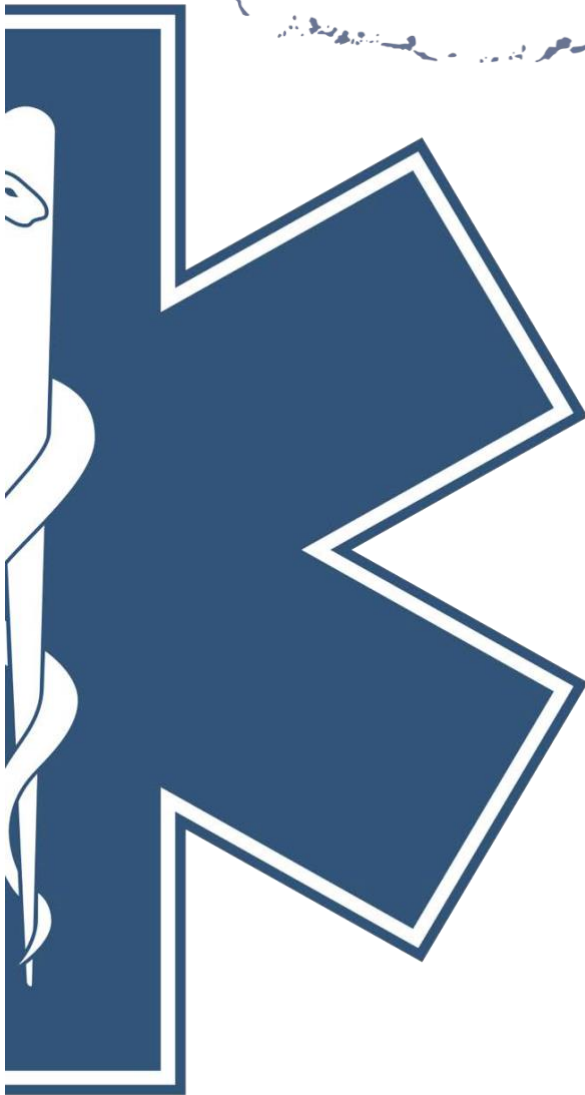
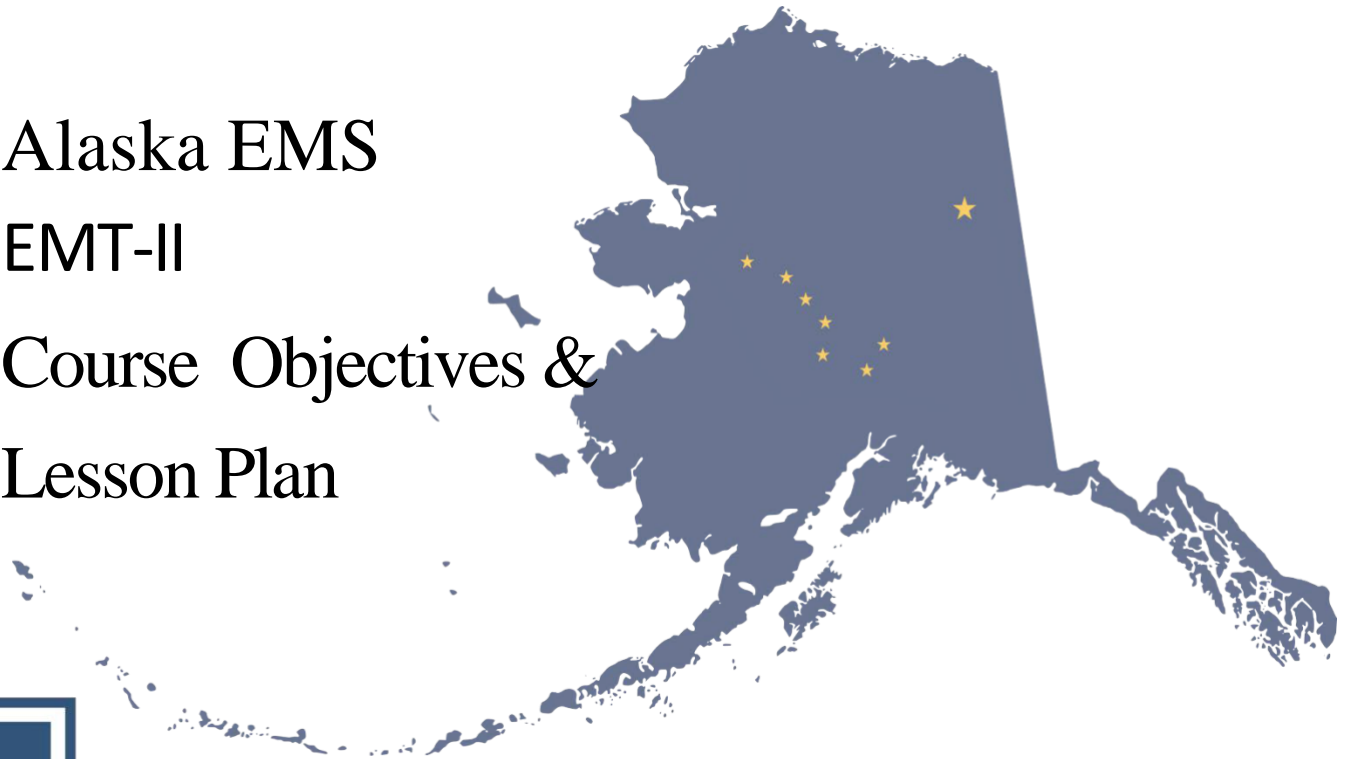


# Alaska EMS

## EMT-II

### Course Objectives & Lesson Plan



Alaska Council on EMS Committees:  
EMS Training Committee and  
Implementation Task Force  
in cooperation with the  
State of Alaska Department of Health and Social  
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Revised October 2020



## PREFACE

The purpose of this outline is to present a framework for the instruction of Alaska Emergency Medical Technician-2 initial training program approved by the Alaska Department of Health and Social Services to qualified students. A qualified student is one that is: currently certified as an Alaska EMT-I; has completed 10 patient contacts; and, has completed 5 patient care reports.

The times for each section are estimates only and will vary with the students' and system's needs. The instruction of medications and procedures which are not covered in the EMT-II scope of certified activities will require an increase in the number of hours proposed. Patient assessment and care objectives are intended to reflect patients of any age, unless specifically noted otherwise.

Before the course, students should spend time focusing on the areas of medical terminology, Alaska-adopted skill sheets, and anatomy/physiology. Students can draw the information to study these areas from the Alaska EMT-I Curriculum, *Alaska EMS Psychomotor Portfolio*, *Alaska Certification and Licensure Manual*, and the *Cold Injury Guidelines*.

This curriculum is designed to be consistent with the version of American Heart Association's Guidelines for CPR and Emergency Cardiovascular Care in effect at the time of writing. In the event that the contents of the curriculum deviate from current BLS or ACLS standards, the BLS or ACLS standards will take precedence, except if specific protocols exist for the area of conflict, such as in the *Cold Injuries Guidelines* exist.

This curriculum is designed to build upon the EMT-I knowledge and skills contained in the Alaska EMT-I Curriculum. Additionally, it outlines what knowledge and skills are expected of an Alaska EMT-II. It does not prohibit the physician sponsor from specifying the scope of activities, whether that be limiting practice to a subset of the EMT-II skills or expanding the EMT-II's skills in accordance with 7 AAC 26.670. Evolving issues should be covered thoroughly by the instructor.

The EMT-II curriculum builds on a presumed shared base of knowledge, skills, and proficiency prior to course start, including:

- All 2019 Scope of Practice (or more recent) EMT-I skills and content\*, including intramuscular injections and inserting supraglottic advanced airway devices;
- All Alaska-specific content required for Alaska reciprocity;

\*This may require successful completion of a 2019 Scope of Practice transition course.

Proficiency in the below skills are required for completion of the EMT-II course. This may be recorded on the *Alaska EMS Psychomotor Portfolio*:

- Initiating, maintaining, and discontinuing intravenous lines containing therapeutic crystalloid solutions;
- Initiating, maintaining, and discontinuing intraosseous lines;
- Obtain blood for laboratory analysis;

- Storing and properly administering dextrose-containing solutions, diphenhydramine, epinephrine (0.1mg/ ml concentration), glucagon, lidocaine for intraosseous infusion analgesia, naloxone HCl (other than intranasal), ondansetron, and tranexamic acid; and,
- Capnography waveform monitoring and interpretation.

Course completion does not guarantee certification in Alaska or endorsement. Candidates must pass cognitive and psychomotor examinations and evaluations as determined by the State of Alaska. In addition, all candidates MUST establish 10 successful IVs in order to complete certification requirements.

Note: ALL punctures performed on people SHALL be performed with a needle manufactured with a “safer medical devices” or engineering and work-practice control such as sharps with an engineered sharps injury protection and/ or needleless system design. Accidental needlestick injuries with a risk for biohazard/ infectious disease transmission must be filed with the course medical director and sponsoring entity’s protocols, with correlating actions and response.

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## Lesson 1: PREPARATORY

The EMT-II has a variety of duties and is imperative they understand their legal, moral and ethical responsibilities. These responsibilities occur during training and in the practice of patient care. At the completion of this section, the student will be able to:

### **ROLES AND RESPONSIBILITIES**

#### **Objectives:**

- 1.1 List current state requirements for enrollment in, and completion of, an EMT-II training program.
- 1.2 Identify and describe those activities performed by an EMT-II in the field.
- 1.3 Define the role of an EMT-II.
- 1.4 Compare and contrast the roles of an EMT-I, EMT-II, EMT-III, AEMT, and MICP.
- 1.5 List current state requirements for EMT-II continuing education.
- 1.6 Discuss why continuing education and skills maintenance are important to the EMT-II.
- 1.7 List current state requirements for EMT-II recertification.
- 1.8 List the duties of the EMT-II before, during, and after an emergency call.
- 1.9 Discuss skill deterioration and methods of prevention.
- 1.10 List examples of self-care for the EMT-II
- 1.11 Discuss methods to optimize personal and team performance

#### **Psychomotor objectives: none**

#### **Lesson Content:**

- A. Review course requirements: state and department specific.
  1. State requirements for and EMT-II course are located in the 2019 Guide for EMS Certifications and Licensure, Appendix A: Personnel, Section 2.3
- B. Review instructor and student expectations.
- C. Course outline.
  1. Didactic.
    - a) The class will follow and teach the requirements as set out in the EMT – 2 Course Objectives, Revised September 2020.
  2. Skills.
    - a) Skills taught within this course will be taught and performed as designated within the required psychomotor portfolio.
    - b) Information from the most current approved textbook or documents may be referenced and used as needed.
    - c) All skills completion will be documented in the *Alaska Psychomotor Skills Portfolio*
  3. Assignments
    - a) Assignment materials may supplement the textbook or may be assigned as a primary information source. Materials may be copied and supplied to the candidates or may be

given as a web address location.

- b) Any reference location not accessible by a candidate must be identified immediately by the candidate and other arrangements must be made with assistance from the instructor.
4. Testing – Class Quizzes and Tests.
- a) Testing material will be based on the information found within the textbook or any other reference materials used for the class lecture and provided to the student.
  - b) Quizzes and tests dates and identification of the expected knowledge being tested are listed on the syllabus.
  - c) A mid-class and end of class test will be given to the candidates. Dates are designated on the syllabus.
  - d) Assessment of practical skills taught will be completed during the classroom skills sessions. If a student cannot perform required skills appropriately and safely, they will not be recommended to attend the state testing.
5. Testing – Certification Testing.
- a) All candidates who receive an in-class passing grade will have the opportunity to take a State of Alaska certification exam after completion of the class.
  - b) This exam is used to ensure each of the candidates have at least the same basic level of knowledge and skill.
  - c) At the time of testing, candidates will need to apply for state certification. State certification is only granted after a candidate has passed all parts of the exam process and has completed 10 successful IV starts on live volunteers.
  - d) The certification testing process allows the State EMS office to manage who can function as an emergency medical responder.
    - 1) You must meet certain requirements that differ from other states.
    - 2) EMT-II is not transferable to another state. It is specific to the state of Alaska.

D. Continuing Education and Recertification.

1. Certification.
- a) Certification timeframe is 2 years.
    - 1) Time may depend on when the certification class is held.
    - 2) Look at the expiration date on your certification when you receive it.
    - 3) Maintenance of your certification is your responsibility.
2. Continuing Education Requirements.
- a) Required training hours and components can be referenced in the 2019 Guide For Emergency Medical Services Certification & Licensure
3. Skills and Knowledge can deteriorate without training, with emphasis on new EMT-II skills.
- a) Instructor-led training can provide immediate answers and feedback to providers.
  - b) Scenario-based training in groups or with a partner can help identify where a provider needs to work or practice to become more competent.
  - c) Scenario-based training also allows providers to practice critical thinking skills in a safe environment.

- d) Encourage the students to think about and discuss 3 reasons continuing education is important.
  - 4. Recertification process for the State of Alaska EMT - 2
    - a) Current expectations can be found in the Guide For Emergency Medical Services Certification & Licensure/ or appendix (link)
- E. Legal information an EMT-II should understand.
1. ADA.
    - a) Americans with Disabilities Act (ADA) of 1990 protects people who have a disability from being denied access to programs and services provided by state or local governments.
    - b) Title I of the ADA protects those with disabilities seeking gainful employment under many circumstances.
    - c) Contact the State of Alaska EMS office for more information about the ADA and employment as an EMT-II.
  2. Criminal Charges and Convictions: 7AAC 26.950.
    - a) Certain criminal charges or convictions may disqualify an applicant from becoming certified as an EMT at any level in Alaska. Current guidelines can be referenced in the GUIDE FOR EMERGENCY MEDICAL SERVICES CERTIFICATION & LICENSURE.
- F. What are the differences between responder levels?
1. Compare and contrast the role between: ETT, EMT-I, 2 and 3, AEMT and MICP. Details for this can be found in the Guide For Emergency Medical Services Certification & Licensure
  2. What is your role as an EMT-II?
    - a) Give a general overview.
      - 1) On arrival at the scene, EMT-II's and other providers who have responded with the ambulance should assume responsibility for the assessment, care, packaging, and if appropriate, transport of the patient to the ED.
    - b) Discuss what the differences and similarities would be, or could be if they worked in the following types of locations:
      - 1) In a larger department: possibly more focus is put on being a good partner and driver.
      - 2) In a rural department: you may be the lead provider for every call.
      - 3) No matter where you train or where you volunteer or work, the underlying knowledge base for all EMT-II's in the state is the same.
  3. What are the expectations of an EMT-II before, during and after a response?
    - a) Be prepared: Know your stuff – information, skills, know your ambulance – check it every day until you know it in your sleep and check it again, make sure your equipment works and the supplies are present; know operation of the ambulance – switches and the idiosyncrasies – find and understand them all. Do you know your local area, how about your standing orders? Don't cut corners in your learning.
    - b) Scene control: Have and continually use situational awareness, look around, pay

attention and give a good picture of what is going on. Ask for help. Ensure safety of yourself, the patient, and crew.

- c) Skills based: Perform good assessments on your patients, have solid IV skills, use proper and safe medication administration techniques, and be comfortable giving a radio report.
  - d) Primary care provider role: You may be the highest level of care on scene; you may be the overall decision maker for treatment. The overall goal is to do a good patient assessment, use your crew and your tools appropriately, provide appropriate treatment in a timely manner, transport and document thoroughly.
  - e) Partners: Be a great partner, anticipate needs of the patient and the crew, be a good listener, know your own job inside and out.
  - f) Debrief: Discuss the good, bad and ugly of the call – talk about your performances, the ways you can improve individually and as a team. Don't yell or accuse if you are upset. Pay attention; be honest about how things went down. Everything you do teaches you something that you want to stay the same or change.
4. Discuss what happens before and after an emergency response.
- a) Stress - Anticipation of calls, working alone, knowing the patients.
  - b) Stress – responding to calls, traffic, sirens, bystanders, bad partners.
  - c) Stress – some calls may not appear like they are stressful, know your limits.
  - d) Stress – go back to the station, stay up and write your report. Get no sleep and go to your day job.
  - e) Identify ways to successfully cope with stress or bad calls.
    - 1) Take care of yourself.
    - 2) Studying and training will relieve some stress.
5. Optimizing Personal and Team Performance (Dynamics)
- a) The EMT-II may find themselves in a role of leadership based on their certification level or otherwise.
    - 1) Titles and ranks are bestowed, but becoming a trustworthy leader is hard-earned.
  - b) Act on behalf of the patient- differences or friction can be sorted out after patient care
    - 1) Courtesy is inferred in radio traffic, but not on scene. Competence doesn't require dictatorship. Be attentive to your facial expressions- others certainly are.
  - c) Good followership is as important as good leadership
  - d) Use communication techniques discussed in: Communication/ Documentation
  - e) Assure shared vision or shared mental model of next steps
  - f) Situational awareness is an individual and group responsibility
  - g) Promote knowledge sharing
    - 1) Safety culture that allows for speaking up
    - 2) Contribute ideas in a respectful way
    - 3) Receive ideas in a respectful way
    - 4) Display mutual respect among team members regardless of training level or experience
  - h) Encourage cognitive offloading (e.g., using protocols, checklists, and resources)



## **EMS SYSTEMS**

### **Cognitive objectives:**

- 1.12 Describe the relationship between the service's physician medical director and the EMT-II in terms of routine or 7 AAC 26.670 (Approval of additional medications and procedures) interventions.
- 1.13 Describe the relationship between a physician on the scene, the EMT-II on the scene, and the EMS physician providing medical direction.
- 1.14 Discuss the EMT-II's initial responsibilities and authorities when arriving on the scene including terms designated in AS 18.08.075.
- 1.15 Discuss prehospital care as an extension of hospital care including transition of patient care from the EMT-II, including:
  - a. Transfer of responsibility (legal and medical).
  - b. Reporting of patient status to physician, midlevel provider, nurse, or ALS responder.
- 1.16 Describe quality assurance programs including evaluation of patient care, physician run critiques, and run report reviews.
- 1.17 Describe engineering controls, work practice controls, and personal protection equipment to protect the EMT-II from airborne and bloodborne pathogens.

