



U.S. Department  
of Transportation  
**National Highway  
Traffic Safety  
Administration**

# **Emergency Medical Technician — Intermediate: National Standard Curriculum**

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Instructor's Lesson Plans

1985



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Emergency Medical Technicians have performed a valuable service for our country for a number of years. The role of the Basic EMT contributes greatly to the enhancement of emergency medical care of the ill and injured. The Basic EMT level is perceived to be somewhat of an “independent practice” role in that the EMT at the scene has all the knowledge and skills to deliver care without orders from another section of the EMS system. The role of the advanced EMT is significantly different in that there is a “partnership role” with the institution providing Medical Control. Therefore the transition from a basic provider level to the advanced provider level is a very important one.

One of the many tasks involved in developing advanced prehospital care is determining what the optimal level of care is. From a national perspective that optimal level is considered to be the EMT-Paramedic. The content of the EMT-P training program was arrived at by the National Academy of Science/National Research Council in the early 1970's.

The EMT-P curriculum then and now is the end result of the careful balancing of many different factors. It was recognized early that the EMT-P would be the highest trained person available in the prehospital setting and therefore needed training in as many potential emergency situations as possible. This had to be balanced with facts such as the cost, the length, and the degree of difficulty of such programs would have to remain within reason. The availability of skills maintenance opportunities had to be balanced with the *need* for certain difficult techniques. When all of these and many other factors were considered, it appeared the optimal was the EMT-P training level.

However, over time greater emphasis was given to certain of the same factors considered in the development of the EMT-P level, and in reconsidering with a change in emphasis, a *different* result appeared. Emphasis was not placed on training for as many emergencies as possible but more on those areas of greatest incidence. Similarly the time and depth of preparing was altered, and those skills that required less skill maintenance were included.

The result of the re-thinking did not change the conclusion of what is optimal—the EMT-P—but did result in purposeful levels other than the basic EMT and the EMT-Paramedic. In 1980 the National Registry of Emergency Medical Technicians, recognizing the need for an evaluation tool for the most significant of these levels, developed the EMT-Intermediate examination.

It became clear that depending on the factors one chose to emphasize, there could be numerous options for levels between the Basic EMT and EMT-Paramedic levels. Therefore, in 1982 Department of Transportation/National Highway Traffic Safety Administration (DOT/NHTSA) sponsored a study conducted by the National Council of State Emergency Medical Services Training Coordinators. The purpose of the study was to collect data nationwide and to collate this information and ultimately recommend both content and nomenclature for existing levels. The National Council project identified the significant levels of program development across America and subsequently labeled the first level beyond the Basic EMT as the EMT-Intermediate.

It is important to understand the true meaning of the data collected during this project for it substantiates the principle from which the EMT-Intermediate level has been developed. Simply stated, the EMT-Intermediate level has as its base the basic

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EMT program and then has certain proven clinical skills and knowledge to support the skills added to the basic program. The program is not intended necessarily to be a stepping stone to the EMT-Paramedic level, but rather to be complete for that particular level of patient care. The application of this principle impacts dramatically on the implementation of the EMT-Intermediate level. The "EMT plus" orientation versus the "EMT-P minus" attitude helps to maintain perspective when developing the training program.

The National Paramedic Committee was charged in mid-1983 with the development of a curriculum for the EMT-Intermediate level. This level does not conflict or compete with the EMT-Paramedic level; it is simply another level that exists as a result of different factors being emphasized.

**Division 1: Prehospital Environment**

**Section 1. Roles and Responsibilities**





**TOPIC****CONTENT OUTLINE**

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**Introduction**

The EMT-Intermediate has a variety of duties. It is imperative that as a health care professional he/she understand his or her legal, moral and ethical responsibilities. These responsibilities occur during training and in the practice of patient care.

**Overview**

Section A. Medical Ethics and Professionalism  
Section B. Post-Graduation Responsibilities  
Appendix A

**Objectives**

At the conclusion of Subsection 1, the instructor will have provided sufficient information, demonstration, and practice to the student to ensure his/her ability to:

- 1.1.1 Identify and describe those activities performed by an EMT-Intermediate in the field.
- 1.1.2 Define the role of an EMT-Intermediate.
- 1.1.3 Describe and contrast the difference between an EMT-Ambulance and EMT-Intermediate training program.
- 1.1.4 Define the term "ethics" and "professionalism."
- 1.1.5 Describe the differences between ethical behavior and legal requirements.
- 1.1.6 State specific activities that are most appropriate to ethical behavior.
- 1.1.7 Identify whether a particular activity is unethical and/or illegal, given certain patient care situations.
- 1.1.8 Identify whether a particular activity is ethical or unethical given certain patient care situations.
- 1.1.9 Define the term "professional."
- 1.1.10 Define the term "health care professional."
- 1.1.11 Identify whether a particular activity is professional or unprofessional given certain patient care situations.
- 1.1.12 State certain activities that are most appropriate to professional behavior.
- 1.1.13 List current State requirements for EMT-Intermediate continuing education.
- 1.1.14 Define and discuss at least three reasons why continuing education is important for the EMT-Intermediate.
- 1.1.15 Define the terms certification/licensure/registration.
- 1.1.16 Name and describe current state legislation outlining the scope of prehospital advanced life support.
- 1.1.17 State the reason it is important to keep one's EMT-Intermediate certification current.
- 1.1.18 State the major purposes of a national association.
- 1.1.19 State the major purposes of a national registration agency.
- 1.1.20 State the major benefits of subscribing to professional journals.
- 1.1.21 State the benefits of EMT-Intermediates teaching in their community.

**Medical Ethics and Professionalism****A. Introduction**

1. This section is one of the most important in the curriculum, not because of the medical information, but because of its long-term value post-graduation.
2. Even though much of this section is intangible, accepting and implementing these concepts into their professional lives will ultimately separate the excellent from the average EMT-I.

**B. Ethics**

1. Ethics are principles governing the conduct of an EMT-I. They deal with the relationship of an EMT-I to his or her patients, the patient's family the EMT-I's peers and society at large.
2. The word ethics comes from the Greek word meaning "character."
3. Ethics set standards of rightness and wrongness of human conduct, but do not address morality.
4. The Oath of Geneva, the EMT Oath, and the Code of Ethics for EMT's.
5. Examples relating to standing versus written orders, professional indiscretions, meeting the medical needs of patients who are unable to pay, and interactions with other members of the health care team.
6. Contrast ethical and unethical behavior versus legal requirements and/or illegal activities.
7. If EMT-I places the patient above all else when providing medical care, he or she will rarely have to worry about committing an unethical act.

**C. Professionalism**

1. A professional is a person who has certain special skills and knowledge in a specific area and conforms to the standards of conduct and performance in that area.
2. Professionalism in health care is necessary to:
  - a. Promote *quality* patient care
  - b. Instill pride in profession
  - c. Promote high standards
  - d. Earn respect of medical team
3. Examples of professional and unprofessional behavior based upon activities itemized in D1-7, below.

**D. Role**

1. Recognizing a medical emergency; assessing the situation; managing emergency care and, if needed, extrication; coordinating EMS efforts with those of other agencies that may be involved in the care and transportation of the patient; and establishing rapport with the patient and significant others to decrease their state of crisis.
2. Assigning priorities of emergency treatment and recording and communicating data to the designated medical command authority.
3. Initiating and continuing emergency medical care under medical control, including the recognition of presenting conditions and initiation of appropriate invasive and noninvasive treatments, e.g., surgical and medical emergencies, airway and respiration problems, cardiac problems and psychological crises; and assessing the response



of the patient to that treatment and modifying medical therapy as required under the direction of a physician or other authorized personnel.

4. Exercising personal judgement in case of interruption in medical direction caused by communication failure or in cases of immediate life-threatening conditions. (Under these circumstances, provides such emergency care as has been specifically authorized in advance.)
5. Directing and coordinating transport of the patient by selecting the best available method(s) in conjunction with medical command authority.
6. Recording in writing or dictation details related to the patient's emergency care and the incident; and
7. Directing the maintenance and preparation of emergency care equipment and supplies.

E. EMT-A versus EMT-Intermediate versus EMT-Paramedic

1. An EMT-A (Basic) should have successfully completed the National Standard Training Course (NSTC) for Basic EMT's. He should be competent in all phases of Basic Life Support (BLS), including the pneumatic antishock garment.
2. An EMT-Intermediate should currently be a State or national certified EMT-A, have successfully completed the National Standard Training Course for EMT-I's, be competent and knowledgeable in all phases of BLS, including the pneumatic antishock garment (PASG), and in those phases of Advance Life Support (ALS) including Esophageal intubation device (EOA) or Esophageal gastric tube (EGTA) and intravenous therapy.
3. An EMT-I is defined under D above.

**Post-Graduation  
Responsibilities**

A. Introduction

1. Once graduated and practicing the EMT-I takes on a multitude of personal responsibilities that go with calling oneself a health care professional.
2. Credentialing is a State function that may take one or more of the following forms (i.e., use of national exams as basis to grant State licensure):
  - a. Registration or certification—The process by which an agency or association grants recognition to an individual who has met certain predetermined qualifications specified by that agency (common method used in medicine, nursing and allied health).
  - b. Protects the public from incompetence and provides for professional identification.
  - c. Licensure—The process by which a governmental agency grants permission to an individual to engage in a given occupation upon finding that the applicant has attained the minimal degree of competency necessary to ensure that the public will be reasonably protected.
3. Current State statutes and/or other pertinent information on the lead State EMS agency governing ALS.
4. It is legally essential to attain and maintain certification/registration under State law as long as one works as an EMT-I.

**INSTRUCTOR'S NOTES**

While over 30 additional levels of EMT's exist in the U.S., only EMT-I described in #2 is nationally recognized.

Handouts.

5. Definitions
  - a. Recertification/relicensure—The process by which an individual's technical competency is periodically reaffirmed.
  - b. Reciprocity—The mutual exchange of privileges or licenses by two certifying agencies.
6. Current State/national continuing education requirements or EMT-I recertification/relicensure.
7. Continuing education is important because:
  - a. A lot of the skill and knowledge learned in the course may not be used with great frequency. Skill decay can occur very quickly.
  - b. The public and medical community need to be continually assured that quality patient care is being delivered.
  - c. It is a basis for reciprocity among many States that can allow for the potential advantages of vertical and horizontal mobility.
  - d. New knowledge, skills, and equipment will continue to be a part of this relatively new profession.
8. The major purposes of a national association include:
  - a. To develop models of required competencies for various roles in the profession.
  - b. To provide learning experiences to help EMT's acquire the skills of self-directed learning and to help instructors acquire the necessary skills as facilitators of learning.
  - c. To stimulate and/or provide the development of study programs, workshops, in-service programs, multi-media packages, and other learning resources accessible to all EMT's.
  - d. To instill awareness among its members regarding the need for continuing professional development and to reward self-development efforts.
  - e. To assure that its members are engaging in continuing professional development, preferably voluntarily but under compulsion if necessary, and
  - f. To inform its members about modern concepts of adult learning and to apply those concepts in its own educational activity.
9. The major purposes of a national registration agency include:
  - a. To promote the improved delivery of Emergency Medical Services (EMS) by:
    - i. Assisting in the development and evaluation of educational programs to train EMT-I's.
    - ii. Establishing qualifications for eligibility to apply for registration.
    - iii. Preparing and conducting examinations designed to assure the competency of EMT-I.
    - iv. Establishing a system for re-registration.
      - v. Establishing procedures for revocation of certificates of registration for cause.
    - vi. Maintaining a directory of registered Emergency Medical Technicians-Intermediate.



