)
10. Discuss mechanisms of burn injury and conditions associated with various burn injuries. (C-2)
11. Explain the indications, precautions, contraindications and dosing for morphine sulfate, nalbuphine and ketorolac. (C-3)
12. Explain the pathophysiology, assessment findings and management considerations for thermal burns, inhalation injuries and electrical burns. (C-2)

13. Formulate a field impression and implement the management plan for a thermal burn, an inhalation burn, and an electrical burn. (C-3)

Affective Objectives

At the completion of this unit, the EMT-Intermediate student will be able to:

1. Value the changes of a patient's self image with a burn injury. (A-4)

2. Value the impact of managing a burn injured patient. (A-4)

3. Advocate empathy for a burn injured patient. (A-5)

4. Value and defend the sense of urgency for early recognition and treatment for an inhalation burn injury. (A-4)

Psychomotor Objectives

At the completion of this unit, the EMT-Intermediate student will be able to:

1. Take body substance isolation procedures during assessment and management of patients with a burn injury. (P-3)

2. Perform assessment and treatment of a patient with a burn injury. (P-4)

Declarative

1) Introduction
   a) Epidemiology
      i) Incidence
         (1) Supportive statistics
      ii) Morbidity/ mortality
         (1) Supportive statistics
      iii) Risk factors
      iv) Prevention strategies
   b) Review the anatomy and physiology of the integumentary system

2) Systemic complications of a significant burn injury
   a) Fluid loss
      i) Electrolyte loss
      ii) Hypovolemia
   b) Increased catecholamine release
      i) Vasoconstriction
   c) Acidosis
   d) Organ failure
      i) Liver
      ii) Heart
      iii) Kidneys
   e) Hypoxia
   f) Dysrhythmias
   g) Hypothermia
   h) Infection
   i) Complications of a circumferential burn
      i) Formation of eschar
3) Assessment of the severity of burn injuries
   a) Depth classification
      i) Superficial
      ii) Partial-thickness
      iii) Full-thickness
      iv) Other depth classifications according to local protocol
   b) Body surface area
      i) The Rule of Nines
         (1) Adult
         (2) Pediatric
      ii) The Rule of Palms
         (1) Use of the patient's palm
         (2) Used for determining the percentage of smaller burns
      iii) Other methods according to local protocol

c) Severity classifications
   i) Minor
   ii) Moderate
   iii) Severe
   iv) Other severity classifications according to local standing orders
   v) Determining the class of burn severity
      (1) Factors to consider
         (a) Age
            (i) Adults
            (ii) Pediatrics
            (iii) Geriatrics
         (b) Pre-existing medical conditions
         (c) Medications
         (d) Presence of other trauma
         (e) Inhalation injury
            (i) Present in 60-70% of all burn patients who die
            (ii) 20-35% of burn centers admissions involve an inhalation injury
      (2) Each may significantly impact the management and prognosis of the burn patient

4) Assessment of burn injuries
   a) Scene assessment
      i) Safety considerations
         (1) Presence of chemicals
         (2) House fires
      ii) Mechanism or cause of the burn
         (1) Blasts
         (2) Motor vehicle crash
         (3) Child abuse
         (4) Electrical burns
         (5) Use of chemicals

(6) House fire

(a) Inhalation injury potential

(b) Escape from the fire (falls)

b) Initial assessment

i) Potentially critical findings

(1) Hoarseness

(2) Adventitious airway or breath sounds

(3) Dysphagia

(4) Dysphasia

(5) Soot in nose or on tongue

(6) Significant dyspnea

(7) Altered level of consciousness or unconsciousness

(8) Singed hair

(9) Facial edema

c) Focused physical assessment

i) Signs of trauma

(1) Soft tissue injuries

(2) Musculoskeletal injuries

(3) Shock

ii) Burn assessment

(1) Appearance of the burn

(a) Redness

(b) Blisters

(c) Edema

(d) Weeping of fluid

(e) Charring/eschar

(f) Sloughing of skin

(2) Associated signs and symptoms

(a) Pain

(b) Paresthesia

(c) Nausea or vomiting

(d) Chest discomfort

(3) Determining burn severity

(a) Depth

(i) Superficial

(ii) Partial-thickness

(iii) Full-thickness

(iv) Other depth classifications according to standing orders

(b) Percentage of body surface area burned

(i) Rule of Nines

1. Adult
2. Pediatric

(ii) Rule of Palms

1. Use of the patient's palm
2. Used for smaller burns

(c) Other factors

(i) Burn location

1. Hands, feet, genitalia

(ii) Age of the patient

(iii) Pre-existing medical conditions

(iv) Medications

(v) Presence of other trauma

(vi) Inhalation injury

(d) Categorizing burn severity

(i) Minor

(ii) Moderate

(iii) Critical

5) General management

a) Airway and ventilatory support

b) Circulatory support

i) Indications for IV therapy

ii) Parkland Formula for fluid resuscitation

c) Non-pharmacological interventions
   i) Stop the burning process
   ii) Application of wet v. dry dressings
d) Pharmacological interventions
   i) Mechanism of action, indications, contraindications, precautions, dosing for prehospital analgesics
      (1) Morphine sulfate
      (2) Fentanyl
      (3) Ketorolac
      (4) Nalbuphine
   ii) Parameters for pain management in burn severity and for burns in the presence of multi-systems trauma
e) Transport considerations
   i) Appropriate mode
   ii) Appropriate facility
      (1) Trauma hospital
      (2) Hyperbaric therapy for carbon monoxide poisoning
f) Psychological support/ communication strategies
   i) Patient and family advocacy

6) Specific burn injuries
   a) Thermal burn injury
      i) Phases of a burn injury
         (1) Emergent phase
         (2) Fluid shift phase
         (3) Hypermetabolic phase
         (4) Resolution phase
      ii) Secondary complications
         (1) Infectious insult
         (2) Eschar formation
            (a) Respiratory compromise from circumferential eschar formation around the thorax

(3) Circulatory compromise from circumferential eschar formation around an extremity

b) Inhalation burn injury
   i) Chemical inhalation injuries are more frequent than thermal inhalation injuries
   ii) Factors that increase the risk for inhalation injury
      (1) Standing
      (2) Screaming
      (3) Enclosed area
   iii) Complications of inhalation injuries
      (1) Local complications
         (a) Chemical and/or thermal burns to airway structures
            (i) Edema
            (ii) Loss of functional tissue
            (iii) Scarring
      (2) Systemic complications
         (a) Absorption of toxins
            (i) Carbon monoxide poisoning
            (ii) Cyanide intoxication
   iv) Assessment and management considerations for inhalation injury
      (1) Determination of severity
         (a) Recognition of critical signs
         (b) Potential progression of signs and symptoms
      (2) Need for ALS airway management
c) Electrical burn injuries
   i) Review of the characteristics of electrical current
   ii) Pathophysiology
      (1) External burn injuries
      (2) Internal burn injuries
      (3) Musculoskeletal injuries
      (4) Cardiovascular injuries
      (5) Respiratory injuries

(6) Neurological injuries

(7) Myoglobin release and renal involvement

iii) Assessment

(1) Depth classification

(2) Severity

(3) Assessment findings for specific burn mechanisms

(a) Contact burn injuries

(b) Arc injuries

(c) Flame or flash burn injuries

(i) Welder's flash

(d) Lightning injuries

(i) Direct stroke

(ii) Side flash (splash)

(iii) "Ferning"

1. Nerve inflammation as a result of the lightning strike
2. Pattern redness on the torso similar to the shape of a branch of a fern
3. Lasts approximately 24 hours

(4) Other physical findings

(a) Muscle rigidity or tremors

(b) Fractures

(c) Cardiac dysrhythmias

iv) Management

(1) Airway and ventilatory support

(2) Circulatory support

(a) Indications for IV therapy

(b) Placement of the EKG

(3) Pharmacological interventions

(a) Analgesia

(4) Non-pharmacological interventions

(a) Electrical burn injury management according to local standing orders

(5) Transport considerations

(a) Appropriate mode

(b) Appropriate facility

(6) Psychological support/ communication strategies

This page intentionally left blank

Thoracic Trauma

Unit Terminal Objective

At the completion of this unit, the EMT-Intermediate student will be able to utilize the assessment findings to formulate a field impression and implement a treatment plan for a patient with a thoracic injury.

Cognitive Objectives

At the completion of this unit, the EMT-Intermediate student will be able to:

1) List the types of thoracic injuries found in blunt and penetrating trauma. (C-1)
2) Discuss the anatomy and physiology of the organs and structures related to thoracic injuries. (C-2)
3) Associate respiratory volumes and capacities in relationship to the need for assisted ventilations in the following chest trauma presentations. (C-3)
   a) Chest wall injuries
   b) Hemothorax
   c) Pneumothorax
   d) Tension pneumothorax
   e) Pulmonary contusion
   f) Myocardial contusion
   g) Pericardial tamponade
4) Discuss the general pathophysiology involved in thoracic injuries. (C-2)
5) Discuss the assessment findings associated with thoracic injuries. (C-2)
6) Predict thoracic injuries based on mechanism of injury. (C-3)
7) Discuss the general management considerations for thoracic injuries. (C-2)
8) Explain the need for rapid intervention and transport of the patient with thoracic injuries. (C-3)
9) Discuss the epidemiology, pathophysiology, assessment findings and management of the following chest wall injuries: (C-2)
   a) Rib fracture
   b) Flail segment

c) Sternal fracture

10) Discuss the epidemiology, pathophysiology, assessment findings and management of the following pulmonary injuries: (C-3)
   a) Simple pneumothorax
   b) Open pneumothorax
   c) Tension pneumothorax
   d) Hemothorax
   e) Hemopneumothorax
   f) Pulmonary contusion
11) Discuss the epidemiology, pathophysiology, assessment findings and management of the following cardiac injuries: (C-2)
   a) Pericardial tamponade
   b) Myocardial contusion
12) Discuss the epidemiology, pathophysiology, assessment findings and management of the following: (C-2)
   a) Aorta dissection/rupture
   b) Traumatic asphyxia
13) Differentiate between thoracic injuries based on assessment and history. (C-3)
14) Formulate a field impression based on the assessment findings. (C-3)
15) Develop a patient management plan based on the field impression. (C-4)

Affective Objectives

At the completion of this unit, the EMT-Intermediate will be able to:

1. Explain the use of a thorough assessment to determine a differential diagnosis and treatment for thoracic trauma. (A-3)
2. Advocate the use of a thorough scene survey to determine the forces involved in thoracic trauma. (A-3)
3. Value the implications of failing to properly diagnose thoracic trauma. (A-4)
4. Value the implications of failing to initiate timely interventions to patients with thoracic trauma. (A-4)

Psychomotor Objectives

At the completion of this unit, the EMT-Intermediate will be able to:

1. Demonstrate a clinical assessment for a patient with suspected thoracic trauma. (P-4)

2. Demonstrate the following techniques of management for thoracic trauma: (P-3)

a. Fracture stabilization
b. ECG monitoring
c. Oxygenation and ventilation

Declarative

1) Injury types by mechanism
   a) Blunt trauma
      i) Rib fractures
         (1) Isolated
         (2) Flail segment
         (3) Sternal fracture
      ii) Pulmonary injuries
         (1) Pneumothorax
         (2) Tension pneumothorax
         (3) Hemothorax
         (4) Hemopneumothorax
         (5) Pulmonary contusion
         (6) Traumatic asphyxia
      iii) Cardiac injuries
         (1) Cardiac contusion
         (2) Pericardial tamponade
      iv) Vessel injuries
         (1) Aortic aneurysm
   b) Penetrating trauma
      i) Pulmonary injuries
         (1) Open pneumothorax

(2) Tension pneumothorax

ii) Cardiac injuries

(1) Pericardial tamponade

iii) Vessel injuries

(1) Tears of the great vessels

2) Anatomy review

a) Protection of thoracic organs

i) Bones

(1) Anterior

(a) Thoracic cage

(b) Sternum

(c) Clavicles

(2) Posterior

(a) Thoracic spine

(b) Scapulae

ii) Muscles

(1) Anterior

(a) Pectoralis muscles

(b) Intercostals

(2) Posterior

(a) Trapezius

(b) Latissimus dorsi

(c) Rhomboids

b) Organ structures and locations

(1) Structures located in the mediastinum

(a) Heart

(b) Trachea

(c) Vena cava

(d) Aorta

(e) Esophagus

(2) Anatomy of the lungs
  (a) Bronchi
  (b) Alveoli
  (c) Lobes of each lung
  (d) Pleura
    (i) Visceral
    (ii) Parietal
    (iii) Serious fluid
(3) Anatomy of the heart
    (i) Myocardium
    (ii) Pericardium
      1. Purpose
        a. Anchors heart
        b. Restricts excess movement
      2. Prevents kinking of great vessels
      3. Anatomy
        a. Layers
          i. Visceral layer forms epicardium
          ii. Parietal layer forms the outer sac
        b. Serous fluid
          i. Minimal amount (10-20mL)
        c. Considered a “potential space”
        d. Serves to reduce friction from the beating heart

3) Physiology review
  a) Ventilation and respiration
    i) Regulation of ventilation and respiration
      (1) Neurological control
      (2) Role of chemoreceptors
    ii) Muscles of ventilation
      (1) Normal muscle use
      (2) Accessory muscles

iii) Gas exchange
(1) Alveolar-capillary interface
(2) Capillary-cellular interface
(3) Pulmonary circulation
(4) Cardiac circulation

4) General pathophysiology of thoracic trauma
a) Impairment of ventilatory efficiency
i) Pain restricting chest excursion
(1) Chest wall injuries
ii) Air entering pleural space
(1) Simple pneumothorax
(2) Open pneumothorax
(3) Tension pneumothorax
iii) Blood in the pleural space
(1) Hemothorax
iv) Chest wall fails to move in unison
(1) Flail chest
b) Impairments to respiration
i) Pulmonary contusion
ii) Disruption of respiratory tract
(1) Penetrating trauma of lung tissue
(a) Alveoli
(b) Bronchi
c) Impairments in cardiac output
i) Blood loss
(1) Pulmonary contusion
(2) Hemothorax
(3) Vascular disruption
ii) Blood in pericardial sac
(1) Pericardial tamponade

iii) Impairment of myocardial contractility

(1) Cardiac contusion

5) Assessment findings in thoracic trauma

a) Scene assessment

i) Mechanism of injury

(1) Vehicular collisions and prediction of injuries

(a) Frontal impact

(b) Lateral impact

(c) Airbags and use of restraints

(d) Ejection from vehicle

(2) Penetrating trauma

(3) Assault

b) General impression and initial assessment

i) Labored ventilation or increased respiratory effort

ii) Dyspnea

iii) Adventitious airway or lung sounds

iv) Hemoptysis

v) Use of accessory muscles

vi) Retractions of chest muscles

vii) Abnormal respiratory rate or rhythm

viii) Signs of shock

(1) Compensated

(2) Decompensated

c) Focused history

i) Chief complaint

(1) Dyspnea

(2) Chest pain

(a) Pleuritic pain

(b) Ischemic pain

ii) Past medical history
(1) Respiratory disease
(2) Cardiac disease
(3) Relationship of symptoms to incident v. chronic medical condition
iii) Use of restraints in MVC

d) Focused physical
i) Neck
(1) Position of trachea
(2) Hematoma
(3) Contusions
(4) Subcutaneous emphysema
(5) Jugular venous distention
(6) Penetrating wounds
ii) Chest
(1) Open wounds or impaled objects
(2) Contusions
(3) Asymmetry
(4) Paradoxical movement of chest wall segment
(5) Lung sounds
(a) Absent or decreased
(i) Unilateral
(ii) Bilateral
(b) Location
(6) Palpation
(a) Point tenderness
(b) Crepitus
(c) Location(s)
iii) Vital signs
(1) Blood pressure
(a) Hypotension
(b) Narrowing pulse pressures

(2) EKG
(a) Tachycardic rhythms
(b) Dysrhythmias
(3) Pulse oximetry
(4) Capnometry/capnography

6) General management of thoracic injuries
a) Airway and ventilatory support
i) Indications for oxygen therapy, positive pressure ventilation and the dual lumen airway
ii) Occlude all open wounds of the neck and chest
iii) Stabilize chest wall
b) Circulatory support
i) Indications for intravenous therapy
ii) Rate of fluid administration
(1) Indications and parameters
(a) Fluid challenge
(b) Wide open
iii) Management of cardiac dysrhythmias
(1) Oxygen administration
(2) ACLS guidelines and local standing orders
c) Pharmacological interventions
i) Analgesics
(1) Indications
(2) Contraindications
(3) Precautions
d) Transport considerations
i) Appropriate mode
ii) Appropriate facility
e) Psychological support/communications strategies

Specific Thoracic Injury Profiles

Chest Wall Injuries

7) Rib fractures
   a) Epidemiology
      i) Incidence
         (1) Commonly caused by blunt trauma
         (2) Common in the adult population
         (3) High incidence in the elderly
      ii) Morbidity/mortality
         (1) Dependent upon location and total number of fractures
            (a) Mortality associated with underlying pulmonary or cardiovascular injury
         (2) Increased mortality in the elderly
   b) Location of fractures and associated complications
      i) Ribs 4 – 9 most often fractured
         (1) Thin and poorly protected
         (2) Open rib fractures are associated with visceral injury
      ii) Significant force required to fracture the first and second ribs
         (1) Associated with major internal trauma
            (a) Rupture of aorta
            (b) Injury to the trachea or bronchi
            (c) Injury to the great vessels
      iii) Lower rib fractures
         (1) Left lower rib fracture associated with splenic rupture
         (2) Right lower rib fracture associated with hepatic injury
      iv) Posterior rib fracture
         (1) Ribs 5-9 most frequently injured
         (2) Lower rib fractures associated with spleen and kidney injury
   c) Pathophysiology of rib fractures
      i) Restriction of tidal volume due to pain and splinting
         (1) Ventilation/perfusion mismatch

ii) Atelectasis from extended restriction of tidal volume
(1) Higher risk in the elderly due to a normal reduction of tidal volume
(2) High likelihood for the development of pneumonia
iii) Risk for underlying pulmonary and cardiac injury potential
(1) Multiple rib fractures
(2) Flail segment
(3) Sternal fractures

d) Assessment findings
i) Symptoms
(1) Localized pain
(2) Provocation of pain
(a) Movement
(b) Deep inspiration
(c) Cough
ii) Signs
(1) Patient self-splinting on respiration
iii) Palpation
(1) Point tenderness
(2) Crepitus or audible crunch
(3) Pain from placement of anteroposterior pressure

e) Management
i) Airway and ventilatory support
(1) Oxygen therapy
(2) Positive pressure not usually necessary with isolated fractures
(3) Encourage coughing and deep breaths
(4) Splinting may decrease pain
(a) Avoid circumferential splinting
(b) Patient self-splinting may be appropriate
ii) Pharmacological intervention
(1) Analgesics
(a) Indications

(b) Precautions

iii) Transport considerations

(1) Appropriate mode

(2) Appropriate facility

iv) Psychological support/communication strategies

8) Flail segment

a) Three or more ribs fractured in two or more places, producing a free floating segment of chest wall

b) Epidemiology

i) Incidence

(1) Commonly caused by vehicular collisions

(a) Frontal impact

(b) Lateral impact

(2) Falls from heights

(3) Industrial accidents

(4) Assault

ii) Morbidity/mortality

(1) Indicates significant energy transfer

(2) Mortality rates 20-40% due to associated injuries

(a) Multi-systems trauma

(b) Pulmonary and cardiac trauma

(3) Additional factors determining mortality

(a) Advanced age

(b) Fracture of seven or more ribs

(c) Presence of three or more associated injuries

(d) Shock

(e) Head injury

c) Pathophysiology

i) Impaired ventilation

(1) Pain

(2) Self-splinting

(3) Muscle spasm surrounding the injury

(a) Common after initial impact

(4) Paradoxical movement of the chest

(a) Must be large to compromise ventilation

(b) Not likely to occur until after the first 45 minutes of the injury

(i) Muscle spasm

ii) Impaired respiration

(1) Underlying pulmonary contusion

(a) Bleeding into the alveoli

(b) Disruption of the alveoli/capillary membrane

(2) Results

(a) Hypoxia

(b) Elevated $PaCO_2$

d) Assessment findings

i) Symptoms

(1) Dyspnea

(2) Pleuritic chest pain

ii) Signs

(1) Observation

(a) Respiratory distress

(b) Shallow respiratory effort

(c) Pain and splinting of affected side

(d) Chest wall contusion

(e) Paradoxical chest wall movement with extended transport time

(2) Palpation

(a) Crepitus in multiple sites on the affected rib(s)

(3) Vital signs

(a) Tachycardia

(b) Tachypnea

(4) Lung sounds

(a) Diminished

(b) Unilateral crackles if pulmonary contusion present

e) Management

i) Airway and ventilatory support

(1) Oxygen – high concentration

(2) Positive pressure ventilation with reduction of tidal volume and mentation

(3) External stabilization of the flail segment is not necessary in the first hour post-trauma