### **Lesson Content:**

- A. Who needs a Medical Director?
  1. Most EMS systems have a physician medical director who authorizes providers to give medical care in the field.
    - a) EMT-II, EMT-III, AEMT, Paramedics, and advanced life support services must all have a physician sponsor in order to provide advanced level or invasive care.
    - b) Specified skills in the EMT-I scope of practice require a physician sponsor.
- B. Scope of Practice
  1. The scope of practice for each level of EMT is set out and adopted by the state.
  2. A Medical Director can limit the scope of practice but cannot expand it beyond state law without approval.
    - a) In Alaska, under 7 AAC 26.670 the Medical Director can apply through the State EMS Office for changes or additions to the scope of practice.
    - b) Any changes or additions must be submitted in writing with a training plan and approval granted before any implementation/evaluation of the changes may occur.
    - c) A list of qualified personnel is sent to the state to have the procedure or medication added to their allowable scope of practice.
    - d) The appropriate additions/changes should be reflected in the protocols and standing orders.
- C. Responsibilities to the certified organization: 7AAC 26.650
  1. Medical direction of pre-hospital care at the scene of an emergency is the responsibility of those approved as Medical Directors, or a designated physician such as the Emergency Room Physician.
  2. All agencies shall have a written policy detailing how certified providers are to deal with the following circumstances:
    - a) Physicians on scene of an emergency who are involved in patient care or a patient's

personal physician who wish to assume responsibility for patient care at the scene or during transport to the hospital.

D. Risk Prevention

1. All EMS personnel should be trained in handling bloodborne pathogens and approaching patients who may have a communicable or infectious disease.
  - a) Training is OSHA (Occupational Safety and Health Administration) mandated.
    - 1) Employers must comply with all applicable OSHA standards.
  - b) The CDC (Centers for Disease Control) has developed a set of standard precautions for healthcare workers.
  - c) NFPA 1999 (National Fire Protection Association) is the Standard on Protective Clothing for Emergency Medical Operations.
2. Effective precautions
  - a) Proper hand hygiene: wash your hands.
  - b) Gloves: Change gloves between patients, do not perform tasks outside of patient care (driving or using computer) when wearing contaminated gloves.
  - c) Eye protection: Prescription glasses and contact lenses are not adequate protection.
  - d) Gowns: should be worn to prevent fluids, droplet or airborne materials from coming in contact with skin/clothing.
  - e) Masks, respirators and barrier devices:
    - 1) Use pocket mask with a one-way valve or BVM when performing CPR.  
Recommended bacterial/viral exhaust filter with BVM
    - 2) If airborne/ droplet transmissible disease is expected, place a surgical mask on the patient and a HEPA respirator on yourself
    - 3) Use respiratory protection when performing aerosolizing procedures.
    - 4) Supplement with current CDC or Alaska State guidelines as indicated
  - f) Needleless systems for all IV set ups and needles with safety systems should be used.
  - g) Properly dispose of sharps in an approved sharps container.
    - 1) Risk reduction
      - (a) Engineering controls are the way things are designed so as to reduce the likelihood of error or injury. Examples for the EMT-II include self-blunting or shielding IV catheter insertion units, safety guards on needles, and needleless IV medication administration systems. These differ greatly, be sure to become familiar with the devices in use at your service.
      - (b) Work practice controls are the way things are done so as to reduce the likelihood of error or injury. Examples for the EMT-II include; placing a sharp directly in the sharps box, not accepting a handed-off sharp, and immediately applying safety guards when a needle is withdrawn from the patient.
      - (c) Anything that is or could become sharp (e.g. needle, glass vial, etc.) is to be immediately placed in a sharps box. Sharps boxes must be latched shut when the full mark is reached and then overwrapped with tape to ensure a seal. It may then be placed in biohazard trash or according to institutional policy.

## E. Errors and Improvement

1. Three main sources of errors that can occur individually or in any combination simultaneously:
  - a) Rules-based failure
  - b) Agencies need to have clear protocols that are understood by all EMTs in service.
  - c) Knowledge-based failure
    - 1) Not understanding why you should do something.
    - 2) Not taking the time to study or to keep up with current research.
  - d) Skills-based failure
    - 1) Not practicing skills.
2. Prospective Quality Improvement
  - a) This is anything you do BEFORE the call happens that can improve the quality of your care.
    - 1) Continuing education: refresher classes, symposiums, conventions, seminars
    - 2) Call-based education: reflection of calls that did not go well
    - 3) On-line training: employee or employer suggested/mandated
    - 4) Research: Books, journals, online sites
    - 5) Skills Competency Verification. Use down time to refresh skills: High risk/Low frequency, Low risk/High frequency.
    - 6) Tailboard talks.
3. Concurrent Quality Improvement
  - a) This occurs during the incident.
    - 1) Take the time to reflect and make an informed decision.
    - 2) If you cannot come up with a solution, ask for help from your partner, medical control, or your EMS supervisor.
    - 3) Cognitive offloading: using “cheat sheets” can help limit errors; keep a copy of your protocol book with you.
    - 4) When you are about to perform a skill, asking yourself “Why am I doing this?”
    - 5) Situational awareness: the environment can also contribute to errors, for example, distractions or poor lighting.
4. Retrospective Quality Improvement
  - a) Occurs after the call.
    - 1) Discuss troublesome calls with your partner and/or supervisor.
    - 2) Be honest about the how and why of an error.
    - 3) Participate in formal or informal debriefings.
5. Quality Assurance and Quality Improvement (QA/QI)
  - a) The medical director maintains quality control to ensure all staff members meet appropriate medical care standards on each call.
    - 1) Medical director and other involved staff review patient care reports (PCR).
  - b) Continuous quality improvement (CQI), also known as quality assurance (QA), is a dynamic circular system of continuous internal and external reviews and audits of all aspects of an EMS call.
    - 1) Periodic run review meetings are held.

- 2) Areas of improvement and positive feedback are discussed.
  - c) The CQI process should be emphasized as educational, not punitive.
    - 1) The goal is to identify and correct with education.
    - 2) However, continuation of poor or questionable care by a provider that cannot be corrected through education and remediation may require disciplinary action.
- F. Patient Care and Transfer of Care
- 1. Discuss the EMT-II's initial responsibilities when arriving on scene.
  - 2. Transfer of Care
    - a) EMS crews delivering a patient to the Emergency Department have the following responsibilities:
      - 1) Continue all necessary patient care until a full transfer of care has been made to a Nurse, Physician, or APP. This ensures patient safety and continuity of care.
      - 2) Do not leave the patient until transfer of care occurs face to face with a Nurse, Physician, or APP who will accept and continue care.
  - 3. Other responsibilities
    - a) Leave copy of field notes, 12-lead ECG, or other paperwork with the patient's chart in the receiving facility.
    - b) If your agency performs electronic charting, make sure the report is complete within the allotted timeframe.
    - c) Return the ambulance to response-ready condition as soon as possible after completing necessary patient care and verbal reporting duties.

## **MEDICAL/LEGAL CONSIDERATIONS**

### **Cognitive objectives:**

- 1.18 Apply the following terms to the role of an EMT-II:
- a. abandonment;
  - b. advance directives;
  - c. Authority of EMT in Alaska;
  - d. breach of duty;
  - e. consent (expressed, implied, informed, involuntary);
  - f. Do Not Resuscitate (DNR) orders;
  - g. negligence;
  - h. refusal of care;
  - i. scope of practice; and
  - j. standard of care.

### **Psychomotor objectives:** none

### **Lesson Content:**

- A. Scope of Practice
  - 1. The scope of practice for each level of EMT is set out and adopted by the state.
  - 2. A Medical Director can limit the scope of practice but cannot expand it beyond state law without

approval.

B. Duty to Act.

1. An obligation to provide patient care in a manner that is consistent with the EMT-II standard of care established by training and local protocols.
2. When contact with the patient is made, there is an absolute duty to perform a thorough assessment and act on the findings thereof.
  - a) If treatment is indicated based on the thorough assessment, and providing treatment is reasonable under the circumstances, the provider has an absolute duty to provide, or attempt to provide, such treatment.
  - b) If the treatment or findings warrant transport, then the transport is also part of the duty to act.
  - c) Patients who demonstrate decision making capacity have the right to refuse treatment and transport.
3. Breach of duty occurs when the person accused of negligence failed to act as another person with similar training would have acted under the same or similar circumstances.

C. Abandonment

1. Is a form of negligence that involves termination of emergency care without the patient's consent.
  - a) Once you initiate care, you have assumed a duty that must not cease until an equally competent person, who is able to meet the patient's actual or anticipated care needs, assumes care.
  - b) An EMT-II may hand off care to an EMT-I if the patient does not require EMT-II level interventions and if the EMT-II has not performed any interventions beyond the EMT-I scope.

D. Negligence

1. The failure to provide the same care that a person with similar training would provide in the same or similar situation.
  - a) A deviation from the accepted standard of care may result in further injury to the patient.
2. Gross negligence is conduct that constitutes a willful or reckless disregard for a duty or standard of care.
3. Negligence is commonly divided into three categories:
  - a) Malfeasance
    - 1) Occurs if you perform an act that you are not authorized to do, such as a medical intervention that is outside of the scope of practice.
    - 2) Occurs if you perform an act that you are legally permitted to do, but you do so in an improper manner.
  - b) Nonfeasance
    - 1) Occurs if you fail to perform an act that you are required or expected to perform.
  - c) *Res ipsa loquitur*
    - 1) Latin for "the thing speaks for itself" occurs if you fail to perform an act that you are required or expected to perform.
    - 2) Under this theory, the injury could only have been caused by negligence.
  - d) In rare cases, the theory of negligence per se may be used if the conduct of the person being sued is alleged to have occurred in clear violation of a statute.
4. All four of these factors must be present for the legal doctrine of negligence to apply and for the plaintiff to prevail in a lawsuit against an EMS service or provider.

- a) Duty
  - b) Breach of duty (EMT-II scope)
  - c) Damages
  - d) Proximate cause
- E. Alaska Immunity Law for EMS
1. Does not preclude liability for civil damages that are the proximate result of gross negligence or intentional misconduct.
  2. You may be charged criminally.
  3. You may lose your certification status.
- F. Advanced Directives:
1. In Alaska, an EMT may honor an advanced directive for Do not Resuscitate:
    - a) when it is in writing,
    - b) has been seen by the provider,
    - c) identifies the patient by name,
    - d) is signed by a physician, and
    - e) was issued in the US or territories,
    - f) or a verbal order is issued directly by a physician (7 AAC 16.010).
  2. Only the physician, the patient, or legal guardian (not power of attorney) may withdraw a DNR order.
  3. Newer advanced directives such as POLST (Physician Order for Life Sustaining Treatment) or MOLST (Medical Order for Life Sustaining Treatment) may be honored according to the above or current state law. They usually specify what treatments are appropriate for the patient and may limit the care delivered. For example, an IV and pain medicine may be permitted but not artificial ventilation.
  4. An EMT is not permitted to follow an advanced directive that does not meet the above requirements.
- G. Consent
1. In most circumstances, consent is required from every responsive, mentally competent adult before emergency medical care can be started.
  2. The foundation of consent is decision-making capacity, the ability of a patient to understand the information you are providing, coupled with the ability to process that information and make an informed choice regarding medical care that is appropriate for the person.
  3. Patients can give consent for one treatment or procedure but not for another. For example, a patient may consent to transport with EMS but refuse IV fluid therapy.
  4. Consent comes in different forms:
    - a) Expressed consent occurs when the patient acknowledges that they want you to provide emergency care or transport. This can be verbal or non-verbal.
    - b) Informed consent must be obtained from every patient who has decision making capacity. The provider should tell them what they believe is wrong, what the treatment is and the potential risks/benefits, if there are alternatives to the treatment and any potential consequences for refusing this treatment.
    - c) Implied Consent is when a person is unresponsive or otherwise unable to make a rational decision about their medical care, the law assumes that the patient would consent to care and transport if they were able to do so. This is limited to a true emergency, such as life-threatening injuries, delusional, altered mentation or a physical limitation that does not allow for an expressed response.
- H. Patient Refusals
1. Providers must make sure the patient has decision making capacity to refuse.
  2. Use of other healthcare providers, such as the receiving facility physician, may assist providers

- with direction in the case of a refusal.
- 3. Extensive documentation of the situation in the PCR is required.
- 4. Minors
- 5. A minor who is living on their own and supporting themselves may make medical decisions for themselves or their children. (AS 25.20.025)
- 6. If the parent is not present and the minor is not emancipated, responders are allowed to provide emergency medical care to a child under implied consent.
- 7. If a parent refuses life-saving care for their child, it can be considered neglect and law enforcement should be requested to the scene.
- 8. Schools, daycare facilities, camps may require the parents to give specific persons on site treatment and transport decisions in absence of the parent. This is called in loco parentis.
- I. EMTs in Alaska are privileged with certain responsibilities
  - 1. AS. 18.08.075. Authority of emergency medical technician.
  - 2. Reference the Alaska Guide For Emergency Medical Services Certification & Licensure for current inclusions

## **COMMUNICATIONS/ DOCUMENTATION**

*Note: Communications/ Documentation content does not have to be delivered in one block, may be inserted as appropriate with other topics.*

### **Cognitive objectives:**

- 1.19 Review the components of a legally defensible EMS report that includes interventions from the EMT-II.

### **Psychomotor objectives:**

- 1.20 Demonstrate proper use of a mobile or portable transmitter in a real or simulated patient situation to transmit patient assessment and treatment information, placing emphasis on medications administered (e.g., TXA).
- 1.21 Properly complete an EMS patient care report, including a narrative in a standardized format, based on a real or simulated patient situation.
- 1.22 Demonstrate effective team communication, to include closed-loop communication.

## **Lesson Content**

- A. Documentation
  - 1. Principles of accurate, defensible medical document and report writing now include additional content from pharmacology, medication administration, and other EMT-II interventions (e.g., intravenous/ intraosseous procedures)
- B. Communicating with Other Health Care Professionals
  - 1. Communication with Medical Control
    - a) EMT-IIs may need to contact medical control for consultation and to get orders for administration of medications
    - b) EMT-IIs must be accurate
    - c) After receiving an order for a medication or procedure—repeat the order back word for word

- d) Orders that are unclear or appear to be inappropriate should be questioned or clarified by the EMT-II
- 2. Communication among EMS Professionals (Team Communications and Dynamics)
  - a) Act on behalf of the patient- differences or friction can be sorted out after patient care
  - b) Use closed- loop communication
  - c) Be mindful of tone. There is a targeted goal that balances competence, control of a scene, and calm composure without being condescending or commandeering.
  - d) Assure shared vision or shared mental model of next steps
  - e) Situational awareness is an individual and group responsibility
  - f) Promote knowledge sharing
    - 1) Safety culture that allows for speaking up
    - 2) Contribute ideas in a respectful way
    - 3) Receive ideas in a respectful way
    - 4) Display mutual respect among team members regardless of training level or experience
  - g) Encourage cognitive offloading (e.g., using protocols, checklists, and resources)
- C. Communication with Receiving Facilities
  - 1. Report from the EMT-II supports having the right room, equipment and personnel prepared, or allow the facility to plan for the patient
  - 2. Promote standardized approach to verbal reports to limit opportunity for omission (E.g., SBAR, SOAP, department template.