- b. To develop guidelines and programs to assist individuals who have completed Emergency Medical Technician-Intermediate programs to raise their level of competence to assure the provision of improved emergency medical services, and
  - c. To do any and all things necessary or desirable for the attainment of the stated purposes.
10. Major benefits of subscribing to professional journals include:
- a. They are a source of continuing education.
  - b. They provide an opportunity for the EMT-I to publish articles.
  - c. They are an informational source whereby EMT-I's can learn about other local, State, regional, or national advancements and/or issues.
  - d. They encourage professional growth and awareness.
11. The benefits of EMT-I's teaching in their community include:
- a. It can be a source of continuing education credit.
  - b. It can provide a review of material and/or skills not commonly used in the field.
  - c. Setting up the EMT-I as a leader and resource person in his community.
  - d. It can fill a much needed void in having BLS and/or Basic Cardiac Life Support qualified individuals trained in the community.
  - e. Providing supervision, direction and evaluation of student EMT-I's during their field internship.







## **Appendix A.**

**Oath of Geneva  
Code of Ethics  
EMT Oath**



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The Oath of Geneva, drafted by the World Medical Association in 1948, provides a good example. It is the oath taken by many medical students upon completion of their studies, at the time of being admitted to the medical profession.

*I solemnly pledge myself to consecrate my life to the service of humanity; I will give to my teachers the respect and gratitude which is their due; I will practice my profession with conscience and dignity; the health of my patient will be my first consideration; I will respect the secrets which are confided in me; I will maintain by all the means in my power the honor and noble traditions of the medical profession; my colleagues will be my brothers; I will not permit considerations of religion, nationality, race, party, politics, or social standing to intervene between my duty and my patient; I will maintain the utmost respect for human life from the time of conception; even under threat, I will not make use of my medical knowledge contrary to the laws of humanity. I make these promises solemnly, freely and upon my honor.*

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## CODE OF ETHICS OF THE NATIONAL ASSOCIATION OF EMT'S

Professional status as an Emergency Medical Technician and Emergency Medical Technician-Intermediate is maintained and enriched by the willingness of the individual practitioner to accept and fulfill obligations to society, other medical professionals, and the profession of Emergency Medical Technician. As an Emergency Medical Technician at the basic level or an Emergency Medical Technician-Intermediate, I solemnly pledge myself to the following code of ethics.

A fundamental responsibility of the Emergency Medical Technician is to conserve life, to alleviate suffering, to promote health, to do no harm, and to encourage the quality and equal availability of emergency medical care. The Emergency Medical Technician provides services based on human need with respect for human dignity, unrestricted by considerations of nationality, race, creed, color, or status.

The Emergency Medical Technician does not use professional knowledge and skills in any enterprise detrimental to the public well-being.

The Emergency Medical Technician respects and holds in confidence all information of a confidential nature obtained in the course of professional work unless required by law to divulge such information.

The Emergency Medical Technician, as a citizen, understands and upholds the law and performs the duties of citizenship. As a professional, the Emergency Medical Technician has the never ending responsibility to work with concerned citizens and other health care professionals in promoting a high standard of emergency medical care to all people.

The Emergency Medical Technician shall maintain professional competence and demonstrate concern for the competence of other members of the Emergency Medical Services health care team.

An Emergency Medical Technician assumes responsibility for individual professional actions and judgement, both in dependent and independent emergency functions, and knows and upholds the laws which affect the practice of the Emergency Medical Technician.

An Emergency Medical Technician has the responsibility to be aware of and participate in, matters of legislation affecting the Emergency Medical Technician and the Emergency Medical Services System.

The Emergency Medical Technician adheres to standards of personal ethics which reflect credit upon the profession.

Emergency Medical Technicians, or groups of Emergency Medical Technicians, who advertise professional services, do so in conformity with the dignity of the profession.

The Emergency Medical Technician has an obligation to protect the public by not delegating to a person, less qualified, any service which requires the professional competence of an Emergency Medical Technician.

The Emergency Medical Technician will work harmoniously with, and sustain confidence in Emergency Medical Technician associates, the nurse, the physician, and other members of the emergency medical services health care team.

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The Emergency Medical Technician refuses to participate in unethical procedures, and assumes the responsibility to expose incompetence or unethical conduct of others to the appropriate authority in a proper and professional manner.

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## THE EMT OATH

Be it pledged as an Emergency Medical Technician, I will honor the physical and judicial laws of God and man. I will follow that regimen which, according to my ability and judgement, I consider for the benefit of my patients and abstain from whatever is deleterious and mischievous, nor shall I suggest any such counsel. Into whatever homes I enter, I will go into them for the benefit of only the sick and injured, never revealing what I see or hear in the lives of men.

I shall also share my medical knowledge with those who may benefit from what I have learned. I will serve unselfishly and continuously in order to help make a better world for all mankind.

While I continue to keep this oath unviolated, may it be granted to me to enjoy life, and the practice of the art, respected by all men, in all times. Should I trespass or violate this oath, may the reverse be my lot. So help me God.

Charles Gillespie, M.D.



**Division 1:  
Prehospital  
Environment**

**Section 2. EMS Systems**



**TOPIC****CONTENT OUTLINE**

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**Introduction**

The student must have successfully completed the following section prior to participating in this section.

**Section I. Roles and Responsibilities****Overview**

- I. Introduction
- II. Prospective
- III. Immediate
- IV. Retrospective

**Objectives**

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

- 1.2.1 Discuss citizen access and the various mechanisms of obtaining it.
- 1.2.2 Discuss prehospital care as an extension of hospital care.
- 1.2.3 Define stabilization of patients.
- 1.2.4 Define and describe medical control.
- 1.2.5 Describe physician responsibility for Medical Control.
- 1.2.6 Describe the relationship between the physician on the scene, the EMT-I, and the physician on the radio.
  - a. Physician who is with the patient when the EMT-I arrives,
  - b. The physician who arrives on the scene after the EMT-I's have started evaluating and treating the patient.
- 1.2.7 Describe the benefits of EMT-I follow-up on patient condition, diagnosis, and retrospective review of prehospital care.
- 1.2.8 Describe GSA/KKK Ambulance standards.
- 1.2.9 Define the American College of Surgeons Essential Equipment List and how it relates to local State laws.
- 1.2.10 Define the national standard levels of prehospital provider as defined by curriculum, respectively
  - a. Discuss ambulance placement and the parameters that should be utilized in its development, including the differences in urban, suburban and rural settings.
- 1.2.11 Discuss the medical community role in overseeing prehospital care.
- 1.2.12 Define protocols and standing orders.
- 1.2.13 Describe the development of protocols.
- 1.2.14 Define local training standards.
- 1.2.15 Describe the legislation in the EMT-I's State as regards prehospital care.
- 1.2.16 Describe integration of prehospital care into the continuum of total patient care with the emergency department phase of hospital care.
- 1.2.17 Discuss replacement of equipment and supplies.
- 1.2.18 Discuss the EMT-I's initial responsibilities when arriving on the scene.
- 1.2.19 Describe the relationship between the physician on the radio and the EMT-I at the scene.
- 1.2.20 Discuss the varying philosophies between the management of medical patients and trauma patients, prehospital.
- 1.2.21 Describe the transition of patient care from the EMT-I, including:
  - a. Transfer of responsibility (legal and medical),

- b. Reporting of patient status to physician or nurse.
- 1.2.22 Describe the ability of physician run critique based on documentation.
- 1.2.23 Describe retrospective evaluation of patient care, including run report review, continuing education, skill practice, and skill deterioration.



**Introduction**

- A. Citizen system overview
  - 1. Care available from EMS
  - 2. What EMS is
  - 3. Cost of service
  - 4. Access
  - 5. First aid
    - a. CPR
    - b. Hemorrhage control
    - c. Do Not Move Patient
    - d. Other
- B. Prehospital care
  - 1. Extension of hospital care
  - 2. Initiation of patient stabilization
    - a. Definitive patient care must be provided as soon as possible. For many patients, this can be started and to a great measure completed in the field.
    - b. Blood replacement and definitive hemorrhage control—for the trauma patient, for example—must be provided in the operating room. For these patients, the resuscitation measures must be initiated in the field or during transport with rapid movement to the appropriate hospital.
    - c. Recognition of the difference between a and b above, and correct action by the EMT-I, is critical to increasing long-term survival and reducing complications and disability
  - 4. Medical Control
    - a. Physician development of patient care protocols
      - i. Overall patient care
      - ii. Standing orders
      - iii. Relationship between the Medical Command Authority and the on-scene physician:
        - (a) Arrival before EMT-I's
        - (b) Arrival after the EMT-I's
    - b. On-line medical control to direct patient care
      - i. Physician
      - ii. Physician designee
    - c. Physician review of run
- C. Hospital care
  - 1. Emergency department
  - 2. Admission
  - 3. In-hospital care
  - 4. Discharge follow-up
- D. Preparation, management, and review
  - 1. Pre-incident planning
  - 2. Immediate field care
  - 3. Incident follow-up



**Prospective**

- A. Vehicles
  - 1. KKK Standards
  - 2. Equipment
    - a. American College of Surgeons' Committee on Trauma Essential Equipment List
    - b. Additional equipment as per service needs
      - i. Environment
      - ii. Rescue
      - iii. Geographic
      - iv. Special services
  - 3. Placement strategy
    - a. Associated services which may provide first response
    - b. Location of ambulances for primary response
- B. Personnel
  - 1. EMT-Ambulance
    - a. National Standard Curriculum
    - b. Skills and knowledge
      - i. CPR
      - ii. Airway and ventilation
      - iii. Hemorrhage control
      - iv. Fracture stabilization
      - v. Emergency childbirth
      - vi. Extrication
      - vii. Special rescue skills
      - viii. Diagnosis and management
      - ix. Pneumatic Antishock Garment (PASG)
      - x. Communication
  - 2. EMT-Intermediate
    - a. National Standard Curriculum
    - b. Skills and knowledge
      - i. All of EMT-A curriculum content
      - ii. Patient assessment and initial management
      - iii. Esophageal intubation device airway (EOA)
      - iv. Optional skill
        - (a) Endotracheal intubation
        - (b) Defibrillation
      - v. Recognition and management of shock
      - vi. Ventilation management
      - vii. Intravenous fluid therapy
  - 3. EMT-Paramedic
    - a. National Standard Curriculum
    - b. Skills and knowledge
      - i. All of EMT and EMT-I
      - ii. Advanced airway management
      - iii. Medical