(a) Muscle spasms will accomplish this by the patient

(b) Paradoxical movement can be stabilized with positive pressure ventilation

(c) Consult with local standing orders

ii) Circulatory support

(1) IV placement

(2) Restrict fluids unless signs of shock are present

(a) Monitor lung sounds

iii) Pharmacological interventions

(1) Analgesics

(a) Indications

(b) Precautions

iv) Transport considerations

(1) Appropriate mode

(2) Appropriate facility

v) Psychological support/communication strategies

9) Sternal Fracture

a) Epidemiology

i) Incidence

(1) 5-8% in blunt chest trauma

(2) Indicates significant energy transfer

(3) Results form a deceleration-compression injury

(a) Steering wheel

(b) Dashboard

(c) Direct blow to the chest

ii) Morbidity/Mortality
(1) 25-45% mortality
(2) High association with myocardial or pulmonary injury
(a) Myocardial contusion
(b) Pericardial tamponade
(c) Pulmonary contusion

b) Pathophysiology
i) Displacement of sternal fractures are rare
(1) No impingement on heart or vessels
ii) Impairment to ventilation and respiration
(1) Restriction of tidal volume due to pain
(2) Dependent upon the presence of pulmonary injuries
iii) Reduced cardiac output and further reduction in ventilation/respiration due to underlying injuries

c) Assessment findings
i) Symptoms
(1) Localized pain
(2) Tenderness over sternum
(3) Pleuritic pain
(4) Ischemic organ pain if a myocardial injury is present
ii) Signs
(1) Shallow respiratory effort
(2) Tachypnea
iii) Palpation
(1) Crepitus and point tenderness over sternum
(2) Other rib fractures may be present
iv) Vital signs
(1) ECG changes associated with myocardial contusion
(2) Tachycardia may be a sign of shock

d) Management
i) Airway and ventilatory support

ii) Circulatory support
(1) Restrict fluids if pulmonary contusion is suspected
(2) Fluid challenge may be helpful for a myocardial contusion
iii) Pharmacological interventions
(1) Analgesics
(a) Indications
(b) Precautions
iv) Transport considerations
(1) Appropriate mode
(2) Appropriate facility
v) Psychological support/communication strategies

Pulmonary Injuries

10) Simple pneumothorax
a) Epidemiology
i) Incidence
(1) 10-30% in blunt chest trauma
(2) Nearly 100% in penetrating chest trauma
ii) Morbidity/mortality
(1) Dependent upon extent of involvement
(2) Dependent upon the presence and severity of associated injuries
b) Pathophysiology
i) Disruption of the pleural space
(1) Internal wounds
(a) Paper Bag Syndrome in frontal vehicular impacts
(2) External wounds
(a) Gunshot wounds
(b) Impalements
(c) Stab wounds
(3) Small tears may self-seal
(4) Larger tears may progress

Air accumulation in the pleural space

(1) Compression of lung tissue

(a) Smaller accumulations of air may have minimal impact on ventilation

(b) Pulmonary function may be adequate in healthy subjects

(2) Ventilation/perfusion mismatch

(3) Air accumulation will change with patient position

(a) Anterior aspects of the lung when supine

(b) Apices when seated or standing

c) Assessment findings

i) Symptoms

(1) Dyspnea

(2) Chest pain referred to shoulder or arm on affected side

(3) Slight pleuritic chest pain

ii) Signs

(1) Severity of respiratory distress dependent upon the size of the pneumothorax

(2) Subcutaneous emphysema

(a) May or may not be present

(3) Decreased or absent breath sounds on the affected side

iii) Vital signs

(1) Tachypnea

(2) Tachycardia

(3) Normal or slightly lowered pulse oximetry readings

d) Management

i) Airway and ventilatory support

(1) Oxygen

(2) Positive pressure ventilation as necessary

(3) Monitor for development of tension pneumothorax

ii) Circulatory support

(1) Indications for IV therapy

(2) EKG

e) Transport considerations
   i) Appropriate mode
   ii) Appropriate facility
f) Psychological support/communication strategies

11) Open pneumothorax
a) Epidemiology
   i) Incidence
      (1) Penetrating trauma
   ii) Morbidity/ mortality
      (1) Death due to profound hypoventilation
      (2) Death related to delayed management
b) Pathophysiology
   i) Deep, open defect in the chest wall
      (1) Encourages atmospheric air flow into the pleural space
         (a) Resistance to air flow through respiratory tract may be greater than through open wound resulting in ineffective respiratory effort
            (i) Air will enter pleural space during inspiration
            (ii) Air may or may not exit during exhalation
      (2) Results
         (a) Collapse/compression of affected lung
         (b) Inability to achieve adequate ventilation of the affected lung
         (c) Potential development of pressure within the pleural space
            (i) Creation of a large area of dead space
            (ii) Potential for the development of a tension pneumothorax
      (3) Ventilation/ perfusion mismatch
         (a) Hypoventilation
         (b) Hypoxia
c) Assessment findings
   i) Symptoms
      (1) Dyspnea

ii) Signs

(1) Open wound in the chest wall

(2) Sucking sound on inhalation

(3) Bubbling of fluid/blood at the wound

(4) Subcutaneous emphysema

(a) Non-linear development from the site of the open wound

(5) Decreased or absent breath sounds on affected side

iii) Vital Signs

(1) Respiratory distress

(2) Tachycardia

(3) Tachypnea

(4) Presence of shock if great vessels are torn or with cardiac injury

d) Management

i) Airway and ventilatory support

(1) Cover open wounds with occlusive dressing

(2) Positive pressure ventilation as necessary

(3) Monitor for development of tension pneumothorax

ii) Circulatory support

(1) Indications for IV therapy

iii) Transport considerations

(1) Appropriate mode

(2) Appropriate facility

iv) Psychological support/ communication strategies

12) Tension pneumothorax

a) Epidemiology

i) Incidence

(1) Penetrating trauma

(2) Blunt trauma

(a) Penetration by rib fracture

(b) Sudden increase in intrapulmonary pressure

(i) Paper Bag Syndrome

(c) Bronchial disruption from shear forces

ii) Morbidity/mortality

(1) Profound hypoventilation could result

(2) Death related to delayed management

b) Pathophysiology

i) Similar development to a pneumothorax and open pneumothorax

ii) Air trapped in pleural space with increased pressure in the thoracic cavity

(1) Severe compression of lung tissue

(a) Affected side

(b) Increased intrathoracic pressure may compress unaffected lung also

(2) Hypoxia and elevated levels of $PaCO_2$

iii) Lung collapses on affected side with mediastinal shift to contralateral side

(1) Impairment to ventilation

(a) Compression of lung tissue

(2) Reduction in cardiac output

(a) Reduced preload due to kinking of vena cava

(b) Profound shock may occur rapidly

c) Assessment findings

i) Signs

(1) Rapid onset of severe respiratory distress

(2) Extreme anxiety or rapidly deteriorating mentation

(3) Cyanosis

(4) Bulging of intercostal muscles

(5) Unilateral decreased or absent breath sounds

(6) Subcutaneous emphysema

(7) Jugular venous distention (late sign)

(8) Tracheal deviation (late sign)

ii) Vital Signs
(1) Tachypnea
(2) Tachycardia
(3) Hypotension
(4) Narrow pulse pressures

d) Management
i) Airway and ventilatory support
(1) Occlude open wounds
(2) Positive pressure ventilation with high concentration of oxygen
(a) High resistance to ventilations due to increased intrathoracic pressure
ii) Transport considerations
(1) Consider ALS intercept for advanced airway procedures
(2) Appropriate mode
(3) Appropriate facility

13) Hemothorax
a) Epidemiology
i) Incidence
(1) Blunt or penetrating trauma
(2) Frequently caused by rib fractures
(3) High association with pneumothorax
(4) Associated with great vessel or cardiac injury
ii) Morbidity/mortality
(1) 50% will die immediately
(2) 25% will live five to 10 minutes
(3) 25% may live 30 minutes or longer

b) Pathophysiology
i) Accumulation of blood in the pleural space
(1) Chest cavity can hold 2,000 – 3,000 ml of blood
(2) Massive hemothorax indicates a great vessel or cardiac injury

ii) Sources of bleeding

(1) Pulmonary contusion

(a) Bleeding from pulmonary contusion generally causes 1,000 – 1,500 ml blood loss

(2) Disruption of pulmonary vessels

(3) Disruption of chest wall vessels

(4) Disruption of intercostal vessels

(a) Estimated bleeding rate at 50 mL/min

(5) Myocardial rupture

iii) Collapse/compression of affected lung tissue

(1) Respiratory insufficiency dependent on amount of blood

(2) Hypoxia

(3) Hypotension and inadequate perfusion may also be present

c) Assessment findings

i) Symptoms

(1) Dyspnea

(2) Pleuritic chest pain

ii) Signs

(1) Respiratory distress

(2) Decreased breath sounds

(3) Signs of shock or decreased perfusion may be present

iii) Vital Signs

(1) Tachypnea

(2) Tachycardia

(3) Hypotension

(4) Narrow pulse pressures

d) Management

i) Airway and ventilatory support

(1) Oxygen

(2) Positive pressure ventilation as necessary

ii) Circulatory support

(1) IV fluid administration if signs of shock

e) Transport considerations

i) Appropriate mode

ii) Appropriate facility

iii) Psychological support/communication strategies

14) Hemopneumothorax

a) Pathophysiology

i) Pneumothorax with bleeding in pleural space

b) Assessment

i) Findings and management same as hemothorax

c) Management

i) Management is the same as a hemothorax

15) Pulmonary contusion

a) Epidemiology

i) Incidence

(1) Commonly caused by blunt thoracic trauma

(a) 30-75% with blunt trauma have pulmonary contusion

(b) Commonly associated with rib fractures

(c) Rapid deceleration mechanisms of injury

(d) Blast injuries

(2) Penetrating trauma

(a) High velocity projectiles

(b) Low velocity weapons

ii) Morbidity/ mortality

(1) Mortality between 14-20%

(2) Commonly missed because of the presence of associated injuries

b) Pathophysiology

i) Alveolar and capillary damage

(1) Bleeding into the alveoli and interstitial space

(2) Edema

ii) Disruption of respiration

(1) Damage to capillary and alveolar walls

(a) Hypoxia and carbon dioxide retention

c) Assessment findings

i) Symptoms

(1) Dyspnea

(2) Cough

ii) Signs

(1) Evidence of blunt chest trauma

(2) Hemoptysis

(3) Apprehension

(4) Changes in skin signs

(5) Respiratory distress

(6) Signs of decreased perfusion

(7) Lung sounds

(a) Crackles in affected lung

(b) Decreased sounds with reduced tidal volume

iii) Vital Signs

(1) Tachypnea

(2) Tachycardia

d) Management

i) Airway and ventilatory support

(1) Oxygen

(2) Positive pressure ventilation as necessary

ii) Circulatory support

(1) IV therapy

(a) Use caution with fluids in hypovolemic patients

(b) Fluid challenges may be more appropriate

(c) Monitor lung sounds frequently

(2) EKG

iii) Transport considerations
(1) Appropriate mode
(2) Appropriate facility
iv) Psychological support/ communication strategies

Cardiac Injuries

16) Pericardial tamponade
a) Epidemiology
i) Incidence
(1) Occurs in less than 2% of all chest trauma
(2) Rare in blunt trauma
(3) More commonly occurs in penetrating trauma
b) Pathophysiology
i) Rapid accumulation of fluid in the pericardial sac exerts pressure on the myocardium
(1) Compression of myocardium and chambers of the heart, restricting diastolic expansion and filling
(2) Restricts venous return to the right atrium
(3) Results
(a) Reduction of cardiac output
(b) Myocardial perfusion decreases from pressure against the coronary arteries
(c) Myocardial infarction may develop
(d) Development of shock
c) Assessment findings
i) Symptoms
(1) Respiratory distress
(2) Chest discomfort

ii) Signs
(1) Open wounds to the chest
(2) Cyanosis
(a) Head
(b) Neck
(c) Upper extremities
(3) Signs of shock
iii) Vital signs
(1) Tachycardia
(2) Narrow pulse pressures
(3) Pulsus paradoxus
(4) ECG changes

d) Management
i) Airway and ventilatory support
(1) Oxygen – high concentration
(2) Positive pressure ventilations as necessary
ii) Circulatory support
(1) IV Placement
(a) Fluid challenge
iii) Transport considerations
(1) Appropriate mode
(a) Consider air medical transport
(2) Appropriate facility
iv) Psychological support/ communication strategies

17)Myocardial contusion
a) Epidemiology
i) Incidence
(1) 16-76% of blunt trauma
(2) Major deceleration injury
(a) Common in frontal vehicular collisions
(b) Direct blows to the chest

(3) High association with sternal fractures

(a) Right ventricle most likely to be contused

ii) Morbidity/ mortality

(1) Significant cause of morbidity and mortality in the blunt trauma patient

b) Pathophysiology

i) Rapid deceleration of right atrium and/or ventricle against the sternum

ii) Vascular damage

(1) Bleeding into the myocardium or pericardium

iii) Injury to contractile and conduction fibers

(1) Disruption of impulse conduction

(2) Damage to muscle fibers

(a) Decrease in stroke volume

iv) Complications

(1) Reduction of cardiac output

(2) Conduction disturbances

(3) Myocardial ischemia

c) Assessment findings

i) Symptoms

(1) Chest discomfort

(2) Palpitations

(3) Dyspnea

ii) Signs

(1) Signs of chest wall trauma

(a) Multiple rib fractures

(b) Sternal fracture

(2) Signs of hypoperfusion

(3) Adventitious lung sounds if associated with lung injuries

iii) Vital signs

(1) Tachycardia

(2) Irregular heart rhythm

iv) ECG changes
(1) Persistent tachycardia despite oxygen and IV fluids
(2) New-onset dysrhythmias
(a) Atrial dysrhythmias
(i) Premature atrial complexes
(ii) Atrial flutter
(iii) Atrial fibrillation
(3) Premature ventricular complexes

d) Management
i) Airway and ventilatory support
(1) Oxygen therapy
ii) Circulatory support
(1) IV therapy
(a) Fluid challenge if signs of hypoperfusion
(2) EKG
(a) Monitor for changes in dysrhythmias after treatments
iii) Pharmacological interventions
(1) ACLS guidelines
(2) Local standing orders
iv) Transport considerations
(1) Appropriate mode
(2) Appropriate facility
v) Psychological support/ communication strategies

Other Thoracic Injuries

18)Aortic dissection/ rupture

a) Epidemiology

i) Incidence

(1) Blunt trauma

(a) 15% of all blunt trauma deaths

(b) Caused by significant, rapid deceleration

(i) Motor vehicle collisions

1. Frontal impacts
2. Lateral impacts

(ii) Falls

b) Morbidity/ mortality

i) 85-95% die instantaneously

ii) Poor survival rates at the hospital

c) Pathophysiology

i) Tear due to effect of high speed deceleration on portions of the aorta at points of relative fixation

(1) Most commonly occurs at the junction of the aorta and the ligamentum arteriosum

(2) Development of injury is similar to an aortic aneurysm

(a) Tear of the intima layer

(b) Blood accumulation between the intima and media layers

(3) Rupture of the aorta may occur as pressure continues to build within the walls of the aorta

d) Assessment findings

i) Symptoms

(1) Retrosternal or interscapular pain

(2) Tearing sensation felt in the back

(3) Dyspnea

(4) Dysphagia

(5) Dizziness

(6) Ischemic pain of the extremities

ii) Signs

(1) Upper extremity hypertension with absent or decreased amplitude of femoral pulses

(2) Signs of decreased perfusion or shock

iii) Vital signs

(1) Tachycardia

(2) Hypotension

e) Management

i) Airway and ventilatory support

(1) Oxygen

ii) Circulatory support

(1) IV placement

(2) Titrate fluid administration to signs of adequate perfusion

(a) Level of consciousness

(b) Systolic BP of 90mm Hg

iii) Pharmacological interventions

(1) Narcotic analgesics are contraindicated

iv) Transport considerations

(1) Appropriate mode

(2) Appropriate facility

v) Psychological support/ communication strategies

19) Traumatic asphyxia

a) Epidemiology

i) Incidence

(1) Hangings

(2) Crush injuries to the torso

ii) Morbidity/ mortality

b) Pathophysiology
   i) Sudden compressional force against the chest
      (1) Disruption of ventilation
      (2) Blood return to the heart is prevented
   ii) Blood backs up into the head and neck
   iii) Jugular veins engorge with blood
   iv) High back-pressure placed on smaller vessels of the head
      (1) Rupture of capillaries
         (a) Petechial rashes to the face and sclera
         (b) Edema to the face, lips and eyes
      (2) Inability to deliver oxygen or nutrients to cells
         (a) Cells transition to anaerobic metabolism
         (b) Production of lactic acid
         (c) Cell death
      (3) Blood stagnates and clots
   v) Prolonged compression will result in massive decompensation when pressure is finally relieved
      (1) Profound hypoxia
      (2) Circulation of acid and blood clots
c) Assessment
   i) Signs
      (1) Dramatic color contrasts of the skin
         (a) Cyanosis to the face and upper neck
         (b) Skin below area of compression remains pink
      (2) Jugular venous distention
      (3) Swelling or hemorrhage of the conjunctiva
      (4) Hypotension when pressure released
d) Management
   i) Airway and ventilatory support
      (1) Oxygen – high concentration

(2) Prepare to support ventilations when compressional force is lifted from the patient

(a) Potential for rapid decompensation

(b) Dual-lumen airway device for unconscious patients

ii) Circulatory support

(1) IV therapy

(a) Large bore IVs

(2) Expect hypotension once compression is released

iii) Transport considerations

(1) Appropriate mode

(2) Appropriate facility

iv) Psychological support/ communication strategies

This page intentionally left blank

Head Trauma

Terminal Objective

At the completion of this unit, the EMT-Intermediate student will be able to utilize the assessment findings to formulate a field impression and implement a treatment plan for a patient with a head injury.

This module follows the "Guidelines For Prehospital Management Of Traumatic Brain Injury" by Brain Trauma Foundation. http://braintrauma.org/

Utilization of the Brain Trauma Foundation "Traumatic Brain Injury" course may be used in place of this module.