## Lesson 2: BASIC ANATOMY, PHYSIOLOGY, AND PATHOPHYSIOLOGY

This content does not have to be delivered in one block, may be inserted as appropriate with other topics. At the completion of this section, the student will be able to:

### Cognitive objectives:

- 2.1 Identify common medical abbreviations relevant to the EMT-II.
- 2.2 Define homeostasis and give examples of compensation mechanisms.
- 2.3 Describe the differences between ventilation, respiration and oxygenation.
- 2.4 Discuss and recognize normal values for PaO<sub>2</sub>, PCO<sub>2</sub>, and SpO<sub>2</sub>.
- 2.5 Describe how PaO<sub>2</sub>, PCO<sub>2</sub>, and SpO<sub>2</sub> relate to respiratory function.
- 2.6 Describe problems that occur with decreased perfusion.
- 2.7 Define acid-base balance.
- 2.8 Describe the relationship between acid-base balance and respiration, perfusion, or metabolism.
- 2.9 Describe general role of electrolytes and their relationship to the EMT-II.
- 2.10 Define terms relevant to total body water and fluid balance and describe their relationships.
- 2.11 Outline the importance of the trauma triad to include acidosis, coagulopathy, and hypothermia.

**Psychomotor objectives:** none

### Lesson Content

- A. Homeostasis
  1. Homeostasis is the body's (organism's) internal mechanisms used to stay within a relatively stable state under normal circumstances. Under duress, compensation mechanisms will attempt to return the body to homeostasis through utilization of baroreceptor and chemoreceptors to detect changes.
    - a) Baroreceptors detect changes in the pressures of gases in the blood stream
    - b) Chemoreceptors detect changes in chemical makeup of blood such as blood sugar or pH
- B. Electrolyte ions
  1. Cations: Sodium (Na<sup>+</sup>) Potassium (K<sup>+</sup>) Calcium (Ca<sup>++</sup>) Magnesium (Mg<sup>++</sup>)
    - a) Potassium is the chief intracellular ion
    - b) Sodium is the chief extracellular ion
  2. Anions: Chloride (Cl<sup>-</sup>) Bicarbonate (HCO<sub>3</sub><sup>-</sup>)
- C. Role of electrolytes
  1. Electrolytes are essential for all cells to perform their specific tasks
    - a) Water follows sodium
    - b) Muscles cannot contract without electrolytes.
    - c) Nervous system is also very adversely affected.
  2. Too much or too little electrolyte creates an imbalance; the body can store only limited amounts. Electrolytes must be replenished if depleted in most cases.
  3. Too much fluid will dilute electrolytes causing loss of cell function.
  4. Too little fluid may result in high concentrations of electrolyte causing cells to behave abnormally. Heart may have arrhythmias, nervous system may have seizures
- D. Osmosis
  1. Semipermeable membrane
    - a) Water, freely interchangeable on both sides
    - b) Electrolytes cannot actively cross to the other side

- c) Water crosses to equalize concentration—higher concentration pulls fluid from lower concentrations (Osmosis)
  - 2. Isotonic fluids: Osmotic pressure is equal to normal body fluids. Examples: Normal Saline 0.9% NaCl and Ringer’s Lactate solution
  - 3. Hypotonic: Osmotic pressure less than that of normal body fluids Examples: 0.45% NaCl, D5W
  - 4. Hypertonic: Osmotic pressure greater than that of normal body fluids Examples: 3% NaCl or greater; some medications
- E. Diffusion.
  - 1. Solute molecules can cross membranes but at a slower rate than water
  - 2. Facilitated diffusion requires proteins that allow passage across the membrane
  - 3. Active transport requires energy to facilitate movement of particles
  - 4. Solutes or molecules will continue to diffuse until they reach a state of equilibrium across an area or all passable membranes
    - a) May occur simultaneously with osmotic shift
- F. Total Body Water
  - 1. Total body water 60% adult weight divided into components
    - a) Intracellular fluid inside the cell membrane 40% body weight
    - b) Extracellular fluid outside the cell (intravascular and interstitial) 20% body weight
- G. Alveolar gas exchange:
  - 1. Air enters alveoli by process of respiration
  - 2. Normally air contains 21% oxygen and, roughly, 79% nitrogen.
  - 3. Alveolar membrane is one cell in thickness and allows for gassed to diffuse to and from blood cells.
    - a) CO<sub>2</sub> is given off into alveolar space and is exhaled which can be detected as End-Tidal CO<sub>2</sub> (EtCO<sub>2</sub>)
    - b) O<sub>2</sub> is taken onto red blood cell for transport to tissues
- H. Respiration and Ventilation
  - 1. Respiration is the process of air being moved into and out of the lungs
  - 2. Ventilation is the process of supplying oxygen to bond to red blood cells(oxygenation) and separation of carbon dioxide for exhalation from the body.
  - 3. Cellular metabolism combines nutrients and oxygen to create energy and warmth, the by-product of which is carbon dioxide which must be excreted. (Typically, by exhalation from the lungs)
    - a) Mechanical obstruction such as mucous or lung disease can prevent gas exchange at alveolar level.
    - b) Chemical obstruction such as carbon monoxide that displaces oxygen is an example.
- I. Perfusion
  - 1. This is the delivery of oxygen, nutrients, and heat to each of the body’s cells via blood and the circulatory system, as well as removal of waste products.
  - 2. Homeostasis is maintained or achieved by the processes above which lead to perfusion utilizing the organ systems of respiratory, circulatory, digestive, and endocrine systems.
  - 3. Loss of blood flow, oxygenation of blood (or decrease in blood glucose levels) are considered hypoperfusion and lead to the death of cells. Cells can cope without oxygen by using anaerobic metabolism, but this produces increasing levels of acidity and can only sustain cells for limited periods of time. Cells cannot survive without glucose to metabolize.
  - 4. Loss of perfusion leads to
    - a) Ischemia – cells/ and or tissues are damaged by lack of perfusion, but may recover if perfusion is returned

- b) Infarction – cellular and/ or tissue death
- 5. Loss of enough cells causes organ damage or death which ultimately affects the organism's ability to survive.

J. Blood Gas Values:

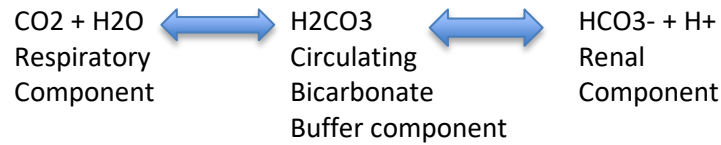
- 1. All values are taken from arterial blood. Many instruments can be programmed to adjust for venous or capillary samples, but accuracy suffers if those sources are used. It should be noted that each laboratory system calibrates their instrumentation differently. Values may be slightly different. The EMT-II should be familiar with local values for arterial gases.
  - a) Partial Pressure of Carbon Dioxide (PCO<sub>2</sub>) is 35-45 mm/Hg
  - b) Partial Pressure of Oxygen (PO<sub>2</sub>) is 70-105 mm/Hg
  - c) Oxygen (O<sub>2</sub>) saturation is 94-100%
- 2. Factors affecting blood gas values: (These are only some examples)
  - a) PCO<sub>2</sub> may be increased and PO<sub>2</sub> may be decreased due to:
    - 1) Poor gas exchange in the lungs
      - (a) Pneumothorax
      - (b) Diaphragmatic injury
      - (c) Flail chest
      - (d) Constrictive airway disease
      - (e) Secretions
    - 2) Increased cellular metabolism
    - 3) Decreased respiratory effort
  - b) PCO<sub>2</sub> and PO<sub>2</sub> may be decreased due to:
    - 1) Airway obstruction
    - 2) Flow restrictions such as COPD, CHF, or asthma
    - 3) Neurological/ pharmacological depression of respirations
    - 4) Pulmonary Embolism
    - 5) Alveolar compromise such as collapse, fluid accumulation, shunt
  - c) PO<sub>2</sub> may be elevated secondary to:
    - 1) Supplemental oxygen administration.
    - 2) Increased level of Fraction of Inspired Oxygen (FiO<sub>2</sub>) via ventilation source
  - d) Carbon Monoxide will cause SpO<sub>2</sub> to read high incorrectly.

K. Acid-Base Balance

- 1. pH is a measure of how acidic or basic a substance is on a scale of 0-14. A pH of 7.0 is considered neutral. A pH of 0 represents very acidic things, (Stomach acid has a pH of about 1.8). A pH of 14 represents basic items (Oven cleaner has a pH of about 13.5.).
- 2. Normal pH of blood is between 7.35-7.45 (Humans are normally slightly basic/alkalotic)
- 3. Higher levels of hydrogen ions (H<sup>+</sup>), caused by increased levels of CO<sub>2</sub>, will make blood more acidic and pH will drop below 7.35
- 4. Decreased levels of hydrogen ions, caused by lower levels of CO<sub>2</sub>, will make blood more basic and pH will increase beyond 7.45
- 5. When Acid-Base balance is compromised, the body chemically regulates with fast acting buffer systems:
  - a) Cellular
  - b) Respiratory
  - c) Renal
- 6. Blood carries excessive molecules to be excreted either through the respiratory system or the renal system.
- 7. The two primary systems for maintaining normal pH through excretion:

- a) Primary system is respiratory to excrete carbon dioxide (CO<sub>2</sub>) molecules that result when carbonic acid (HCO<sub>3</sub><sup>-</sup>) is broken down. This system is far faster than the other.
- b) Kidneys will excrete H<sup>+</sup> ion from the HCO<sub>3</sub><sup>-</sup>, but this process is slower and takes longer to be effective. It also relies on functioning and well-perfused kidneys, which may not exist in a shock state.

Process known as "Ion Shift":



- 8. There are 4 main clinical presentations of acid-base disorders. The body uses bicarbonate to attempt to maintain balance, but uses other systems to compensate and restore homeostasis.
- 9. Though there may be mixed mechanisms or compensation actions which blur the origin of the derangement in laboratory analysis, the four categories below represent primary disorders (complex or mixed etiologies are not generally presented in the scope of EMT-II):
  - a) Respiratory Acidosis (pH <7.34)
    - 1) Almost always the result of hypoventilation (the result of mechanisms listed above)
    - 2) If not corrected quickly, will result in ischemia or death
  - b) Respiratory Alkalosis (pH >7.46)
    - 1) Almost always the result of hyperventilation
      - (a) Emotional/psychological reaction
      - (b) Drug overdoses that cause tachypnea
      - (c) Fever
      - (d) Over-breathing with BVM or ventilator
  - c) Metabolic Acidosis (pH <7.34)
    - 1) Any acidosis not occurring due to primary respiratory issues
    - 2) Body generally compensates by increasing respiratory rate or depth
    - 3) Lactic acidosis caused by poor cellular ventilation (anaerobic metabolism) is a common cause. High levels of lactate may indicate overwhelming cellular infection.
    - 4) Aspirin overdose (acetylsalicylic acid)
    - 5) Ketoacidosis from ETOH or diabetes
  - d) Metabolic Alkalosis (pH >7.46)
    - 1) Excessive vomiting – including eating disorders
    - 2) Excessive water intake
    - 3) Nasogastric suctioning (removes stomach acid which removes H<sup>+</sup> ions)
    - 4) Excessive intake of base/ alkali (usually antacids)
- 10. Acidosis, coagulopathy, and hypothermia in the presence of trauma can have detrimental effects.
- 11. The body's ability to clot is influenced by temperature and pH. When problems involving pH or temperature occur, it can inhibit platelet aggregation, and activity of clotting factors.
  - a) Acidosis can be created by a lack of tissue perfusion, leading to an increase in lactic acid secondary to anaerobic metabolism.
    - 1) Some intravenous fluid therapy can worsen acidosis.
  - b) Coagulopathy: a disease or condition affecting the blood's ability to coagulate.
  - c) Coagulopathy in trauma can be due to several factors including:
    - 1) Hypothermia.
    - 2) Blood loss leads to a decrease in platelets and other clotting factors.
    - 3) Dilutional coagulopathy can occur with use of IV fluid therapy.

- 4) Medications
- d) Hypothermia is defined as a core body temperature below 35.6°C.
  - 1) Elderly are at a higher risk of developing hypothermia.
  - 2) As a patient's core body temperature decreases, so does the body's ability to clot.
- 12. These components contribute to the other. For example, anaerobic metabolism results in significantly less heat production in the body, which can lead to hypothermia, which promotes coagulopathy.

## **Lesson 3: PHARMACOLOGY**

### **PRINCIPLES OF PHARMACOLOGY**

#### **Cognitive objectives:**

- 3.1 Demonstrate functional use of the metric system as it applies to medication administration
- 3.2 Identify categories of medication names and classifications (e.g., based on mechanism of action).
- 3.3 Describe concepts of pharmacodynamics and pharmacokinetics

#### **ADMINISTRATION**

#### **Cognitive objectives:**

- 3.4 Describe, compare, and contrast the various drug administration routes and recall the indications for each (e.g. SL, IV, SQ, IM, inhalation, and IO).
- 3.5 Describe the indications, equipment needed, techniques used, precautions (including the “rights” of medication administration) and general principles of administering medications by different routes.
- 3.6 Describe potential complications that can occur with various routes and discuss how to prevent and/or treat potential complications that could result from each.
- 3.7 Describe reconstitution (e.g., Glucagon) or admixture (e.g., TXA) of medications for administration

#### **Psychomotor objectives:**

- 3.8 Demonstrate withdrawal of medication from an ampule, vial (single dose or multi-dose), and assembly of prefilled syringes.
- 3.9 Demonstrate preparation and administration of medications given by the following routes:
  - a. Aerosolized/nebulized
  - b. Inhaled
  - c. Intramuscular
  - d. Intranasal
  - e. Sublingual
  - f. Oral
  - g. Intravenous/ Intraosseous push
  - h. Intravenous/Intraosseous infusion, including addition of medication and label to appropriate IV fluid
  - i. Subcutaneous
- 3.10 Demonstrate bolus drug dose calculations, including volume to be administered, confirming with a double-check system (preferably by a second provider).
- 3.11 Demonstrate calculation and preparation of a pediatric medication dose, using a length-based measuring device or weight-based calculation.

#### **Lesson Content**

- A. Medication Safety
- B. Medication Legislation

1. Pure Food and Drug Act
  2. Federal Food, Drug and Cosmetic Act
  3. Drug Enforcement Agency
  4. Development of Pharmaceuticals
    - a) Food and Drug Administration approval process
    - b) Special Considerations
      - 1) Pregnancy
      - 2) Pediatrics
      - 3) Geriatrics
- C. Drug Forms
1. Liquids
  2. Solids
  3. Gases
- D. Naming
1. Chemical
  2. Generic
  3. Propriety/Trade
  4. Official
  5. Authoritative Sources of Drug Information
    - a) United States Pharmacopeia (USP)
    - b) Physician's Desk Reference (PDR)
    - c) Drug package inserts
    - d) Drug handbooks
- E. Classifications
1. Body System Affected
  2. Class of Agent
  3. Classifications by Body System
    - a) Central nervous system
      - 1) Autonomic pharmacology
        - (a) cholinergic
        - (b) anticholinergic drug definitions
        - (c) adrenergic
        - (d) antiadrenergic
          - (1) alpha – adrenergic blockers
          - (2) beta – adrenergic blockers
            - a. beta-1; beta-2
      - 2) Analgesics
        - (a) opioid agonists
        - (b) opioid antagonists
        - (c) non-steroidal anti-inflammatory drugs (NSAIDs)
        - (d) other analgesics (e.g., acetaminophen)
      - 3) Sedative/hypnotic
        - (a) benzodiazepines
        - (b) barbiturates
      - 4) Anticonvulsants
      - 5) Stimulants
    - b) Cardiovascular drug definitions

- 1) Anti-dysrhythmics
      - 2) Antihypertensives
      - 3) Antianginal drugs
    - c) Drugs affecting the blood (e.g., that affect clotting or cell formation)
    - d) Psychiatric medications
    - e) Respiratory system
      - 1) Mucolytics
      - 2) Cholinergic antagonists
      - 3) Sympathomimetics
      - 4) Antihistamines
    - f) Endocrine system -- drugs affecting the pancreas
      - 1) Insulin preparations
      - 2) Oral hypoglycemic agents
      - 3) Hyperglycemic agents
  - 4. Herbal preparations
    - a) Potential Implications
      - 1) interaction with pharmaceuticals
      - 2) idiosyncratic reactions
      - 3) manufacturing error
      - 4) contamination
    - b) Adulteration
      - 1) incorrect preparation
      - 2) incorrect labeling
  - 5. Over the counter medications
    - a) Drugs affecting the central nervous system
      - 1) sedatives
      - 2) stimulants
      - 3) hallucinogenic (dextromethorphan)
    - b) Drugs affecting the respiratory system
      - 1) asthma treatment products
      - 2) cold and allergy products
    - c) Supplements
      - 1) herbs
      - 2) vitamins
      - 3) minerals
      - 4) other
- F. Storage and Security
- 1. Factors Affecting Drug Potency
    - a) Temperature
    - b) Light
    - c) Moisture
    - d) Shelf Life
  - 2. Locking and Double Locking of Medications
- G. Pharmacological Concepts
- 1. Pharmacokinetics
    - a) Absorption
    - b) Distribution
    - c) Biotransformation