- (a) Cardiac (AHA-ACLS)
    - (b) Other medical emergencies
  - iv. Advanced trauma management as identified by the American College of Surgeons and American Academy of Orthopedic Surgeons
  - v. Optional skill and therapeutics
- C. Citizen access
  - 1. Telephone
    - a. 9-1-1
    - b. Well-publicized telephone number
  - 2. Citizen education
- D. Dispatch
  - 1. Training: Department of Transportation (DOT)
    - a. Knowledgeable of EMT-skills
    - b. Telephone first aid until unit arrives
  - 2. Dispatch of appropriate unit
    - a. Distance
    - b. Time
    - c. Appropriate level of care
- E. Communication
  - 1. Dispatcher to ambulance
    - a. Availability at all times
    - b. Two-way communication
  - 2. Medical
    - a. Two-way
    - b. Frequencies
      - UHF
      - VHF
    - c. Physician to EMT-I
    - d. Type
      - i. Simplex
      - ii. Duplex
      - iii. Multiplex
    - e. Telemetry (local option)
    - f. Telephone
- F. Medical standards
  - 1. Medical Society role
    - a. EMS committee
    - b. Medical Director
  - 2. Patient care protocols
    - a. Patient management guidelines
    - b. Standing orders
    - c. Verbal orders
    - d. Major incident protocols
  - 3. Training standards



- a. Initial training
- b. Continuing education
- 4. Legislation regarding prehospital care
- 5. Role of EMS system and its interface with hospitals
  - a. Drug and supply exchange
  - b. Housing for unit
  - c. Emergency department (ED) observation
  - d. Education

**Immediate**

- A. EMT arrival on scene
  - 1. Scene assessment
  - 2. Patient(s) evaluation
  - 3. Management if life-threatening conditions
- B. EMT-I physician contact
  - 1. Description of situation
  - 2. Description of patient
  - 3. Description of care instituted
  - 4. Physician instruction for additional care
- C. EMT-I management
  - 1. Completion of physician instructions for patient care
  - 2. Preparation for transportation
  - 3. Transportation
    - a. Trauma—as soon as possible
    - b. Medical—usually after initiation stabilization

**Retrospective**

- A. Run critique
  - 1. Adequate
    - a. Assessment
    - b. Care
    - c. Communication
    - d. Documentation
- B. Continuing education
  - 1. Based on run critiques
  - 2. Review of original training
  - 3. New information
    - a. Skills
    - b. Procedures
    - c. Devices
    - d. Drugs
- C. Skill review
- D. Changes in protocols and standing orders





**Division 1:  
Prehospital  
Environment**

**Section 3. Medical/Legal Considerations**





**TOPIC****CONTENT OUTLINE**

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**Introduction**

The student must have successfully completed the following Sections prior to participating in this Section:

Section 1. Roles and Responsibilities

Section 2. EMS Systems

**Overview**

I. Introduction

II. Essential Principles

III. Standard of Care

IV. Medical Liability

V. Areas of Potential Medical Liability

VI. Medical Liability Protection

**Objectives**

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

- 1.3.1 Discuss the significance and scope of the following in relationship to EMT practice:
  - a. State Medical Practice Act.
  - b. Good Samaritan Act/ Civil Immunity.
  - c. State EMS statutes.
  - d. State motor vehicle codes.
  - e. State and local guidelines for "Do Not Resuscitate."
- 1.3.2 Define the following:
  - a. Negligence
  - b. Medical liability
  - c. Tort
  - d. Duty to act
  - e. Battery
  - f. Slander
  - g. Informed consent
  - h. Expressed consent
  - i. Implied consent
  - j. Abandonment
  - k. Liable
  - l. Assault
  - m. False imprisonment
- 1.3.3 Describe the significance of accurate documentation and record keeping in substantiating incident.
- 1.3.4 Identify those situations that require the EMT-I to report those incidents to appropriate authorities.
- 1.3.5 Describe the four elements to prove medical liability.
- 1.3.6 Describe the significance of obtaining expressed consent.
- 1.3.7 Describe the extent to which force and restraint may be used to protect the EMT, the patient, and the third party.

**Introduction**

- A. Appropriate emergency medical care and accurate recording of patient condition and treatment rendered is the best protection if medical legal questions are asked.
- B. Practically every EMT at one time or another has asked about medical liability.
- C. Often damages can be recovered only by action through a court of law.
- D. The EMT must have a basic knowledge of terms and legal process and a working knowledge of applicable local laws and regulations.

**Essential Principles**

- A. Classification of Laws.
  - 1. Criminal law.
  - 2. Civil (tort) law.
- B. Medical practice act
  - 1. Differs somewhat from State to State.
  - 2. EMT must understand purpose of the legislation.
  - 3. EMT must be familiar with appropriate State act particularly the delegation of practice.
- C. Good samaritan act
  - 1. Refer to the origin of concept.
  - 2. Differ from State to State.
  - 3. EMT must understand limitation of such acts.
  - 4. Must be familiar with the appropriate State act.
- D. State EMS legislation
  - 1. Actual statutes promulgated by legal process to provide for the practice of emergency care
    - a. Usually define scope of practice
    - b. Licensure, regulations, certification
    - c. Deals with medical control
    - d. Deals with protocols and communications
  - 2. Motor vehicle laws
    - a. Vary considerably from State to State
    - b. Mandatory for EMT to be familiar with appropriate State statutes regarding operation of emergency vehicles
  - 3. Other significant laws
    - a. Obligation to report:
      - i. Abuse or neglect of the elderly
      - ii. Abuse or neglect of children
      - iii. Rape
      - iv. Gunshot wounds
      - v. Animal bites
      - vi. Other
    - b. Laws dealing with specific privileges/responsibility
      - i. Use of restraint and degree of force allowed
      - ii. Access to restricted areas
      - iii. Living wills
      - iv. Obtaining blood samples for alcohol or narcotic testing
    - c. Interface with other agencies that have statutory responsibility

**INSTRUCTOR'S NOTES**

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Defines crimes and associated punishments. Deals with civil wrongs committed by one individual against another.

Bible:  
Luke 10:30-35.

Copies of State documents should be made available to each student.

Age, speed, use of siren and lights.

Airports, military installations, prisons.  
Request not to be resuscitated.

- i. Law enforcement
  - ii. Fire/fire scenes
  - iii. Search and rescue agencies
  - iv. Military/restricted areas
- Standard of Care**
  - A. The level of practice identified as common and accepted by law
  - B. Provider held to the standard of care of others with similar training and experience
    - 1. Basic EMT versus EMT-P, etc.
    - 2. May be defined by protocols
- Medical Liability**
  - A. Neglect/omission
    - 1. Conduct failing to meet standard of care
    - 2. Four elements must be proven
      - a. Duty to perform
      - b. Breach of duty
      - c. Damages
      - d. Proximate cause
- Areas of Potential Medical Liability**
  - A. Consent
    - 1. Elements of consent
      - a. Informed consent—patient knows and agrees
      - b. Expressed consent—patient gives verbal or written consent
      - c. Implied consent—patient’s condition or status implies consent
    - 2. Document/record refusal of consent or treatment
    - 3. Who can give consent?
      - a. Parent or legal guardian
      - b. State may give consent for wards of the State
  - B. Abandonment
    - 1. Termination of the provider/patient relationship without making certain that equal services are available
      - a. Do *not* begin providing care and then discontinue such care
      - b. Do not release care of patient to a lesser level provider if the patient’s condition warrants the higher level
  - C. Assault
    - 1. Creating apprehension of immediate bodily harm without consent
      - a. May be criminal or tort
      - b. Most easily avoided by informing the patient and then obtaining consent
  - D. Battery
    - 1. Touching the patient without consent
    - 2. May be either criminal or tort
    - 3. Avoided by obtaining consent
  - E. False imprisonment
    - 1. Intentional and unjustifiable detention
      - a. Often raised in conjunction with psychiatric cases
      - b. Circumstances may justify the detention
        - i. Evidence of medical necessity
        - ii. Avoided by obtaining consent



iii. Actions consistent with protocol strengthens your position

F. Libel

1. Injuring a person's character, name, or reputation by false and malicious writings
2. Written record must be accurate and confidential
  - a. Avoid slang terms
  - b. Describe behavior; avoid labels

G. Slander

1. Limit oral reporting to appropriate personnel
  - a. Avoid slang terms
  - b. Describe behavior; avoid labels
2. Injuring a person's character, name, or reputation by false and malicious spoken words

**Medical Liability  
Protection**

A. Municipal service immunity/institution/agency coverage

1. May not cover individual not on duty
2. Often very limited in coverage

B. Individual medical liability insurance

1. Policy written for specific needs
2. Advocate for policy holder
3. Essential that the EMT understands the contract
4. Prompt accurate report to carrier essential



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## BIBLIOGRAPHY

- Chayet, N.L., *Legal Implications of Emergency Care*; Chicago, Ill., Appleton-Century-Crofts, 1969
- Frew, Stephen A., *Street Law Rights and Responsibilities of the EMT*, Reston, Va., Reston Publishing Company Inc. 1983
- Goldstein, A.S., *EMS and the Law*; Bowie, Md., R.J. Brady Co., 1983
- George, J., *Law and Emergency Care*; St. Louis, Mo., C.V. Mosby Company, 1980
- George, J., Editor; "Psychiatric Emergencies"; *EMT Legal Bulletin*, 3 (1):4, 1973



**Division 1:  
Prehospital  
Environment**

**Section 4. Medical Terminology**



**Introduction**

The student must have successfully completed the following sections prior to participating in this section:

Section 1. Roles and Responsibilities

Section 2. EMS Systems

Section 3. Medical/Legal Considerations

**Overview**

I. Medical Terminology

II. Prefixes and Suffixes

III. Medical Dictionary

IV. Appendix A: Handout Medical Terminology

**Objectives**

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

1.4.1 Define and contrast medical terms

1.4.2 Identify various medical terms given one or more anatomical parts of the body.

1.4.3 Identify common medical abbreviations.

1.4.4 Identify common root words and determine their meaning.

1.4.5 Identify and define common prefixes and suffixes.

1.4.6 Locate one or more medical terms in a medical dictionary.

**TOPIC****CONTENT OUTLINE**

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**Medical Terminology**

- A. Needed to understand what is said in class
- B. Needed to communicate with:
  - 1. Doctors
  - 2. Nurses
  - 3. Emergency Medical Technician Intermediates and Paramedics
- C. Used in international language

**Prefixes and Suffixes**

- A. Prefixes
  - 1. Beginning of words
  - 2. Examples:
    - a. A = without or lack of, e.g., apnea = without breath
    - b. Derma = skin, e.g., dermatitis = inflammation of skin
    - c. Macro = large, e.g., macroblast = abnormally large cell
- B. Suffixes
  - 1. Ends of words
  - 2. Examples:
    - a. Cyte = cell, e.g., leukocyte = white cell
    - b. Ectomy = cutting out, e.g., tonsillectomy = cutting out of tonsils
    - c. Phasia = speech, e.g., aphasia = loss of speech power
- C. If basic prefixes and suffixes are known, medical terminology becomes less difficult
- D. Root words

**Medical Dictionary**

- A. Exercise: discussion of selected words
  - 1. Pronunciation
  - 2. Spelling
  - 3. Definition
  - 4. Subtopics
  - 5. Medical synonyms
  - 6. Word variation
  - 7. Capital letters
- B. Contents and use of the appendix
  - 1. Glossary
  - 2. Signs and symbols