Cognitive Objectives

1) Identify primary and secondary brain injury. (C-1)
2) Describe the signs and symptoms of hypoxia in TBI. (C-2)
3) Discuss the effects of hypotension on the TBI patient. (C-2)
4) Calculate an accurate GCS score. (C3)
5) Differentiate between flexor/decorticate and extensor/decerebrate posturing. (C-2)
6) Identify pre-hospital signs of herniation. (C3)

Affective Objectives

1) None identified for this module

Psychomotor Objective

1) Demonstrate management of a patient experiencing a TBI. (P3)

Declarative

1) Primary Brain Injury
    a) Damage to the brain from the biomechanical effects of the trauma, causing:
        i) Ischemia
        ii) Anoxia/hypoxia or
        iii) Shear injury

2) Secondary Brain Injury
    a) The result of one or more of the following:
        i) Hypoxia
        ii) Hypotension (decreased cerebral blood flow)
        iii) Increased intracranial pressure (ICP)
        iv) Hyper- or hypoglycemia
        v) Metabolic disturbances
        vi) Seizures
3) Resuscitation
    a) Following in order is essential.
        i) A - Airway
        ii) B - Breathing
        iii) C - Circulation
        iv) D - Disability
        v) E - Exposure
4) Airway
    a) Maintain C-spine precautions
    b) Determine that airway is open
    c) Assess the need for artificial airway
    d) Assess every 5 minutes and as needed
5) Breathing
    a) Assess rate, depth, quality, and effectiveness of ventilation every 5 minutes and as needed.
    b) Hypoxia occurs in 40% of severe TBI.
    c) Assess for hypoxia.
    d) Important indicators of hypoxia:
        i) $SaO_2 < 90\%$
        ii) Central cyanosis

e) Assess Respiratory Rate
   i) Consider tachypnea at or above the following rates a sign of neurological deterioration:
      (1) Infant: 40 bpm
      (2) Children: 30 bpm
      (3) Adults: 20 bpm

6) Circulation for hypotension
   a) Look for visible signs of “shock”
   b) Assess Systolic BP every 5 minutes & as needed
   c) Adult critical threshold level 90 mm Hg
   d) Child and infant levels are lower
   e) Use age/size appropriate BP cuff
      i) BP cuff: should be about 2/3 as wide as length of upper arm.
   f) Signs that indicate the need for fluid resuscitation include:
      i) Hypotension
      ii) Tachycardia
      iii) Loss of central pulses
      iv) Prolonged capillary refill time (> 3 seconds)
      v) Hypotension is a LATE sign of shock in children.
   g) Hypotension is defined as the following systolic blood pressure (SBP) levels:
      i) neonates 0 to 28 days - SBP < 60mm Hg
      ii) infants 1 to 12 months -SBP < 70 mm Hg
      iii) children 1 to 10 years old - SBP < 70 mm Hg + (2 x age in years)
      iv) children > 10 years old - SBP < 90 mm Hg
      v) adults SBP ~ 90 mmHg
7) Any episode of hypotension can worsen outcome TBI.
8) Clinical features of Increased ICP
   a) Newborns and infants present a special case because increased pressure can be partially vented by the open fontanels

9) Acute Signs of Increased ICP
    a) In Infants
        i) Bulging anterior fontanel
        ii) Lethargy
        iii) Shrill cry
        iv) Setting sun sign (impaired upward gaze)
    b) In Children
        i) Headache
        ii) Mental status changes
        iii) Nausea
        iv) Vomiting
10) Modified GCS: Children < 4 years old
11) GCS Indicators of TBI Severity
    a) GCS 14-15 = MILD TBI
    b) GCS 9-13 = MODERATE TBI
    c) GCS 3-8 = SEVERE TBI
12) Pupillary Response
    a) Assess pupils every 5 minutes & as needed.
    b) Pupil size
    c) Symmetry
        i) (equal size)
    d) Reactivity to light
13) Systolic Blood Pressure Thresholds
    a) Hypotension should be considered according to age groups:
        i) <65 mmHg (0-1 year)
        ii) <75 mmHg (2-5 years)
        iii) <80 mmHg (6-12 years)
        iv) <90 mmHg (13-16 years)
        v) Adult hypotension systolic blood pressure <90 mmHg
14) Take Home Message:
    a) Maintaining Blood Pressure is Critical

15) Level of Consciousness
   a) Level of consciousness is an important predictor of TBI
16) Glasgow Coma Scale
   a) A reproducible measure of level of consciousness
   b) Assess every 5 minutes & as needed
   c) Deterioration by 2 or more points is significant
   d) Use it:
      i) After initial assessment
      ii) After airway, breathing and circulation
      iii) Prior to sedation and muscle relaxants
17) GCS – Adult & Child
   a) GCS Motor Scale
      i) Motor Response
         (1) obeys
         (2) localizes
         (3) withdraws from pain
         (4) abnormal flexion
         (5) abnormal extension
         (6) no response
18) GCS – Infant
   a) Verbal response

Coos babble	5
Irritable cry	4
Cries to pain	3
Moans, grunts	2
None	1

19) GCS Indicators of TBI Severity
   a) GCS 14-15 --- MILD
   b) GCS 9-13 --- MODERATE
   c) GCS 3-8 --- SEVERE

20) In a severe TBI patient, a decline in the GCS score over time can be indicative of the need for acute management and neurosurgical intervention
21) Pupil Response
    a) Assess every 5 minutes & as needed
    b) Pupil size
    c) Symmetry
    d) Reactivity to light
22) Document these findings:
    a) Bilateral symmetry (asymmetric pupils differ more than 1 mm)
    b) Reactivity to light (a fixed pupil shows <1mm change in response to bright light)
    c) Dilation (greater than or equal to 4mm diameter in adults)
23) Research Findings
    a) In-Hospital Studies
        i) Single fixed and dilated pupil 45% poor outcome
        ii) Bilateral fixed and dilated pupils 82% poor outcome
24) Pupil Abnormalities
    a) Conditions that can mimic pupil abnormalities:
        i) Hypoxia
        ii) Hypothermia
        iii) orbital trauma
        iv) pharmacological treatment
        v) cataract surgery
        vi) hypotension
        vii) illegal drug use
        viii) toxic exposure
        ix) artificial eye
        x) congenital abnormality
        xi) anisocoria
25) Blown Pupil
    a) Suggests herniation, which is compression of the brain stem
    b) Usually indicative of same-side mass

26) Indicators of Herniation
   a) An unresponsive patient (comatose) with:
      i) Bilateral dilated unresponsive pupils OR Asymmetric pupils AND
      ii) Abnormal extension (decerebrate posturing) OR No motor response to painful stimuli

27) Take Home Messages
   a) ABCs
   b) Level of Consciousness – GCS
   c) Herniation – Pupils and Motor Exam
   d) Thresholds: 90 / 90 / 9
   e) These are the low-end shoot for higher numbers!

28) Treatment
   a) Airway
      i) SaO_2 at Scene of Accident

	Oxygen Saturation	Mortality	Severe Disability
iii)	>90%	14.3%	4.8%
iv)	60-90%	27.3%	27.3%
v)	<60%	50.0%	50.0%

29) Normal Ventilation Rates
   a) Approximate normal ventilation rates:
      i) 10 bpm Adult
      ii) 20 bpm Child
      iii) 25 bpm Infant

30) Hyper-Ventilation Rates
   a) Approximate hyper-ventilation rates:
      i) 20 bpm Adult
      ii) 30 bpm Child
      iii) 35 bpm Infant
   b) Early post-injury episodes of hypoxia greatly increase mortality and morbidity
   c) Evidence defines hypoxia as an oxygen saturation <90%
   d) PEAD unconscious and unresponsive TBI patients improves outcome

31) Treat Circulation - Hypotension
   a) Maintain Systolic BP > 90mmHg in adults (lower for infants and children)
   b) Use isotonic IV fluids
   c) Fluid Resuscitation
      i) Infuse volume to achieve normal BP
   d) Evidence defines hypotension as a single observation of SBP < 90mm Hg (in adults)
      i) A single episode of hypotension DOUBLES mortality and increases morbidity
   e) Goal is to maintain SBP >90mmHg in adults

32) Brain-Targeted Therapy
   a) Glucose for hypoglycemia
      i) Perform rapid blood glucose determination
      ii) Rule out ↓ level of consciousness due to hypoglycemia
      iii) Give IV glucose
   b) Sedatives for agitation
   c) Analgesics for pain
   d) Other Factors Affecting ICP
      i) Fear and anxiety
      ii) Pain
      iii) Vomiting
      iv) Straining
      v) Environmental stimulation
      vi) Endotracheal intubation
      vii) Airway suctioning

33) Triage and Transport
   a) Identify local and regional trauma centers with severe TBI capabilities
   b) Destination Decisions
      i) GCS 14-15 Hospital Emergency Room
      ii) GCS 9-13 Trauma Center
      iii) GCS < 9 Trauma Center with severe TBI capabilities

34) Take Home Messages
   a) Manage ABCs

b) Airway and intubation (PEAD)
   i) Avoid hypoxia, keep SaO2 > 90%
   ii) Oxygenation
   iii) Hyperventilate (only when indicated)
c) Blood pressure
   i) Avoid hypotension, keep SBP > 90mmHg
d) Do early and repeated neurological assessments
   i) Identify patients with severe TBI (GCS < 9
   ii) Glucose when appropriate
   iii) Sedatives and analgesics per protocol
e) Triage and transport TBI to appropriate facilities based on severity.

This page intentionally left blank

Trauma Skills Lab

Terminal Objective

At the completion of this unit, the EMT-Intermediate student will be able to demonstrate the practical skills of managing trauma patients.

Cognitive Objectives

None identified for this unit.

Affective Objectives

None identified for this unit.

Psychomotor Objectives

At the completion of this unit, the EMT-Intermediate student will be able to:

i) Demonstrate the assessment and management of a patient with signs and symptoms of compensated shock. (P-2)

ii) Demonstrate the assessment and management of a patient with signs and symptoms of decompensated shock. (P-2)

iii) Demonstrate a clinical assessment for a patient with suspected thoracic trauma. (P-1)

iv) Demonstrate the following techniques of management for thoracic injuries: (P-1)

2) Fracture stabilization
3) ECG monitoring
4) Oxygenation and ventilation
5) Demonstrate a clinical assessment to determine the proper treatment plan for a patient with a suspected musculoskeletal injury. (P-1)
6) Demonstrate the proper use of fixation, soft and traction splints for a patient with a suspected fracture. (P-1)
7) Demonstrate the assessment and management of a patient with signs and symptoms of soft tissue injury, including: (P-2)
    i) Contusion
    ii) Hematoma
    iii) Crushing
    iv) Abrasion

v) Laceration
vi) Avulsion
vii) Amputation
viii) Impaled object
ix) Penetration/ puncture
x) Blast

b) Demonstrate a clinical assessment to determine the proper management modality for a patient with a suspected traumatic spinal injury. (P-1)
c) Demonstrate a clinical assessment to determine the proper management modality for a patient with a suspected non-traumatic spinal injury. (P-1)
d) Demonstrate immobilization of the urgent and non-urgent patient with assessment findings of spinal injury from the following presentations: (P-1)
   i) Supine
   ii) Prone
   iii) Semi-prone
   iv) Sitting
   v) Standing

8) Demonstrate preferred methods for stabilization of a helmet from a potentially spine injured patient. (P-1)
9) Demonstrate helmet removal techniques. (P-1)
10) Demonstrate alternative methods for stabilization of a helmet from a potentially spine injured patient. (P-1)
11) Demonstrate documentation of assessment before spinal immobilization. (P-1)
12) Demonstrate documentation of assessment during spinal immobilization. (P-1)
13) Demonstrate documentation of assessment after spinal immobilization. (P-1)

This page intentionally left blank

Pediatrics

Terminal Objective

At the completion of this module, the EMT-Intermediate student will be able utilize assessment findings to formulate a field impression and implement the treatment plan for a pediatric patient.

An acceptable substitution for this module is the national PEPP course.

Cognitive Objectives

At the completion of this module, the EMT-Intermediate student will be able to:

1) Identify the growth and developmental characteristics of infants and children. (C-2)
2) Explain anatomy and physiology characteristics of infants and children. (C-3)
3) Outline differences in adult and childhood anatomy and physiology. (C-3)
4) Describe techniques for successful assessment of infants and children. (C-3)
5) Identify the common responses of families to acute illness and injury of an infant or child. (C-1)
6) Describe techniques for successful interaction with families of acutely ill or injured infants and children. (C-1)
7) Discuss pediatric patient assessment. (C-2)
   a) Assessment triangle
   b) Other assessment tools
8) Identify “normal” age group related vital signs. (C-2)
9) Discuss the appropriate equipment utilized to obtain pediatric vital signs. (C-2)
10) Determine appropriate airway adjuncts for infants and children. (C-3)
11) Discuss complications of improper utilization of airway adjuncts with infants and children. (C-3)
12) Discuss appropriate ventilation devices for infants and children. (C-3)
13) Discuss complications of improper utilization of ventilation devices with infants and children. (C-3)
14) Discuss age appropriate vascular access sites for infants and children. (C-2)

15) Discuss the appropriate equipment for vascular access in infants and children. (C-2)
    a) Large-bore
        i) 18ga
16) Identify complications of vascular access for infants and children. (C-1)
17) Define respiratory distress. (C-3)
18) Define respiratory failure. (C-3)
19) Define respiratory arrest. (C-3)
20) Describe the epidemiology, including the incidence, morbidity/ mortality, and risk factors for respiratory distress/ failure in infants and children. (C-1)
21) Discuss the pathophysiology of respiratory distress/ failure in infants and children. (C-3)
22) Discuss the assessment findings associated with respiratory distress/ failure in infants and children. (C-3)
23) Discuss the management/ treatment plan for respiratory distress/ failure in infants and children. (C-3)
24) List the indications for placement of an oral gastric tube for infants and children. (C-1)
25) Differentiate between upper and lower airway obstruction. (C-2)
26) Describe the epidemiology, including the incidence, morbidity/ mortality, and risk factors for croup in infants and children. (C-1)
27) Discuss the pathophysiology of croup in infants and children. (C-2)
28) Discuss the assessment findings associated with foreign body aspiration in infants and children. (C-2)
29) Discuss the management/ treatment plan for foreign body aspiration in infants and children. (C-2)
30) Describe the epidemiology, including the incidence, morbidity/ mortality, and risk factors for epiglottitis in infants and children. (C-2)
31) Discuss the pathophysiology of epiglottitis in infants and children. (C-2)
32) Discuss the assessment findings associated with epiglottitis in infants and children. (C-2)
33) Discuss the management/ treatment plan for epiglottitis in infants and children. (C-3)
34) Describe the epidemiology, including the incidence, morbidity/ mortality, and risk factors for asthma/bronchiolitis in infants and children. (C-2)
35) Discuss the pathophysiology of asthma/bronchiolitis in infants and children. (C-2)

36) Discuss the assessment findings associated with asthma/bronchiolitis in infants and children. (C-2)
37) Discuss the management/ treatment plan for asthma/bronchiolitis in infants and children. (C-3)
38) Describe the epidemiology, including the incidence, morbidity/ mortality, and risk factors for pneumonia in infants and children. (C-2)
39) Discuss the pathophysiology of pneumonia in infants and children. (C-2)
40) Discuss the assessment findings associated with pneumonia in infants and children. (C-2)
41) Discuss the management/ treatment plan for pneumonia in infants and children. (C-3)
42) Describe the epidemiology, including the incidence; morbidity/ mortality, and risk factors for foreign body lower airway obstruction in infants and children. (C-2) – Enhanced objective
43) Discuss the pathophysiology of foreign body lower airway obstruction in infants and children. (C-2) – Enhanced objective
44) Discuss the assessment findings associated with foreign body lower airway obstruction in infants and children. (C-2) – Enhanced objective
45) Discuss the management/ treatment plan for foreign body lower airway obstruction in infants and children. (C-3) – Enhanced objective
46) Discuss the common causes of shock in infants and children. (C-2)
47) Evaluate the severity of shock in infants and children. (C-3)
    a) Epidemiology,
    b) Incidence,
    c) Morbidity/ mortality,
    d) Risk factors
48) Differentiate the assessment findings associated between compensated, and decompensated shock between infants, children and adults. (C-2)
49) Discuss the management/ treatment plan for shock in infants and children. (C-3)
50) Identify the major classifications of pediatric cardiac rhythms. (C-2) – Enhanced objective
51) Describe the epidemiology, including the incidence, morbidity/ mortality, and risk factors for cardiac dysrhythmias in infants and children. (C-2) – Enhanced objective
52) Discuss the pathophysiology of cardiac dysrhythmias in infants and children. (C-2)

53) Discuss the assessment findings associated with cardiac dysrhythmias in infants and children. (C-2) – Enhanced objective
54) Discuss the management/ treatment plan for cardiac dysrhythmias in infants and children. (C-3) – Enhanced objective
55) Describe the epidemiology, including the incidence, morbidity/ mortality, and risk factors for tachydysrythmias in infants and children. (C-2) – Enhanced objective
56) Discuss the pathophysiology of tachydysrythmias in infants and children. (C-2) – Enhanced objective
57) Discuss the assessment findings associated with tachydysrythmias in infants and children. (C-2) – Enhanced objective
58) Discuss the management/ treatment plan for tachydysrythmias in infants and children. (C-3) – Enhanced objective
59) Describe the epidemiology, including the incidence, morbidity/ mortality, and risk factors for bradydysrythmias in infants and children. (C-2)
60) Discuss the pathophysiology of bradydysrythmias in infants and children. (C-2)
61) Discuss the assessment findings associated with bradydysrythmias in infants and children. (C-2)
62) Discuss the management/ treatment plan for bradydysrythmias in infants and children. (C-3)
63) Discuss the primary etiologies of cardiopulmonary arrest in infants and children. (C-2)
64) Discuss basic cardiac life support (CPR) guidelines for infants and children. (C-2)
65) Identify appropriate parameters for performing infant and child CPR. (C-2)
66) Integrate advanced life support skills with basic cardiac life support for infants and children. (C-3)
67) Describe the epidemiology, including the incidence, morbidity/ mortality, and risk factors for seizures in infants and children. (C-2)
68) Discuss the pathophysiology of seizures in infants and children. (C-2)
69) Discuss the assessment findings associated with seizures in infants and children. (C-2)
70) Discuss the management/ treatment plan for seizures in infants and children. (C-3)
71) Describe the epidemiology, including the incidence, morbidity/ mortality, and risk factors for hypoglycemia in infants and children. (C-2)

72) Discuss the pathophysiology of hypoglycemia in infants and children. (C-2)
73) Discuss the assessment findings associated with hypoglycemia in infants and children. (C-2)
74) Discuss the management/ treatment plan for hypoglycemia in infants and children. (C-3)
75) Describe the epidemiology, including the incidence, morbidity/ mortality, and risk factors for hyperglycemia in infants and children. (C-2)
76) Discuss the pathophysiology of hyperglycemia in infants and children. (C-2)
77) Discuss the assessment findings associated with hyperglycemia in infants and children. (C-2)
78) Discuss the management/ treatment plan for hyperglycemia in infants and children. (C-2)
79) Identify common lethal mechanisms of injury in infants and children. (C-1)
80) Discuss anatomical features of children that predispose or protect them from certain injuries. (C-2)
81) Describe aspects of infant and children airway management that are affected by potential cervical spine injury. (C-2)
82) Identify infant and child trauma patients who require spinal immobilization. (C-1)
83) Discuss the pathophysiology of trauma in infants and children. (C-2)
84) Discuss the assessment findings associated with trauma in infants and children. (C-2)
85) Discuss the management/ treatment plan for trauma in infants and children. (C-3)
86) Discuss the assessment findings and management considerations for pediatric trauma patients with the following specific injuries: head/neck injuries, chest injuries, abdominal injuries, extremities injuries, burn injuries. (C-3)
87) Define child abuse. (C-1)
    a) See state web page
        i) http://www.oregon.gov/DHS/children/index.shtml
88) Define child neglect. (C-1)
    a) See above
89) Describe the epidemiology, including the incidence, morbidity/ mortality, and risk factors and reporting requirements for abuse and neglect in infants and children. (C-1)
90) Discuss the assessment findings associated with abuse and neglect in infants and children. (C-1)

91) Discuss the management/ treatment plan for abuse and neglect in infants and children. (C-3)
92) Define sudden infant death syndrome (SIDS). (C-1)
93) Discuss the parent/ caregiver responses to the death of an infant or child. (C-1)
94) Describe the epidemiology, including the incidence, morbidity/ mortality, and risk factors for SIDS infants. (C-1)
95) Discuss the pathophysiology of SIDS in infants. (C-1)
96) Discuss the assessment findings associated with SIDS infants. (C-2)
97) Discuss the management/ treatment plan for SIDS in infants. (C-3)

Affective Objectives

At the completion of this module, the EMT Intermediate student will be able to:

1) Demonstrate and advocate appropriate interactions with the infant/ child that conveys an understanding of their developmental stage. (A-3)
2) Recognize the emotional dependance of the infant/ child to their parent/ guardian. (A-1)
3) Recognize the emotional impact of the infant/ child injuries and illnesses on the parent/ guardian. (A-1)
4) Recognize and appreciate the physical and emotional difficulties associated with separation of the parent/ guardian of a special needs child (A-3)
5) Demonstrate the ability to provide reassurance, empathy and compassion for the parent/ guardian. (A-1)

Psychomotor Objectives

At the completion of this module, the EMT-Intermediate student will be able to:

1) Demonstrate the appropriate approach for treating infants and children. (P-2)
2) Demonstrate appropriate intervention techniques with families of acutely ill or injured infants and children. (P-2)
3) Demonstrate an appropriate assessment for different developmental age groups. (P-2)
4) Demonstrate appropriate technique for measuring pediatric vital signs. (P-2)
5) Demonstrate the use of a length-based resuscitation device for determining equipment sizes, drug doses and other pertinent information for a pediatric patient. (P-2)

6) Demonstrate the techniques/ procedures for treating infants and children with respiratory distress. (P-2)
7) Demonstrate proper technique for administering blow-by oxygen to infants and children. (P-2)
8) Demonstrate the proper utilization of a pediatric non-rebreather oxygen mask. (P-2)
9) Demonstrate appropriate use of airway adjuncts with infants and children. (P-2)

Demonstrate appropriate use of ventilation devices for infants and children. (P-2)

10) Demonstrate proper placement of an oral gastric tube in infants and children. (P-2)
11) Demonstrate appropriate technique for insertion of peripheral intravenous catheters for infants and children. (P-2)
12) Demonstrate appropriate techniques for administration of intramuscular, subcutaneous, and oral medication for infants and children. (P-2)
13) Demonstrate appropriate technique for insertion of an intraosseous line for infants and children. (P-2)
14) Demonstrate age appropriate interventions for infants and children with an obstructed airway. (P-2)
15) Demonstrate appropriate airway control maneuvers for infant and child trauma patients. (P-2)
16) Demonstrate appropriate treatment of infants and children requiring advanced airway and breathing control. (P-2)
17) Demonstrate appropriate immobilization techniques for infant and child trauma patients. (P-2)
18) Demonstrate treatment of infants and children with head injuries. (P-2)
19) Demonstrate appropriate treatment of infants and children with chest injuries. (P-2)
20) Demonstrate appropriate treatment of infants and children with abdominal injuries. (P-2)
21) Demonstrate appropriate treatment of infants and children with extremity injuries. (P-2)
22) Demonstrate appropriate treatment of infants and children with burns. (P-2)
23) Demonstrate appropriate parent/ caregiver interviewing techniques for infant and child death situations. (P-2)
24) Demonstrate proper infant CPR. (P-2)
25) Demonstrate proper child CPR. (P-2)