- d) Metabolism and Excretion -- organs of elimination
  - 1) kidneys
  - 2) intestine
  - 3) lungs
  - 4) exocrine glands
- 2. Pharmacodynamics
  - a) Mechanism of action
    - 1) Drug receptor interaction
      - (a) agonists
      - (b) antagonists
      - (c) affinity
      - (d) efficacy
    - 2) Drug enzyme interaction
  - b) Medication response relationship
    - 1) Plasma levels
    - 2) Biologic half-life
    - 3) Therapeutic threshold
    - 4) Therapeutic index
    - 5) LD 50
    - 6) Factors altering drug response
      - (a) age
      - (b) sex
      - (c) body mass index
      - (d) pathologic state
      - (e) genetic factors
      - (f) time of administration
      - (g) psychological factors
      - (h) predictable responses
        - (1) tolerance
        - (2) cross tolerance
      - (i) iatrogenic responses
      - (j) drug allergy
      - (k) anaphylactic reaction
      - (l) delayed reaction ("serum sickness")
      - (m) hypersensitivity
      - (n) idiosyncrasy
      - (o) cumulative effect
      - (p) drug dependence
      - (q) drug antagonism
      - (r) summation (addition or additive effect)
      - (s) synergism
      - (t) potentiation
      - (u) interference
- 3. Medication interaction
- 4. Toxicity

## H. Routes of Administration

- 1. Alimentary Tract

- a) Oral
- b) Sublingual
- 2. Parenteral
  - a) Subcutaneous
    - 1) Appendix available in this document
  - b) Intramuscular
    - 1) Lateral Deltoid- easily accessible in many patients, low risk of complications
    - 2) Vastus Lateralis- easily accessible in many patients, significant blood flow due to large muscle group; low risk of complications
  - c) Intravenous
    - 1) See section: Intravenous/ Intraosseous Access and Therapy
  - d) Intraosseous
    - 1) See section: Intravenous/ Intraosseous Access and Therapy
  - e) Inhalational
- I. Administration of Medication to a Patient
  - 1. The “Rights” of Drug Administration
    - a) Right patient – prescribed to patient
    - b) Right medication – patient condition
    - c) Right route – patient condition
    - d) Right dose – prescribed to patient
    - e) Right time – within expiration date
  - 2. Drug Dose Calculations
    - a) System of weights and measures
    - b) Drug calculations
      - 1) Desired dose
      - 2) Concentration on hand
      - 3) Volume on hand
    - c) Calculate
      - 1) Volume based bolus
      - 2) IV drip rate
  - 3. Techniques of Medication Administration (Advantages, Disadvantages, Techniques explored in other content areas of this document and in EMT-I content)
    - a) Peripheral venous cannulation
    - b) Intraosseous
    - c) Intramuscular (manual)
    - d) Subcutaneous (manual)
    - e) Aerosolized
    - f) Nebulized
    - g) Sublingual
    - h) Intranasal
  - 4. Special Considerations for Preparation
    - a) Reconstitution (e.g. Glucagon)
      - 1) Generally requires 1 mL of sterile water for injection (or diluent supplied by the manufacturer).
        - (a) Other medications may require a different amount of fluid.
      - 2) Shake the vial gently until the powder is completely dissolved.
      - 3) Reconstituted injection should be clear and of water-like consistency.
      - 4) The concentration is approximately 1 mg/ml for glucagon.

- J. Reassessment and Documentation
1. Data – Indications for medication and route of administration
  2. Action – Medication and dose administered
  3. Response – Effect of medication and reassessment

## **MEDICATIONS**

### **Cognitive objectives:**

- 3.12 For each of the following medications give the following: 1) state the generic and trade names, 2) classification, 3) indications, 4) contraindications, 5) precautions including compatibility, 6) medication form(s), 7) dose, 8) route of administration, 9) action, 10) side effects and 11) re-assessment strategies:
- a. Dextrose in Water (5%, 10%, 25%, 50%)
  - b. Diphenhydramine
  - c. Epinephrine 1mg/10ml (100mcg/ml) IV (cardiac arrest only)
  - d. Epinephrine 1mg/1ml IM (anaphylaxis)
  - e. Glucagon
  - f. Intravenous fluids
  - g. Lidocaine (analgesic) for IO flush
  - h. Nitrous Oxide (NO<sub>2</sub>)
  - i. Ondansetron
  - j. Tranexamic Acid (TXA)

### **Psychomotor objectives:**

- 3.13 Given a patient scenario, state and/ or demonstrate the correct drug, dosage, and administration route(s) for:
- a. Dextrose- containing fluids
  - b. Diphenhydramine
  - c. Epinephrine 1mg/ 10ml IV
  - d. Epinephrine 1mg/ 1ml IM
  - e. Glucagon
  - f. Intravenous fluids
  - g. Lidocaine for IO flush
  - h. Nitrous Oxide (Optional due to availability)
  - i. Ondansetron
  - j. Tranexamic Acid
    1. Verbalize and demonstrate safe hand-off report procedure after TXA administration to assure ongoing care, to include patient marking or wristband.

## **Lesson Content**

Sample drug information cards and other supporting materials are available in the Alaska EMS instructor reference repository

## Lesson 4: INTRAVENOUS/ INTRAOSSEOUS ACCESS AND THERAPY

### **Cognitive objectives:**

- 4.1 Describe the anatomy of the skin and blood vessels as it relates to intravenous access.
- 4.2 Discuss how fluid replacement is monitored and controlled.
- 4.3 Describe the effect of tubing length, needle size, needle length, and IV bag height on flow rates.
- 4.4 Given a scenario, list current intravenous/ intraosseous solutions used in practice in EMS and advantages or disadvantages of each, including for pediatric care.
- 4.5 Discuss how to recognize, prevent, and/or treat potential complications that could result from intravenous access and fluid therapy.
- 4.6 Discuss adult and pediatric insertion sites for both IV and IO, and the advantages and disadvantages of each.
- 4.7 Use an approved burn fluid resuscitation formula (or approved Alaska reference) to determine fluid replacement dose when given a patient scenario for an infant, child, and adult.
- 4.8 Recognize patients who require IV/IO access and/or fluid replacement when given several patient presentations, including pediatric patients.

### **Psychomotor objectives:**

- 4.9 Demonstrate access and fluid therapy equipment including:
  - a. Over the needle intravenous catheters (manufactured with a “safe” design);
  - b. Butterfly needles;
  - c. Intraosseous needles;
  - d. Micro drip administration sets (including needle-less system);
  - e. Macro drip administration sets (including needle-less system);
  - f. Saline locks (including needle-less system)
  - g. IV/ IO fluids;
  - h. Pressure infusion devices;
  - i. Tourniquets;
  - j. Arm restraints; and
  - k. Equipment for drawing blood (manufactured with a “safe” design).
- 4.10 Demonstrate drip rate calculations with various administration sets (e.g., 250ml in one hour using a 10, 20, or 60 gtt/ml set)
- 4.11 Demonstrate proper aseptic technique for the insertion and securing of an intravenous catheter for the purposes of establishing an intravenous line.
- 4.12 Troubleshoot problems that may occur after an intravenous line has been successfully started in a patient (e.g. infiltration, slowing flow rates, etc.).
- 4.13 Demonstrate an appropriate technique for removing air from an established IV line.
- 4.14 Demonstrate the successful establishment of an intraosseous line, using proper aseptic technique, in an IO mannequin (or similar set up).
- 4.15 Demonstrate fluid infusion techniques for both IV and IO therapy.
- 4.16 Demonstrate the ability to adjust flow rate to comply with physician orders.
- 4.17 Demonstrate a safe technique for changing bags of infusing solution using aseptic technique
- 4.18 Demonstrate appropriate documentation for initiation of IV/IO and IV/IO-associated therapies
- 4.19 Demonstrate termination of IV/IO infusion and safe removal and inspection of catheter

## **Lesson Content**

- A. Anatomy of Skin and Blood Vessels as they Relate to Intravenous Access
  - 1. Integumentary System (Skin)
  - 2. Structures
    - a) Epidermis
    - b) Dermis
    - c) Subcutaneous layer
  - 3. Blood vessels and circulation
    - a) Structure and function of the blood vessels, arteries, veins and capillaries
    - b) Mechanism that regulate blood flow through arteries, capillaries, and veins
      - 1) Two-cusp valves in extremity veins direct blood return to the heart and prevent backward flow of blood
        - (a) This is why peripheral extremity IVs must be placed pointing toward the heart
    - c) Categories of veins by depth
      - 1) Deep veins are located in the muscles and along bones
      - 2) Superficial veins are located in the fatty layer under the skin
      - 3) Short veins (also called connecting) link superficial and deep veins
    - d) Veins in upper extremities
      - 1) Preferred sites
      - 2) Link for anatomical graphics (media commons) can be found in Instructor Repository
    - e) Veins in distal extremities
      - 1) Leg veins are particularly at risk of blood clotting or swelling of the vein because when a person is standing, blood must flow upward from the leg veins, against gravity, to reach the heart.
      - 2) IV starts in lower extremities in adults is generally discouraged due to risk of thrombus dislodgement.
- B. Fluid Replacement
  - 1. Replacement may be administered over a period of time. Circumstances will dictate rate of fluid administration.
  - 2. Rate of administration determined by:
    - a) Length of catheter
    - b) Internal diameter of catheter
      - 1) Small increase in radius equals large increase in area
      - 2) Area inside lumen determines rate of flow
      - 3) Maximum rate
        - (a) 18 gauge preferred for trauma
  - 3. Size of vein has less relationship to flow than catheter size
  - 4. Peripheral Veins
    - a) Advantages (relative to central veins)
      - 1) Rapid identification
      - 2) Minimal equipment
      - 3) Rapid insertion
      - 4) Does not interfere with other tasks
      - 5) Easy to maintain
      - 6) Easily accessible

- b) Disadvantages
  - 1) In severe volume depletion may be difficult to locate or obtain access
  - 2) These veins collapse and roll easily. Technique must be developed to overcome this.
- 5. Intravenous Access Technique
  - a) Preparation and equipment
    - 1) Tourniquet
    - 2) Vein identified
    - 3) Prepare tape and/ or adhesive securing device
    - 4) Prepare saline lock (if used) with flush being aware of clamps
    - 5) Alternately, spike unexpired, clear, appropriate bag of intravenous fluids with administration set, prime tubing with no large air bubbles, fill drip chamber to 1/3-1/2 full and leave aseptic cover on distal end of administration set tubing.
  - b) Perform venipuncture (sequence is not of primary importance as long as procedure is safe for provider and patient)
    - 1) 15-degree (or less) angle of puncture with bevel up (away from skin)
    - 2) Verbalize or note a "pop" from entrance into intravascular space
    - 3) Visualize return of blood into flash chamber of catheter
    - 4) Advance catheter over the needle in single movement until hub of catheter is flush with skin
    - 5) Tamponades site proximal to end of catheter
    - 6) Withdraw needle using manufacturer's engineering controls for safety
    - 7) Place sharps into appropriate sharps container
    - 8) Remove tourniquet
    - 9) Connects tubing or saline flush. May elect to aspirate blood to confirm placement. Flush a minimal amount of saline into patient to clear tubing of blood.
    - 10) Administers IV solution while assessing for signs of infiltration
    - 11) Secures catheter and attached devices in a logical and effective manner.
    - 12) Adjusts rate according to medical direction
    - 13) Considers use of pressure-infusion devices in limited indications
- C. Documentation
  - 1. Depending on local protocol, when an IV is started, the following must be documented on the run report:
    - a) Date and time of the venipuncture
    - b) Type and amount of solution
    - c) Type of venipuncture device used, including the gauge
    - d) Venipuncture site
    - e) Number of insertion attempts (if more than one)
    - f) IV flow rate
    - g) Any adverse reactions and the actions taken to correct them
    - h) Name or identification number of the EMT-II initiating the infusion
  - 2. In addition to documenting correct IV placement, unsuccessful attempts also should be documented
  - 3. Some local protocols call for the EMT-II to document the following information directly on the tape that is used to secure the venipuncture device and administration set tubing in place:
    - a) Date and time of insertion
    - b) Type and gauge of needle or catheter
    - c) Initial of the EMT-II who obtained IV access.

4. To do this procedure:
  - a) A piece of tape should be cut and placed on a flat surface
  - b) Information should be written on the tape then applied over the dressing
  - c) Never label the tape after it has been applied over the dressing. Doing so will irritate the venipuncture site
- D. Special Considerations in Fluid Resuscitation
  1. Permissive Hypotension
    - a) Many protocols guide IV fluid resuscitation amounts by targeted blood pressure (for example, achieving a SBP of 100 and then keeping IV fluids at KVO) or by decreasing tachycardia. Follow local protocols.
  2. Reperfusion Injury
  3. Burn Patients- *(Below content is based on Alaska burn care guidelines which are currently being revised and updated by the Alaska Trauma System Review Committee.)*
    - a) Start at least one large bore IV in patients meeting any of the burn criteria in the beginning of this document.
    - b) A second IV should be placed for large burns (>20%) or those presenting with altered mentation or other signs of shock.
    - c) If accessible, a longer length catheter will tolerate swelling associated with burn edema. IVs may be inserted through burned area, if necessary.
    - d) IO may be considered and, as with IV placement, a longer IO needle will be more likely to tolerate swelling.
    - e) Humoral IO in adults is preferred.
    - f) Frequent reassessment of patency is recommended.
    - g) For obvious large burns, begin age-appropriate burn fluid administration during the initial prehospital ALS care (until a formal TBSA can be calculated).
    - h) Fluid administration guidelines:
      - 1) For the first hour of initial stabilization, use an hourly rate:
        - (a) Adults: 500ml/hour for those  $\geq$  14 years old, until an accurate assessment of burn injury may be performed
        - (b) Age  $\leq$  5 yo: 125ml /hr for children less than 5 years;
        - (c) Age 6-13: 250ml/hour
      - 2) If transport will be greater than one hour, perform an initial assessment of TBSA using the Rule of 9's and begin initial fluid resuscitation based on the American Burn Association Consensus Formula:
        - (a) 2-4ml/kg/% TBSA Burn (LR preferred) in the 1st 24 hours
        - (b) Give  $\frac{1}{2}$  in the first 8 hours post-burn
        - (c) Give  $\frac{1}{2}$  in the next 16 hours post-burn
        - (d) Adults: 2ml/kg/TBSA%
        - (e) Children: 3ml/kg/TBSA%
        - (f) Electrical: 4ml/kg/TBSA%
- E. Pediatrics
  1. Temperature control is critical in maintaining perfusion
  2. Use of IV is for known required fluid replacement
  3. Lower extremities are safe options for IV access and sites around the ankle or foot may be easier to find in infants, relative to upper extremity sites.
  4. Consider use of IO if peripheral vein is not accessible and patient is in
  5. immediate need of fluid
    - a) Keep normal vital signs by age on hand



- b) Infuse up to 20ml/kg of warmed isotonic solution
    - 1) the exception to this is some cases of cardiogenic shock, as guided by local protocol or medical direction.
  - c) Consider a second infusion of 20ml/kg if there is no response to first
  - d) Second infusion should be done keeping in mind that the trauma patient needs rapid restoration of red blood cells while awaiting definitive care, if shock is due to non-compressible hemorrhage
  - e) A third infusion of 20ml/kg may be considered in patients with controlled hemorrhage, sepsis, or profound dehydration
  - f) The use of continuous infusion in uncontrolled hemorrhage should be done to maintain adequate perfusion levels of critical organs en route to the hospital.
- F. Geriatrics
- 1. Patients with chronic hypertension may have higher blood pressure value needs to achieve the same level of end organ perfusion than other patients
    - a) Patient may be in shock with SBP >100mmHg
    - b) Modest amounts of blood loss can lead to shock
      - 1) i. reduced blood volume
      - 2) ii. possible anemia
    - c) Patient is less able to tolerate excessive fluids
      - 1) possible anemia
      - 2) possible electrolyte alterations
  - 2. IV fluid therapy may lead to hypothermia; maintain normothermia
- G. Obstetrical Patients (see also: Medicine)
- 1. Shock states lead to shunting of blood away from fetus
  - 2. The closer the maternal blood pressure is to normal, the better the fetal perfusion
- H. Complications:
- 1. Pain
  - 2. Catheter shear
  - 3. Cannulation of an artery
  - 4. Hematoma or infiltration
  - 5. Phlebitis or infection
  - 6. Extravasation
  - 7. Air in tubing/air embolism
  - 8. Circulatory overload and pulmonary edema
  - 9. Allergic reaction
  - 10. Pulmonary embolism
  - 11. Failure to infuse properly
    - a) Was the venous tourniquet removed?
    - b) Is there swelling at the cannulation site?
    - c) Is the flow regulator in an open position?
    - d) Is the tip of the catheter positioned against a valve or wall of the vein?
    - e) Is the IV bag high enough (drip chamber above patient's heart)?
    - f) Is the drip chamber completely filled with IV solution?
- I. Steps to discontinue an intravenous infusion

1. Equipment
  - a) Gloves
  - b) Sterile gauze pad
  - c) adhesive bandage
2. Technique
  - a) Close the flow control valve completely
  - b) Taking care not to disturb the catheter, carefully untape and remove the dressing
  - c) Hold the sterile gauze pad just above the site to stabilize the tissue and withdraw the catheter by pulling straight back until the catheter is completely out of the vein
  - d) Immediately cover the site with the sterile gauze pad and hold it against the puncture site until the bleeding has stopped
  - e) Tape the dressing in place or cover with an adhesive bandage
- 3.