## Appendix A

### Medical Terminology

### Common Abbreviations

Abbreviation	Meaning
aa	of each
ad lib	as much as desired
aq	water
ASA; APC	aspirin, phenacetin and codeine
b.i.d.	twice a day
BP	blood pressure
CA	cancer
c	with
CAD	coronary artery disease
CBC	complete blood count
cc	cubic centimeter (equal to ml)
Č.C. or C/C	chief complaint
CCU	coronary care unit
CHF	congestive heart failure
c/o	complains of
CO <sub>2</sub>	carbon dioxide
CPR	cardiopulmonary resuscitation
COPD	chronic obstructive pulmonary disease
CVA	cerebrovascular accident
CVP	central venous pressure
D.C.	discontinue
DOA	dead on arrival
DOE	dyspnea on exertion
Dx	diagnosis
EEG	cietroencephalogram
EKG, ECG	electrocardiogram
ER/ED	emergency room/emergency department
ETOH	alcohol
fl	fluid
Fx	fracture
GB	gall bladder
GI	gastrointestinal
Gm.	gram
gr.	grain
GU	genitourinary
h, hr.	hour
H, (H)	hypodermic
Hb, Hgb	hemoglobin
Hct.	hematocrit

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H & H	hemoglobin and hematocrit
Hg	mercury
Hx	history
H & P	history and physical
IC	intracardiac
ICU	intensive care unit
IM	intramuscular
IV	intravenous
L	liter
LOC	level of consciousness
MAE	moves all extremities
mEq	Milliequivalent
mg, mgm	milligram
MI	myocardial infarction
MICU	mobile intensive care unit
	medical intensive care unit
ml	milliliter
MS	morphine sulfate
MS	multiple sclerosis
NaHCO <sub>3</sub>	sodium bicarbonate
NPO	nothing by mouth
NTG	nitroglycerin
O <sub>2</sub>	oxygen
OB	obstetrics
O.D.	overdose
O.R.	operating room
p	after
p.c.	after meals
P.E.	physical exam
p.o. or PND	by mouth
pt.	patient
PT	physical therapy
PTA	prior to admission
PERL	pupils equal and react to light
q	every
q.h.	every hour
q.i.d.	four times a day
qtt	drop
RBC	red blood cells
RHD	rheumatic heart disease
R/O	rule out
Rx	take; treatment
ROM	range of motion
s	without
S.C., S.Q.	subcutaneous

---

SICU	surgical intensive care unit
S.L.	sublingual
S.O.B.	shortness of breath
ss	half
stat.	immediately
SubQ	subcutaneous
t.i.d.	three times a day
TPR	temperature, pulse, respiration
V.S.	vital signs
WBC	white blood cells
W/	with
WNL	within normal limits
y.o.	year old



## Appendix A

### Medical Terminology

Prefixes	Meaning	Example
1. a-, an-	without, lack of	apnea—without breath; anemia—lack of blood
2. ab-	away from	abnormal—away from the normal
3. abdomi(n)	abdomen	abdominal—pertaining to abdomen
4. acr-	pertaining to extremity	acromegaly—enlargement of extremity
5. ad-	to, toward	adhesion—something stuck to
6. aden-	pertaining to gland	adenitis—inflammation of gland
7. ana-	up, back, again	anastomosis—joining of two parts
8. angio-	blood vessel	angiogram—study of vessels
9. ante-	before, forward	antenatal—occurring or formed before birth
10. anti-	against, opposed to	antipyretic—against fever
11. arter-	artery	arteriogram—study of arteries
12. arthro-	pertaining to joint	arthroscopy—inspection of joint
13. auto-	self	auto-intoxication—poisoning by a toxin generated within the body
14. bi-	two	bilateral—both sides
15. blast-	germ or cell	blastoma—a true tumor of cells
16. bleph-	pertaining to eyelid	blepharotomy—surgical cutting of an eyelid
17. bio-	life	biology—study of life
18. brady-	slow	bradycardia—slow heart rate
19. calc-; lith-	stone	renal calculi—kidney stone; pyelolithotomy—removal of stone from kidney by surgical incision
20. cardi-	pertaining to heart	cardiography—recording of the movements of the heart
21. cerebr-	brain	cerebral—pertaining to brain
22. cerv-	neck	cervical—pertaining to neck
23. cephal-	pertaining to head	cephalopathy—any disease of the head
24. chole-	pertaining to bile	cholelithiasis—stones in the gall bladder
25. chondr-	cartilage	costochondral—junction of ribs and cartilage
26. circum-	around, about	circumoral—around the mouth
27. contra-	against, opposite	contrastimulant—against stimulating
28. cost-	pertaining to rib	costal margin—margin of lower limits of ribs
29. cyan-	blue	cyanotic—bluish discoloration
30. cyst-	pertaining to bladder or any fluid containing sac	cystitis—inflammation of urinary bladder
31. cyt-	cell	cytology—study of cells
32. derma-	skin	dermatitis—inflammation of the skin
33. di-	twice, double	diplopia—double vision
34. Dia-	through, completely	diagnosis—knowing completely
35. dys-	with difficulty	dyspnea—difficulty breathing

36.	ecto-	out from	ectopic—out of place
37.	edem-	swelling	edema—swelling
38.	electr-	electricity	electroencephalogram—electric record of brain activity
39.	endo-	within	endometrium—within the uterus
40.	enter-	pertaining to the intestines	enteritis—inflammation of the intestines
41.	epi-	upon, on	epidermis—on the skin
42.	erythro-	red	erythrocyte—red blood cells
43.	exo-	outside	exogenous—produced outside the body
44.	febr-	fever	afebrile—without fever
45.	gastr-	pertaining to the stomach	gastritis—inflammation of the stomach
46.	glyco-	sugar	glycosuria—sugar in urine
47.	gynec-	pertaining to women	gynecology—study of diseases of women
48.	hem-; hemat-	pertaining to blood	hemoglobin—coloring matter of red cells
49.	hemi-	half	hemiplegia—paralysis of one side of the body
50.	hepat-	liver	hepatitis—inflammation of liver
51.	hydr(o)-	water	hydrocele—water tumor of testicle
52.	hyper-	over, excessive in	hyperplasia—excessive formation
53.	hypo-	under, deficient in	hypotension—low blood pressure
54.	hyster-	pertaining to uterus	hysterectomy—removal of the uterus
55.	infra-	below, after	infrascapular—below the scapular bone
56.	inter-	between	intercostal—between ribs
57.	intra-	within	intralobar—within the lobe
58.	iso-	equal	isotonic—having equal tension
59.	later(o)-	side	lateral—pertaining to side
60.	leuk-	pertaining to anything white	leukocyte—white blood cells
61.	macro-	large	macroblast—abnormally large cell
62.	mal-	bad, abdominal disorder	malnutrition—poorly balanced diet malaise—general discomfort, unease
63.	mening(o)-	meninges	meningitis—inflammation of meninges
64.	micro-	small	microplasia—dwarfism
65.	mono-	one	monocular—one eye
66.	my-	pertaining to muscle	myoma—muscle tumor
67.	mas(o)-	nose	nasopharynx—pertaining to nose and pharynx
68.	neo-	new	neoplasm—new growth
69.	nephr-	pertaining to kidney	nephrectomy—surgical excision of kidney
70.	neur(o)-	nerve	neurogenic—caused by nerve
71.	olig-	little	oliguria—little outpour of urine
72.	oophor-	pertaining to ovary	oophorectomy—surgical excision of ovary
73.	ophthal-	pertaining to eye	exophthalmos—protruding eyeballs
74.	orchi-	testicle	orchitis—inflammation of testicle
75.	ortho(o)-	straight	orthopnea—unable to breathe lying down

76.	os-	mouth	cervical os—mouth of cervix
77.	osteo-	pertaining to bone	osteoblast—bone cells
78.	ot-	pertaining to ear	otitis media—inflammation of middle ear
79.	para-	by the side of	parathyroids—along side of the thyroid
80.	per-	through	perforation—a breaking through
81.	phago-	to eat	phagocyte—cells that eat debris
82.	pharyng-	throat	pharyngitis—inflammation of pharynx
83.	peri-	surrounding	periosteum—covering of bone
84.	phleb-	vein	phlebitis—inflammation of vein
85.	pneum-	pertaining to lung	pneumococcus—organism causing pneumonia
86.	poly-	many	polycystic—containing many cysts
87.	post-	after, behind	postpartum—after childbirth
88.	pre-	before	prediastolic—before diastole
89.	pro-	before, in front of, forward	prognosis—forecast as to result of disease
90.	plumo-	lung	pulmonary thrombosis—clot in lung
91.	proct-	pertaining to rectum	proctoscopy—inspection of rectum
92.	pseudo-	false	pseudoanemia—condition of paleness without true anemia
93.	psych-	pertaining to the mind	psychiatry—treatment of mental diseases
94.	py-	pertaining to pus	pyorrhea—discharge of pus
95.	pyel-	pertaining to kidney pelvis	pyelitis—inflammation of pelvis of kidney
96.	quadr-	four	quadrilateral—four sides
97.	rhin-	pertaining to nose	rinitis—inflammation of nose
98.	retro-	backward	retroflexion—bending backward
99.	salping-	pertaining to a tube	salpingectomy—excision of oviduct
100.	sclero-	hard	sclerosis—hardening
101.	semi-	half	semilunar—half-moon, or crescent-shaped
102.	sub-	under, moderately	subacute—moderately sharp
103.	super; supra-	above	supraventricular—above the ventricles
104.	sym-	with, together	symphysis—grow together
105.	tachy-	fast	tachycardia—fast pulse
106.	thorac(o)-	chest	thoracotomy—cutting into chest
107.	trans-	across	transfusion—pour across
108.	tri-	three	tricuspid—having three cusps
109.	uni-	one	unilateral—one sided
110.	vaso-	vessel	vasoconstriction—constriction of vessel

## Appendix A

### Medical Terminology

Suffixes:	Meaning	Example
1. -algia	pertains to pain	neuralgia—pain along a nerve
2. -asthenia	weakness	myosthenia—muscle weakness
3. -blast	germ of immature cell	myeoblast—bone marrow cell
4. -cele	tumor, hernia	exterocele—hernia of the intestine
5. -centesis	puncturing	thorocentesis—puncturing and drainage of pleural space
6. -cyte	cell	leukocyte—white cell
7. -ectomy	a cutting out	tonsillectomy
8. -emia	blood	anemia
9. -esthesia	sensation	anesthesia—without sensation
10. -genic	causing	carcinogenic—cancer causing
11. -gram; graph	record	angiogram—record of graph
12. -itis	inflammation	tonsillitis
13. -lysis	gradual decline; weakening	lysis of adhesions
14. -megaly	enlargement of	hepatomegaly—enlargement of liver
15. -ology	science of	biology—science or study of life
16. -ostomy	creation of an opening	gastrostomy—artificial opening
17. -oma	tumor, swelling	neuroma
18. -osis	condition of	psychosis—condition of the mind
19. -paresis	weakness	hemiparesis—one-sided weakness
20. -phagia	eating	polyphagia—excessive eating
21. -plegia	paralysis	hemiplegia—one-sided paralysis
22. -pnea	breathing	apnea—no (or without) breathing
23. -pathy	disease	neuropathy—functional disturbances and/or changes in peripheral nervous systems
24. -phasia	speech	aphasia—loss of speech power
25. -phobia	fear	hydrophobia—fear of water
26. -plasty	repair of; tying of	nephroplasty—suturing up of a kidney
27. -ptosis	falling	enteroptosis—falling of the intestine
28. -rhythmia	rhythm	arrhythmia—variation from normal rhythm
29. -rrhagia	bursting forth	hemorrhage—flowing of blood
30. -rrhaphy	suture of; repair of	herniorrhaphy—repair of a hernia
31. -rrhea	flowing	pyorrhea—discharge of pus
32. -scope	instrument for examination	bronchoscope
33. -scopy	exam by inspection	bronchoscopy—examination of the bronchi through a bronchoscope
34. -taxia	order, arrangement of	ataxia—failure of muscle coordination

- 
35. -trophia      nourishment      atrophy—wasting  
36. -uria      to do with urine      polyuria—excessive secretion of urine



**Division 1:  
Prehospital  
Environment**

**Section 5. EMS Communications**





**Introduction**

The student must have successfully completed the following sections prior to participating in this section:

Section 1. Roles and Responsibilities

Section 2. EMS Systems

Section 3. Medical/Legal Considerations

Section 4. Medical Terminology

There are many ways in which the EMT-I communicates. This section of the curriculum is meant to deal specifically with communication through written or spoken words, as this is the form of communication by which information is transmitted all along the EMS chain. This section covers knowledge of technical aspects of communication equipment and rules governing radio transmission as well as actual content and techniques of written and verbal communication of patient information.