26) Demonstrate proper techniques for performing infant and child defibrillation. (P-2)
27) Demonstrate appropriate treatment of infants and children with abdominal injuries. (P-2)
28) Demonstrate appropriate treatment of infants and children with extremity injuries. (P-2)
29) Demonstrate appropriate treatment of infants and children with burns. (P-2)
30) Demonstrate appropriate parent/ caregiver interviewing techniques for infant and child death situations. (P-2)
31) Demonstrate proper infant CPR. (P-2)
32) Demonstrate proper child CPR. (P-2)
33) Demonstrate proper techniques for performing infant and child defibrillation. (P-2)

DECLARATIVE

Introduction

1) Definitions
   a) Newborn
      i) First few hours of life (perinatal period)
      ii) Resuscitation follows Neonatal Advanced Life Support (NALS) guidelines
   b) Infant
      i) Neonatal period (first 28 days of life) is included
         (1) First month after birth to approximately 12 months of age
         (2) Resuscitation follows Pediatric Advanced Life Support (PALS) guidelines
   c) Toddler
      i) A child between 12 and 36 months of age
   d) Preschool
      i) A child between three and five years of age
   e) School age
      i) The child between 6 and 12 years of age
   f) Adolescent
      i) The period between the end of childhood and adulthood (18 years)
         (1) Early (puberty)
         (2) Middle (junior high school/ high school age)
         (3) Late (high school/ college age)

(4) End of childhood is usually defined as the beginning of puberty

(a) Highly child specific

(b) Male child average 13 years

(c) Female child average 11 years

2) Anatomy and physiology

a) Review differences between adult, child and infants

b) Head

i) Proportionally larger size

ii) Larger occipital region

iii) Fontanelles open in infancy

iv) Face is small in comparison to size of head

v) EMT-Intermediate implications

(1) Higher proportion of blunt trauma involves the head

(2) Different airway positioning techniques

(a) Place thin layer of padding under back of seriously injured child < 3 years of age to obtain neutral position

(b) Place folded sheet under occiput of medically ill child < 3 years of age to obtain sniffing position

(3) Examine fontanelle in infants

(a) Bulging fontanelle suggests increased intracranial pressure

(b) Sunken fontanelle suggests dehydration

c) Airway

i) Narrower at all age levels

ii) Infants are obligate nasal breathers

iii) Jaw is proportionally smaller in young children

(1) Larynx is higher (C 3-4) and more anterior

iv) Cricoid ring is the narrowest part of the airway in young children

v) Tracheal cartilage softer

vi) Trachea smaller in both length and diameter

vii) Epiglottis

(1) Omega shaped in infants

(2) Extends at a 45 degree angle into airway

(3) Epiglottic folds have softer cartilage, therefore are more floppy, especially in infants

viii) EMT-Intermediate implications

(1) Keep nares clear in infants < 6 months of age

(2) Narrower upper airways are more easily obstructed

(3) Flexion or hyperextension

(4) Particulate matter

(5) Soft tissue swelling (injury, inflammation)

d) Chest and lungs

i) Ribs are positioned horizontally

ii) Ribs are more pliable and offer less protection to organs

iii) Chest muscles are immature and fatigue easily

iv) Lung tissue is more fragile

v) Mediastinum is more mobile

vi) Thin chest wall allows for easily transmitted breath sounds

vii) EMT-Intermediate implications

(1) Infants and children are diaphragmatic breathers

(2) Infants and children are prone to gastric distention

(3) Rib fractures are less frequent but not uncommon in child abuse and trauma

(4) Greater energy transmitted to underlying organs following trauma, therefore, significant internal injury can be present without external signs

(5) Pulmonary contusions are more common in major trauma

(6) Lungs prone to pneumothorax following barotrauma

(7) Mediastinum has greater shift with tension pneumothorax

(8) Easy to miss a pneumothorax due to transmitted breath sounds

e) Abdomen
   i) Immature abdominal muscles offer less protection
   ii) Abdominal organs are closer together
   iii) Liver and spleen proportionally larger and more vascular
   iv) EMT-Intermediate implications
      (1) Liver and spleen more frequently injured
      (2) Multiple organ injuries more common

f) Extremities
   i) Bones are softer and more porous until adolescence
   ii) Injuries to growth plate may disrupt bone growth
   iii) EMT-Intermediate implications
      (1) Immobilize any sprain or strain as it is likely a fracture
      (2) Avoid piercing growth plate during intraosseous needle insertion

g) Skin and body surface area (BSA)
   i) Thinner and more elastic
   ii) Thermal exposure results in deeper burn
   iii) Less subcutaneous fat
   iv) Larger surface area to body mass
   v) EMT-Intermediate implications
      (1) More easily and deeply burned
      (2) Larger losses of fluid and heat

h) Respiratory system
   i) Tidal volume proportionally similar to that of adolescents and adults
   ii) Metabolic oxygen requirements of infants and children are approximately double those of adolescents and adults
   iii) Proportionally smaller functional residual capacity, therefore proportionally smaller oxygen reserves
   iv) EMT-Intermediate implications
      (1) Hypoxia develops rapidly because of increased oxygen requirements and decreased oxygen reserves

i) Cardiovascular system
  i) Cardiac output is rate dependent in infants and small children
  ii) Vigorous but limited cardiovascular reserves
  iii) Bradycardia is a response to hypoxia
  iv) Can maintain blood pressure longer than an adult
  v) Circulating blood volume is proportionally larger than in an adult
    (a) 85 – 90 ml/kg in neonate
    (b) 75 – 80 ml/kg in infant to one year
    (c) 67 – 75 ml/kg one year to adult
    (d) 55 – 75 ml/kg in adult
  vi) Absolute blood volume is smaller than in an adult
  vii) IV access only when needed. Do not delay transport
  viii) IV/IO
    (1) IV take no longer than 90 seconds to establish
      (a) Sites
      (b) Large-bore
        (i) 18ga
      (c) Fluid
    (2) IO when unable to establish IV or patient is in cardiac arrest
      (a) Sites
      (b) Large-bore
      (c) Fluid
  ix) EMT-Intermediate implications
    (1) Smaller absolute volume of fluid/ blood loss needed to cause shock
    (2) Larger proportional volume of fluid/ blood loss needed to cause shock
    (3) Hypotension is a late sign of shock don't wait for it
    (4) A child may be in shock despite normal blood pressure
    (5) Shock assessment is based upon clinical signs of tissue perfusion
    (6) Carefully assess for shock if tachycardia is present
    (7) Monitor carefully for development of hypotension
    (8) Establish IV/IO without delaying transport

(9) Recognize early signs of shock and treat aggressively

j) Nervous system

i) Develops throughout childhood

ii) Developing neural tissue is more fragile

iii) Brain and spinal cord are less well protected by skull and spinal column

iv) EMT-Intermediate implications

(1) Brain injuries are more devastating in young children

(2) Greater force transmitted to underlying brain of young children

(3) Spinal cord injury can occur without spinal column injury

k) Metabolic differences

i) Infants and children have limited glycogen and glucose stores

ii) Significant volume loss can result from vomiting and diarrhea

iii) Prone to hypothermia due to increased body surface area

iv) Newborns and neonates are unable to shiver to maintain body temperature

v) EMT-Intermediate implications

(1) Keep child warm during treatment and transport

(2) Cover the head to minimize heat loss

3) Assessment

a) General considerations

i) Many components of the initial patient evaluation can be done by observing the patient

ii) Utilize the parent/ guardian to assist in making the infant or child more comfortable as appropriate

iii) Interacting with parents and family

iv) Normal responses to acute illness and injury

(1) Child may regress up to two age years

v) Parent/ guardian and child interaction

vi) Intervention techniques

b) Physical exam

i) Scene survey

(1) Observe the scene for hazards or potential hazards

(2) Observe the scene for mechanism of injury/ illness

(a) Ingestion

(i) Pills, medicine bottles, household chemicals, etc.

(b) Child abuse

(i) Injury and history do not coincide, bruises not where they should be for mechanism of injury, etc.

(c) Position patient found

(3) Observe the parent/ guardian/ caregiver interaction with the child

(a) Do they act appropriately

(b) Is parent/ guardian/ caregiver concerned

(c) Is parent/ guardian/ caregiver angry

(d) Is parent/ guardian/ caregiver indifferent

ii) Initial assessment

(1) The general impression

(2) General impression of environment

(3) General impression of parent/ guardian and child interaction

(4) General impression of the patient

(a) Pediatric Assessment Triangle

(i) A structure for assessing the pediatric patient

(ii) Focuses on the most valuable information for pediatric patients

(iii) Used to ascertain if any life-threatening condition exists

(iv) Components

1. Appearance
2. Mental status
3. Muscle tone
4. Work of breathing
5. Respiratory rate
6. Respiratory effort
7. Circulation
8. Skin signs
9. Skin color

(5) Initial triage decisions

(a) Urgent - proceed with rapid ABC assessment, treatment, and transport

(b) Non urgent - proceed with focused history, detailed physical exam after initial assessment

(6) Vital functions

(a) Determine level of consciousness

(b) AVPU scale

(i) Alert

(ii) Responds to verbal stimuli

(iii) Responds to painful stimuli

(iv) Unresponsive

(v) Use only for quick initial impression then change to GCS

(c) Modified Glasgow Coma Scale

(i) Baby – verbal response

Coos babble 5
Irritable cry 4
Cries to pain 3
Moans, grunts 2
None 1

(ii) Provides more information than AVPU

(iii) Gives a better picture of the LOC

(d) Signs of inadequate oxygenation

iii) Airway

(1) Determine patency

iv) Breathing

(1) Adequate chest rise and fall

(2) Use of accessory muscles

(3) Nasal flaring

(4) Tachypnea

(5) Bradypnea

(6) Irregular breathing pattern

(7) Head bobbing

(8) Grunting

(9) Absent breath sounds

(10) Abnormal sounds

v) Circulation

vi) Pulse

(a) Central

(b) Peripheral

(c) Quality of pulse

vii) Blood pressure

viii) Skin color

ix) Active hemorrhage

c) Vital signs in the pediatric patient

i) Equipment

(1) Sizes

ii) Normal age appropriate ranges for blood pressure, heart rate and respiratory rate for:

(1) Infant

(2) Toddler

(3) Preschool

(4) School aged

(5) Adolescent

d) Proper technique for obtaining the following in pediatric patients

i) Pulse

ii) Respirations

iii) Blood pressure

4) Transition phase

a) Utilized to allow the infant or child to become familiar with you and your equipment

b) Use of transition phase depends on the seriousness of the patient's condition

c) For the conscious, non-acutely ill child

d) For the unconscious, non-acutely ill child do not perform the transition phase but proceed to the physical examination

5) Focused history

a) Approach

i) For infant, toddler, and preschool age patient, obtain from parent/ guardian

ii) For school age and young adolescent patient, most information may be obtained from the patient

iii) For older adolescent patient, question the patient in private regarding sexual activity, pregnancy, illicit drug and alcohol use.

b) Initial assessment

i) Chief complaint

(1) Nature of illness/ injury

(2) How long has the patient been sick/ injured

(3) Presence of fever

(4) Effects on behavior

(5) Bowel/ urine habits

(6) Vomiting/ diarrhea
(7) Frequency of urination
(8) Past medical history
(9) Infant or child under the care of a physician
(10) Chronic illnesses
(11) Medications
(12) Allergies

6) Focused exam
   a) Examine all body regions
      i) Head-to-toe in older child
      ii) Toe-to-head in younger child
   b) Some or all of the following may be appropriate, depending on the situation
      i) Pupils
      ii) Capillary refill
         (1) Normal - two seconds or less
         (2) Valuable to assess on patients less than six years of age
         (3) Less reliable in cold environment
         (4) Blanch nailbed, base of the thumb, sole of the feet
      iii) Hydration
         (1) Skin turgor
         (2) Sunken or flat fontanelle in an infant
         (3) Presence or absence of tears and saliva
      iv) Pulse oximetry
         (1) Should be utilized on any moderately injured or ill infant or child
         (2) Hypothermia and shock can alter reading
      v) Cardiac monitor
7) Ongoing Exam - continually monitor the following
   a) Respiratory effort
   b) Color
   c) Mental status - GCS
   d) Pulse oximetry

e) Vital signs

f) Patient temperature

8) General management

a) Airway management in pediatric patients

i) Basic airway management

(1) Manual positioning

(a) Allow medical patients to assume position of comfort

(b) Support under the torso for trauma patients less than 3 years old

(c) Occipital elevation for supine medical patients 3 years of age or older

(2) Foreign body airway obstruction - basic clearing methods

(a) Infants

(i) Back blows

(ii) Chest thrusts

(b) Children

(i) Abdominal thrusts

(3) Suction

(a) Avoid hypoxia

(b) Avoid upper airway stimulation

(c) Decrease suction negative pressure (100 mm/Hg) in infants

(4) Oxygenation

(a) Non-rebreather mask

(b) Blow-by oxygen if mask is not tolerated

(c) Utilize the parent or guardian to deliver oxygen if patient condition warrants

(d) Maintain proper head position

(5) Oropharyngeal airway

(a) Sizing

(b) Preferred method of insertion uses the tongue blade to depress the tongue and jaw

(6) Nasopharyngeal airway

(a) Sizing

(b) No major differences in sizing or use compared to adults

(7) Ventilation

(a) Bag size

(b) Proper mask fit

(c) Proper mask position and seal (E-C clamp)

(d) Ventilate at age appropriate rate (squeeze-release-release)

(e) Obtain chest rise with each breath

(f) Allow adequate time for exhalation

(g) Assess BVM ventilation

(h) Apply cricoid pressure to minimize gastric inflation and passive regurgitation

(i) Complications of improper technique or equipment

b) Circulation

i) Vascular access

(1) Intraosseous access in children of any age (AHA guidelines) in cardiac arrest or if intravenous access fails

(a) Fluid resuscitation

(i) 20 ml/kg bolus of crystalloid for infant and child

(ii) 10 ml/kg bolus for neonate

c) Pharmacological

d) Non-pharmacological

i) Cervical spine immobilization for traumatic cause

e) Transport considerations

i) Appropriate mode

(1) Transport should not be delayed to perform procedures that can be done en route

(2) Proper BLS care must be performed prior to any ALS interventions

ii) Appropriate facility

(1) The availability of a receiving hospital with expertise in pediatric care may improve the patient's outcome

f) Psychological support/ communication strategies

i) Utilize the parent/ guardian to assist in making the infant or child more comfortable

ii) Encourage parents to help calm the child during painful procedures

iii) Infants, toddlers, preschool and school aged patients do not like to be separated from parent/ guardian

iv) Infants and children have a natural fear of strangers; for stable patients, allow them to become accustomed to you before your hands-on assessment

v) Give some control of what is going to happen to the patient (which arm to have their IV)

vi) When possible and practical, physically position your face at the same level as the patient's face to facilitate communication and minimize fear

vii) Use age-appropriate vocabulary

viii) Keep patient warm

ix) Allow child to take their favorite toy/ blanket if possible

x) Permit the child to express their feelings (e.g., fear, pain, crying)

xi) Let the child know that certain physical actions (e.g., hitting, biting, spitting) are not permitted

9) Specific pathophysiology, assessment and management

a) Respiratory compromise

i) Introduction

(1) Epidemiology

(2) Categories of respiratory compromise

(a) Upper airway obstruction

(b) Lower airway disease

ii) Pathophysiology

(1) Respiratory illnesses cause respiratory compromise in airway/ lung

(a) Severity of respiratory compromise depends on extent of respiratory illness

(b) Approach to treatment depends on severity of respiratory compromise

iii) Severity

(1) Respiratory distress

(a) Increased work of breathing

(b) Carbon dioxide tension in the blood initially decreases, then increases as condition deteriorates

(c) If uncorrected, respiratory distress leads to respiratory failure

(2) Respiratory failure

(a) Inadequate ventilation or oxygenation

(b) Respiratory and circulatory systems are unable to exchange enough oxygen and carbon dioxide

(c) Carbon dioxide tension in the blood increases, leading to metabolic acidosis

(d) Very ominous condition; patient is on the verge of respiratory arrest

(3) Respiratory arrest

(a) Cessation of breathing

(b) Failure to intervene will result in cardiopulmonary arrest

(c) Good outcomes can be expected with early intervention that prevents cardiopulmonary arrest

iv) Assessment

(1) Chief complaint

(2) History

(3) Physical findings

(a) Signs and symptoms of respiratory distress

(i) Normal mental status ➔irritability or anxiety

(ii) Tachypnea

(iii) Retractions

(iv) Nasal flaring

(v) Good muscle tone

(vi) Tachycardia

(vii) Head bobbing

(viii) Grunting

(ix) Cyanosis which improves with supplemental oxygen

(b) Signs and symptoms of respiratory failure

(i) Irritability or anxiety ➔ lethargy

(ii) Marked tachypnea➔ bradypnea

(iii) Marked retractions ➔ agonal respirations

(iv) Poor muscle tone

(v) Marked tachycardia ➔ bradycardia

(vi) Central cyanosis

(c) Signs and symptoms of respiratory arrest

(i) Obtunded➔ coma

(ii) Bradypnea ➔apnea

(iii) Absent chest wall motion

(iv) Limp muscle tone

(v) Bradycardia ➔ asystole

(vi) Profound cyanosis

(4) Ongoing assessment - improvement indicated by

(a) Improvement in color

(b) Improvement in oxygen saturation

(c) Increased pulse rate

(d) Increased level of consciousness

v) Management

(1) Graded approach to treatment

(2) Consider separating parent and child

(3) Airway support

(a) Manage upper airway obstructions as needed

(b) Insert airway adjunct if needed

(4) Ventilatory and oxygenation support

(a) Respiratory distress/ early respiratory failure

(i) Administer high flow oxygen

(b) Late respiratory failure/ respiratory arrest

(i) BVM - ventilate patient with 100% oxygen via age-appropriate sized bag

(ii) Consider gastric decompression via OG tube if abdominal distention is impeding ventilation

(5) Circulatory support

(a) Consider IV or IO

(6) Pharmacologic interventions

(7) Non-pharmacologic interventions

(8) Transport considerations

(a) Appropriate mode

(b) Appropriate facility

(9) Psychological support/ communication strategies

10) Upper airway obstruction

a) Croup

i) Pathophysiology

(1) An inflammatory process of the upper respiratory tract involving the subglottic region

(2) Most commonly seen in infants and children between 6 months and 4 years of age

(3) Main cause is viral infection of the upper airway

(4) Another form is spasmodic croup

(a) Occurs mostly in the middle of the night

(b) Usually without prior upper respiratory infection

ii) Assessment

(1) Signs and symptoms of respiratory distress or failure, depending on severity, plus:

(a) Appears sick

(b) Stridor

(c) Barking (seal- or dog-like) or brassy cough

(d) Hoarseness

(e) Fever (+/-)

(2) History

(a) Usually with history of upper respiratory infection in classic croup (1-2 days)

(b) Rarely progresses to respiratory failure

iii) Management

(1) Airway and ventilatory support

(a) Humidified or nebulized oxygen

(b) Cool mist oxygen at 4 - 6 L/min

iv) Circulatory support

v) Pharmacological interventions

vi) Non-pharmacological interventions

(1) Keep child in position of comfort

vii) Transport considerations

viii) Psychological support/ communication strategies

(1) Do not agitate the infant or child (no IVs, blood pressure, etc.)