J. Intraosseous Line Placement and Infusion

1. The chief indications for intraosseous line insertion are:
  - a) Compensated and Uncompensated Shock
    - 1) Shock is usually the result of:
      - (a) Hypovolemia
      - (b) Sepsis
      - (c) Cardiac problems
  - b) Cardiac Arrest:
    - 1) A protocol for obtaining vascular access is helpful in making a decision about the use of an intraosseous line when venous access cannot be obtained rapidly.
      - (a) Peripheral intravenous access often requires more time to insert than an intraosseous line. A median time of 10 minutes is required to achieve peripheral vascular access during cardiac arrests; only 18% of these attempts are successful within 90 seconds.
      - (b) If peripheral access is not achieved within 90 seconds, or at provider discretion, attempts to insert an intraosseous line should be initiated.
      - (c) The intraosseous route delivers fluids and medications into the bone marrow cavity, which acts as a non-collapsible vein and permits access to the central circulation.
    - 2) All fluids and medications that are administered through a peripheral IV can be administered through an intraosseous line.
2. Contraindications for insertion of an intraosseous line
  - a) An intraosseous line should not be inserted when there is a known fracture of the bone chosen for line placement, or significant trauma proximal to the site.
  - b) An intraosseous line should not be inserted when there is infection present in the leg chosen for line placement.
  - c) Insertion of an intraosseous needle should not be attempted on the same site two times, as the hole made by the attempted insertion does not close rapidly and fluid will extravasate. However, a missed IO in the proximal tibia does not preclude an attempt for an IO in the distal femur of the ipsilateral side.
  - d) IO placement is not overly painful, but infusion of fluids is quite painful. IO is often reserved for use in patients for whom severe pain is not a consequence of therapy.
3. Common Sites for Intraosseous Needle Insertion
  - a) Proximal Tibia
    - 1) The site is easily identified.

- 2) A large marrow cavity exists with no adjacent structures that are likely to be damaged.
  - 3) The site of insertion is on the flat medial surface of the anterior tibia, one to two finger breadths below and medial to the tibial tuberosity.
- b) Distal Femur
- 1) The site of insertion is midline or slightly medial to midline, approximately two centimeters above the superior to the patella.
  - 2) This site avoids epiphyseal plate (growth plate) involvement
  - 3) May be preferred in young infants whose tibias are too narrow for an IO
- c) Distal Tibia
- 1) The site of insertion is just above the medial malleolus.
- d) Proximal Humerus
- 1) Greater than 10 years old
  - 2) Internally rotate arm prior to placement
  - 3) The ideal insertion site is 1cm above surgical neck
  - 4) IO should be placed at a 45- degree angle with the humeral head
  - 5) Secure arm in order to limit potential for dislodgement
4. Equipment for Intraosseous Infusion
- a) Needles:
- 1) Either an intraosseous or bone marrow aspiration needle may be used. They are preferable because of the following:
    - (a) They may contain a trocar or stylet, which minimizes the risk of occlusion from bone marrow.
    - (b) They are shorter, sturdier and less flexible.
    - (c) They are less likely to be dislodged in transport because they are threaded and shorter.
    - (d) Some of these needles have side infusion ports within the threads so a stylet or trocar is not necessary.
    - (e) Some needle lengths can be adjusted.
- b) Other Equipment:
- 1) Placement device (this may be a powered drill or other injection aid)
  - 2) Prefer Chlorhexidine or Iodine solution - for cleaning insertion site
  - 3) 4x4 gauze pads - for cleaning and for use in applying pressure if needle is withdrawn
  - 4) Two 5 or 10 cc syringes - to aspirate bone marrow and to infuse saline
  - 5) IV solution and tubing or saline lock
  - 6) Towel (if needed) for stabilizing extremity during and after insertion of the intraosseous needle
  - 7) Commercial device to secure IO or bulky dressings and tape
  - 8) Pressure infusion bag
  - 9) Volume limiting device
  - 10) Consider lidocaine for anesthetic after placement
5. Four steps for intraosseous needle insertion
- a) Step one - Stabilize the insertion site using roll of towels for support or to prevent movement as needed
- b) Step two - Prepare the insertion site
- 1) Clean the skin with chlorhexidine or iodine solution and 4x4 gauze pads.
  - 2) Wipe in a circular motion starting at the planned insertion site and moving outward.
  - 3) Wipe the area dry with a sterile 4x4 gauze pad.

- c) Step three - Insert the needle
  - 1) Check the needle packaging and manufacturer for additional instructions. Some needles require back and forth or a clockwise motion. Some needles require a motorized driver device.
    - (a) Use aseptic technique.
    - (b) The needle should be directed in a manner that decreases the risk of insertion into the growth plate.
    - (c) Apply pressure to the top of the needle in order to push through the cortex of bone.
    - (d) A slight give or lack of resistance (“pop”) will be felt as the tip enters the marrow cavity.
    - (e) If the needle is properly inserted, it will stand without support.
  - 2) Caution: If too much pressure is applied, the needle may exit through the bone on the other side. If this occurs:
    - (a) Fluid will infiltrate into the tissue and compartment syndrome may develop.
    - (b) Remove the needle
    - (c) A site on the other leg or proximal to the missed site must be chosen for the next insertion attempt.
- d) Step four - Confirm needle placement
  - 1) Remove the stylet from the needle.
  - 2) Connect a syringe to the hub of the needle.
  - 3) Aspirate approximately 1ml of bone marrow. Marrow may not always be aspirated.
  - 4) Bone marrow aspirate can be used for various lab studies such as glucose
  - 5) 5 – 10ml of normal saline may be used to initially flush the syringe and intraosseous needle while observing for extravasation. This fluid should flush easily. If no extravasation occurs, placement is confirmed.
  - 6) For the patent IO, consider lidocaine for anaesthetic effects.
  - 7) If the needle placement cannot be confirmed, remove the needle.
  - 8) Do not attempt to re-insert the needle on the same site, as this will cause leakage of fluids from the insertion site into the surrounding tissue.
  - 9) If the needle is removed, apply pressure for 5 minutes and cover the insertion site with a sterile dressing.
- 6. Securing the intraosseous needle
  - a) Connect the IV tubing to the hub of the correctly placed needle.
    - 1) IV fluid should flow without obstruction when the needle is correctly positioned.
    - 2) IF the IV fluid is not flowing and correct insertion cannot be verified, remove the intraosseous needle and attempt insertion at another location.
    - 3) When correct insertion is confirmed, tape the tubing or use a commercial device to prevent dislodgment.
- 7. Carefully monitor the insertion site for signs of infiltration.
  - a) Remove the needle if infiltration is observed.
  - b) The needle should not be left in place for over 24 hours.
- 8. Adjusting the Rate of Infusion
  - a) IO flow rate is often slower than through an IV. Two methods may be used to increase the flow rate:
    - 1) Pressure bag inflated to 300 torr.
    - 2) A syringe with a three-way stopcock directly attached to the IV line flowing to the intraosseous needle will allow administration of fluid boluses.

- (a) Attach an empty 30 or 60ml Luer-Lok™ syringe (with the plunger depressed) to the three-way stopcock.
  - (b) Close the stopcock valve allowing IV flow to the patient and open the valve from the IV bag to the syringe.
  - (c) Withdraw the plunger to fill the syringe with the desired amount of IV fluid from the IV bag.
  - (d) Close off the flow to the IV bag and open the valve allowing fluid to flow from the syringe to the patient.
  - (e) Depress the plunger of the syringe to administer the desired amount of IV fluid to the patient.
  - (f) Repeat steps (b)-(e) above as necessary until the full amount of fluid bolus has been administered.
  - (g) Reopen the valve to the patient so that the IV continues to flow; check flow rate.
  - (h) Reassess the patient to determine need for additional fluid, repeating steps (b)-(f) above, if appropriate.
- b) Carefully monitor the amount of fluid administered to the pediatric patient to prevent fluid overload. The use of small volume IV bags (i.e., 250-500ml bags) may be helpful in this monitoring process.
  - c) A child in shock may require several 10-20ml/kg boluses of fluid (there may be indications for less fluid for the pediatric patient in cardiogenic shock, follow local protocols).
  - d) Frequent reassessments are necessary as cardiogenic shock is not easily apparent and fluid administration can be detrimental.
9. Potential Complications
- a) Potential complications from intraosseous insertion and infusion include:
    - 1) Extravasation of fluid:
      - (a) This is generally the result of improper needle placement or multiple insertion attempts.
      - (b) Collection of fluid in the tissue can lead to compartment syndrome (very rare <1%) which can lead to loss of limb
    - 2) Skin infection:
      - (a) The infection rate for intraosseous is lower than that found with intravenous cannulation.
      - (b) Osteomyelitis (very rare).
  - b) Overall, complications from intraosseous insertion and infusion are rare.

## Lesson 5: PATIENT ASSESSMENT

Upon the completion of this section, the student will be able to:

### **Cognitive objectives:**

- 5.1 Discuss the methods/techniques listed below for assessing placement of an advanced airway device and the limitations of each:
  - a. Auscultation of lung sounds and gastric sounds
  - b. End-tidal CO<sub>2</sub>, particularly waveform capnography
  - c. Chest rise; and Clinical change in condition.
- 5.2 Correlate waveform capnogram components to the respiratory cycle
- 5.3 Affiliate capnography waveform morphology with underlying patient pathophysiology
- 5.4 Address possible therapies for concerning waveform morphologies representative of hypoperfusion/ shock, bronchoconstriction, hypothermia, and poor airway seal
- 5.5 Discuss important components that must be identified by the EMT-II while taking an appropriate history from a patient, including SAMPLE and OPQRST.

### **Psychomotor objectives:**

- 5.6 Demonstrate appropriate bloodborne and airborne pathogen protective equipment the EMT-II must use when in potential exposure situations.
- 5.7 As part of an integrated approach to care, perform a patient assessment for both a medical and a trauma patient.

### **Lesson Content**

Patient assessment is performed in same manner by an EMT-II as it would be by an EMT-I. The EMT-II will incorporate experiences gained as an EMT-I and apply those to help form general impressions, identify trends, and recognize relative urgency of changes presenting during care.

Additionally, EMT-II assessment may include assessment of waveform capnography and morphology. Additional resources regarding waveform components and morphology may be found in the instructor repository.

- A. Definitions:
  1. Capnography
  2. Capnometer
  3. Capnogram
  4. End Tidal CO<sub>2</sub> (EtCO<sub>2</sub> or PetCO<sub>2</sub>)
- B. Oxygenations versus ventilation
- C. Capnography versus pulse oximetry
- D. Circulation and metabolism
- E. PaCO<sub>2</sub> vs. PetCO<sub>2</sub>
  1. Do not correlate in many pathologies
- F. Normal capnography values
  1. EtCO<sub>2</sub> 35-45 mmHg
- G. Abnormal values and wave forms
  1. EtCO<sub>2</sub> less than 35mmHg

2. EtCO<sub>2</sub> greater than 45mmHg
- H. Capnography wave form
  1. Post inspiration/dead space exhalation
  2. Start of alveolar exhalation
  3. Exhalation upstroke where dead space gas mixes with lung gas
  4. Continuation of exhalation or plateau
  5. End tidal value
  6. Inspiration washout
- I. Clinical uses of capnography
  1. Monitoring ventilation
    - a) Hyperventilation
    - b) Hypoventilation
  2. Confirming, maintaining, and assisting advanced airway placement
    - a) Continuous wave form capnography versus colorimetric capnography
  3. Measuring cardiac output during CPR
    - a) Return of Spontaneous Circulation (ROSC)
    - b) Loss of spontaneous circulation
  4. End Tidal CO<sub>2</sub> as predictor of resuscitation outcomes
  5. Monitoring sedated patients
  6. EtCO<sub>2</sub> in Asthma, COPD and CHF
    - a) "Sharkfin" morphology representative of bronchospasm
  7. Ventilation of head-injured patients may be guided by EtCO<sub>2</sub> values
  8. Perfusion warning sign
    - a) The patient with poor perfusion will have poor blood return to the lungs and correlating low EtCO<sub>2</sub> values
  9. Other issues
    - a) DKA
    - b) Alveolar compromise (collapse, overdistended, fluid accumulation)
    - c) Pulmonary embolus
    - d) Hyperthermia
    - e) Trauma
    - f) Disaster triage
    - g) Hyperventilation
    - h) Anaphylaxis
    - i) Accurate respiratory rate (less accurate when the patient is talking)
  10. Using the equipment
    - a) In-line versus sidestream analyzers
    - b) Monitor/ analyzer-specific orientation required
    - c) Analyzers are susceptible to moisture in the line
    - d) Nasal cannulas with integrated capnography may not be able to perform high flow oxygen delivery. Confirm with manufacturer product insert.

## Lesson 6: MEDICINE/ MEDICAL EMERGENCIES

At the completion of this section, the student will be able to:

### **Cognitive objectives:**

- 6.1 Differentiate conditions in which the EMT-II should provide treatment on scene, versus prioritizing limited scene times.
- 6.2 Define and describe the signs, symptoms and EMT-II management of an adult or pediatric patient with:
  - a. Altered mental status
  - b. Hypoglycemia
  - c. Hyperglycemia
  - d. Substance(s) abuse/overdose (including opioids and alcohol)
  - e. Poisoning
  - f. Stroke
  - g. Neurological emergencies
  - h. Chest pain of suspected cardiac origin
  - i. Cardiac arrest
  - j. Anaphylaxis
  - k. Acute abdominal emergencies
  - l. Obstetric emergencies
  - m. Seizures
  - n. Heat-related illness (hyperthermia)
- 6.3 Describe the management of hypotension secondary to the administration of nitroglycerin.
- 6.4 Recall the National Poison Control Center phone number: 1-800-222-1222
- 6.5 Describe the EMT-II level management of the hypothermic and/or coldwater drowning patient, per the *Cold Injuries Guidelines*.

### **Psychomotor objectives:**

- 6.6 Demonstrate assessment and appropriate management for an adult or pediatric patient experiencing a medical emergency, when given a scenario, using an integrated assessment and care approach.
- 6.7 Demonstrate assessment and appropriate management for a patient experiencing a cardiac arrest emergency, when given a scenario, using an integrated assessment and care approach.

### **Lesson Content**

Note: Supplement this material with additional documents such as the *Cold Injuries Guidelines*.

- A. Transport Decision Making: Will the patient benefit the most from scene stabilization or urgent transport?
  1. It must be considered that urgent (Lights and Sirens) transport creates significantly increased risk. (There are more than 6000 ambulance crashes every year) Often, only little time is gained, which does not justify the risk.
  2. When considering mode of transport, the needs of the patient should take precedent. Only in cases where a clear benefit to the patient is evident should this mode of transport be employed. Examples: Uncontrolled bleeding, unexplained altered mental status, or obstetric event with known complications.