**Overview**

I. Communications Systems: Technical Aspects.

A. Communications System Components

B. Radio Communications

C. Equipment Maintenance

II. Rules and Operating Procedures

A. Regulatory Agencies

B. Rules and Regulations

C. Dispatch Procedures

D. Radio Communications Techniques

III. Communication of Medical Information

A. Medical Protocols

B. Communication of Patient Information by the EMT

IV. Techniques of Management: Communications Skills

A. Use of Mobile and Portable Transmitter/ Receiver

B. Use of a Digital Encoder

C. Transmission of Patient Assessment Information and Telemetry

**Objectives**

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

- 1.5.1 Describe the phases of communications necessary to complete a typical EMS event.
- 1.5.2 Name the possible components of an EMS communications system and explain the function of each.
- 1.5.3 Describe maintenance procedures for the field radio equipment.
- 1.5.4 Describe the position of the antenna on a portable transmitter/receiver that will deliver maximum coverage.
- 1.5.5 Describe an advantage of a repeater system over a nonrepeater system.
- 1.5.6 Describe basic functions and responsibilities of the Federal Communications Commission (FCC).
- 1.5.7 Describe the responsibilities of an EMS dispatcher.
- 1.5.8 Name information items that *must* be gathered from a caller by the dispatcher.
- \*1.5.9 Describe the ten-code used in the local community.

\* Indicates optional

- 1.5.10 Describe three communications techniques that influence the clarity of radio transmissions.
- 1.5.11 Describe three communications techniques that influence the content of radio transmissions.
- 1.5.12 Describe the importance of written medical protocols.
- 1.5.13 Describe two purposes of verbal communication of patient information to the hospital.
- 1.5.14 Describe information that should be included in patient assessment information verbally reported to the physician.
- 1.5.15 Organize a list of patient assessment information in the correct order for radio transmission to the physician according to the format used locally.
- 1.5.16 Name five uses of the written EMS run form.
- S1.5.17 Demonstrate the proper use of a mobile transmitter/receiver to receive and transmit information.
- S1.5.18 Demonstrate the proper use of a portable transmitter/receiver to receive and transmit information.
- S1.5.19 Demonstrate the proper use of a digital encoder.
- S1.5.20 Demonstrate the proper use of a mobile or portable transmitter in a real or simulated patient situation to:
  - a. Organize and transmit patient assessment information, using a standardized format
- S1.5.21 Properly complete a written EMS form based on a real or simulated patient situation.



**Introduction**

- A. Steps in the progression of a typical EMS event include:
  - 1. Occurrence
  - 2. Detection
  - 3. Notification and response
  - 4. Treatment and preparation for transport
  - 5. Transport and delivery
  - 6. Preparation for next event
- B. Communications links in the EMS chain necessary to accomplish the above steps include:
  - 1. Communications between party requesting help and the dispatcher
    - a. Via the public telephone system—preferably 9-1-1—or some other widely publicized emergency number
    - b. Via nonpublic telephone or radio from another emergency agency (police, fire)
  - 2. Communications between the dispatcher and the EMT team
    - a. Alert response personnel and direct to scene
    - b. May be telephone notification, voice radio communication, or radio paging (tone, digital)
  - 3. Communications between the dispatcher and public safety units, local hospitals, and other community agencies
  - 4. Communications among EMT's in the field
  - 5. Communications between EMT in the field and receiving hospital and/or medical control physician
    - a. Early alert of hospital for arrival of patients
    - b. Receiving advice regarding transport and orders for medical treatment
- C. Purpose of this section: to make the EMT-I knowledgeable and proficient with the equipment and procedures used in all the stages of EMS communications to maximize emergency medical care of the patient

*Communications Systems: Technical Aspects***Communications System Components**

- A. Communications systems vary greatly in complexity
  - 1. Simple systems may include:
    - a. Self-contained desktop transmitter/receiver
    - b. Speaker
    - c. Microphone
    - d. Antenna
    - e. One-piece dashboard-mounted vehicle radio with single channel capabilities
  - 2. Complex systems may include:
    - a. Remote consoles
    - b. High power transmitters
    - c. Repeaters
    - d. Satellite receivers

**INSTRUCTOR'S NOTES**

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Including notification of  
medical facility.

Especially important in  
rescue and multiple casualty  
situations.

**Equipment Maintenance**

- A. Handling:
  - 1. Do not subject radio equipment to harsh environments if possible
  - 2. Dusty conditions, damp or wet conditions, and dropping radio equipment are among the most frequent causes of equipment failure
- B. Cleaning:
  - 1. Frequent cleaning of radio equipment will improve appearance and life expectancy
  - 2. Use only a slightly damp rag with very mild detergent (no cleaning solvents) on exterior surfaces of radio equipment
- C. Repair:
  - 1. When malfunctioning, radio equipment must be referred to a licensed technician
- D. Batteries:
  - 1. Rechargeable batteries in portable equipment (monitor/defibrillators included) must be used properly to maximize life and power output
  - 2. Nicad rechargeable batteries must be properly “exercised” for best results

*Rule and Operating Procedures*

**Regulatory Agencies**

- A. Federal Communications Commission (FCC)
  - 1. Federal agency established to control and regulate all radio communications in the U.S.
  - 2. Primary functions are:
    - a. Licensing and frequency allocation
    - b. Establishing technical standards for radio equipment
    - c. Establishing and enforcing rules and regulations for radio equipment operation
      - i. Monitor frequencies for appropriate usage
      - ii. Spot check base stations and dispatch centers for appropriate licensing, records, etc.
- B. State and local governments may have additional requirements for radio operations
  - 1. Regional plans to ensure cooperation of all radio users
  - 2. Minimum equipment standards for ambulance licensure

**Dispatch Procedures**

- A. All procedures used must fall within Federal, State and local guidelines
- B. Responsibilities of the dispatcher include:
  - 1. Obtaining as much information as possible about the emergency (often from a distraught caller)
  - 2. Directing the appropriate emergency vehicle(s) to the correct address
  - 3. Monitoring and coordinating communications among everyone in the system
  - 4. In some instances, instructing the caller in measures that should be taken until assistance arrives
  - 5. Maintaining written records
- C. Dispatch personnel may be responsible for EMS events only or may dispatch for police, fire, and EMS in any combination

**INSTRUCTOR'S NOTES**

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Refer to manufacturer  
recommendations for proper  
exercising methods and  
intervals.

See Emergency Medical  
Services Dispatcher National  
Standard Curriculum  
(Second Edition) 1983.

- D. Dispatcher must make appropriate decisions regarding which response vehicles to send
  - 1. Must know location of all vehicles
  - 2. Must know capabilities of various vehicles
  - 3. Must determine if any support services necessary
- E. Dispatcher must know what information is essential to gather from caller prior to dispatching vehicle.
  - 1. Location and nature. Vehicle can be dispatched as soon as these are known
  - 2. Call-back number also high priority in case of accidental telephone disconnection
  - 3. Sample of logical order for questioning caller about an EMS event to insure adequate information:
    - a. Caller's name and call-back number
    - b. Address of event
    - c. Nature of event

**Dispatch First Ambulance**

- d. Is victim unconscious, not breathing, bleeding severely?
- e. Is victim trapped? Is there a fire or other hazard?

**Update Ambulance Crew and Dispatch Support Help**

- f. Determine whether caller needs to, and is competent to, carry out immediate emergency care measures.
- F. Complete dispatcher training for the EMT-I available in the EMS Dispatcher National Standard Curriculum

**Codes**

- A. Used by some EMS systems alone or in combination with clear English
- B. Advantages of codes
  - 1. Can shorten radio air time
  - 2. Provide unambiguous information
  - 3. Enable transmission of information in a format not understood by patient, family, or bystanders
- C. Disadvantages of codes
  - 1. Useless unless everyone in system understands
  - 2. Medical information is often too complex to use codes
- D. Ten-code
  - 1. A system of codes utilizing the number 10 plus another number to indicate a specific message
  - 2. Numbers are brief and easily understood and therefore speed up communications
  - 3. Local decision must be made about which specific list of ten-codes will be used, if any
  - 4. Associated Public Safety Communications Officers (APCO) publishes a widely used ten-code, recommended primarily for dispatcher use
  - 5. Codes discouraged for communication of medical information



**INSTRUCTOR'S NOTES**

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Follow local protocols.

See bibliograhly.

Optional section.

	<ul style="list-style-type: none"> <li>E. Review of codes used by local EMS (if any)</li> <li>F. Remember: Plain English often works as well or better than codes</li> </ul>
<b>Radio Communications Techniques</b>	<ul style="list-style-type: none"> <li>A. Proper radio use results in efficient, professional communications           <ul style="list-style-type: none"> <li>1. Transmissions must be clear</li> <li>2. Content of transmission should be concise and professional</li> </ul> </li> <li>B. General guidelines regarding clarity of transmissions           <ul style="list-style-type: none"> <li>1. Listen to the channel before transmitting to be sure it is not in use</li> <li>2. Press the transmit button for one second before speaking</li> <li>3. Speak at a close range (2–3 inches) directly into or across the face of the microphone</li> <li>4. Speak slowly and clearly. Attempt to pronounce each word distinctly, avoiding words that are difficult to hear</li> <li>5. Speak in a normal pitch, keeping your voice free of emotion</li> <li>6. Be brief. Know what you are going to say before pressing the transmit button</li> <li>7. Avoid codes unless they are part of your system</li> <li>8. Do not waste air time with supercilious phrases</li> </ul> </li> <li>C. General guidelines regarding content of transmissions           <ul style="list-style-type: none"> <li>1. Protect the privacy of the patient. When appropriate:               <ul style="list-style-type: none"> <li>a. Use codes</li> <li>b. Use telephone rather than radio</li> <li>c. Turn off external speaker or radio</li> <li>d. Avoid use of patient's name</li> </ul> </li> <li>2. Use proper unit numbers, hospital numbers, proper names and titles</li> <li>3. Do not use slang or profanity</li> <li>4. Use standard formats for transmission</li> <li>5. Utilize the “echo” procedure when receiving directions from the dispatcher or physician orders</li> <li>6. When completing a transmission, obtain confirmation that your message was received</li> </ul> </li> </ul>
<b>Communication of Medical Information</b>	<ul style="list-style-type: none"> <li>A. Written protocols           <ul style="list-style-type: none"> <li>1. Predetermined guidelines for the EMT-I on prehospital medical care</li> <li>2. Should be developed by the medical group responsible for medical control</li> <li>3. Varies greatly from system to system:               <ul style="list-style-type: none"> <li>a. Obviously ill patient refusing treatment/transport</li> <li>b. Uncertainty if continuation or termination of resuscitation is appropriate (i.e., questionable “Do not resuscitate”)</li> <li>c. Difficulty with non-EMS physician who is interfering at the scene</li> </ul> </li> </ul> </li> </ul>
<b>Communication of Patient Information by the EMT-I</b>	<ul style="list-style-type: none"> <li>A. Verbal communication           <ul style="list-style-type: none"> <li>1. May occur via radio or landline</li> <li>2. Purpose:               <ul style="list-style-type: none"> <li>a. To provide hospital with enough information regarding patient's condition to begin preparations for care</li> <li>b. To obtain medical orders for patient treatment in the field</li> </ul> </li> </ul> </li> </ul>

**INSTRUCTOR'S NOTES**

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May be acceptable in some localities.