(2) Keep the parent/ guardian/ caregiver with the infant or child if appropriate

b) Foreign body aspiration

i) Pathophysiology

(1) Partial or complete blockage of the upper airway by a foreign body

(2) Most common in toddlers and preschool (1-4 years of age) but can occur any age

(3) Objects are usually food (hard candy, nuts, seeds, hot dog) or small objects (coins, balloons)

(4) If no interventions or if interventions are unsuccessful, respiratory arrest followed by cardiopulmonary arrest will ensue

(5) Partial

(a) Most children show signs of mild distress

(b) Appears anxious, but not toxic

(c) Interventions other than oxygen and transport may precipitate complete obstruction

(6) Complete

(a) Most children show signs of severe distress

(b) Appears agitated, but not toxic

(c) If no interventions, respiratory arrest ensues, followed by cardiopulmonary arrest

ii) Assessment

(1) Partial obstruction

(a) Signs and symptoms of respiratory distress or failure depending on severity, plus

(i) Appears irritable or anxious, but not toxic

(ii) Inspiratory stridor

(iii) Muffled or hoarse voice

(iv) Drooling

(v) Pain in throat

(b) History

(i) Usually a history of choking if observed by adult

(2) Complete obstruction

(a) Signs and symptoms of respiratory failure or arrest, depending on severity, plus

(i) Appears agitated or lethargic

(ii) No or minimal air movement

(b) History

(i) History often lacking

(ii) Inability to ventilate despite proper airway positioning

iii) Management

(1) Airway and ventilatory support

(a) Partial obstruction

(i) Place patient in sitting position

(ii) Deliver oxygen by non-rebreather mask or blow-by

(iii) DO NOT ATTEMPT TO LOOK IN MOUTH

(iv) Interventions other than oxygen and transport may precipitate complete obstruction

(b) Complete obstruction

(i) Open airway and attempt to visualize the obstruction

(ii) Sweep visible obstructions with your finger (do NOT perform blind finger sweeps)

(iii) Perform BLS foreign body airway obstruction (FBAO) maneuvers

(iv) Attempt BVM ventilations

(v) Continue BLS FBAO maneuvers if ALS unsuccessful

(2) Circulatory support

(3) Pharmacological interventions

(4) Non-pharmacological interventions

(5) Transport considerations

(a) Notify hospital of patient status

(b) Transport expeditiously

(6) Psychological support/ communication strategies

(a) Do not agitate patient

(b) No IV's or medications

(c) Do not look in patient's mouth

(d) Keep caregiver with child, if appropriate

c) Epiglottitis

i) Pathophysiology

(1) Rapidly forming cellulitis of the epiglottis and its surrounding structures

(2) Most common in children between 3 and 7 years of age but can occur at any age

(3) Bacterial infection, usually Haemophilus influenza type B

(4) Increasingly uncommon due to the H-flu vaccine

(5) Can be a true life-threatening emergency

ii) Assessment

(1) Signs and symptoms of respiratory distress or failure, depending on severity, plus

(a) Appears agitated, sick

(b) Stridor

(c) Muffled voice

(d) Drooling

(e) Sore throat

(f) Pain on swallowing

(g) High fever

(2) History

(a) Usually no previous history, but a rapid onset of symptoms (6-8 hours)

(b) Can quickly progress to respiratory arrest

iii) Management

(1) Airway and ventilatory support

(a) NEVER ATTEMPT TO VISUALIZE THE AIRWAY IF THE PATIENT IS AWAKE

(b) Allow the parent to administer oxygen

(c) If airway becomes obstructed, two rescuer ventilation with BVM is almost always effective

(2) Circulatory support

(3) Pharmacological interventions

(4) Non-pharmacological interventions

(5) Transport considerations

(a) Allow patient to assume position of comfort

(b) Notify hospital of patient status early

(c) Transport to the hospital without delay, keeping child warm

(6) Psychological support/ communication strategies

(a) DO NOT AGITATE THE PATIENT - no IV's, BP, do not look in patient's mouth

(b) Keep the parent/ caregiver with the child if appropriate

d) Lower airway disease

i) Asthma/ bronchiolitis

(a) Pathophysiology

(i) Bronchospasm, excessive mucous production, inflammation of the small airways

(ii) Typically in child with known history of asthma

(iii) Triggered by upper respiratory infections, allergies, changes in temperature, physical exercise, and emotional response

(iv) Children that experience prolonged asthma attacks tire easily; watch for signs of failure

(2) Assessment

(a) Signs and symptoms - signs of respiratory distress or failure depend on severity, plus

(i) Appears anxious

(ii) Wheezes

(iii) Prolonged expiratory phase

(iv) A silent chest means danger

(b) History

(c) Bronchiolitis and asthma may present very similarly, however, albuterol will not improve bronchiolitis but it will also not harm the patient

(3) Management

(a) Airway and ventilatory support

(i) Administer oxygen by tolerated method

(ii) BVM ventilations for respiratory failure/ arrest (progressive lethargy, poor muscle tone, shallow respiratory effort).

(b) Circulatory support

(c) Pharmacological interventions

(i) Albuterol nebulizer

1. Medications can be repeated if no effect

(d) Non-pharmacological interventions

(e) Transport considerations

(i) Allow patient to assume position of comfort

(f) Psychological support/ communication strategies

(i) Keep parent/ caregiver with child if appropriate

e) Pneumonia

i) Pathophysiology

(1) Infection of the lower airway and lung

(2) Most common in infants, toddlers and preschoolers (1 - 5 years of age), but can occur at any age

(3) Very common disease process

(4) May be caused by bacteria or virus

ii) Assessment

(1) Signs and symptoms - signs of respiratory distress of failure, depending on the severity, plus

(a) Appears anxious

(b) Decreased breath sounds

(c) Rales

(d) Rhonchi (localized or diffuse)

(e) Pain in the chest

(f) Fever

iii) History

(1) Usually a history of lower respiratory infectious symptoms

iv) Management

(1) Airway and ventilatory support

(a) Administer oxygen by tolerated method

(b) BVM ventilations for respiratory failure/ arrest (progressive lethargy, poor muscle tone, shallow respiratory effort)

(2) Circulatory support

(a) Consider IV or IO

(3) Pharmacological interventions

(4) Non-pharmacological interventions

(5) Transport considerations

(a) Allow patient to assume position of comfort

(6) Psychological support/ communication strategies

(a) Keep parent/ caregiver with child if appropriate

f) Foreign body lower airway obstruction – Enhanced

i) Pathophysiology

(a) Foreign body in the lower airway or lung

(b) Rarely progresses rapidly to respiratory failure or arrest

(c) Objects are usually food (nuts, seeds, etc.) or small objects

ii) Assessment

(1) Signs and symptoms - signs of respiratory distress or failure, depending on the severity, plus

(a) Appears anxious

(b) Decreased breath sounds

(c) Rales

(d) Rhonchi (localized or diffuse)

(e) Pain in the chest

(2) History

(a) May be a history of choking if witnessed by an adult

iii) Management

(1) Airway and ventilatory support

(a) Administer oxygen by tolerated method

(2) Circulatory support

(a) Consider IV or IO

(3) Pharmacological interventions

(4) Non-pharmacological interventions

(5) Transport considerations

(a) Allow patient to assume position of comfort

(6) Psychological support/ communication strategies

(a) Keep parent/ caregiver with child if appropriate

11)Shock

a) Pathophysiology

i) An abnormal condition characterized by inadequate delivery of oxygen and metabolic substrates to meet the metabolic demands of tissues

ii) Not just little adults, review differences

iii) Severity

(1) Compensated (early)

(a) Patient's blood pressure is normal although signs of inadequate tissue perfusion are present

(b) Reversible

(2) Decompensated (late)

(a) Hypotension and signs of inadequate organ perfusion are present

(b) Often irreversible

iv) Assessment

(1) Chief complaint

(2) History

(3) Physical findings

(a) Signs and symptoms compensated shock

(i) Irritability or anxiety

(ii) Tachycardia

(iii) Tachypnea

(iv) Weak peripheral pulses, full central pulses

(v) Delayed capillary refill

(vi) Cool, pale extremities

(vii) Systolic blood pressure within normal limits

(viii) Decreased urinary output

(b) Signs and symptoms of decompensated shock

(i) Lethargy or coma

(ii) Marked tachycardia or bradycardia

(iii) Marked tachypnea or bradypnea

(iv) Absent peripheral pulses, weak central pulses

(v) Markedly delayed capillary refill

(vi) Cool, pale, dusky, mottled extremities

(vii) Hypotension

(viii) Markedly decreased urinary output

b) Etiology

i) Hypovolemia - common

(1) Pathophysiology

(a) Dehydration

(i) Vomiting

(ii) Diarrhea

(iii) Excessive respiratory excursions

(iv) Excessive perspiration

(b) Blood loss

(i) Trauma

(ii) Child abuse

1. Other, e.g., GI bleed

(2) Signs and symptoms -assess for general compensated or decompensated shock plus

(a) Dehydration

(i) Poor skin turgor

(ii) Decreased saliva and/ or tears

(iii) Sunken fontanelle (infants)

(iv) Dry mucosa

(3) Treatment

(a) Compensated

(i) Oxygen

1. Consider IV or IO

(ii) 20 ml/kg of crystalloid as needed

(b) Decompensated

(i) Airway and ventilation

1. High flow oxygen

(ii) Circulation

1. IV or IO

a. 20 ml/kg of crystalloid as needed

(iii) Transport considerations

(iv) Psychological support/ communication strategies

1. Allow patient to assume position of comfort

(c) Cervical spine immobilization for trauma

ii) Distributive - uncommon

(1) Etiology

(a) Sepsis

(b) Neurogenic

(c) Anaphylactic

(2) Pathophysiology

(a) Peripheral pooling due to loss of vasomotor tone

(b) Shift of fluid from intravascular space to extravascular space

(3) Signs and symptoms - assess for general compensated or decompensated shock plus

(a) Sepsis

(i) Early - warm skin

(ii) Late - cool skin

(b) Neurogenic

(i) Warm skin

(ii) Bradycardia

(c) Anaphylactic

(i) Allergic rash

(ii) Airway swelling

(4) Treatment

(a) Compensated

(i) Oxygen

1. Consider IV or IO

a. 20 ml/kg of crystalloid as needed

(b) Decompensated

(i) Airway and ventilation

(ii) High flow oxygen

(iii) Circulation

1. IV or IO

a. 20 ml/kg crystalloid bolus as needed

(iv) Transport considerations

(v) Psychological support communication strategies

1. Allow patient to assume position of comfort

c) Cardiogenic shock - Enhanced

i) Pathophysiology

(1) An abnormal condition characterized by inadequate delivery of oxygen and metabolic substrates to meet the metabolic demands of tissues

(a) Mechanical pump failure

(b) Usually biventricular

ii) Assessment

(1) Signs and symptoms of compensated or decompensated shock, depending on severity, plus

(a) Rales

(b) Jugular venous distention

(c) Hepatomegaly

(d) Peripheral edema

(2) History

iii) Treatment

(1) Airway and ventilation

(a) High flow oxygen

(b) Circulation

(i) Consider IV or IO

1. 20 ml/kg of Crystalloid bolus as needed

(c) Pharmacological

(d) Transport considerations

(e) Psychological support/ communication strategies

(i) Allow patient to assume position of comfort

12) Dysrhythmias - Enhanced

a) Tachydysrhythmia

i) Supraventricular tachycardia

(1) Assessment

(a) Signs and symptoms - signs of compensated or decompensated shock, plus

(i) Narrow complex tachycardia rates greater than 220 beats per minute

(ii) Poor feeding

(iii) Hypotension

(2) Management

(a) Stable - supportive care

(b) Unstable

(i) Airway and ventilatory support

(ii) Oxygen

(iii) Circulatory support

(iv) Pharmacological interventions

(v) Non-pharmacological interventions

(vi) Transport considerations

(vii) Psychological support/ communication strategies

ii) Ventricular tachycardia with a pulse

(1) Assessment

(a) Signs and symptoms - signs of compensated or decompensated shock, depending on severity, plus

(i) Rapid, wide complex tachycardia

(ii) Poor feeding

(iii) Hypotension

(b) History

(2) Management

(a) Stable - supportive care

(b) Unstable

(i) Airway and ventilatory support

(ii) High flow oxygen

(iii) Circulatory support

(iv) Pharmacological interventions

(v) Consider lidocaine

(vi) Non-pharmacological interventions

(vii) Transport considerations

(viii) Psychological support/ communication strategies

b) Bradydysrhythmia

i) Epidemiology

(1) Incidence- most common dysrhythmia in children

ii) Pathophysiology

(1) Usually develops as a result of hypoxia

(2) May develop due to vagal stimulation (rare)

iii) Assessment

(1) Signs and symptoms - compensated or decompensated shock, depending on severity, plus

(a) Bradycardia

(b) Slow, narrow complex heart rhythm, QRS duration may be normal or prolonged

(2) History

iv) Management

(1) Stable - supportive care

(2) Unstable

(i) Airway and ventilatory support

(ii) Ventilate patient with 100% oxygen via BVM

(3) Circulatory support

(a) Perform chest compressions if oxygen does not increase heart rate

(4) Pharmacological interventions

(a) Administer epinephrine

(b) Administer atropine for vagally induced bradycardia

(5) Non-pharmacological interventions

(6) Transport considerations

(7) Psychological support/ communication strategies

c) Absent rhythm - Enhanced

i) Asystole

(1) Epidemiology

(a) Incidence - may be the initial cardiac arrest rhythm

(2) Assessment

(a) Signs and symptoms

(i) Pulseless

(ii) Apneic

(iii) Cardiac monitor indicating no electrical activity

(b) History

(3) Management

(a) Confirm in two EKG leads

(b) Airway and ventilatory support

(i) Ventilate the patient with 100% oxygen via BVM

(ii) Intubate patient if poor response to BVM ventilations

(c) Circulatory support

(i) Perform chest compressions

(d) Pharmacological interventions

(i) Administer epinephrine

(e) Non-pharmacological interventions

(f) Transport considerations

(g) Psychological support/ communication strategies

d) Pulseless electrical activity
   i) Pathophysiology
      (1) Pneumothorax
      (2) Cardiac tamponade
      (3) Hypovolemia
      (4) Hypoxia
      (5) Acidosis
      (6) Hypothermia
      (7) Hypoglycemia
   ii) Assessment
      (1) Signs and symptoms
         (a) Pulseless
         (b) Apneic
         (c) Cardiac monitor indicating organized electrical activity
      (2) History
   iii) Management
      (1) Resuscitation should be directed toward relieving cause
      (2) Airway and ventilatory support
         (a) Ventilate the patient with 100% oxygen via BVM
      (3) Circulatory support
         (a) Perform chest compressions
      (4) Pharmacological interventions
         (a) Administer epinephrine
      (5) Non-pharmacological interventions
      (6) Transport considerations
      (7) Psychological support/ communication strategies
e) Seizure
   i) Pathophysiology
      (1) Types
         (a) Generalized
         (b) Partial

ii) Assessment

(1) Signs and symptoms

(a) Generalized

(i) Sudden jerking of both sides of the body followed by tenseness and relaxation of the body

(ii) Loss of consciousness

(b) Partial

(i) Sudden jerking of a part of the body (arm, leg)

(ii) Lip smacking

(iii) Eye blinking

(iv) Staring

(v) Confusion

(vi) Lethargy

(2) History

iii) Management

(1) Airway and ventilatory support

(a) Maintain patent airway

(b) Administer high flow oxygen

(2) Circulatory support

(3) Pharmacological interventions

(a) Consider dextrose if hypoglycemic

(4) Non-pharmacological interventions

(a) Protect patient from further injury

(b) Protect head and cervical spine if injury has occurred

(5) Transport considerations

(6) Psychological support/ communication strategies

f) Hypoglycemia

i) Pathophysiology

(1) Children have limited glucose storage

(2) In severe cases, if not treated promptly, can cause brain damage

ii) Assessment

(1) Signs and symptoms

(a) Mild

(i) Hunger

(ii) Weakness

(iii) Tachypnea

(iv) Tachycardia

(b) Moderate

(i) Sweating

(ii) Tremors

(iii) Irritability

(iv) Vomiting

(v) Mood swings

(vi) Blurred vision

(vii) Stomach ache

(viii) Headache

(ix) Dizziness

(c) Severe

(i) Decreased level of consciousness

(ii) Seizure

(2) Measure blood glucose

(a) Normal range same as adult

(3) History

(a) May be first episode

iii) Management

(1) Airway and ventilatory support

(2) Circulatory support

(3) Pharmacological interventions

(a) Administer Dextrose per medical direction

(b) Repeat blood glucose test 10-15 minutes after dextrose infusion

(4) Non-pharmacological interventions

(5) Transport considerations

(6) Psychological support/ communication strategies

g) Hyperglycemia

i) Pathophysiology

(1) Leads to dehydration and ketoacidosis

ii) Assessment

(1) Signs and symptoms

(a) Early

(i) Increased thirst

(ii) Increased urination

(iii) Weight loss

(b) Acute (dehydration and early ketoacidosis)

(i) Weakness

(ii) Abdominal pain

(iii) Generalized aches

(iv) Loss of appetite

(v) Nausea

(vi) Vomiting

(vii) Signs of dehydration except decreased urinary output

(viii) Fruity breath odor

(ix) Tachypnea

(x) Hyperventilation

(xi) Tachycardia

(2) If untreated, progresses to

(a) Coma

(b) Deep and slow respirations (Kussmaul)

(c) Signs of severe dehydration

iii) Management

(1) Airway and ventilatory support

(2) Circulatory support

(3) Pharmacological interventions

(a) Consider crystalloid solution if signs of dehydration are present per medical direction.

(4) Non-pharmacological interventions

(5) Transport considerations

(6) Psychological support/ communication strategies

13) Pediatric Trauma

a) Pathophysiology

i) Blunt

(1) Thinner body wall allows forces to be readily transmitted to body contents

(2) Predominant cause of injury in children

(3) Cardiac arrest in blunt trauma

(a) Management considerations

ii) Penetrating

(1) Becoming an increasing problem in adolescents

(2) Higher incidence in the inner city (mostly intentional), but significant incidence in other areas (mostly unintentional)

b) Mechanism of injury

i) Fall

(1) Single most common cause of injury in children

(2) Serious injury or death resulting from truly accidental falls is relatively uncommon unless from a significant height

ii) Motor vehicle crash

(1) Leading cause of permanent brain injury and new cases of epilepsy

(2) Leading cause of death and serious injury in children

iii) Pedestrian vehicle crash

(1) Particularly lethal form of trauma in children

(2) Initial injury due to impact with vehicle (extremity/ trunk)

(3) Child is thrown from force of impact causing additional injury (head/ spine) upon impact with other objects (ground, another vehicle, light standard, etc.)

iv) Near-drowning

(1) Third leading cause of injury or death in children between birth and 4 years of age

(2) Causes approximately 2000 deaths annually

(3) Severe, permanent brain damage occurs in 5-20% of hospitalized children for near drowning

v) Penetrating injuries

(1) Risk of death from firearm injuries increases with age

(2) Stab wounds and firearm injuries account for approximately 10-15% of all pediatric trauma admissions

(3) Visual inspection of external injuries cannot evaluate the extent of internal involvement

vi) Burns

(1) The leading cause of accidental death in the home for children under the age of 14 years

(2) Burn survival is a function of burn size and concomitant injuries

(3) Modified rule of nines is utilized to determine percentage of surface area involved

(4) Rule of Palms

vii) Physical abuse

(1) Classified into four categories: physical abuse, sexual abuse, emotional abuse, and child neglect

(2) Social phenomena such as increased poverty, domestic disturbance, younger aged parents, substance abuse, and community violence have been attributed to increase of abuse

(3) Document all pertinent findings, treatments, and interventions

(a) Mandatory reporting requirements

c) Special considerations

i) Airway control

(1) Maintain in-line stabilization in neutral, not sniffing, position

(2) Administer 100% oxygen to all trauma patients

(3) Patent airway must be maintained via suctioning and jaw thrust

(4) Be prepared to assist ineffective respirations

ii) Immobilization

(1) Indications for stabilization and immobilization of cervical spine

(2) Utilize appropriate-sized pediatric immobilization equipment

(a) Rigid cervical collar

(b) Towel/ blanket roll

(c) Child safety seat

(d) Pediatric immobilization device

(e) Vest-type/ short wooden backboard

(f) Long backboard

(g) Straps, cravats

(h) Tape

(i) Padding

iii) Maintain supine neutral in-line position for infants, toddlers, and preschooler's by placing padding from the shoulders to the hips

d) Fluid management

i) Management of the airway and breathing take priority over management of circulation because circulatory compromise is less common in children than adults

ii) Vascular access

(1) Large-bore IV catheter should be inserted into a large peripheral vein

(a) 18ga

(2) Do not delay transport to gain access

(3) Intraosseous access if IV access fails

(4) Initial fluid bolus of 20 ml/kg of lactated ringers or NS

(5) Reassess vital signs and re-bolus with 20 ml/kg if no improvement

(6) If improvement does not occur after the second bolus, there is likely to be significant blood loss and the need for rapid surgical intervention

e) Traumatic brain injury

i) Early recognition and aggressive management can reduce morbidity and mortality

ii) Severity

(1) Mild - GCS is 13 to 15

(2) Moderate - GCS is 9 to 12

(3) Severe - GCS is less than or equal to 8

iii) Signs of increased intracranial pressure

(1) Elevated blood pressure

(2) Bradycardia

(3) Slow, deep respirations (Kussmaul) progressing to slow deep respirations alternating with rapid deep respirations (Cheyne-Stokes)

(4) Bulging fontanelle (infant)

iv) Signs of herniation

(1) Asymmetrical pupils

(2) Posturing

v) Specific management

(1) Administer high concentration of oxygen for mild to moderate head injuries (GCS 9-15)

vi) Indications for hyperventilation

(1) Asymmetric pupils

(2) Active seizures

(3) Neurologic posturing

f) Specific injuries

i) Head and neck injury

(1) Larger relative mass of the head and lack of neck muscle strength provides increased momentum in acceleration-deceleration injuries and a greater stress to the cervical spine region

(2) Fulcrum of cervical mobility in the younger child is at the C2-(C-3) level

(3) 60% to 70% of pediatric fractures occur in C1 or C2

(4) Head injury is the most common cause of death in pediatric trauma victim

(5) Diffuse injuries are common in children, focal injuries are rare

(6) Soft tissues, skull and brain are more compliant in children than in adults

(7) Due to open fontanelles and sutures, infants up to an average age of 16 months may be more tolerant to an increase of intracranial pressure and can have delayed signs

(8) Subdural bleeds in a infant can produce hypotension (extremely rare)