3. The EMT-II should consider the risks versus the benefits in each case.
- B. Recognition and Treatment of Medical Conditions in Adult and Pediatric patients
1. **Altered Mental Status (AMS)** has many causes and widely varying treatments accordingly. All AMS must be considered to have medical cause unless proven otherwise. Patient is never “just drunk” until other causes are ruled out
    - a) Ischemic Brain Attack (Stroke)
      - 1) Most often caused by blockage of arteries supplying blood to brain (Embolus, thrombus, ischemia second to hypoperfusion)
      - 2) Hemorrhagic stroke cause by rupture of blood vessels (Subdural, Subarachnoid, Epidural, or Intracerebral)
        - (a) Often the patient describes “the worst headache of my life”
    - b) Transient Ischemic Attack (TIA)
      - 1) Symptoms of stroke with spontaneous resolution to previous state
      - 2) Often caused by clot that is broken down within
      - 3) All causes have similar symptoms
      - 4) Patient symptoms range widely from strange sensations, tastes, and smells to more extremes of paralysis of limbs or even death.
      - 5) Stroke scales are used to rate severity of stroke, discuss local protocol for which scale is used: RACE, NIH, Cincinnati etc...
      - 6) Treatment:
        - (a) Determining the time of onset is critical to determine patient’s treatment path
        - (b) Pre-hospital treatment consists of prompt treatment to a Stroke Center and supportive care.
        - (c) IV fluid should be limited to maintain BP. Rapid reduction of BP may lead to worsening ischemia if stroke is hemorrhagic in nature.
        - (d) Position patient with head between 30- and 45-degrees elevation
        - (e) Treat hypoglycemia accordingly
      - 7) Low blood glucose
        - (a) May mimic stroke symptoms
        - (b) May cause seizures
        - (c) Usually has gradual onset of symptoms
        - (d) Patient often has history of Diabetes
        - (e) Easily detectable with blood glucose meters
        - (f) Treatment per protocol with IV/IO administration of dextrose-containing fluids or solutions
          - (1) If IV/IO line is not attainable, consider Glucagon IM injection as an alternative
            - a. Slower onset of reversal of low blood sugar
            - b. May not be effective if body has already used glycogen stores from liver
      - 8) High blood glucose
        - (a) Onset of symptoms, including altered mental status, may be hours or days
        - (b) May show signs of dehydration, sunken eyes, extreme thirst, dry warm skin secondary to body attempting to regulate blood glucose by using kidneys to excrete glucose.
        - (c) Kussmaul respirations
        - (d) Fruity odor on breath (ketotic)

- (1) Treatment is to give IV fluids to support BP
- (2) Transport promptly

2. **Substance/ETOH abuse**

- a) ETOH is most common drug used in U.S. (Alaska's rate of alcoholism is 700% of U.S. national average)
  - 1) ETOH is a powerful CNS depressant and can cause depressed respiratory efforts or death
  - 2) Aspiration of vomitus is a significant danger
  - 3) Chronic use of ETOH may lead to esophageal bleeding(varices)
  - 4) Patient may be experiencing ETOH withdrawal with Delirium Tremens if withdrawal is sudden may lead to: (this is a very serious condition)
    - (a) Death
    - (b) Confusion/restlessness/combativeness
    - (c) Tremors
    - (d) Hypotension
    - (e) Seizures
    - (1) Treatment includes:
      - a. O2 via cannula
      - b. Treat hypoglycemia if found
      - c. IV of normal saline
      - d. Reassure patient to maintain orientation
- b) Substance abuse may be any substance but usually is confined to mood altering drugs
  - 1) Cannabinoids – not usually needing treatment beyond reassurance
  - 2) Stimulants
    - (a) Cocaine
    - (b) Amphetamines and Methamphetamines
    - (c) Treatment:
      - (1) IV access
      - (2) Transport to point where sedation is available if patient's symptoms worsen. (advanced EMT or Paramedic intercept or hospital/clinic)
      - (3) Patients often have hallucinations and may be combative or violent
      - (4) Be prepared to deal with hyperthermia by applying cold packs
  - 3) Opioids – CNS depressants
    - (a) Opium, Morphine, Heroin, Fentanyl
    - (b) Treatment:
      - (1) IV access
      - (2) 0.4 mg naloxone given IV push or intranasal if IV not available up to 2.0 mg total.
        - a. Rapid administration may precipitate vomiting or seizures.
        - b. Be prepared to dose patient repeatedly as naloxone will lose effectiveness over time.
        - c. Naloxone does not remove opioids; it blocks their access to receptors on the cells.
        - d. The patient is only safe after the body breaks down the opioid
  - 4) Hallucinogens
    - (a) Examples:
      - (1) LSD

- (2) Psilocybin “Magic” Mushrooms
- (3) PCP
- (4) Ketamine
- (5) Mescaline
- (b) All hallucinogens may produce a patient that:
  - (1) Stares into space
  - (2) Has slurred speech
  - (3) Makes bizarre statements
  - (4) Horizontal Nystagmus (Rhythmic twitching of the eyes)
  - (5) Staggering gait
- (c) Treatment of hallucinogens:
  - (1) Typically supportive in nature
  - (2) Be alert for combative or self-destructive behavior
  - (3) IV access
  - (4) Transport to higher level of care
  - (5) Avoid use of lights and sirens as this may cause increased anxiety
- 5) Sedatives and hypnotics
  - (a) Barbiturates
    - (1) Seizure medications
    - (2) Some sleep aids
    - (3) Anti-anxiety
  - (b) Benzodiazepines
    - (1) Striated (voluntary) muscle relaxant – typically to treat muscle spasms
    - (2) Anti-seizure treatment
    - (3) Anti-anxiety
    - (4) ETOH withdrawal
  - (c) Signs & Symptoms: Both medication types cause:
    - (1) Confusion and drowsiness
    - (2) Ataxic gait
    - (3) Slurred speech
    - (4) Unresponsiveness
    - (5) Depressed respirations and inability to protect airway
  - (d) Treatment:
    - (1) Options are limited as reversal is not possible in most EMS services
    - (2) Maintain airway and ventilation
    - (3) IV access with IV of normal saline to support BP – may require rapid infusion and repeat boluses
    - (4) Activated charcoal is shown to be effective even after 60 minutes, as it almost immediately reduces blood levels of drug
- 6) Anti-depressants
  - (a) SSRI (Selective Serotonin Re-uptake Inhibitor)
  - (b) SNRI (Serotonin and Norepinephrine Re-uptake Inhibitor)
  - (c) NDRI (Norepinephrine and Dopamine Re-uptake Inhibitor)
  - (d) Tricyclic Antidepressants
  - (e) MAOI (Monoamine Oxidase Inhibitor)
    - (1) Overdose of these drugs will create serotonin storm which may present with
      - a. Increase BP and high heart rate – mild symptoms

- b. High body temperature, increased reflexes, agitation, tremor, sweating, dilated pupils, confusion, vomiting, and diarrhea are moderate symptoms
- c. Extreme body temperature (> 106 degrees), seizure, massive muscle breakdown, and heart dysrhythmias are examples of severe symptoms. Patient may be confused and combative at this point.
- (f) Treatment is limited to supportive care
  - (1) Assure airway
  - (2) Active cooling of hyperthermic patient (Ice packs place in axillary and groin areas)
  - (3) Establish IV access and be prepared for hypotension

### 3. **Poisoning**

- a) Organophosphates - Pesticides
  - 1) Signs & Symptoms:
    - (a) Patient presents with SLUDGE,
      - (1) Salivation
      - (2) Lacrimation(tears)
      - (3) Urination (frequently and maybe uncontrollable)
      - (4) Gastric Upset
      - (5) Emesis
  - 2) Treatment:
    - (a) Monitor airway and suction as needed
    - (b) Establish IV access
    - (c) Maintain SPO2 above 94%
    - (d) Call for advanced EMT or transport promptly to hospital
- b) CO2 poisoning
  - 1) CO displaces O2 on red blood cells but give blood a “redder” appearance which will confound SPO2 sensors – Bright red skin is a late sign though.
  - 2) Most common form of poisoning encountered either by intentional or accidental reasons.
  - 3) Effects are much increased in children
  - 4) Symptoms:
    - (a) Headache/Confusion
    - (b) Vomiting
    - (c) “Roaring in my ears”
  - 5) Without an obvious cause this can be hard to diagnose. Some patient monitors now have SPO2 sensors that also monitor CO2 levels as well
  - 6) Treatment:
    - (a) Remove patient from that environment
    - (b) High flow O2 via a well fitted NRB mask
    - (c) IV access
    - (d) Keep patient quiet to minimize O2 demand
    - (e) Transport promptly – if possible send to hospital with a hyperbaric treatment option
    - (f) If CO poisoning was from some type of structure or car fire, consider concurrent cyanide poisoning
- c) Illicit Methamphetamine/Fentanyl labs

- 1) Often contain hazardous substances such as:
  - (a) Ammonia
  - (b) Red phosphorous
  - (c) Aerosolized methamphetamine or fentanyl or residues on surfaces
- 2) Safe operations would require proper PPE to protect EMT's
  - (a) Respirator
  - (b) Chemical protection suit and gloves
- 3) Remove clothing from patient and place them inside protective clothing or blankets to contain contaminants if decontamination is not feasible

#### 4. Cardiac Chest Pain (Acute Coronary Syndrome – ACS)

- a) Ischemic chest pain has two conditions that are similar in presentation. Both can be caused by Atherosclerosis (narrowing of the coronary arteries by fatty plaques) which leads to ischemia when blood flow is restricted, and cellular O<sub>2</sub> demand cannot be met.
  - 1) Angina Pectoris which is usually caused by O<sub>2</sub> demand of the heart being more than the arteries can supply (often due to physical activity or emotional upset) or Prinzmetal's Angina (this form of angina is predictable in its onset at consistent time of the day as the body cycles through the circadian rhythm, usually between midnight and 08:00. This causes arteries to constrict and decrease blood flow to the heart)
    - (a) Sub-sternal chest pain which may radiate into Left shoulder or neck
    - (b) "Crushing" sensation – often described as "an elephant sitting on my chest"
    - (c) Radiating pain may include the patient's midback or upper epigastrium
  - 2) Acute Myocardial Infarction (AMI) – infarction because cells will die if blood flow is not restored within 2-6 hours
    - (a) May be cause by emboli (clot that floated in blood stream and occluded artery, usually at the site of) or thrombus (clot that formed at site of) atherosclerosis
    - (b) Presents with the same symptoms as Angina
      - (1) Up to 30% of AMI's are "silent" because pain is not present or typical. This is more common in females and diabetic patients. Females die of heart disease more often than males, even though more males have diagnosed heart disease.
      - (2) Shortness of air, indigestion, irregular pulse, and diaphoresis may be first outward indication.
      - (3) Pain usually lasts from 30 minutes up to six hours.
      - (4) Just because pain is not present does not mean that AMI is not evolving, remain alert.
      - (5) If patient states they feel like they are going to die, believe them. This is a common occurrence. Prepare AED or seek ALS intercept.
- b) Treatment of ACS
  - 1) Angina resolves spontaneously with rest or patient may take a dose of nitroglycerin (NTG) to create resolution. If pain returns this may be AMI.
    - (a) If patient has a prescription for NTG, this would be an indicator that their condition is historically stable and a doctor is aware of their condition. The EMT should ask why the patient is concerned about this incident in particular? Is something different? Symptoms? Quality or quantity of pain? Length of episode? Treat as an AMI if necessary.

- (b) Any first-time onset of chest pain should be treated as AMI even if it has resolved on its own.
- (c) Reassurance is a therapeutic treatment.
- 2) AMI is usually only resolved by drug or surgical intervention at the hospital
  - (a) EMT's provide supportive care and prompt, but calm, transport to higher levels of care. Lights and sirens transport may significantly increase patient's level of stress
  - (b) Attempt to establish time the pain or symptoms started – this affects treatment decisions for the physicians
  - (c) Monitor pulse oximetry and vital signs – reassess often
    - (1) Pulse rate may be elevated or very slow
    - (2) BP may be elevated, but be alert for precipitous drop
  - (d) Give supplemental O2 to maintain SPO2 between 94-97%
  - (e) Establish IV access – if hypotensive, administer isotonic crystalloid in safe manner to target SBP >90
  - (f) Be aware that NTG may cause precipitous drop in patient's BP and rapid bolus may be required. It may even appear patient is pulseless until fluids are sufficient to improve BP. CPR is indicated if no pulse is detectable

5. **Cardiac arrest**

- a) May have various causes
  - 1) AMI - about 40% of AMI patients die from cardiac arrest prior to getting to the hospital
  - 2) Spontaneous arrest may happen secondary to heart defects – sometimes seen in young athletes
  - 3) In pediatric patients the most common cause is respiratory arrest – resolve respiratory arrest and cardiac arrest will often resolve more easily
- b) Treatment of cardiac arrest
  - 1) Follow BLS guidelines
    - (a) Establish pulselessness
    - (b) Begin CPR per BLS guidelines
    - (c) Earliest use of AED is recommended
    - (d) Assure airway adjunct (supraglottic airway or simple adjunct) are placed properly and achieving adequate ventilation
    - (e) Epinephrine 1mg/10ml (100mcg/ml) IVP for continued pulseless arrest in accordance with current recommended guidelines (e.g, ILCOR, Resuscitation Academy)
    - (f) ALS intercept or emergent transport to hospital for advanced medications

6. **Anaphylaxis** – allergic reaction that creates shock when allergen triggers over-release of histamine that dilate the vessels of the circulatory system and allows fluids to escape into tissues. Vessels dilate to the point of permeability

- a) Often caused by food allergies or bee stings but may be any substance the patient has encountered before. Even if they have encountered it before and had no reaction at all.
- b) Symptoms develop over seconds to minutes
  - 1) Skin may develop
    - (a) Flushing, itching, or burning over face and chest usually
    - (b) Urticaria (Hives), which may spread over wide areas of the body

- (c) Edema of face, tongue, and lips
- (d) Bluish color of lips is a late sign
- 2) Circulatory system may develop
  - (a) Severe hypotension due to vessel dilation
  - (b) Barely palpable pulses
  - (c) Dizziness or fainting
  - (d) Coma
- 3) Respiratory
  - (a) Sneezing and itching in nasal passages
  - (b) Dry cough and tightness in the chest
  - (c) Wheezing and dyspnea
  - (d) Secretions blocking airways
  - (e) Constriction of airways leading to forced exhalation
  - (f) Respiratory arrest
- c) Treatment
  - 1) Remove allergen if safe to do so
  - 2) Assure working airway and supplemental O2 as needed
  - 3) Administer epinephrine via
    - (a) autoinjector or
    - (b) withdraw 0.3-0.5mg of Epinephrine (concentration 1mg/ml) from a vial or ampoule and administer IM
  - 4) Vastus Lateralis or Lateral Deltoid are preferred sites due to accessibility and blood flow to these large muscle groups
  - 5) A second dose of Epinephrine may be required, though this is infrequent
  - 6) Establish 2 large bore IV's and rapidly infuse Normal Saline to stabilize BP if patient is hypotensive
  - 7) Position patient in upright position to protect airway if possible, and if hemodynamically stable to tolerate repositioning

## 7. Neurological Emergencies

- a) Headache
  - 1) Migraine headache is usually due to size changes in vasculature of the brain. Pain is described as pounding or throbbing or pulsating.
    - (a) May last for days
    - (b) Patient is usually aware of their condition
  - 2) Cluster headache is similar to migraine in cause but often begin with pain around one eye which progresses with increased intensity and pain on one side of the face. This is accompanied by anxiety.
  - 3) Sinus headache may be severe
    - (a) Pain and pressure behind both eyes. Pain usually in upper part of face/head
    - (b) Patient may feel dizziness upon movement of head
  - 4) Simple headache – typically not a serious condition, but patient should be observed closely to assure there is no progression.
  - 5) Meningitis may cause headache as well; this is likely only detected by a high level of suspicion on the EMT-II's part. As this is typically caused by infection, the EMT-II should treat patient as infectious and use appropriate PPE.
    - (a) May be bacterial or viral
    - (b) Often presents with slow onset over hours

- (c) Patient may have current history of significant or extended exertion such as travel or physical efforts such as a skiing trip or similar activities
- (d) This is a life-threatening condition and requires immediate transport to higher levels of care
- 6) Treatment of headache
- 7) Monitor patient's vital signs – watch for changing Level of Consciousness (LOC)
  - (a) Most patients prefer quiet and dark environments
  - (b) Anticipate vomiting and consider ondansetron under consultation from medical direction
- b) Seizures
  - 1) May be caused by many issues and have many presentations
    - (a) Unknown genetic causes - epilepsy
    - (b) Hypoxia – often seen during initial phase of cardiac arrest
    - (c) Hypoglycemia
    - (d) Infection
    - (e) Traumatic Brain Injury (TBI) of current or previous nature (even years before) which may have created scar tissue
    - (f) CVA
    - (g) Drug Overdose
    - (h) Hyponatremia
    - (i) Heat stroke
  - 2) Three categories of seizures- each type has variation in presentation and severity.
    - (a) Generalized Seizures (Tonic-clonic or *Grand Mal*)
      - (1) Often preceded by an “aura” – a strange taste of smell or other strange sensation
      - (2) Patient loses consciousness and proceeds to have full body contraction (tonic phase) and alternating rhythmic jerking of extremities (clonic phase)
      - (3) Activity may last several minutes and then progress to “post-ictal” phase in which patient is often very sleepy and disoriented.
      - (4) Beware – these patients can become very combative
      - (5) Observe patient closely for signs of returning seizure activity. Two seizures in a row without an intervening period of lucidity is considered “status epilepticus” and requires treatment and transport to hospital.
      - (6) Treatment of Generalized Seizures
        - a. Assure patient does not injure themselves on objects in area. (Do not attempt to restrain patient)
        - b. Assess blood glucose level and treat for hypoglycemia
        - c. If possible, establish IV access.
        - d. Be prepared to support airway and breathing if patient does not recover on their own. Suction may be indicated after the seizure has ceased.
        - e. If seizure activity does not relent, immediate transport to ALS intercept or hospital is indicated.
        - f. Even if no outward seizure activity is visible, there may be continuing activity, and this can cause brain damage
    - (b) Absence Seizures (Formerly known as *Petit mal*)



- (1) Characterized by “absence” spells where patient may stop moving, is unaware of their surroundings. Lip smacking or eye blinking are common. Patient may lose control of motor function.
- (2) Most common in children between 4 -12 years of age, rarely found in patients beyond 20 years old.
- (3) Patient will return to normal level of consciousness spontaneously
- (c) Partial (Focal) seizures- 2 Types
  - (1) Simple partial seizure
    - a. Also referred to as focal-motor seizure
    - b. Characterized by tonic-clonic activity localized to one part of the body
    - c. Activity may spread to include full body
    - d. No aura and patient may return to full consciousness without post-ictal phase.
  - (2) Complex-partial seizure
    - a. Also referred to as temporal lobe or psychomotor seizure
    - b. Presents as changes in behavior or mood. (May include bouts of rage)
    - c. Often preceded by an aura
    - d. Patient often returns to normal behavior after 1 to 2 minutes