The immediate repetition of information to assure accuracy.

3. Use of standard format for transmission of patient assessment information
    - a. Allows efficient use of medical communications system, i.e., limits radio air time
    - b. Allows physician to quickly receive and assimilate information regarding patient's condition
    - c. Assures no significant information is omitted
  4. Format should be brief and concise. Should include:
    - a. Unit call name and number or name of EMT-I
    - b. Description of scene
    - c. Patient's age and sex
    - d. Patient's chief complaint
    - e. Associated symptoms
    - f. Brief, pertinent history of the present illness
    - g. Pertinent past medical history, medications, and allergies
    - h. Physical exam findings, including:
      - i. Level of consciousness
      - ii. Vital signs
      - iii. Neuro exam
      - iv. General appearance and degree of distress
      - v. Trauma index or Glasgow Coma Scale (if applicable)
      - vi. Other pertinent observations, significant positive and negative findings
    - i. Treatment given so far
    - j. Estimated time of arrival at hospital
    - k. Name of private medical physician
    - l. Await further questions and orders from base physician
  5. Remember: When communicating with the physician from the field, the EMT should:
    - a. Be accurate and complete in reporting
    - b. Provide additional information when requested
    - c. "Echo" back orders given by physician
    - d. Question orders that are not clear or do not seem appropriate for the patient's condition
    - e. Report back when orders have been carried out, and indicate patient response
    - f. Keep physician informed of any changes in patient condition
    - g. Consult with physician when transport of the patient is not deemed necessary
    - h. Protect patient privacy
    - i. In addition to usual base communication contact procedures, consult with physician *any* time you are uncertain of what course to take
  6. Verbal communications also include brief report of patient information to person assuming care of patient at hospital
- B. Written communications (EMS forms)



1. A document developed by State or local EMS
2. Purpose:
  - a. Written record of patient's initial condition that remains at hospital after EMT's have left
  - b. Legal record of medical treatment rendered patient in prehospital phase of care
  - c. Documentation of patient's refusal of care and/or transport
  - d. Other uses:
    - i. Medical audits
    - ii. Quality control
    - iii. Data collection
    - iv. Billing
3. EMS forms must be:
  - a. Complete
  - b. Legible
  - c. Signed by EMT

**Techniques of  
Management:  
Communication Skills**

- A. Use of a mobile and portable transmitter/receiver
  1. Turn the unit on
  2. Adjust the squelch (if available)
  3. Listen to be sure the airways are free of other communications
  4. Hold the microphone within the unit at a proper distance from the mouth and maintain a vertical antenna position
  5. Push the transmit button and pause before speaking
  6. Call another unit using proper unit I.D. numbers
  7. Upon termination of communication state that you are clear of the channel so other users may transmit
- B. Use of a digital encoder
  1. Turn the unit on
  2. Adjust the squelch
  3. Listen to be sure the airways are free of other communications
  4. Select the address code to be dialed
  5. Dial the selected code numbers
  6. Hold the microphone at a proper distance from the mouth
  7. Push the transmit button and pause before speaking
  8. Call the unit dialed using assigned unit I.D. numbers
  9. Upon termination of communication state that you are clear on the channel, so other users may transmit
- C. Transmission of patient assessment information
  1. Turn the unit on
  2. Adjust the squelch
  3. Listen to be sure the airways are free of other communications
  4. Hold the microphone a proper distance from your mouth
  5. Push the transmit button and pause before speaking
  6. Call the physician, using proper unit I.D. numbers
  7. Following local procedures and protocols, relay patient assessment information to the physician



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## BIBLIOGRAPHY

Associated Public Safety Communications Officers, Inc., (APCO), *Journal of Public Safety Communications*, various issues.

Caroline, Nancy, L., M.D.: *Emergency Care in the Streets*, Boston: Little, Brown and Co., 1979.

Federal Communications Commission, *Rules and Regulations, Part 90*, U.S. Government Printing Office, Public Documents Department, Washington, D.C.: March 1979.

U.S. Department of Transportation/National Highway Traffic Safety Administration; *Emergency Medical Services Dispatcher National Standard Curriculum*, Second Edition, 1983.



**Division 1:  
Prehospital  
Environment**

**Section 6. General Patient Assessment  
and Initial Management**



**Introduction**

The student must have successfully completed the following sections prior to participating in this section:

Section 1. Roles and Responsibilities

Section 2. EMS Systems

Section 3. Medical/Legal Considerations

Section 4. Medical Terminology

Section 5. EMS Communications

Although it would be ideal to evaluate the patient completely then go back and manage those conditions found. This is impossible in the acutely ill or injured patient. Many things must be managed when found (e.g., airway compromise). This section on patient assessment and management tries to combine those areas in which simultaneous management and assessment are required. The EMT-I, upon completion of this section, should have enough knowledge to identify when such simultaneous evaluation and management are required and when they are not.

The EMT-I should not attempt to memorize the skill and the condition for which it is used. The prehospital care phase of emergency patient care contains so many variables (e.g., location of the accident, weather, attitude of bystanders, possible contamination or fire), that to match one for one would be an impossibility. For this reason, the EMT must acquire a wide spectrum of knowledge and skills so that they can be applied when and how the situation dictates.

The principles, however, are that life-threatening conditions are treated first, access to definitive care is as rapid as possible, and evaluations which will not alter prehospital management do not extend prehospital on-the-scene time.

The middle principle of access to definitive care as soon as possible will differ in the trauma patient versus the medical patient. In the latter, especially at the EMT-I level, definitive care can be started at the scene (defibrillation for ventricular fibrillation, or glucose for insulin shock).

In the trauma patient, the blood loss must be stopped, the injury repaired, and oxygen carrying whole blood replaced. These cannot be carried out at the scene or in some instances even in the emergency department. Delay for inappropriate evaluations or unnecessary IV's should not be allowed in the field or in the emergency department. There is a finite period for each patient between the time the injury occurs and the time when the hemorrhage must be controlled or the injury repaired.

**Overview**

- I. Introduction
- II. Scene Survey
- III. Primary Survey
- IV. Resuscitation
- V. Secondary Survey
- VI. History
- VII. Definitive Field Management
- VIII. Re-evaluation

**Objectives**

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

- 1.6.1 Establish priorities of care based on threat to life conditions.
- 1.6.2 Describe the four phases of patient assessment.

- 1.6.3 Discuss the possible environmental hazards that the EMT-I may encounter and the means of protecting him in this environment.
- 1.6.4 Describe the environmental hazards which a patient might encounter.
- 1.6.5 Describe the problems an EMT-I might encounter in a hostile situation and describe mechanisms of management.
- 1.6.6 Describe the various types of protective equipment available to the EMT-I for self-protection and patient protection.
- 1.6.7 Discuss the appropriate methods of patient protection in each situation.
- 1.6.8 Discuss backup personnel, transportation, and equipment.
- 1.6.9 Define and describe the various classifications of emergencies which an EMT-I will encounter. Base this on medical needs.
- 1.6.10 Describe the primary survey and what areas are critical to evaluate.
- 1.6.11 Describe the anatomy of the following: upper airway, tongue, hypopharynx, nasopharynx, oropharynx, larynx, vocal cords.
- 1.6.12 Describe the function of the vocal cords.
- 1.6.13 Describe the flow of air from outside the body into the trachea.
- 1.6.14 Describe the reasons for and mechanism of humidification and warming of the air as it passes through the naso-and oral pharynx.
- 1.6.15 Describe the pathological conditions that can occur in the nose, pharynx, and larynx to obstruct or retard air flow and identify the complications of laryngeal fracture.
- 1.6.16 Describe the methods of airway management.
- 1.6.17 Describe the methods and management of an obstructed airway.
- 1.6.18 Describe the mechanical methods of airway management including the benefits and limitations. Oral, nasal and EOA.
- 1.6.19 Describe how the cervical spine is protected throughout these maneuvers.
- 1.6.20 Describe the anatomy of the following:
  - a. Lungs
  - b. Trachea
  - c. Alveolus
  - d. Diaphragm
  - e. Thoracic wall
  - f. Pleural space.
- 1.6.21 Describe how pulmonary ventilation (inhalation and exhalation) is accomplished.
- 1.6.22 Describe the gaseous exchange across the alveoli-capillary membrane (O<sub>2</sub> and CO<sub>2</sub>)
- 1.6.23 Describe the pulmonary problems that can complicate exhalation and inhalation, the mechanisms by which they reduce ventilation and management of each problem, including:
  - a. Open pneumothorax
  - b. Diaphragmatic injury
  - c. Closed pneumothorax (simple and tension)
  - d. Flail chest.
- 1.6.24 Describe the problems of ventilation.

- 1.6.25 Define mouth-to-mask ventilation, its benefits and limitations.
- 1.6.26 Discuss the bag-valve-mask (BVM), its benefits and limitations.
- 1.6.27 Discuss the techniques for evaluating the effectiveness of ventilation.
- 1.6.28 Describe the anatomy of the heart and the cardiovascular system.
- 1.6.29 Describe the problems that occur with decreased perfusion.
- 1.6.30 Describe the pathophysiology of cardiac arrest.
- 1.6.31 Describe the mechanisms of evaluating the effectiveness of perfusion, including pulse, skin color, capillary refill.
- 1.6.32 Discuss ventilation with an EOA.
- \*1.6.33 Discuss ventilation with an endotracheal tube (optional).
- \*1.6.34 Describe the equipment and method of suctioning the airway, pharynx, and endotracheal tube (optional).
- 1.6.35 Describe the anatomy of the skin, bones, vessels, and subcutaneous tissue as it relates to hemorrhage control.
- 1.6.36 Discuss the benefits and complications of hemorrhage control by the following means:
  - a. Direct pressure
  - b. Tourniquets
  - c. Hemostats.
- 1.6.37 Define a mini-neurological examination (level of consciousness).
- 1.6.38 Describe exposing the patient's body for total evaluation.
- 1.6.39 Discuss when this should and should not be carried out.
- 1.6.40 Define shock.
- 1.6.41 Describe the reasons for and mechanisms of patient reassessment in the resuscitation phase.
- 1.6.42 Define the components of secondary survey and its benefits for patient evaluation.
- 1.6.43 Describe the assessment of the head, neck, thorax, abdomen, extremities, and nervous system.
- 1.6.44 Describe the trauma score, define its usefulness and how it is accomplished.
- 1.6.45 Discuss the important components that must be identified in taking an appropriate history from a patient.
- 1.6.46 Describe which laboratory samples are drawn in the field when the IV is started and their usefulness.
- 1.6.47 Define the definitive care phase.
- 1.6.48 Describe how a patient is packaged and stabilized for transportation to the hospital, including airway ventilation, IV fluids, pneumatic anti-shock garment, fracture stabilization, bandaging.
- 1.6.49 Describe how the patient is immobilized to the backboard.
- 1.6.50 Describe how the patient is immobilized to the stretcher, and to the ambulance.
- 1.6.51 Describe patient extrication.
- 1.6.52 Describe how the patient is monitored en route to the hospital.
- 1.6.53 Describe how the hospitals are selected for receipt of patients based on patient need and hospital capability.