(9) Significant blood loss can occur through scalp lacerations and should be controlled immediately

(10) The Modified Glasgow Coma Score should be utilized for infants and young children

g) Chest injury

i) Chest injuries in children under 14 years of age are usually the result of blunt trauma

ii) Due to the compliance of the chest wall, severe intrathoracic injury can be present without signs of external injury

iii) Tension pneumothorax is poorly tolerated and is an immediate threat to life

iv) Flail segment is an uncommon injury in children; when noted without a significant mechanism of injury, suspect child abuse

v) Many children with cardiac tamponade will have no physical signs of tamponade other then hypotension

h) Abdominal injury

i) Musculature is minimal and poorly protects the viscera

ii) Organs most commonly injured are liver, kidney, and spleen

iii) Onset of symptoms may be rapid or gradual

iv) Due to the small size of the abdomen, be certain to palpate only one quadrant at a time

v) Any child who is hemodynamically unstable without evidence of obvious source of blood loss should be considered as having an abdominal injury until proven otherwise

i) Extremity
   i) Relatively more common in children than adults
   ii) Growth plate injuries are common
   iii) Compartment syndrome is an emergency in children
   iv) Any sites of active bleeding must be controlled
   v) Splinting should be performed to prevent further injury and blood loss
   vi) PASG may be useful in unstable pelvic fractures with hypotension

14) Burns
   a) Thermal
   b) Chemical
   c) Electrical
   d) Management priorities
      i) Follow burn center guidelines
      ii) Prompt management of the airway is required as swelling can develop rapidly
      iii) Thermally-burned children are very susceptible to hypothermia; maintain normal body temperature
      iv) Suspect musculoskeletal injuries in electrical burn patients and perform spine immobilization techniques

15) Sudden Infant Death Syndrome (SIDS)
   a) Epidemiology
      i) Risk factors
         (1) Occurs most frequently in the fall and winter months
         (2) Minor illness (cold or upper respiratory infection) within two weeks prior to the death
         (3) Premature and low birth-weight infants
         (4) Infants of young mothers
         (5) Infants of mothers who did not receive prenatal care
         (6) Infants of mothers who used cocaine, methadone, or heroin during pregnancy

b) Pathophysiology

i) Sudden and unexpected death of a seemingly healthy infant which remains unexplained even after a thorough postmortem examination

ii) No prior symptoms of life-threatening illness

iii) Death usually occurs during sleep

iv) No definitive answer at this time

v) A small percentage is abuse related

vi) Many victims of SIDS appear to have suffered from long-term underventilation of the lungs, possibly due to poor control of breathing during sleep; prone positioning may be a factor

vii) Abnormalities in the brainstem

c) Assessment

i) Signs and symptoms

(1) No external signs of injury

(2) Lividity

(3) Frothy blood-tinged drainage from nose/ mouth

(4) Rigor mortis

(5) Evidence that the baby was very active just prior to the death (i.e., rumpled bed clothes, unusual position or location in the bed)

ii) History

d) Management

(1) Airway and ventilatory support

(2) Circulatory support

(3) Pharmacological interventions

(4) Non-pharmacological interventions

(5) Transport considerations

(6) Psychological support/ communication strategies
  (a) Initiate CPR unless the infant is obviously dead (unquestionably dead to a lay person)
  (b) Perform ALS as indicated
  (c) Be prepared for the range of possible family emotional reactions
  (d) Parents/ caregiver should be allowed to accompany the baby in the ambulance
  (e) Explain that certain information regarding the infant's health is necessary to determine the care to be given
  (f) Utilize the baby's name
  (g) Questions should be phrased so blame is not implied
  (h) Debriefing
  (i) Resources for SIDS families

16) Child abuse and neglect
  a) Epidemiology
    i) Second leading cause of death in infants less than 6 months of age
    ii) Between 2,000 and 5,000 children die each year due to abuse and neglect
  b) Age considerations
    i) Under 18 years of age
    ii) Physically or mentally handicapped person under 21 years of age
  c) Abuse or neglect perpetrators
    i) Parent, legal guardian, foster parent
    ii) Person, institution, agency, or program having custody of the child
    iii) Person serving as a caretaker (i.e., baby-sitter)
  d) Abuse
    i) Types
      (1) Physical
      (2) Emotional
      (3) Sexual
  e) Abuse indicators
    i) Historical

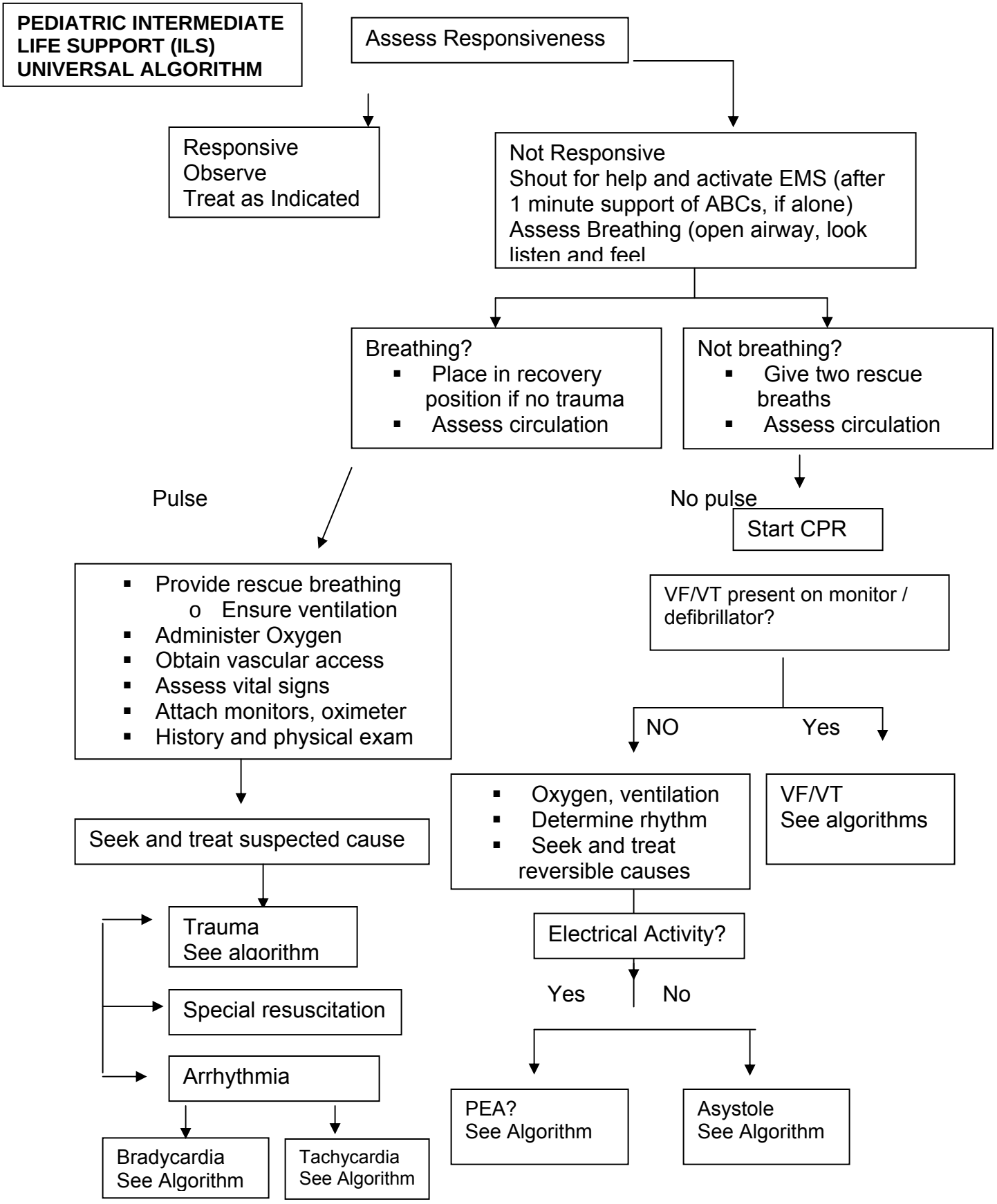
ii) Psychosocial
iii) Signs of physical abuse
iv) Signs of emotional abuse
(1) Physical indicators
(2) Behavioral indicators
v) Signs of sexual abuse

f) Neglect
i) Types
(1) Physical
(2) Emotional

g) Neglect indicators
i) Behavioral
ii) Physical

h) EMT-Intermediate role in treating abuse and neglect
i) Assess the injuries/ neglect and render appropriate care
j) Look at the environment for condition and cleanliness
k) Look for evidence of anything out of the ordinary
l) Look and listen to caregiver/ family members
m) Assess whether the explanation fits the injury
n) Document all findings thoroughly
o) Report suspicion
i) Mandated reporter
ii) Immunity from liability

17) Resources for abuse and neglect
a) State, regional, and local child protection agency
b) Hospital social service department


PEDIATRIC INTERMEDIATE LIFE SUPPORT (ILS) UNIVERSAL ALGORITHM
Assess Responsiveness
Responsive
Observe
Treat as Indicated
Not Responsive
Shout for help and activate EMS (after 1 minute support of ABCs, if alone)
Assess Breathing (open airway, look listen and feel
Breathing?
Place in recovery position if no trauma
Assess circulation
Not breathing?
Give two rescue breaths
Assess circulation
Pulse
No pulse
Start CPR
Provide rescue breathing
Ensure ventilation
Administer Oxygen
Obtain vascular access
Assess vital signs
Attach monitors, oximeter
History and physical exam
VF/VT present on monitor / defibrillator?
NO
Yes
Oxygen, ventilation
Determine rhythm
Seek and treat reversible causes
VF/VT
See algorithms
Seek and treat suspected cause
Electrical Activity?
Trauma
See algorithm
Special resuscitation
Arrhythmia
Yes
No
PEA?
See Algorithm
Asystole
See Algorithm
Bradycardia
See Algorithm
Tachycardia
See Algorithm

AED algorithm for children ≥ 8 years

Unresponsive – 911—AED
- Check if unresponsive
- Phone 911
- Get AED
- Identify and respond to special situations

Unresponsive

AED USE:
- Use pediatric AED or pediatric AED pads if available, but an adult AED can be used on a child.
- Perform 1 minute of CPR to ensure the problem is not respiratory in nature, before using the AED.

Start the ABCs:
- **A**irway: open
- **B**reathing: Look Listen Feel

Yes, Breathing

Not Breathing

- If breathing is adequate: place in recovery position
- If breathing is inadequate: begin rescue breathing (1 breath every 5 seconds)
- Monitor for signs of circulation (every 30 to 60 seconds)

- 2 slow rescue breaths (2 seconds per breath)
- **C**irculation: check for signs

Yes Circulation

No Circulation

- CPR until AED arrives and is ready
- Chest compressions (100/min)
- Rescue breathing (10 – 12 breaths/min)
- Ratio 15 compressions to 2 breaths

- Rescue breathing (1 breath every 3 - 5 seconds depending on age)
- Recheck pulse every 2 minutes

- Attempt Defibrillation
- Analyze (clear)
- Shock (clear) 1 shock
- 5 cycles of CPR

After 1 shocks or any “no shock indicated”
- CPR for 1 minute or 5 cycles
- Press analyze
- Attempt defibrillation
- Repeat

PEDIATRIC BRADYCARDIA ALGORITHM

- BLS Algorithm: Assess and support ABCs
- Provide oxygen
- Attach monitor/defibrillator

Is bradycardia causing severe cardiorespiratory compromise? (poor perfusion, hypotension, respiratory difficulty, altered consciousness)

No

- Observe
- Support ABCs
- Transport

Yes

- Preform chest compressions if despite oxygenation and ventilation:
- Heart rate is < 60/min in infant and child *and* poor systemic perfusion

During CPR
Attempt/verify
- Vascular access
- AED Electrode position and contact

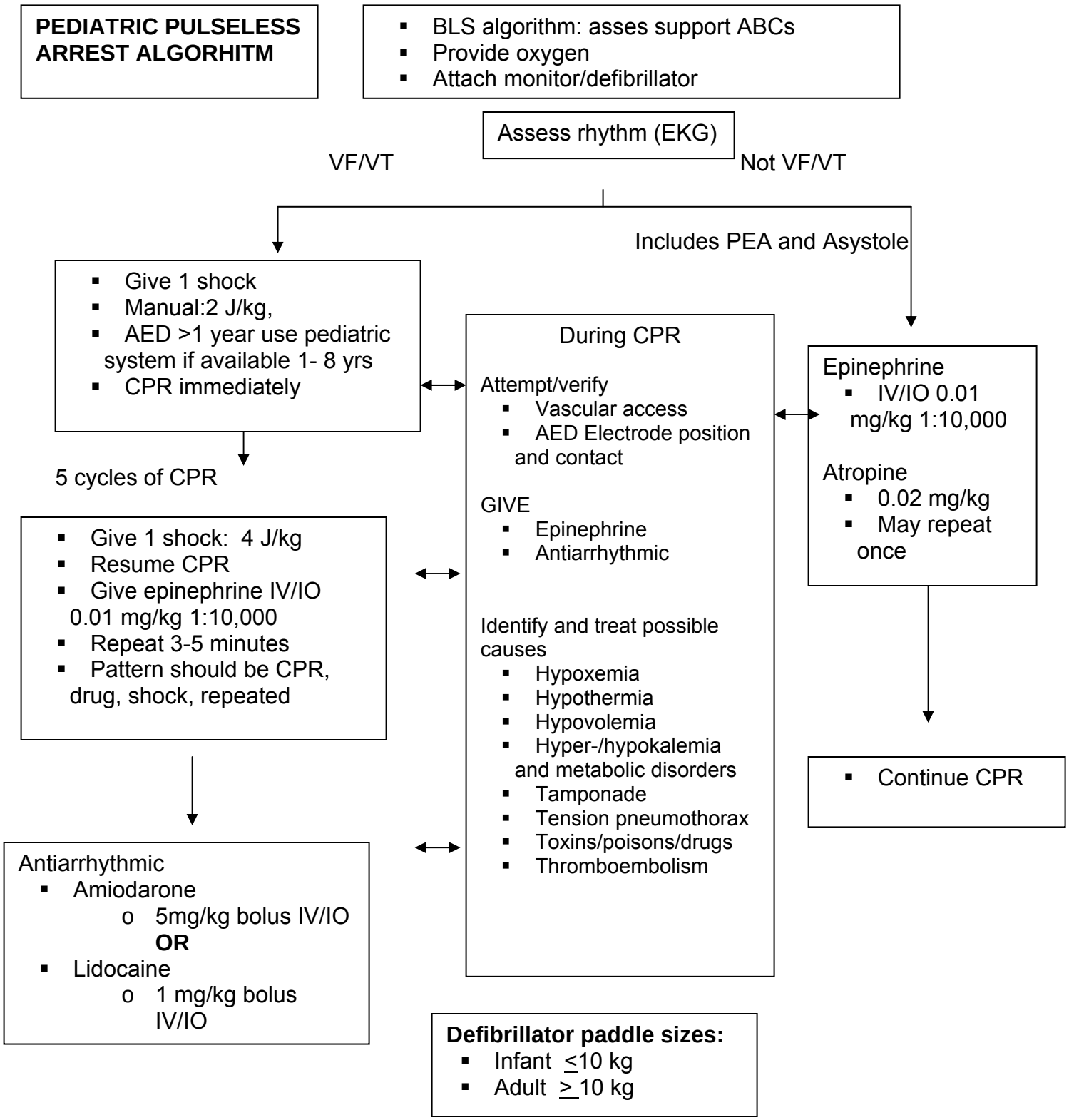
GIVE
- Epinephrine
- Atropine

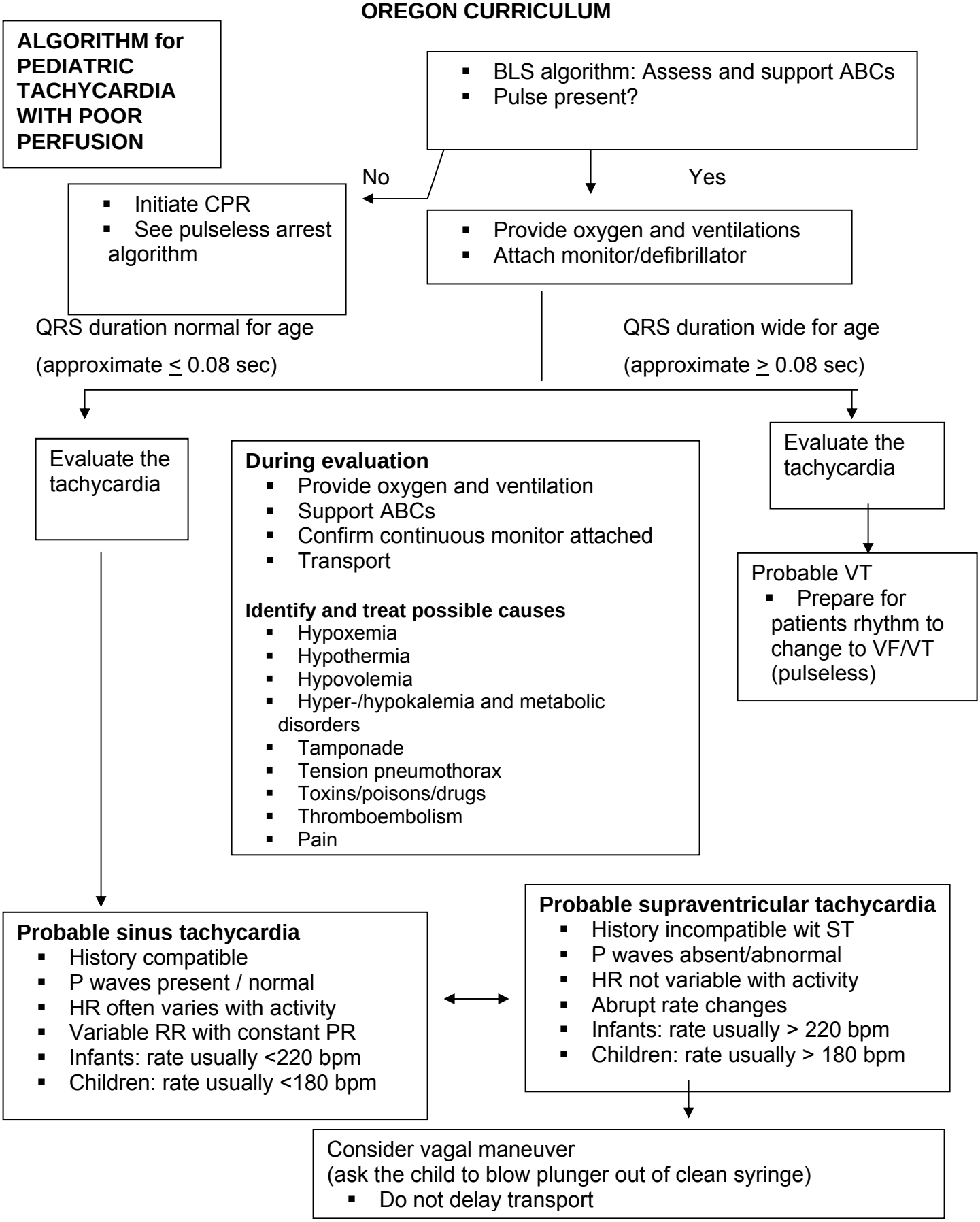
Identify and treat possible causes
- Hypoxemia
- Hypothermia
- Head injury
- Heart block
- Heart transplant (special situation)
- Toxins/poisons/drugs

Epinephrine
IV/IO: 0.01 mg/kg 1:10,000
- Repeat every 3 to 5 minutes

Atropine
- 0.02 mg/kg
- May repeat once

If pulseless arrest develops, see Pulseless Arrest Algorithm


PEDIATRIC PULSELESS ARREST ALGORHITM
BLS algorithm: asses support ABCs
Provide oxygen
Attach monitor/defibrillator
Assess rhythm (EKG)
VF/VT
Not VF/VT
Includes PEA and Asystole
Give 1 shock
Manual:2 J/kg,
AED >1 year use pediatric system if available 1- 8 yrs
CPR immediately
5 cycles of CPR
Give 1 shock: 4 J/kg
Resume CPR
Give epinephrine IV/IO 0.01 mg/kg 1:10,000
Repeat 3-5 minutes
Pattern should be CPR, drug, shock, repeated
Antiarrhythmic
Amiodarone
5mg/kg bolus IV/IO
OR
Lidocaine
1 mg/kg bolus IV/IO
During CPR
Attempt/verify
Vascular access
AED Electrode position and contact
GIVE
Epinephrine
Antiarrhythmic
Identify and treat possible causes
Hypoxemia
Hypothermia
Hypovolemia
Hyper-/hypokalemia and metabolic disorders
Tamponade
Tension pneumothorax
Toxins/poisons/drugs
Thromboembolism
Epinephrine
IV/IO 0.01 mg/kg 1:10,000
Atropine
0.02 mg/kg
May repeat once
Continue CPR
Defibrillator paddle sizes:
Infant ≤10 kg
Adult ≥ 10 kg