## 8. Acute Abdomen

- a) Assessment
  - 1) Abdominal Pain is a common complaint and is often not life threatening.
  - 2) Thorough assessment is required to detect serious conditions
    - (a) Remember to listen for bowel sounds before palpating abdomen
    - (b) Obtain OPQRST and
    - (c) Palpate abdomen if indicated, but do not continue to elicit pain if it will not change the course of therapies by the EMT-II
  - 3) Nausea, vomiting, and diarrhea are often present
    - (a) Interview the patient for history of blood present in the urine, stools, or vomit
- b) Causes: It can be difficult to discern source of problem in the field
  - 1) Gastroenteritis
    - (a) Bacterial or viral infection often caused by eating contaminated food
    - (b) Typically has gradual onset and lasts 2-3 days
    - (c) Not typically life threatening, but dehydration may be present
  - 2) Gastric ulcers – often the result of H. Pylori infection
    - (a) Alcohol, smoking, and continuous use of NSAIDs may worsen condition
    - (b) If the patient indicates that they have blood in their vomit or dark tarry stools, this condition may be life-threatening
    - (c) Pain is typically in mid-upper epigastrium
  - 3) Esophageal varices and esophagitis
    - (a) Lining of esophagus is eroded by stomach acids, infection or ETOH abuse
    - (b) Patient may describe heartburn
    - (c) Potential for critical bleeding
  - 4) Gallstones
    - (a) Gall ducts become blocked and cause significant pain
    - (b) If stone(s) do not pass, gallbladder may rupture which irritates diaphragm and bowel.
    - (c) Danger of infection and peritonitis
    - (d) Presents as pain in Right Upper Quadrant (RUQ)

- 5) Appendicitis
    - (a) Infection and inflammation of appendix
      - (1) Characteristically has pain in Right Lower Quadrant (RLQ)
      - (2) Rebound tenderness is a classic quality
      - (3) Heel strike may also be used to evaluate pain
      - (4) Infection from ruptured appendix will cause peritonitis
  - 6) Pancreatitis
    - (a) Considered a very serious condition
    - (b) Often caused by ETOH abuse
    - (c) May be caused by gallstones
      - (1) May present with severe pain in both upper quadrants
      - (2) Pain may radiate into back
    - (d) Complications such as sepsis or hemorrhage are common
  - 7) Diverticulitis
    - (a) Pouches form in the lining of small intestines
      - (1) Typically presents as pain in Lower Left Quadrant (LLQ)
      - (2) Usually accompanied by signs of infection such as fever, nausea, and diarrhea
      - (3) Bleeding is not common with this condition, but small bowel obstruction is.
  - 8) Urinary Tract Infection
    - (a) Infection develops when the normal flora of the skin enters the urinary tract
    - (b) More common in females secondary to shorter urethra
    - (c) Infection often produces foul-smelling urine
    - (d) Untreated infection may lead to kidney infection (Pyelonephritis)
    - (e) Patient may become septic if infection is not managed
  - 9) Kidney Stones
    - (a) Crystalline stones are formed from various substances such as calcium or uric acid. Stones are typically from 3mm up to 12 mm in size
    - (b) Stone may migrate from the kidney into the ureter and cause substantial pain
    - (c) Patient often describes pain as “an 11” on a scale from 1 to 10
    - (d) Pain may temporarily subside but will likely come back as stone moves along ureter.
    - (e) Stones may have to be surgically removed if they are too large to pass
  - 10) Gynecological Emergencies
    - (a) Women experience widely varying levels of pain during normal menses, but they are generally very cognizant of differences indicating something is wrong
    - (b) Pelvic Inflammatory Disease (PID) is a common infection and can be very painful and can be accompanied by a high fever.
      - (1) Patient typically reports a foul-smelling discharge
    - (c) Ovarian cysts rupture and cause extreme pain in lower abdomen
      - (1) Rapid onset of pain without fever or discharge is indicative that this is not PID
      - (2) Bleeding into pelvis causes pain and patient often is resistant to lying flat.
- c) Treatment of Acute Abdomen
- 1) Oxygen may help patient feel less nauseous
  - 2) Establish IV Access and administer IV fluids if needed for dehydration or shock
  - 3) 4-8mg ondansetron for nausea
  - 4) Transport in position of comfort

## 9. Heat Emergencies

- a) Hot and humid environments which are often combined with exertion can lead to the body's ability to regulate its temperature
- b) Sweating can cause the loss of 1 liter of fluid per hour and may cause significant change in levels of electrolytes
- c) Patient may develop one or all of 3 problems associated with heat
  - 1) Heat cramps
    - (a) Generally experienced in lower abdomen and legs
    - (b) May occur due to vigorous exercise in a hot environment
    - (c) Treated with
      - (1) Cooling and rest.
      - (2) Oral fluids are generally preferable especially if they contain diluted electrolytes
      - (3) O<sub>2</sub> may be helpful
  - 2) Heat Exhaustion
    - (a) The most common illness associated with heat
    - (b) Result of loss of fluids and electrolytes
    - (c) May occur without high temperatures if patient is wearing multiple layers of clothes and exerting themselves.
    - (d) May be an increase in patient's temperature up to 104° F
    - (e) Symptoms of dehydration
      - (1) Increased heart rate
      - (2) Orthostatic hypotension
      - (3) Patient may experience neurological symptoms with weakness or confusion
    - (f) Treatment includes
      - (1) High flow O<sub>2</sub> may be helpful
      - (2) Cooling patient/removing from hot environment
      - (3) Swab patient with cool moist cloths or mist with cool water
      - (4) If patient can tolerate it, oral fluids are recommended – observe closely for nausea and slow or cease oral intake
      - (5) If patient shows signs of poor airway control establish IV access and give bolus of 20ml/kg of Normal Saline
  - 3) Heat Stroke
    - (a) Least common heat illness but most serious
    - (b) The body has lost all ability to regulate its internal temperature and death is imminent if conditions are not changed
    - (c) May develop in hot humid environments with poor ventilation
      - (1) Elderly patients that cannot afford air conditioning
      - (2) Children left in cars
      - (3) Industrial environments (e.g., engine rooms, boiler rooms)
    - (d) Patient presents with
      - (1) Behavioral changes (may be first indication)
      - (2) Body temperature of 104° F or higher
    - (e) Condition quickly leads to brain damage if not treated aggressively
      - (1) Treatment focus is on rapid, immediate cooling whichever way is fastest:

- a. Move patient out of hot environment/turn ambulance A/C on full blast
- b. Place cool packs in patient's axillary space, groin, and around neck
- c. Cover patient in wet towels or mist patient with cool water
- d. Support respiration as required
- e. High flow O<sub>2</sub> via NRB as indicated
- f. Establish IV access and administer fluid therapy if needed to maintain SBP >90mmHg.
- g. Rapid transport is indicated to nearest facility or ALS intercept for treatment of possible seizures

10. **Obstetric Emergencies** – This can be one of the more stressful calls that any medical provider encounters. It is recommended that the EMT-II take special care to remain proficient at recognizing and treating these emergencies as the outcome is often emotional, whether a good or bad outcome occurs.

Also Note: It is almost always indicated to transport a pregnant woman in the left lateral recumbent position to avoid the weight of fetus and uterus compressing the patient's inferior vena cava, diminishing blood return to the heart. This condition is known as Supine Hypotensive Syndrome and may have serious effects on fetus and mother. If transport in left lateral recumbent position is not favorable, right lateral recumbent is acceptable and will have similar benefits.

- a) Antepartum: Normal length of pregnancy is 36-40 weeks
  - 1) Ectopic Pregnancy
    - (a) One of the earliest emergencies in pregnancy– within weeks of conception
    - (b) Egg implants in the fallopian tube or other site outside of the uterus and begins to grow
    - (c) Patient may or may not have “spotting,” but will have severe abdominal pain
    - (d) As fetus grows it forces surrounding tissues to tear and eventually rupture
    - (e) There will be significant bleeding, but it may be internal only.
    - (f) There may be profound shock
    - (g) This is the most life-threatening emergency in the first trimester
      - (1) Fetus is not viable and has to be removed
      - (2) Surgical repair is required to stop internal bleeding
    - (h) Treatment of Ectopic Pregnancy
      - (1) Emotional support for the mother
      - (2) Oxygen to support SpO<sub>2</sub> between 94-97%
      - (3) Establish IV access – prepare to give isotonic crystalloid as needed to support BP
      - (4) Rapid transport to hospital or ALS intercept
  - 2) Premature contractions
    - (a) are not uncommon – especially in the third trimester
    - (b) Often caused when patient gets dehydrated –
      - (1) fluid replacement usually forestalls further development.
      - (2) This can be accomplished orally most times, if not an IV of isotonic crystalloid may be required to return mother to homeostasis
    - (c) May be caused by infection in vagina or urinary tract –
      - (1) Antibiotics are effective means of ending premature contractions

- (2) Oral antibiotics are slower, but can have positive effects
  - (d) If contractions continue patient should be taken to higher level of care that may need to use medications to slow or arrest contractions.
  - (e) Additional Treatment:
    - (1) Oxygen therapy is sometimes helpful
    - (2) Transport patient in left lateral recumbent position
- 3) Pregnancy Induced Hypertension (PIH) or Pre-eclampsia
  - (a) Pregnancy related hypertension
  - (b) This generally develops at greater than 20 weeks' gestation and is indicated if BP is >140 systolic or >90 diastolic
  - (c) Additional signs and symptoms include:
    - (1) Patient may present with swollen face, hands, and feet
    - (2) Headache is common finding
    - (3) Nausea, vomiting, and anxiety may also be present
  - (d) Condition is serious as it may cause mother to have seizures (Eclampsia) or CVA
  - (e) Seizures may extend to status seizures and fetus may suffer hypoxia as mother's SPO<sub>2</sub> levels fall
  - (f) Treatment of PIH/Eclampsia
    - (1) Maintain calm atmosphere
    - (2) Avoid bright lights and loud noises
    - (3) Monitor and support SpO<sub>2</sub>
    - (4) Establish IV access
    - (5) If patient seizes, assure that she does not injure herself
      - a. Aggressively attempt to maintain or establish airway
      - b. Immediate transport to higher level of care is required.
- 4) Eclampsia also presents in the post-partum stage
  - (a) ~20% of Eclampsia cases are post-partum and ~90% of those occur within the first week, though they may occur as late as four weeks after delivery
  - (b) Symptoms are the same as prenatal Eclampsia
- 5) Spontaneous abortion is common in first trimester
  - (a) Any pregnancy that terminates before 20 weeks' gestation is considered an abortion regardless of cause
  - (b) Patient will present with vaginal bleeding and may pass placenta and fetus
  - (c) Patient may not express any physical pain, or she may have significant pain
  - (d) Bleeding will usually stop once products of conception have passed
  - (e) Fetus is generally considered non-viable in this time frame
  - (f) Patient must be seen by a physician to assure that there are no retained products of conception or serious infection may occur
  - (g) Treatment of Spontaneous abortion
    - (1) Emotional support for the mother
    - (2) Oxygen to support SpO<sub>2</sub> between 94-97%
    - (3) Establish IV access – prepare to give bolus of isotonic crystalloid to support BP if patient is in hemorrhagic shock
    - (4) Retain all products of conception
- 6) Third Trimester Bleeding
  - (a) Often caused by Placenta Previa or Abruptio Placenta
  - (b) EMT-II should be very concerned and attempt to answer the following questions:

- (1) When did bleeding start?
- (2) What activity was patient involved with at the time? (active or at rest?)
- (3) How much blood has she lost? (e.g., How many pads are soaked?) Note that blood loss is very difficult to accurately measure
  - a. Evaluate for orthostatic hypotension if safe to do so
- (4) Is patient having any pain? Use OPQRST mnemonic
- (c) Treatment is the same for all causes, thus defining a diagnosis is unnecessary, but having the information ready to tell the receiving facility will allow them to prepare
- (d) Treatment:
  - (1) Rapid transport in left lateral recumbent position
  - (2) Administer 100% O<sub>2</sub> via NRB if indicated
  - (3) Two large bore IV lines recommended and administer isotonic crystalloid as needed to maintain SBP >90
  - (4) Do not attempt to examine the women and do not pack vagina with trauma pads
  - (5) Use loosely placed trauma pads over vagina to attempt to slow/stop the bleeding
- b) Intrapartum and Postpartum- Care of the new-born infant (neonate):
  - 1) Temperature – Immediately dry and stimulate the baby using a clean cloth. Often attempts to simply clean off amniotic fluid and meconium is enough stimulation. Keep baby warm, this is often accomplished with skin to skin contact with the mother, and cover baby as well as possible
  - 2) Airway – depending on gestational age you may have to completely supplement baby's breathing or only supply oxygen briefly. Examine airway quickly to determine if there are blockages and correct them by suction if necessary
  - 3) Breathing- Normal oxygen saturation in a newborn is very different. Oxygen should only be used if levels are lower than (minutes of life):
    - (a) 1 min 60-65%
    - (b) 2 min 65%-70
    - (c) 3 min 70% -75
    - (d) 4 min 75% - 80
    - (e) 5 min 80% -85
    - (f) 10 min 85% - 90
  - 4) Bleeding – neonates cannot tolerate the loss of more than a few milliliters of blood. Assure there is no bleeding from umbilical cord
  - 5) Delivery prior to 36 weeks is considered "premature"
  - 6) Infants born prematurely may have a plethora of problems
    - (a) Infants below 28 weeks will likely have respiratory issues since lung surfactant may not be present.
    - (b) Due to small size neonate will often deliver precipitously
    - (c) More prone to cold stress than larger infants because they have not developed brown body fat to insulate and draw energy from
      - (1) Treatment of premature infant
        - a. Sugar – Provide some means of nutrition If the patient can suckle a commercially prepared solution may be used. (e.g. Sweet-eze) or allow baby to nurse from mother, but this is not as fast a remedy for hypoglycemic state.

- b. If baby is too depressed to suckle, IV should be established and size appropriate dose of D10% given.
  - c. Temperature – Immediately dry and stimulate the baby. Keep baby warm, this is often accomplished with skin to skin contact with the mother, and cover baby as well as possible
  - d. Airway – depending on gestational age you may have to completely supplement baby’s breathing or only supply oxygen briefly. Examine airway quickly to determine if there are blockages and correct them by suction if necessary
  - e. Bleeding – neonates cannot tolerate the loss of more than a few milliliters of blood. Assure there is no bleeding from umbilical cord
- c) Endocrine disorders of pregnancy or in infants
  - 1) Patient may also develop gestational diabetes during the pregnancy which can cause problems with the fetus at delivery due to exaggerated growth causing baby to be larger than the birth canal.
  - 2) Carnitine palmitoyltransferase 1A(CPT1A) is more common in Alaskan infants than general population (Arctic variant)
  - 3) For either of these conditions, baby may be born in hypoglycemic state or be unable to maintain a euglycemic state
    - (a) Secondary to hypoglycemia, neonate may not spontaneously breathe
    - (b) Also, neonate will have less ability to regulate body temperature as cells have no glucose the generate heat during cellular respiration
    - (c) Treatment of hypoglycemic neonate
      - (1) If mother is diabetic, she may have used all her available glucose in the delivery. Be prepared to treat her hypoglycemia with dextrose-containing solutions per protocol
      - (2) For the depressed hypoglycemic neonate
        - a. If baby is too depressed to suckle, IV/IO should be established and size appropriate dose of D10% given.
      - (3) For the vigorous neonate or for ongoing nutrition– allow baby to nurse from mother, but this is not as fast of a remedy for hypoglycemic state. If the patient can suckle 5ml/kg of D5W or a commercially prepared solution may be used.
  - 4) Treatment: Remember that what very is good for the mother is good for the baby
    - (a) Maintain SpO<sub>2</sub> between 94-97%
    - (b) If patient requires transport on spine board or vacuum mattress raise left side of device 30° to avoid pressure on mother’s vena cava
    - (c) Large bore IV access recommended and administer IV fluids as indicated to maintain SBP >90
- d) Complications of Delivery
  - (a) The vast majority of deliveries are normal and uneventful, but the EMT-II must be prepared for many other possibilities. Any of these situations may result in a depressed neonate that requires additional resuscitation and/ or a maternal shock or physiologic distress. The EMT-II will need to be conscientious of the risk of maternal and fetal decompensation.
  - (b) To determine potential for high-risk delivery, determine:

- (1) Access to prenatal care- patients with poor access to prenatal care may present with a variety of undiagnosed complications such as low or high birth weight, placenta previa, or other fetal stressors.
  - (2) Social factors surrounding pregnancy- Malnutrition affects the baby's healthy weight and growth. Be astute to the woman who may be hiding a pregnancy (e.g., clothing choices or vague answers) due to fear of abuse or assault and ask questions privately.
  - (3) Illicit drug use during pregnancy, which can affect fetal viability and vigor upon delivery.
- (c) Evaluate for the potential complications of delivery below. Evaluation of, or assistance with, a normal or complicated delivery is no different for the EMT-II than for an EMT-I.
- (1) Prolapsed cord
  - (2) Treatment:
    - a. Evaluation of, or assistance with, a complicated delivery involving a prolapsed cord is not different for the EMT-II than for an EMT-I.
- (d) Breech Presentation
- a. Fortunately, this delivery generally develops slowly. It is possible that neonate can pass in breech position. Evaluation of, or assistance with, a complicated delivery involving breech presentation is not different for the EMT-II than for an EMT-I.
- (e) Limb Presentation – typically only one arm or leg
- (1) Evaluation of, or assistance with, a complicated delivery involving a limb presentation is not different for the EMT-II than for an EMT-I.
- (f) Uterine Rupture
- (1) Life-threatening to mother and fetus
  - (2) Patient typically has had previous Cesarean section
  - (3) Patient may describe having very strong contractions which suddenly stop
  - (4) Patient will describe extreme abdominal pain secondary to peritonitis from bleeding within the abdomen. Abdomen may become rigid
  - (5) EMT-II may be able to palpate body parts of fetus – being able to feel definitive parts is not usually possible.
  - (6) Patient will begin to exhibit signs of shock
  - (7) Treat patient for shock
- (g) Postpartum Hemorrhage
- (1) Life-threatening to mother
  - (2) Normal blood loss after delivery is 150 ml. More than 500 ml is considered postpartum hemorrhage.
  - (3) Attempt deep massage over the uterus continuously until bleeding resolves and/ or the uterus becomes firm, like a grapefruit
  - (4) Place newborn on mother's breast which may stimulate release of hormone that can cause uterus to contract and tamponade bleeding
  - (5) Rapid transport may be required if bleeding is significant
  - (6) Do not attempt to examine the vagina or pack it with any dressing.
  - (7) External dressings can be applied to control vaginal/perineal tears
  - (8) Administer O<sub>2</sub> as indicated
  - (9) Initiate two large bore IV lines and administer isotonic crystalloids as needed to support SBP >90



- (h) Prolapsed Uterus
  - (1) May occur after rapid delivery or if there is any pulling upon umbilical cord prior to delivery of placenta
  - (2) Treatment includes:
    - a. One attempt may be made to use the palm (not the fingers) of one hand to push uterus back in. (Fingers may cause a tear and possibly massive bleeding)
    - b. If replacement is not possible, cover uterus with moist dressings and transport promptly
- (i) Pulmonary Embolism is a blockage of the pulmonary arteries caused by:
  - (1) Embolus that forms in pelvis during childbirth
  - (2) Air entering an open vessel
  - (3) Amniotic fluid entering blood stream
  - (4) Water entering vagina after a water birth
  - (5) Signs and Symptoms:
    - a. Patient will present with sudden dyspnea, tachycardia, and hypotension after delivery
    - b. Patient may complain of sudden onset of chest or abdominal pain
    - c. Patient may have syncope
  - (6) Treatment is the same as for non-pregnant patient with pulmonary embolism
    - a. High flow O<sub>2</sub> or BVM may be required
    - b. Establish IV Access
    - c. May progress to cardiac arrest quickly
- (j) Spina Bifida is a defect in which parts of spinal cord develop outside the body
  - (1) Cover exposed sections of cord with moist dressings to prevent infection
  - (2) Take care not to cool the baby too much with moist dressings
  - (3) Warm baby by placing against mother's skin if possible or a team member's skin if necessary
- (k) Traumatic Injury
  - (1) A pregnant woman that has been involved in traumatic incident should be strongly encouraged to seek medical assessment at a facility. Trauma to the mother may have profound effect on fetus which cannot be assessed in the pre-hospital environment.
  - (2) Common causes of traumatic injury
    - a. Fall- patient's center of gravity has changed drastically, and falls are common
    - b. Domestic abuse/ Non-accidental trauma – This is the most common cause of trauma for the pregnant patient.
    - c. Have a high level of suspicion if patient is not forthcoming about the nature of the injury.
    - d. Often the patient has been pushed, or punched/ kicked in lower abdomen
    - e. MVC's – improperly worn seatbelts may cause significant injury to fetus
  - (3) Assess:
    - a. ABC's

- b. Careful examination of abdomen for bruising, seat belts marks, or signs of trauma
- c. Palpation may reveal unusual fetal position, easily palpated fetus (which might indicate uterine rupture), or inability to palpate fetus/uterus at all
- d. Expose vagina to check for bleeding or signs of trauma
- e. Remember that mother may be able to compensate due to increased blood volume, but this may rob the fetus of perfusion. Be astute for subtle and early signs of shock.

## Lesson 7: SHOCK AND RESUSCITATION

At the completion of this section, the student will be able to:

### **Cognitive objectives:**

- 7.1 Define and explore etiologies of shock with greater depth and breadth than EMT-I knowledge and understanding, including pediatric and geriatric presentations.
- 7.2 Discuss management of a shock patient by the EMT-II, including treating the cause, oxygenation, administration of IV/IO fluids, and warmth.

### **Psychomotor objectives:**

- 7.3 Demonstrate management of a shock patient by the EMT-II, including treating the cause, and providing oxygenation, administration of IV/IO fluids, and warmth as needed.

### **Lesson Content**

- A. Shock
  1. Definitions
    - a) Perfusion is the passage of blood and oxygen and other essential nutrients to the body's cells
      - 1) While delivering these essentials to the body's cells, the circulatory system is also removing waste such as carbon dioxide from the cells
    - b) Shock is a state of systemic hypoperfusion, or inadequate perfusion of blood through body tissues which leads to anaerobic metabolism, hypothermia, and acidosis.
      - 1) Hypoperfusion can lead to death if not corrected
  2. Tissue Hypoperfusion
    - a) Inadequate fluid volume
    - b) Inadequate pump
    - c) Inadequate container size
  3. Physiologic Response to Shock
    - a) Cellular
      - 1) Fick principle
      - 2) Waste removal
      - 3) Aerobic metabolism/glycolysis
      - 4) Anaerobic metabolism
    - b) Sympathetic nervous system and endocrine implications
- B. Categories of Shock
  1. Compensated shock
  2. Decompensated shock
  3. Irreversible shock
- C. Specific Types of Shock
  1. Hypovolemic
    - a) Hemorrhage
      - 1) Classifications
        - (a) hemostasis
        - (b) vascular phase
        - (c) platelet phase
        - (d) coagulation phase

- (e) tension lines
      - (f) factors affecting clotting/coagulation
    - b) Non-hemorrhagic fluid loss
      - 1) dehydration
      - 2) third spacing
      - 3) insensible loss (perhaps this is just dehydration)
      - 4) large burns
  - 2. Distributive
    - a) Neurogenic
      - 1) High spinal cord injury will be accompanied by paralysis/paresis and or dysesthesia.
    - b) Anaphylactic
    - c) Septic
      - 1) search for sources of infection e.g. UTI, skin, lungs
    - d) Psychogenic (vasovagal)
  - 3. Cardiogenic
    - a) Intrinsic causes -- heart muscle damage
      - 1) physiology
      - 2) signs/symptoms
      - 3) assessment
      - 4) management
    - b) Extrinsic causes
      - 1) cardiac tamponade
      - 2) tension pneumothorax
      - 3) Pulmonary embolism
- D. Complications of Shock
1. Multiple Organ Dysfunction Syndrome (MODS)
    - a) Sepsis
    - b) Death of organs
    - c) Death of organism
  2. Acute Respiratory Distress Syndrome (ARDS)
  3. Trauma mortality triad (acidosis, coagulopathy, hypothermia)
- E. Patient Assessment
1. Scene size-up
  2. Perform a primary assessment
  3. Obtains a relevant history
  4. Perform a secondary assessment
  5. Perform a reassessment
  6. Shock index
    - a) heart rate divided by systolic blood pressure. Values over 0.7 should prompt a suspicion for shock though may be due to pain, anxiety or fever.
- F. Management
1. Control external bleeding and/ or consider pelvic wrap
  2. Provide spinal motion restriction if indicated
  3. Comfort, calm, and reassure the patient
  4. Do not give food or drink
  5. Provide airway control as indicated
  6. Breathing
    - a) Assist ventilation, as needed

- b) Oxygen administration
  - 7. Circulation
    - a) Attempt to control obvious external bleeding.
    - b) Apply pelvic binder or splint long bones as indicated
    - c) Patient positioning
    - d) Keep patient warm - attempt to maintain normal body temperature.
  - 8. Begin transport at the earliest possible moment. Trauma patients cannot be treated in the field.
  - 9. Do not stay on-scene to start IVs in a case of hemorrhage or surgical emergency; this can be done *en route*
  - 10. Fluid resuscitation including permissive hypotension
  - 11. Administer TXA as indicated, *en route* preferred
  - 12. Treat or stabilize any additional injuries that might be present
  - 13. Passive leg raise to determine need for additional fluid resuscitation, if not contraindicated by mechanism (i.e., head trauma, significant chest trauma)
- G. Age-Related Variations
- 1. Pediatrics
    - a) Common causes of shock
      - 1) Trauma
      - 2) Fluid loss
      - 3) Neurological injury
      - 4) Anaphylaxis
      - 5) Heart disease
      - 6) Infection
    - b) Presentation
      - 1) Mental status
      - 2) Skin signs
      - 3) Cardiovascular
      - 4) Decreased fluid output
      - 5) Vital signs
    - c) Anatomic and physiologic implications
      - 1) Unreliable indicators
      - 2) Indicators of shock
        - (a) tachycardia for age
        - (b) weak distal pulses
      - 3) delayed capillary refill time
      - 4) cool mottled extremities
      - 5) altered mental status
    - d) Management
      - 1) Control bleeding
      - 2) Provide spinal motion restriction
      - 3) Suction, as needed
      - 4) Oxygen therapy
      - 5) Positioning
      - 6) Maintain body temperature
      - 7) Fluid replacement
      - 8) Transport
  - 2. Geriatrics

- a) Assessment
  - 1) Body system changes affecting presentation of shock
    - (a) nervous system
    - (b) cardiovascular
      - (1) difficulty tolerating hypotension from hemorrhage
      - (2) beta-blocker and calcium channel blockers can alter physiologic response to shock
    - (c) respiratory
    - (d) integumentary
    - (e) renal
    - (f) gastrointestinal
  - 2) Vital sign variations
    - (a) altered mental status
    - (b) sudden onset
    - (c) other causes
    - (d) hypoxia
  - 3) Airway
    - (a) decreased cough reflex
    - (b) cervical arthritis
    - (c) loose dentures
  - 4) Breathing
    - (a) higher resting respiratory rate
    - (b) lower tidal volume
    - (c) less elasticity/compliance of chest wall
  - 5) Circulation
    - (a) Higher resting heart rate
    - (b) Irregular pulses
  - 6) Skin
    - (a) dry, less elastic
    - (b) cold
    - (c) fever, not common
    - (d) hot
- b) Management
  - 1) Control bleeding
  - 2) Provide spinal motion restriction
  - 3) Suction, as needed
  - 4) Oxygen therapy
  - 5) Positioning
  - 6) Maintain body temperature
  - 7) Suspect sepsis or non-hemorrhagic fluid loss in the geriatric patient with undifferentiated shock.
- c) Transport

## **Lesson 8: TRAUMA**

### **Cognitive objectives:**

8.1 Describe the signs, symptoms, and management of a patient with head trauma.

### **Psychomotor objectives:**

8.2 Demonstrate assessment and integrated EMT-II level management of a simulated or hypothetical multi-system trauma patient.

### **Lesson Content**

- A References: current NASEMSO National Model EMS Clinical Guidelines; Tranexamic Acid Medication Reference
- B. Appropriate care will reflect recommendations in the current NASEMSO National Model EMS Clinical Guidelines
  - 1. With the addition of tranexamic acid for noncompressible hemorrhage with indication of shock:
    - a) If safely indicated by mechanism and presentation
    - b) Dose and delivery route may differ based on local protocols
    - c) TXA administration is also covered in SHOCK AND RESUSCITATION

## APPENDIX

### SUBCUTANEOUS (SQ) & OBTAINING BLOOD FOR LABORATORY ANALYSIS

#### Cognitive Objectives:

Describe the layers of the skin, as they relate to the practice of medication injection

#### Psychomotor objectives:

Demonstrate the proper technique for the SQ and IM routes.

Demonstrate drawing of blood samples during or after placing an IV (*Determine local facility's protocol for accepting blood samples.*)

Demonstrates drawing blood with a vacuum system needle (not with IV start)

#### Lesson Content

- A. Integumentary System (Skin)
  - 1. Structures
    - a) Epidermis
    - b) Dermis
    - c) Subcutaneous layer
  
- B. Obtaining blood for laboratory analysis
  - 1. Has blood tubes ready to receive sample
  - 2. Knows that tubes should be rocked gently, immediately, after they are filled to mix additives in tube into sample.
  - 3. If drawing during placement procedure:
    - a) Occludes catheter end to avoid blood spillage
    - b) Uses small syringes and does not draw too quickly (Avoids hemolysis of blood cells)
    - c) Places drawn blood quickly into tubes
  - 4. If drawing from existing IV catheter:
    - a) May require placement of a tourniquet
    - b) Knows to discard 5 ml of blood to avoid skewing lab results
  
- C. Subcutaneous Injections
  - 1. A subcutaneous injection is given in the fatty layer of tissue just under the skin.
  - 2. These injections are given because there is little blood flow to fatty tissue, and the injected medication is generally absorbed more slowly.
  - 3. Since the skin is the body's first defense against infection, it must be cleansed thoroughly before a needle is inserted.
  - 4. Procedure:



- a) Cleanse the skin in a circular motion using an alcohol swab. Begin at the center of the site and progress outward. This motion moves bacteria away from the injection site. Allow the alcohol to dry completely either by air or by using a sterile 2x2 gauze.
- b) Giving the injection
  - 1) Ensure that you are using proper personal protective equipment and considerations are made for body substance isolation
  - 2) Take the cover off the needle. Be careful not to contaminate the needle. Place the cover on its side.
  - 3) Hold the syringe in one hand like a pencil or a dart.
  - 4) Grasp the skin between the thumb and index finger.
  - 5) Quickly insert the needle all the way into the skin. Do not press down on the top of the plunger while piercing the skin and inserting the needle.
  - 6) Insert the needle at a 45-degree angle. This angle is important to ensure that the medication will be injected into the fatty tissue.
  - 7) After the needle is completely inserted into the skin, release the skin that you are grasping.
  - 8) With your free hand, grasp the syringe near its base to stabilize it.
  - 9) Inject the medication at a slow, steady rate. Medication should be injected within 5 seconds.
  - 10) As the needle is pulled out of the skin, gently press a 2x2 gauze onto the needle insertion site. Applying gently pressure over the site while removing the needle prevents skin from pulling back which may be uncomfortable for the patient. The gauze also helps seal the punctured tissue and prevent leakage.
- c) It is not serious if you notice blood at the site after the needle is removed. You may have nicked a surface blood vessel when you injected, and blood is following the needle track out to the surface. Simply press the site with a 2x2 gauze pad. Also, a small amount of clear fluid may appear at the site. This may be the medication that is following the needle track to the surface. Again, apply gentle pressure using a 2x2 gauze pad.
- d) Safe needle disposal
  - 1) Depending on the style of needle being used
    - (a) safely retract the needle back into the base of the autoinjector or
    - (b) place the attached cover over the needle; and dispose of in an approved sharps container.

## A Note on Medications and Educational Strategies

A service's Medical Director may elect to limit the use of various medications. Students should be familiar with all of the medications listed below, with emphasis placed on medications that a given service will use.

- a. Aspirin (ASA)
- b. Bronchodilators via metered dose inhaler, or nebulized (medical director required if not patient's own. On-line medical control required if EMT has no medical director.)
- c. Dextrose
- d. Diphenhydramine
- e. Epinephrine 1mg/10ml (100mcg/ml) IV (cardiac arrest only)
- f. Epinephrine 1mg/1ml IM (anaphylaxis)
- g. Epinephrine auto-injector
- h. Glucagon
- i. Lidocaine (analgesic) for IO flush
- j. Nitrous Oxide (NO<sub>2</sub>)
- k. Ondansetron
- l. Opioid antagonist (Naloxone)
- m. Oral glucose
- n. Oral over the counter (OTC) analgesics for pain or fever
- o. Oxygen (O<sub>2</sub>)
- p. Nitroglycerin (sublingual) (NTG)
- q. Autoinjector antidote (e.g., DuoDote<sup>®</sup>) for chemical/hazardous material exposures
- r. Tranexamic Acid (TXA) (Optional)

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