- 1.6.54 Describe the benefits and complications of lights and sirens and when they should be used.
- 1.6.55 Describe the interaction between the EMT-I and Medical Command authority in regard to: receiving hospital, family physician on the scene, bystander physician on the scene, orders for patient care, needs of the family, and needs of the patient.
- 1.6.56 Describe the usefulness of a run report.
- 1.6.57 Describe the mechanisms of continued evaluation of the patient en route to the hospital.
- S1.6.58 Perform a rapid assessment of the patient to identify priorities for care.
- S1.6.59 Demonstrate the assessment of the head, neck, thorax, abdomen, extremities, and neurological system.
- S1.6.60 Demonstrate effective mouth-to-mask ventilation.
- S1.6.61 Demonstrate effective bag-valve
  - a. Mask
  - b. EOA
  - \*c. ET (optional)
- S1.6.62 Demonstrate effective cardiopulmonary resuscitation.
- S1.6.63 Demonstrate the manual methods of airway management.
- S1.6.64 Demonstrate the methods of management of an obstructed airway.
- S1.6.65 Demonstrate the mechanical methods of airway management
  - a. Nasal
  - b. Oral
  - c. EOA
  - \*d. ET (optional)
- S1.6.66 Demonstrate the use of self-protection equipment such as air pack (breathing apparatus), etc.
- S1.6.67 Demonstrate the use of various types of portable and fixed suction devices.

\* Indicates optional

(S) Indicates Skill Objective



**Introduction**

- A. Priorities
  - 1. Establish priorities of evaluation and care based on threat-to-life
  - 2. Rapid assessment (primary survey identifies conditions which potentially involve threat-to-life)
  - 3. Simultaneous management on these conditions
- B. Initial Assessment
  - 1. Step-wise evaluation of patient to determine priorities of care
  - 2. Steps are:
    - a. Scene survey
    - b. EMT-I and patient protection
    - c. Primary survey
    - d. Resuscitation
      - i. Initiate airway management
      - ii. Control hemorrhage
      - iii. Initiation of shock management
      - iv. Reassessment of threat-to-life conditions identified in primary survey
      - v. Continued management of these conditions
    - e. Secondary survey
    - f. Definitive field management
      - i. Stabilization of fractures
      - ii. Packaging for transport
    - g. Re-evaluation

**Scene Survey**

- A. Hazards.
  - 1. EMT-I safety precautions
    - a. Environment
      - i. Location of emergency
        - (a) Fire (or risk of fire)
        - (b) Wilderness
        - (c) Heights
      - ii. Physical scene
        - (a) Environmental
        - (b) Movement (fire, auto, building)
      - iii. Weather
    - b. Hostile situation
      - i. Perpetrator(s) location known or captured
      - ii. Bystanders' mood
        - (a) Hostile
        - (b) Supportive
      - iii. Law enforcement assistance available
    - c. Special equipment
      - i. Self-contained breathing apparatus
      - ii. Protective clothing
        - (a) Chemical



**INSTRUCTOR'S NOTES**

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The EMT-I is no benefit to the patient if he is injured or otherwise incapacitated. This only increases number of victims which must be cared for by the remaining rescue personnel. Therefore a prime concern of an EMT-I must be self-protection.

Do not assume only one perpetrator.

- (b) Gas
        - (c) Fire
        - (d) Environmental extremes
        - (e) Decontamination suit
      - iii. Aerial access equipment
      - iv. Water rescue protection
    - 2. Patient
      - a. Environment
        - i. Patient protection
          - (a) Rain, snow, heat, cold
          - (b) Air or fluid chemical contamination
        - ii. Preserve modesty as much as possible
        - iii. Protection against further injury
      - b. Hostile situation
        - i. Perpetrator
        - ii. Crowd
      - c. Special protection equipment
        - i. Blankets
        - ii. Breathing apparatus
  - B. Backup
    - 1. Personnel
    - 2. Transport vehicle
    - 3. Equipment for patient removal
    - 4. EMT protection
    - 5. Patient protection
  - C. Classification
    - 1. Medical
    - 2. Trauma
    - 3. Behavioral
    - 4. OB/GYN
    - 5. Major incident
  - D. History of emergency
    - 1. Events preceding emergency
      - a. Accident
        - i. Type of trauma—blunt or penetrating
        - ii. Mechanism of injury
      - b. Medical
      - c. Change in environment
    - 2. Pertinent medical history
  - E. Access to patient
    - 1. Special equipment
    - 2. Special personnel
- Primary Survey**
- A. Airway
    - 1. Anatomy

**INSTRUCTOR'S NOTES**

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Radiation.

Falls, glass, fire, noise, etc.

Need for such backup must be recognized and requested immediately on arriving on the scene. Additional help needs to be en route as soon as possible.

Medical alert tags.

Brief summary, allergies.

- a. Tongue/hypopharynx
  - b. Nasal air passages
    - i. Hemorrhage
      - (a) Spontaneous
      - (b) Traumatic
  - c. Oral air passages
  - d. Pharynx
  - e. Larynx
  - f. Vocal cord function
2. Physiology
- a. Flow of air
  - b. Humidification of air
3. Pathophysiology
- a. Pharyngeal
  - b. Larynx
4. Management
- a. Manual
    - i. Hyperextension
    - ii. Chin lift
    - iii. Jaw lift
    - iv. Jaw thrust
  - b. Obstructed airway
    - i. Back blows
    - ii. Manual thrust
    - iii. Laryngoscope/McGill forceps
  - c. Mechanical
    - i. Nasal airway
      - (a) Construction
      - (b) Benefits
      - (c) Limitations
      - (d) Method of insertion
    - ii. Oral airway
      - (a) Construction
      - (b) Benefits
      - (c) Limitations
      - (d) Method of insertion
      - (e) Contraindications
    - iii. Esophageal intubation
      - (a) Construction
      - (b) Benefits
      - (c) Limitations
      - (d) Method of insertion
      - (e) Contraindications
    - iv. Endotracheal intubation
      - (a) Construction



- (b) Benefits
  - (c) Limitations
  - (d) Method of insertion
  - (e) Contraindications
  - d. Ventilation
    - i. Bag-valve
      - (a) Assessment of effective ventilation
        - (i) Rise in chest wall
        - (ii) Auscultation of lungs
        - (iii) Auscultation of stomach
        - (iv) Skin color
        - (v) Heart rate
    - ii. Demand valve
      - (a) Construction
      - (b) Method of operation
      - (c) Connection to airway
      - (d) Assessment of effective operation
        - (i) Rise in chestwall
        - (ii) Auscultation bilaterally of lungs
        - (iii) Auscultation of stomach
        - (iv) Skin color
        - (v) Heart rate
  - e. Protection of C-spine
    - i. Indication of C-spine trauma
      - (a) Identify injury above clavicle
      - (b) Unconscious
      - (c) Mechanism of injury
- B. Breathing
  - 1. Anatomy
    - a. Lungs, trachea, alveoli
    - b. Diaphragm
    - c. Thoracic wall
    - d. Pleural space
  - 2. Physiology
    - a. Pulmonary expansion (inhalation/exhalation)
      - i. Diaphragm action
      - ii. Rib action
      - iii. Accessory muscles of respiration
      - iv. Inhalation by negative pressure, not positive
      - v. Pleural space effect
    - b. Gas exchange
      - i. Alveolar capillary membrane
      - ii. O<sub>2</sub> across membrane
      - iii. O<sub>2</sub> into red blood cells
      - iv. O<sub>2</sub> into solution



- v. CO<sub>2</sub> across membrane
- vi. CO<sub>2</sub> out of RBC
- vii. CO<sub>2</sub> in solution
- 3. Pathophysiology
  - a. Chest wall
    - i. Open pneumothorax
      - (a) Air follows easiest pathway
      - (b) Collapse of lung
      - (c) Decreased air exchange
  - b. Diaphragm
    - i. Paralysis
    - ii. Injury
    - iii. Rupture
  - c. Lung-rupture/perforation
    - i. Pneumothorax (simple)
      - (a) Mild decreased exchange
      - (b) No field treatment
      - (c) Observation
    - ii. Pneumothorax (tension)
      - (a) Marked decrease air exchange
      - (b) Signs and symptoms
        - (i) Unilateral-absent breath sounds
        - (ii) Deviated trachea
        - (iii) Distended neck veins
        - (iv) Cyanosis
        - (v) Decreased blood pressure and pulse changes
  - d. Flail chest
    - i. Paradoxical chest wall movement
    - ii. Pain-producing decreased chest expansion
    - iii. Pulmonary contusion
- 4. Assessment
  - a. Auscultation
  - b. Respiratory effort
  - c. Retraction
  - d. Abdominal/thoracic respirations
  - e. Exposure of chest
  - f. Technique of exam
- 5. Management
  - a. Mechanisms
    - i. Mouth-to-mouth
    - ii. Mouth-to-mask
    - iii. Bag-valve-mask (BVM)
    - iv. Esophageal intubation device
    - v. Endotracheal intubation (ET)
  - b. Evaluation of effectiveness





- i. Chest movement
    - ii. Auscultation
      - (a) Left lung field
      - (b) Right lung field
      - (c) Stomach (esogastrium)
  - c. Trauma
    - i. Thoracic wall stabilization
      - (a) Reduction of movement of flail segment
      - (b) Methods of achieving
      - (c) Limitations
    - ii. Evacuation pleural space
      - (a) Needle
      - (b) Dart
    - iii. Open chest wound
      - (a) Hand occlusion
      - (b) Vaseline gauze
      - (c) Plastic taped on three or four sides
- C. Circulation
  - 1. Perfusion
    - a. Anatomy
      - i. Circulation
      - ii. Heart
      - iii. Thorax
      - iv. Vascular system
    - b. Pathophysiology
      - i. Decreased perfusion
      - ii. Cardiac arrest
    - c. Evaluation
      - i. Pulse
        - (a) Rate
        - (b) Character
      - ii. Capillary refill
      - iii. Location of pulse
        - (a) Radial
        - (b) Femoral
        - (c) Carotid
      - iv. Skin color
        - (a) Pink
        - (b) Pale
        - (c) Cyanotic
        - (d) Mottled
    - d. Management
      - i. Cardiac compressions
      - ii. Hemorrhage
        - (a) anatomy

**INSTRUCTOR'S NOTES**

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(BP>80 mm Hg)  
(BP>70 mm Hg)  
(BP>60 mm Hg)

Any changes developed by  
the American Heart  
Association for Basic or  
Advanced Cardiac Life  
Support should be reflected

- (i) Skin
- (ii) Bone
- (iii) Vessels
- (iv) Subcutaneous fat
- (b) Evaluation—massive hemorrhage versus minor hemorrhage
- (c) Management
  - (i) Direct pressures
  - (ii) Tourniquets
  - (iii) Hemostats
- D. Disability: mini-neuro exam
  - 1. Level of consciousness (AVPU)
    - a. A—Alert
    - b. V—Vocal stimuli response
    - c. P—Painful stimuli response
    - d. U—Unresponsive
- E. Expose
  - 1. Expose entire body for exam, limited only to environment, bystanders, and situation.