ALGORITHM for PEDIATRIC TACHYCARDIA WITH POOR PERFUSION
BLS algorithm: Assess and support ABCs
Pulse present?
No
Yes
Initiate CPR
See pulseless arrest algorithm
Provide oxygen and ventilations
Attach monitor/defibrillator
QRS duration normal for age
(approximate ≤ 0.08 sec)
QRS duration wide for age
(approximate ≥ 0.08 sec)
Evaluate the tachycardia
During evaluation
Provide oxygen and ventilation
Support ABCs
Confirm continuous monitor attached
Transport
Identify and treat possible causes
Hypoxemia
Hypothermia
Hypovolemia
Hyper-/hypokalemia and metabolic disorders
Tamponade
Tension pneumothorax
Toxins/poisons/drugs
Thromboembolism
Pain
Evaluate the tachycardia
Probable VT
Prepare for patients rhythm to change to VF/VT (pulseless)
Probable sinus tachycardia
History compatible
P waves present / normal
HR often varies with activity
Variable RR with constant PR
Infants: rate usually <220 bpm
Children: rate usually <180 bpm
Probable supraventricular tachycardia
History incompatible wit ST
P waves absent/abnormal
HR not variable with activity
Abrupt rate changes
Infants: rate usually > 220 bpm
Children: rate usually > 180 bpm
Consider vagal maneuver
(ask the child to blow plunger out of clean syringe)
Do not delay transport

ALGORITHIM FOR PEDIATRIC TACHYCARDIA WITH ADEQUEATE PERFUSION

BLS Algorithm:
- Assess and support ABCs
- Provide Oxygen
- Attach monitor/defibrillator

QRS duration normal for age

(Approximately ≤0.08 sec)

QRS abnormal for age

(Approximately ≥ 0.08 sec)

Evaluate rhythm ↔ What is the QRS duration? ↔ Probable VT

Prepare for patients rhythm to change to VF/VT (pulseless)

Probable sinus tachycardia
- History compatible
- P waves present/normal
- HR often varies with activity
- Variable RR with constant PR
- Infant rates usually <220 bpm
- Child rates usually < 180 bpm

Probable supraventricular tachycardia
- History incompatible wit ST
- P waves absent/abnormal
- HR not variable with activity
- Abrupt rate changes
- Infants: rate usually > 220 bpm
- Children: rate usually > 180 bpm

During evaluation
- Provide oxygen and ventilation
- Support ABCs
- Confirm continuous monitor attached
- Transport

Identify and treat possible causes
- Hypoxemia
- Hypothermia
- Hypovolemia
- Hyper-/hypokalemia and metabolic disorders
- Tamponade
- Tension pneumothorax
- Toxins/poisons/drugs
- Thromboembolism
- Pain

Consider vagal maneuver

(ask the child to blow the plunger out of clean syringe)
- Do not delay transport

Pediatric FLUID RESUSCITATION AND TRAUMA

Signs of inadequate systemic perfusion:

- **Early**
  - Irritability or anxiety
  - Tachypnea
  - Tachycardia
  - Weak peripheral pulses but full central pulses
  - Delayed capillary refill
  - Cool pale extremities
  - Systolic blood pressure within normal limits but may have a widened pulse pressure
  - Decreased urinary output
- **Late**
  - Lethargy or coma
  - Marked tachypnea or bradypnea
  - Absent peripheral pulses and weak or absent central pulses
  - Markedly delayed or absent capillary refill
  - Cool, pale, dusky, mottled extremities
  - Hypotension
  - Markedly decreased or absent urinary output

Signs of inadequate systemic perfusion are present

Yes

- Rapid infusion (<20 minutes) 20 mL/kg of NS or LR
- Do not delay transport to start IV/IO

- Continued signs of inadequate systemic perfusion?

Yes

- Second Rapid infusion 20 mL/kg of NS or LR

- Continued signs of inadequate systemic perfusion?

Yes

- Third Rapid infusion 20 mL/kg of NS or LR


This page intentionally left blank

Geriatrics

TERMINAL OBJECTIVE

At the completion of this module, the EMT-Intermediate student will be able to use assessment findings to formulate a management plan for the geriatric patient.

An acceptable substitution for this module is the GEMS course.

Cognitive Objectives

At the completion of this lesson, the EMT-Intermediate student will be able to:

1) Describe dependent and independent living environments. (C-1)
2) Identify local resources available to assist the elderly and discuss strategies to refer at-risk patients to appropriate community services. (C-1)
3) Discuss assessment techniques of the elderly patient. (C-2)
   a) GEMS assessment diamond
4) Describe communication strategies used to provide psychological support. (C-3)
5) Discuss expected physiological changes associated with aging. (C-3)
6) Discuss problems with mobility in the elderly. (C-3)
7) Discuss problems with continence and elimination. (C-3)
8) Discuss pathophysiology changes associated with the elderly in regards to drug distribution, metabolism, and elimination. (C-3)
9) Discuss the impact of polypharmacy, dosing errors, medication non-compliance, and drug sensitivity on patient assessment and management. (C-3)
10) Discuss the assessment and management of the elderly patient with complaints related to the following body systems: (C-3)
    a) Respiratory
    b) Cardiovascular
    c) Nervous
    d) Endocrine
    e) Gastrointestinal
11) Describe the assessment of nervous system diseases in the elderly, including (C-3)
    a) Cerebral vascular disease
    b) Delirium, dementia
    c) Alzheimer's disease

d) Parkinson's disease

12) Discuss the assessment of an elderly patient with gastrointestinal problems, including GI hemorrhage and bowel obstruction. (C-3)
13) Discuss the normal and abnormal changes with age related to toxicology. (C-3)
14) Discuss the assessment of the elderly patient with complaints related to toxicology. (C-3)
15) Describe the assessment and management of the elderly patient with toxicological problems. (C-3)
16) Discuss the assessment and management of the patient with environmental considerations. (C-3)
17) Discuss the normal and abnormal changes of the musculoskeletal system with age. (C-3)
18) Discuss the assessment and management of the elderly patient with complaints associated with trauma. (C-3)
19) Discuss the general management of the elderly patient. (C-3)
20) Describe common psychological reactions associated with aging. (C-2)
    a) Anxiety
    b) Depression
    c) Suicidal tendencies
    d) Substance abuse

Affective Objectives

At the completion of this module, the EMT-Intermediate student will be able to:

1) Demonstrate and advocate appropriate interactions with the elderly that convey respect for their position in life. (A-3)
2) Recognize and appreciate the many impediments to physical and emotional well being in the elderly. (A-2)

Psychomotor Objectives

At the completion of this module, the EMT-Intermediate student will be able to:

1) Demonstrate the ability to assess a geriatric patient. (P-3)
2) Demonstrate the ability to apply assessment findings to the management plan for a geriatric patient. (P-3)

Declarative

1) Introduction
    a) Geriatrics is a population with special and varying needs
        i) Demographics
            (1) Increasing older adult population
                (a) Societal issues
                    (i) Social issues
                    (ii) Society's view of aging
                    (iii) Isolation
                (b) Living environments
                    (i) Independent living
                        1. Spouse/ family support
                        2. Visiting nursing
                    (ii) Dependent living
                        1. Live-in nursing care
                        2. Assisted living environments
                        3. Nursing homes
                    (iii) Financial aspects
                    (iv) Ethics
                        1. Advanced directives
                    (v) Referral resources
                        1. National, state, local
2) General Assessment of the elderly
    a) Best if conducted over time
    b) Ask family or caretakers for information to determine the progression
    c) Focus on the patient's perceptions, thought processes, and communication
    d) Provide an environment with minimal distractions
    e) General Health Assessment
        i) Patience is important
        ii) GEMS Assessment diamond
            (1) Environment

(2) Medication History

(3) Social history

iii) Ability for self care

iv) Social support system

v) Activity level

(1) Prescription medications

(2) Non-prescription medications

(3) Over the counter

(4) Herbal

(5) Friends

vi) Mental status/ cognitive functioning exam

(1) Be calm, unhurried

(2) Ask clear, direct questions

(3) Give the patient time to respond

(4) Establish normal patterns of behavior and changes in behavior

(5) Include ability to perform activities of daily living

(6) Look for patterns of behavior over time

(7) Assess the patient's mood and affective or emotional state

vii) Assess for

(1) Weakness

(2) Chronic fatigue

(3) Changes in sleep patterns

(4) Syncope or near syncope

(5) Altered mentation

(a) Use VITAMINS C & D mnemonic to recall potential causes.

(b) Vascular

(c) Inflammation

(d) Toxins, trauma, tumors

(e) Autoimmune

(f) Metabolic

(g) Infection

(h) Narcotics

(i) Systemic

(j) Congenital

(k) Degenerative

viii) History

(1) Common medical complaints

(2) Physical exam

(3) Mental status assessment

ix) Factors complicating assessment

(1) Multiple diseases/ complaints

(2) Absence of classical symptoms

(3) Failure to relate symptoms

(4) Sensory alterations

(5) Polypharmacy

3) Communicating with the elderly patient

a) Communication Strategies

i) Position yourself face to face.

ii) Turn lights on.

iii) Assist with glasses or hearing aids.

iv) Use touch to calm and reassure.

v) Do not assume that blind means deaf.

vi) Speak to good ear; raise volume, and lower pitch of speech.

vii) Aphasia

(1) Inability to understand or produce speech

(2) Can affect ability to read and write

(3) Due to brain injury

viii) Use focused, simple questions.

ix) Give patient time to talk.

x) Use gestures and visual aids.

xi) Use proper verbal and nonverbal communication strategies

xii) Preserve dignity

xiii) Always explain before you do

xiv) Supportive strategies

(1) Encourage patient to express feelings

(2) Avoid questions which are judgmental

(3) Confirm what the patient says

(4) Take responsibility for communication breakdown

xv) Common Fears that Can Decrease Communication

(1) Loss of independence

(2) Never leave hospital

(3) Nursing home

(4) Separation anxiety

(5) Pet care and household security

(6) Medical expenses

4) Common Changes With Age

a) Specific system pathophysiology, assessment, and management

i) Integumentary System

(1) Wrinkles

(2) Thinner skin

(3) Decreased fat

(4) Gray hair

ii) Respiratory System

(1) Changes with age

(2) Decreasing muscles of ventilation

(3) Increased residual volume

(4) Decreased sensitivity of chemoreceptors

(5) Decreased lung function due to

(a) Chronic exposure to pollutants

(b) Decreased respiratory muscle tone

(c) Changes in alveolar/ capillary exchange

(d) Respiratory center changes

(i) Most common pulmonary diseases in the elderly

1. Pneumonia
    a. Leading cause of death in the elderly
2. Pulmonary embolism
    a. Mortality is high due to difficulty in diagnosis
3. Obstructive airway diseases
    a. Combined bronchitis and emphysema in patients with a long history of smoking

(6) Assessment

(a) History

(b) Smoking

(c) Home oxygen use

(d) Medications

(e) Breathing difficulty

(f) Physical exam

(g) Wheezing / prolonged expiratory phase

(h) Breath sounds unreliable

iii) Cardiovascular system

(1) Changes with age

(a) Arteries become increasingly rigid

(b) Decreased peripheral resistance

(c) Reduced blood flow to all organs

(d) Increased blood pressure

(e) Widened pulse pressure

(f) Heart muscle stiffens

(g) Increased incidence of postural hypotension

(h) Increased atherosclerosis throughout the body

(i) The heart increases in size

(j) Development of atherosclerosis

(k) Decreasing cardiac output

(l) Development of arrhythmias

(2) Conditions

(a) CAD

(b) CHF

(c) Angina

(d) Hypertension

(e) Dysrhythmias

(f) Ventricular

(g) Atrial

(h) Blocks

iv) Assessment

(a) History

(b) Cardiovascular fitness

(c) Changes in exercise tolerance

(d) Recent diet history

(e) Medications

(f) Smoking

(g) Breathing difficulty, especially at night

(h) Palpitations, flutter, skipped beats

(i) Physical exam

(j) Hypertension and orthostatic hypotension

(k) Dependent edema

(l) Consider checking the blood pressure in both arms

(m)Check pulses in all extremities routinely

(n) Check for dehydration

(o) Chest pain is less common in the elderly

(p) Dyspnea is the most common sign in patients over 85

(q) PVC's are present in most adults over 80

v) Nervous system

(1) Changes with age

(a) Cognition requires perceptual organs and the brain

(b) Cognitive function is not affected by the normal aging process

(c) Slight changes in the following are normal

(i) Difficulty with recent memory

(ii) Psychomotor slowing

(iii) Forgetfulness

(iv) Decrease in reaction time

(d) Brain shrinkage

(e) Slowing of peripheral nerves

(f) Slowed reflexes

(g) Decreasing pain sensation

(h) Common medical conditions

(i) Stroke

(ii) Transient ischemic attack

(iii) Delirium

(iv) Organic brain dysfunction

1. Potentially reversible, if caught early
2. Can progress into chronic mental dysfunction
3. Possible causes
   a. Tumor
   b. Metabolic disorders
   c. Fever
   d. Drug reaction
   e. Alcohol intoxication/ withdrawal

(v) Assessment

1. Acute onset of anxiety
2. Unable to focus
3. Unable to think logically or maintain attention
4. Memory is intact

(vi) Dementia

1. Increases with age
2. Half of nursing home patients have some form of dementia
3. Generally considered irreversible
4. Patient becomes dependent on others

5. Causes include
    a. Strokes
    b. Genetic or viral factors
    c. Alzheimer's

(vii) Assessment

a. Progressive disorientation
b. Shortened attention span
c. Aphasia, nonsense talking
d. Hallucinations
e. Caretaker exhaustion
f. Severely limits ability to communicate

(viii) Alzheimer's disease

1. Pathophysiology
2. Assessment

(ix) Parkinson's disease

1. Pathophysiology
2. Assessment

vi) Endocrine system

(1) Pituitary/Pancreatic disorders

(a) Diabetes
(b) Approximately 20% of older adults have diabetes
(c) Almost 40% have some impaired glucose tolerance
(d) Most commonly type II

(2) Metabolic disorders

(a) Hypoglycemia
(b) Hyperglycemia
(c) Dehydration
    (i) Causes
(d) Acidosis
(e) Alkalosis

(3) Assessment

(a) SHOPS (street, herbal, over the counter, prescribed, & sex (Cialis, Levitra)).

vii) Gastrointestinal System

(1) Conditions

(a) Bowel obstruction

(b) GI hemorrhage

(c) Risk factors

(2) Assessment

(a) Look for indication of malnutrition

(b) Look for indications of decreased mobility

viii) Renal, Hepatic, and GU Systems

(1) Nephrons decrease in number

(a) Kidneys become smaller.

(b) Decrease filtration of blood

(2) Hepatic changes

(a) Decrease of blood flow

(b) Decrease production of hepatic enzymes

(3) Production of enzymes declines.

(a) Decreased efficiency of drug metabolism

(4) Salivation decreases

(5) Changes with continence and elimination

(a) Incontinence

(i) Incontinence is never normal

(ii) Involves urinary or bowel

(iii) Decrease in bladder capacity

(iv) Involuntary bladder contractions

(v) Decreased ability to postpone voiding

(vi) Medications may affect bladder/ bowel control

1. Mild to total
2. Extremely embarrassing

(vii) Can lead to skin irritation or urinary tract infection.

(b) Elimination

(i) Causes of difficulty in urination

1. Enlargement of the prostate in men
2. Urinary tract infections
3. Acute or chronic renal failure

(ii) Causes of difficulty in bowel elimination

1. Diverticular disease
2. Constipation
3. Colorectal cancer

(c) Concomitant disease processes.

(d) Gastric motility slows

(6) Assessment

ix) Musculoskeletal System

(1) Decreased muscle mass

(2) Changes in posture

(3) Arthritic changes

(4) Decrease in bone mass

(5) Assessment

x) Immune System

(1) Less effective immune response

(2) Pneumonia and UTI are common.

(3) Assessment

xi) Changes with sensations

(1) Vision

(a) Visual changes begin at age 40 and problems increase gradually

(b) Cataracts

(c) Glaucoma

(d) Hearing

(e) Hearing loss

(f) Impairs the ability to communicate

(g) Hearing aids may not restore hearing to normal

(2) Speech

(a) Word retrieval

(b) Decreased fluency of speech

(c) Slowed rate of speech

(d) Change in voice quality

(3) Pain perception

(a) Alterations for sensory deficits

(b) Non specific complaints

(c) Decreased ability to detect changes

(4) Changes with mobility and falls

(a) Physical effects of decreased mobility

(b) Poor nutrition

(c) Poor health care

(5) Risk factors for falls

(a) History of falls

(b) Dizziness, weakness, impaired vision

(c) Altered gait

(d) CNS Changes/ decreased mental status

(e) Medications

(6) Psychological effect of decreased mobility

(a) Loss of confidence

(b) Feeling “old”

(c) Loss of independence

xii) Special considerations

(1) Toxicology considerations

(a) Intentional / unintentional

(i) Polypharmacy

1. Increased likelihood of CNS side effects

(ii) Antidepressants

(iii) Antihypertensives

(iv) Antianxiety

(v) Substance abuse

1. Common problem

(vi) Stress is a factor

(2) Assessment

(a) Often very subtle signs

(b) Small amounts of alcohol can cause intoxications

(c) Mood swings, denial, and hostility

(d) Question family and friends

(e) Confusion

(f) History of falls

(g) Anorexia

(h) Insomnia

(i) Vision and memory changes

(j) Poor dexterity

xiii) Environmental considerations

(1) Hypothermia in the elderly

(2) Hyperthermia in the elderly

xiv) Trauma considerations

(1) Bones fracture with mild trauma

(2) Osteoporosis and muscle weakness increase likelihood of fractures

(3) Susceptible to stress fractures of femur, pelvis, tibia

(4) Hip fracture is the most common acute orthopedic condition

(5) Reduced cardiac reserve decreases the ability to compensate for blood loss

(6) Head injuries are more serious

(a) Brain shrinkage allows brain to move

(b) Subdural hematoma may develop more slowly

(7) Burn injuries are more serious

(a) Increased severity due to pre-existing disease

(b) Skin changes result in increased burn depth

(c) Decreased defense against infection

(d) Slower healing

(e) Mortality rates markedly increased

(f) Post injury disability more common

(8) Assessment

(a) Fractures can be occult due to diminished pain perception

(b) Observe scene for clues of abuse

(9) Management

(a) Immobilization

(b) Packaging should include bulk, and padding to fill in areas

(c) Kyphosis may require extra padding under the shoulders to maintain alignment

(d) Dentures may need to be removed

(e) Oxygen is very important due to vascular disease

(f) Monitor fluid administration for signs/ symptoms of pulmonary edema

(g) Prevent hypothermia by keeping patient warm

(h) EKG monitoring is indicated due to increased cardiac disease

(i) Transportation

(i) Appropriate mode

(ii) Appropriate facilities

xv) General management

(1) Airway and ventilation

(2) Circulation

(3) Pharmacological

(a) Pharmacological concerns

(i) Older adults are more sensitive to drugs

(ii) Experience prolonged drug effects

(iii) Have more adverse reactions

(iv) Polypharmacy

(v) Many chronic illnesses

(vi) Medication interaction

1. Proper dosing is very important due to

a. Less lean body mass

b. Low fluid reserve

c. Slow metabolism

d. Decreased renal and hepatic function

(b) Non-pharmacological

(c) Transport considerations

(i) Position of comfort

(ii) Gentle handling

(iii) Extra padding

(d) Psychological support

b) Psychological support

i) Psychological Changes

ii) Depression

(1) Common, debilitating psychiatric disorder

(2) Affects 2 million older adults

(3) 30% of older adults in nursing facilities suffer some form of clinical depression.

iii) Red Flags for Depression

(1) Frequent non-urgent calls or ED/doctor visits

(2) Severity of complaint unequal to findings

(3) Personal neglect

(4) Lack of social support

(5) Loss of sense of enjoyment

(6) Management of Depression

(7) Patients suffering depression should be transported for evaluation.

(8) Treatment usually includes medication or therapy.

(9) Social networks can also help individuals fight depression.

iv) Suicide

(1) Older males have one of the highest rates.

(2) Older people use more lethal means.

(3) Men commit suicide 4 times more than women.

(4) Circumstances that Increase

v) Risk for Suicide

(1) Death of a loved one

(2) Physical illness

(3) Depression

(4) Isolation

(5) Substance abuse

(6) Loss of life roles

vi) Red Flags for Suicidal Patients

(1) Preoccupation with death

(2) Giving away prized possessions

(3) Taking unnecessary risks

(4) Increased use of alcohol/drugs

(5) Medication non adherence

(6) Getting a weapon

vii) Management of a Suicidal Patient

(1) Ask if patient is contemplating suicide.

(2) Take patient seriously.

(3) Secure dangerous items.

(4) Transport potentially suicidal patients.

(5) Report concerns to ED.

(6) Do not leave patient unattended.

(7) Offer hope.

viii) Substance Abuse

(1) Includes misuse and abuse of alcohol, illicit drugs, and medications

(2) Under detected in older population, but about 10% are chemically dependent

(3) Variety of medications for chronic conditions increases likelihood of medication problems

(4) Misuse

(a) Older people make up an eighth of the population but use a third of prescription medications.

(b) Misuse can be:

(i) Intentional (suicide attempt)

(ii) Unintentional (trouble reading label)

ix) Management of Substance Abuse

(1) Provide a complete medication history.

(2) Provide contact info for social service agencies and crisis hotlines.

(3) Consider making initial contact for patient.

x) Anxiety

xi) Adjustment disorders

(1) Loss of loved one

(2) Spouse

(3) Child

(4) Pet

xii) Summary

(1) Depression, suicide, and substance abuse occur in older people.

(2) Treatment and transport of the older patient experiencing a psychiatric emergency requires safety first.

(3) Psychiatric emergencies in older patients require evaluation by qualified personnel.

c) Recognizing Caregiver Stress or “Burnout”

i) Physical effects on caregiver

ii) Emotional effects on caregiver

iii) Effects on “patient” and other family members

iv) Reducing caregiver stress

(1) More than one patient?


This page intentionally left blank

Environmental

Terminal Objective

At the completion of this module, the EMT-Intermediate student will be able to utilize the assessment findings to formulate a field impression and implement the treatment plan for the patient with an environmentally induced or exacerbated emergency.

Cognitive Objectives

At the completion of this module, the EMT-Intermediate student will be able to:

1) Define “environmental emergency.” (C-1)
2) Identify risk factors most predisposing to environmental emergencies. (C-1)
3) Identify environmental factors that may cause illness or exacerbate a pre-existing illness. (C-1)
4) Identify environmental factors that may complicate treatment or transport decisions. (C-1)
5) List the principal types of environmental illnesses. (C-1)
6) Identify normal, critically high and critically low body temperatures. (C-1)
7) Describe several methods of temperature monitoring. (C-1)
8) Identify the methods of heat loss. (C-2)
9) Describe the body’s compensatory process for over heating. (C-2)
10) Describe the body’s compensatory process for excess heat loss. (C-2)
11) Explain the common forms of heat and cold disorders. (C-2)
12) List the common predisposing factors associated with heat and cold disorders. (C-1)
13) List the common preventative measures associated with heat and cold disorders. (C-1)
14) Define heat illness. (C-1)
15) Identify signs and symptoms of heat illness. (C-1)
16) List the predisposing factors for heat illness. (C-1)
17) List measures to prevent heat illness. (C-1)
18) Relate symptomatic findings to the commonly used terms: heat exhaustion, and heat stroke. (C-3)
19) Discuss the role of fluid therapy in the treatment of heat disorders. (C-1)
20) Differentiate among the various treatments and interventions in the management of heat disorders. (C-3)

21) Integrate the pathophysiological principles and the assessment findings to formulate a field impression and implement a treatment plan for the patient who has dehydration, heat exhaustion, or heat stroke. (C-3)
22) Define hypothermia. (C-1)
23) List predisposing factors for hypothermia. (C-1)
24) List measures to prevent hypothermia. (C-1)
25) Identify differences between mild and severe hypothermia. (C-1)
26) Describe differences between chronic and acute hypothermia. (C-1)
27) List signs and symptoms of hypothermia. (C-1)
28) Correlate abnormal findings in assessment with their clinical significance in the patient with hypothermia. (C-3)
29) Discuss the impact of severe hypothermia on standard BCLS and ACLS algorithms and transport considerations. (C-1)
30) Integrate pathophysiological principles and the assessment findings to formulate a field impression and implement a treatment plan for the patient who has either mild or severe hypothermia. (C-3)
31) Define near drowning. (C-1)
32) Discuss the complications and protective role of hypothermia in the context of near-drowning. (C-1)
33) Correlate the abnormal findings in assessment with the clinical significance in the patient with near drowning. (C-3)
34) Differentiate among the various treatments and interventions in the management of near drowning. (C-3)
35) Integrate pathophysiological principles and the assessment findings to formulate a field impression and implement a treatment plan for the near-drowning patient. (C-3)
36) Integrate pathophysiological principles of the patient affected by an environmental emergency. (C-3)
37) Differentiate between environmental emergencies based on assessment findings. (C-3)
38) Correlate abnormal findings in the assessment with the clinical significance in the patient affected by an environmental emergency. (C-3)

39) Develop a patient management plan based on the field impression the patient affected by an environmental emergency. (C-3)

Affective Objectives

None identified for this module.

Psychomotor Objectives

None identified for this module.

Declarative

1) Environmental emergencies
   a) A medical condition caused or exacerbated by the weather, terrain, atmospheric pressure, or other local factors
   b) Instances of environmental emergencies
      i) Environmental impact on morbidity and mortality
      ii) Environmental stressors that induce or exacerbate other medical or traumatic conditions
2) Risk factors
   a) Age
      i) Elderly
         (1) Economic factors
            (a) Heat
            (b) Air conditioner
         (2) General health
         (3) Fatigue
         (4) Predisposing medical conditions
      ii) Young
         (1) Inability to remove self from environment
         (2) Inability to remove clothing
3) Medications
   a) Prescription
   b) Over the counter (OTC)
   c) Herbal

d) Recreational

4) Environmental factors that may complicate treatment and transport
   a) Climate
   b) Season
   c) Weather
      i) Wind
      ii) Rain
      iii) Snow
      iv) Humidity
      v) Temperature
      vi) Radiation
      vii) Heat
      viii) Cold
      ix) Atmospheric pressure
      x) Terrain
5) Types of environmental illnesses
   a) Heat illness
   b) Cold illness
      i) Localized injuries
         (1) Frostbite
6) General pathophysiology, assessment, and management
   a) Homeostasis
      i) “Normal” body temperatures
         (1) Core
         (2) Periphery
7) Evaluation of body temperatures
   a) Oral
   b) Axillary
   c) Tympanic
   d) Rectal
   e) Tactile

8) Thermolysis (Methods of heat loss)
    a) Conduction
    b) Convection
    c) Radiation
    d) Evaporation
    e) Respiration
9) Specific pathology, assessment, and management - heat disorders
    a) Heat illness
        i) Definition
            (1) Increased core body temperature (CBT) due to inadequate thermolysis
    b) General signs and symptoms
        i) Diaphoresis
        ii) Posture
        iii) Increased skin temperature
        iv) Flushing
    c) Signs of thermolytic inadequacy
        i) Altered mentation
        ii) Altered level of consciousness
    d) General health and medications
        i) Diabetes
            (1) Autonomic neuropathy interferes with vasodilation and perspiration
            (2) Autonomic neuropathy may interfere with thermoregulatory input
                (a) Various medications
    e) Acclimatization
        i) Length of exposure
        ii) Intensity of exposure
        iii) Environmental
        iv) Humidity
        v) Wind
    f) Preventative measures
        i) Maintain adequate fluid intake

ii) Thirst is an inadequate indicator of dehydration

(1) Acclimatize

(a) Acclimatization results in more perspiration with lower salt concentration

(b) Increases fluid volume in body

(i) Limit exposure

g) Heat exhaustion (mild heat illness)

i) Ill-defined term referring to milder forms of heat illness

ii) Increased CBT with some neurologic deficit.

iii) Signs of active sweating usually present

(1) Symptoms may be due solely to simple dehydration, combined with overexertion

(2) Result is orthostatic hypotension

(3) Symptoms resolve with rest and supine positioning

(4) Fluids and elevation of knees beneficial

(5) Symptoms that do not resolve with rest and supine positioning may be due to increased CBT, are predictive of impending heat stroke and must be treated aggressively

(6) Heat stroke

(a) Increased CBT with significant neurologic deficit

(b) Organ damage

(i) Brain

(ii) Liver

(iii) Kidneys

h) Signs of active sweating may be present or absent

i) Classic

(1) Commonly presents in those with chronic illnesses

(2) Increased CBT due to deficient thermoregulatory function

(3) Predisposing conditions include age, diabetes, and other medical conditions

(4) “Hot, red, dry” skin is common

ii) Exertional

(1) Commonly presents in those who are in good general health

(2) Increased CBT due to overwhelming heat stress

(3) Excessive ambient temperature

(4) Excessive exertion

(5) Prolonged exposure

(6) Poor acclimatization

(7) “Moist, pale” skin is common

i) Treatment

i) Remove from environment

ii) Active cooling

iii) Misting and fanning

iv) Moist wraps

v) Risks of over-cooling

vi) Reflex hypothermia

(1) Use of tepid water for cooling

(2) Ice packs and cold water immersion may produce reflex vasoconstriction and shivering due to effect on peripheral thermoreceptors

j) Fluid therapy

i) Oral

(a) Some salt additive is beneficial

(b) Limited need for other electrolytes in oral rehydration

(c) Salt tablets

(i) Should be avoided

(ii) May cause GI irritation and ulceration

(iii) May cause hypernatremia

ii) Intravenous

(1) Normal saline solution preferred

10) Specific pathology, assessment, and management - cold disorders

a) Hypothermia

i) Definition

(1) Decreased CBT due to

(a) Inadequate thermogenesis

(b) Excess cold stress

(c) A combination of both

ii) Mechanisms of heat loss

(1) Physiological

(2) Environmental

b) Predisposing factors

i) Age

(1) Pediatric

(2) Geriatric

ii) General health and medications

iii) Hypothyroidism

iv) Malnutrition

v) Hypoglycemia

vi) Medication may interfere with thermogenesis

vii) Fatigue and exhaustion

viii) Length of exposure

ix) Intensity of exposure

x) Environmental

(1) Humidity

(2) Wind

(3) Temperature

(a) In home temperatures low due to cost of heating

(i) Urban hypothermia

c) Preventative measures

i) Dress

ii) Rest

iii) Food

iv) Limit exposure

11) Categories of hypothermia

a) Severity

b) Mild

i) Presence of signs and symptoms with a CBT that is greater than 90° F

c) Severe

i) Presence of signs and symptoms with a CBT that is less than 90° F

ii) Compensated

(1) Presence of signs and symptoms with a normal CBT

(2) CBT being maintained by thermogenesis

(3) As energy stores (liver and muscle glycogen) are exhausted, CBT will drop

(4) Onset

(a) Acute (immersion)

(b) Subacute (exposure)

(c) Chronic (urban)

d) Primacy

i) Primary cause of symptoms

ii) Secondary presentation of other etiology

e) Principal signs and symptoms

i) No reliable correlation between signs or symptoms and specific CBT

ii) Signs of thermogenesis effort

iii) Diminished coordination and psychomotor function

iv) Altered mentation

(1) Altered level of consciousness

(2) Cardiac irritability

f) Specific treatment

i) Stop heat loss

ii) Remove from environment

iii) Dry

iv) Wind/ vapor/ moisture barrier

(1) Insulate

v) Rewarming

(1) Passive external

(2) Insulation

(a) Wind/ vapor/ moisture barrier

(3) Active external

(a) Heat packs

(i) Placed over areas of high heat transfer with core

1. Base of neck
2. Axilla
3. Groin
4. Insulate underneath to prevent burning
5. Heat guns
6. Lights

(b) Warm water immersion

(i) Little application in out-of-hospital setting

(ii) 102^{o} F to 104^{o} F

(iii) Can induce rewarming shock

(c) Active internal

(i) Warmed (102^{o} F to 104^{o} F) humidified oxygen

(ii) Warmed (102^{o} F to 104^{o} F) intravenous administration

(iii) Role of warmed administration

(iv) Crucial, to prevent further heat loss

(v) Limitations of warmed administration

1. Actual heat transferred is minimal
2. Limited contribution to rewarming

(d) Rewarming shock

(i) Active external rewarming causes reflex vasodilation

(ii) Requires more heat transference than is possible with methods available in out-of-hospital setting

(iii) Easily prevented by IV fluid administration during rewarming

(e) Cold diuresis and the need for fluid resuscitation

(i) Oral

(ii) Intravenous

12) Resuscitation considerations

a) BCLS

i) Increased time to evaluate vital signs
ii) Use of normal chest compression and ventilation rates
iii) Use of oxygen
iv) AED recommendations

b) ACLS considerations
i) Effects of cold on cardiac medications
ii) Considerations for airway management

c) AHA recommendations
i) Risks and management of V-fib
ii) Risks of V-fib related both to depth and duration of hypothermia
iii) Rough handling can induce V-fib
iv) It is generally impossible to electrically defibrillate a hypothermic heart that is colder than 86^{o} F
v) Lidocaine paradoxically lower fibrillatory threshold in a hypothermic heart and increase resistance to defibrillation

d) Transport considerations
i) Gentle transportation necessary due to myocardial irritability
ii) Transport with patient level or head slightly down
iii) General rewarming options of destination
iv) Availability of cardiac bypass rewarming preferable in destination consideration

13) Specific pathology, assessment, and management - near-drowning

a) Definition
i) Drowning
(1) Suffocation due to submersion in water or other fluids
ii) Near-drowning
(1) Near suffocation due to submersion in water or other fluids with a recovery event that last at least 24 hours

b) Pathophysiology
i) Hypothermic considerations in near-drowning
ii) Common concomitant syndrome
iii) May be organ protective in cold water near-drowning

iv) Always treat hypoxia first

v) Treat all near-drowning patients for hypothermia

c) Treatment

i) Establish airway

(1) Ventilation

(2) Oxygen

d) Trauma considerations

i) Immersion episode of unknown etiology warrants trauma management

e) Post-resuscitation complications

i) Adult respiratory distress syndrome (ARDS) or renal failure often occur post-resuscitation

ii) Symptoms may not appear for 24 hours or more, post-resuscitation

iii) All near-drowning patients should be transported for evaluation

14) Locale-specific environmental emergencies

15) Integration

a) Impact of the environment on human metabolism

i) Heat gain or loss that exceeds the body's capacity to compensate

ii) Pressure changes that exceed the body's capacity to compensate

iii) Assessment findings in patients with environmentally-induced illness

(1) Abnormal core body temperatures

(2) Signs of metabolic decompensation

(3) Development of shock state

b) Patient management

c) Field stabilization

i) Removal of environmental influence

ii) Support of metabolic compensation

iii) Selection of definitive care location

This page intentionally left blank

Clinical Decision Making

Terminal Objective

The EMT-Intermediate should be able to apply a process of decision making to use the assignment findings to help form a field impression. (Development of critical thinking)

Cognitive Objectives

1) Compare the factors influencing medical care in the out-of-hospital environment to other medical settings (C-1)
2) Differentiate between critical life threatening, potentially life-threatening, and non-life-threatening patient presentations. (C-5)
3) Evaluate the benefits and shortfalls of protocols, standing orders, and patient care algorithms. (C-3)
4) Define the components, stages, and sequences of the critical thinking process for EMT-Intermediates. (C-2)
5) Describe the effects of the "fight or flight" response and the positive and negative effects on an EMT-Intermediates decision-making. (C-2)
6) Develop strategies for effective thinking under pressure (C-3)
7) Summarize the "six R's" of putting it all together; (C-3)
    a) Read the patient
    b) Read the scene
    c) React
    d) Reevaluate
    e) Revise the management plan
    f) Review performance

Affective Objectives

1) Using scenarios, the EMT-Intermediate student will be able to practice facilitating behaviors when thinking under pressure. (A-4)

Psychomotor Objectives

1) Using scenarios, the EMT-Intermediate will be able to demonstrate appropriate critical thinking skills. (P-4)

Declarative

1) Key concepts
   a) The cornerstones of effective EMT-Intermediate practice
      i) Gathering, evaluating, and synthesizing information
      ii) Developing and implementing appropriate patient management plans
      iii) Applying judgment and exercising independent decision making
      iv) Thinking and working effectively under pressure
   b) The out-of-hospital environment
      i) Unlike other environments where medical care is traditionally rendered
      ii) Unique, heavily influenced by factors that do not exist in other medical settings
   c) Patient care in the out-of-hospital setting
      i) Obvious, critical life-threats
         (1) Major, multi-system trauma
         (2) Devastating single system trauma
         (3) End-stage disease presentations
         (4) Acute presentations of chronic conditions
      ii) Potential life-threats
         (1) Serious, multi-system trauma
         (2) Multiple disease etiologies
      iii) Non life-threatening presentations

d) Guidance and authority for EMT-Intermediate action and treatments
   i) Protocols, standing orders, and patient care algorithms
      (1) Can clearly define and outline performance parameters
      (2) Promote a standardized approach
   ii) Limitations of protocols, standing orders, and patient care algorithms
      (1) Only address "classic" patient presentations
         (a) non-specific patient complaints do not follow model
         (b) limited clarity of presenting patient problems
      (2) Do not address multiple disease etiologies
      (3) Do not address multiple treatment modalities
      (4) Promote linear thinking, "cookbook medicine"

2) Components, stages, and sequence of critical thinking process for EMT-Intermediates
   a) Concept formation
      i) MOI/scene assessment
      ii) Initial assessment and physical examination
      iii) Chief complaint
      iv) Patient history
      v) Patient affect
      vi) Technical tools
         (1) Pulse oximetry
         (2) Glucose monitoring
         (3) Other tools
   b) Data interpretation
      i) Data gathered
      ii) EMT-Intermediate knowledge of anatomy and physiology and pathophysiology
      iii) EMT-Intermediate attitude
      iv) Previous experience base of the EMT Intermediate
   c) Application of principles
      i) Field impression/working diagnosis
      ii) Protocols/ standing orders
      iii) Treatment/ intervention

d) Evaluation
   i) Reassessment of patient
   ii) Reflection in action
   iii) Revision of impression
   iv) Protocol/ standing orders
   v) Revision of treatment/ intervention
e) Reflection on action
   i) Run critique
   ii) Addition to/ modification of experience base of the EMT-Intermediate

3) Fundamental elements of critical thinking for EMT-Intermediates
   a) Adequate foundation of knowledge
   b) Ability to focus on specific and multiple elements of data
   c) Ability to gather and organize data and form concepts
   d) Ability to identify and deal with medical ambiguity
   e) Ability to differentiate between relevant and irrelevant data
   f) Ability to analyze and compare similar situations
   g) Ability to recall contrary situations
   h) Ability to articulate assessment based decisions and construct arguments
4) Considerations with field application of assessment-based patient management
   a) The patient acuity spectrum
      i) EMT is activated for countless reasons
      ii) Few out-of-hospital calls constitute true life-threatening emergencies
         (1) Minor medical and traumatic events require little critical thinking and are relatively easy decisions
         (2) Patients with obvious life-threats pose limited critical thinking challenges
         (3) Patients who fall on the acuity spectrum between minor and life-threatening pose the greatest critical thinking challenge
   b) Thinking under pressure
      i) Hormonal influence – fight or flight response impacts the EMT-Intermediates decision making both positively and negatively
         (1) Enhanced visual and auditory acuity

(2) Improved reflexes and muscle strength

(3) Impaired critical thinking skills

(4) Diminished concentration and assessment ability

ii) Mental conditioning is the key to effective performance under pressure

(1) Development of "muscle memory"

(a) Practicing tasks until they can be performed automatically, without conscious thought

(b) "Muscle memory" allows the EMT-I to concentrate on other activities and information at the scene

c) Mental checklist for thinking under pressure

i) Stop and think

ii) Scan the situation

iii) Decide and act

iv) Maintain clear, concise control

v) Regularly and continually reevaluate the patient

d) Facilitating behaviors

i) Stay calm, don't panic

ii) Assume and plan for the worst; err on the side of the patient

iii) Maintain a systematic assessment pattern

e) Situation awareness

i) Reading the scene

ii) Reading the patient

f) Putting it all together – the six R's

i) Read the patient

(1) Observe the patient

(a) Observe level of responsiveness/ consciousness

(b) Skin color

(c) Position and location of patient – obvious deformity or asymmetry

(2) Talk to the patient

(a) Determine the chief complaint

(b) New problem or worsening of preexisting condition

(3) Touch the patient
  (a) Skin temperature and moisture
  (b) Pulse rate, strength, and regularity
(4) Auscultate the patient
  (a) Identify problems with the lower airway
  (b) Identify problems with the upper airway
(5) Status of ABC's – identifying life-threats
(6) Complete and accurate set of vital signs
  (a) Use as triage tool to estimate severity
  (b) Can assist in identifying the majority of life-threatening conditions
  (c) Influenced by patient age, underlying physical and medical conditions, and current medications

ii) Read the scene
(1) General environmental conditions
(2) Evaluate immediate surroundings
(3) Mechanism of injury

iii) React
(1) Address life-threats in the order they are found
(2) Determine the most common and statistically probable cause that fits the patients initial presentation
(3) Consider the most serious condition that fits the patient's initial presentation
(4) If a clear medical problem is elusive, treat based on presenting signs and symptoms

iv) Reevaluate
(1) Focused and detailed assessment
(2) Response to initial management/interventions
(3) Discovery of less obvious problems

v) Revise management plan

vi) Review performance at run critique