**Resuscitation**

- A. Shock resuscitation
  - 1. Physiology
    - a. Shock-tissue anaerobic metabolism. The Fick Principle has two components.
      - i. Oxygenation of RBC
      - ii. RBC delivery to tissue cells
  - 2. Evaluation
    - a. Heart rate
    - b. Diastolic pressure
    - c. Systolic pressure
    - d. Capillary refilling
    - e. Skin color
    - f. Skin temperature
  - 3. Management
    - a. Oxygenation
    - b. Pneumatic antishock
    - c. Fluid replacement
- B. Maintain stability of items in primary survey

**Secondary Survey**

- A. Technique
  - 1. Look
  - 2. Listen
  - 3. Feel
  - 4. Smell
- B. Regional evaluation
  - 1. Step-wise organized evaluation

## INSTRUCTOR'S NOTES

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in the objectives and outline  
of the instructor.

Hand, 4 × 4, & pneumatic  
splints are effective if  
correctly used. Ischemic  
distal to side. May force  
amputation at that point.  
Seldom if ever required.

Appropriately/Inappropriately.  
Appropriately/Inappropriately.

The patient's modesty and  
comfort should be taken into  
consideration along with  
severity of possible injury  
when deciding when and  
where to expose the entire  
body.

If either of these components  
is not adequate, RBC will  
receive inadequate oxygen  
and be forced from aerobic  
to anaerobic.

Inspection  
Auscultation  
Palpation

Organized by body region.

2. Redefine priorities
- C. Head
  1. Skin, scalp
  2. Eyes
  3. Nose
  4. Mouth
  5. Bones
    - a. Facial
    - b. Mandible
    - c. Skull
- D. Neck
  1. Skin
  2. Soft tissue
  3. Trachea
  4. Vessels
  5. Cervical spine
- E. Thorax
  1. Skin
  2. Chest wall
    - a. Bones
    - b. Muscles
  3. Lungs
    - a. Auscultation
    - b. Palpation
  4. Heart
    - a. Auscultation
    - b. Palpation
    - c. Electrocardiogram
- F. Abdomen
  1. Structures
    - a. Skin
    - b. Muscles
    - c. Peritoneal contents
    - d. Retroperitoneal
    - e. Lumbar spine
    - f. Pelvis
    - g. Genitalia
  2. Technique
    - a. Inspection
    - b. Palpation
  3. Objective
- G. Extremities
  1. Structures
    - a. Skin
    - b. Soft tissue



c. Vessels

d. Bones

2. Technique

a. Inspection

b. Palpation

H. Neurological

1. Level of consciousness

2. Seizure activity

3. Motor

4. Sensory

5. Pupils

6. Range of motion

I. Trauma Score

1. Technique

a. Capillary return

b. Respiratory effort

c. Eye opening

d. Verbal response

e. Motor response

2. Significance

**History**

A. Chief complaint

1. Verbal complaint

2. Nonverbal complaint

B. Present illness

1. Symptoms as related to chief complaint

2. Associated symptoms

3. Referred symptoms

C. History mnemonic

1. A. = Allergies

2. M = Medications

3. P = Past history

4. L = Last oral intake

5. E = Events leading up to emergency

**Definitive Field Management**

A. Packaging for transportation

1. Airway

2. Ventilation

3. IV fluids

4. PASG

5. Cardiac monitoring

6. Fracture stabilization

7. Bandaging

8. Immobilization to stretcher

9. Additional drugs prior to transport



**INSTRUCTOR'S NOTES**

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Deviation, swelling,  
discoloration. Range of  
motion, circulation,  
sensation, crepitation, bone  
deformation, pain.

At the time of the  
development of curricula  
Trauma Scores are under  
revision. Consult current  
literature.

History obtained at  
appropriate opportunity.

AMPLE.  
Ample.  
aMple.  
amPle.  
ampLe.  
ample.

Optional.

10. Blood
  - a. Glucose
  - b. Samples for hospital
    - i. Types and match
    - ii. Complete blood count (CBC)
    - iii. Chemistries
11. Extrication from emergency situation
- B. Loading
  1. Placement of vehicle
  2. Movement of patient into vehicle
- C. Transportation
  1. Hospital
    - a. Patient choice
    - b. Closest appropriate
  2. Speed
    - a. Light and sirens
    - b. Patient comfort
    - c. EMT-I access to patient
      - i. Re-evaluation
      - ii. Treatment
  3. Delay at scene for inappropriate evaluation/treatment should not occur
- D. Communication
  1. Family
  2. Patient reassurance
  3. Medical control
    - a. Medical command authority
      - i. Physician
      - ii. Nurse with physician backup
    - b. Procedure
      - i. Situation
      - ii. Category
        - (a) Medical
        - (b) Trauma
        - (c) Behavioral
        - (d) OB/GYN
      - iii. Sex and age
      - iv. Chief complaint
      - v. Trauma score
      - vi. Brief present illness
      - vii. Physical findings
      - viii. AMPLE history
      - ix. Clinical impression
      - x. Treatment to present
      - xi. Requests further treatment
      - xii. Estimate time of arrival at hospital

**INSTRUCTOR'S NOTES**

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To be drawn based on local desires.

< than 5% occurrence.

This system enables the EMT-I and the physician at the hospital to assess objectively the severity of the patient's injury. This will provide appropriate transportation to the appropriate hospital while appropriate care is given en route and appropriate preparations made to receive & care for the patient at the hospital.

ETA.

4. Run report
  - a. Completeness
  - b. Medical/legal
  - c. Signatures

**Re-evaluation**

- A. Need
  1. Rapid change in condition
    - a. Continuing blood loss
    - b. Airway compromise
    - c. Decreased ventilation
  2. Missed injuries
    - a. Poor environment for initial evaluation
    - b. Improved status of patient allows identification by additional areas of injury
  3. Change in methods by life support as condition changed
- B. Parameters
  1. Airway
  2. Ventilation
  3. Pulse
  4. Skin color
  5. Blood pressure
  6. Electrocardiogram
  7. Neurological status
  8. Circulation distal to fracture
  9. Intravenous rate
  10. Oxygenation
  11. Lung sounds





**Division 1:  
Prehospital  
Environment**

**Section 7. Airway Management and Ventilation**





**Introduction**

The student must have successfully completed the following sections prior to participating in this section:

Section 1. Roles and Responsibilities

Section 2. EMS Systems

Section 3. Medical/Legal Considerations

Section 4. Medical Terminology

Section 5. EMS Communications

Section 6. General Patient Assessment and Initial Management

Although emphasis has been placed on airway management in the specific segments of the first curriculum as well as this one, as to the methods of airway management, extra training and time should be allotted as lack of adequate airway and ventilation is the major cause of nonsurvival and/or neurological, cardiac, and pulmonary complications of both medical and trauma prehospital disease processes.

Management of almost any medical emergency requires adequate oxygenation, and according to the Fick Principal it is dependent upon two parameters:

1. Red blood cell oxygenation;
2. Delivery by the red blood cells to the tissue and off-loading of the oxygen.

This section will address the first step, that of oxygenation of the red cell. Since it is impossible to measure red cell oxygenation in the prehospital setting, the outcome of that process will be addressed. This is identified by color of the skin and by the function (or lack of function) of the specific organ in question—for example, level of consciousness and cerebration of the patient or cardiac rate, rhythm and if available, ECG. Short of evaluating organ function, which also requires oxygenated red cell delivery, adequacy of air movement into the lungs is another method of checking on the completeness of ventilation.

If any specific areas of inadequacy in prehospital care could be identified, these would be:

1. Lack of mask/face seal
2. Inadequate volume of pulmonary ventilation
3. Delay time in instituting airway-management (or during the change of methods, e.g., BVM ventilation to ventilation via ET tube)
4. Low  $FiO_2$

These and other airway ventilation parameters will be addressed in this section.

**Overview**

- I. Introduction
- II. Airway Anatomy and Physiology
- III. Assessment
- IV. Management
- V. Ventilation
- VI. Suction
- VII. Endotracheal intubation (optional)

**Objectives**

At the conclusion of this lesson, the student will be able to:

- 1.7.1 Describe anatomy of the mouth, hypopharynx, trachea, larynx.
- 1.7.2 Describe the relationship between:

- a. Cords and larynx
  - b. Esophagus and larynx
  - c. Epiglottis and larynx
  - d. Tongue and larynx
  - e. True cords and false cords
  - f. Pharynx and larynx
- 1.7.3 Given a list of arterial oxygen concentrations, the student should be able to select the normal  $PO_2$ , for a young adult breathing air.
  - 1.7.4 Given a list of arterial carbon dioxide concentrations, the student should be able to select the normal  $PCO_2$ .
  - 1.7.5 Given an increase in arterial  $PCO_2$ , the student should be able to name this condition and describe its effect on respiratory activity and on blood pH in the normal individual.
  - 1.7.6 Given a decrease in arterial  $PO_2$ , the student should be able to name this condition and describe its effect on respiratory activity in the normal individual.
  - 1.7.7 Given an increase in  $CO_2$  production, the student should be able to list at least two ways in which this increase may occur.
  - 1.7.8 Given an increase in  $CO_2$  elimination, the student should be able to describe how this elimination can occur.
  - 1.7.9 Given a list of statements, the student should be able to identify the statement that best describes the purpose of suctioning a patient.
  - 1.7.10 Given a diagram of a piston-powered suction unit, the student should be able to label and describe the operation and cleaning of each component and attached part.
  - 1.7.11 Given that there are various types of suction units, the student should be able to list at least four different types of units determined by the method in which the suction effect is obtained.
  - 1.7.12 Given that there are various types of suction catheters, the student should be able to list at least three different types, determined by difference in use and material composition.
  - 1.7.13 Given a list of situations describing patients who require suctioning, the student should indicate which type of catheter should be used.
  - 1.7.14 Given a list of statements, the student should be able to identify the statement that best describes the purpose of using the esophageal obturator airway.
  - 1.7.15 Given a list of situations describing patients with airway maintenance problems or potential airway maintenance problems, the student should be able to identify situations in which the use of the esophageal obturator airway is indicated and contraindicated.
  - 1.7.16 Given a list of situations, the student should be able to identify those situations in which the esophageal airway may be removed.
  - 1.7.17 Given a list of advantages, the student should be able to identify the advantages of using the esophageal obturator airway over other methods of airway control.
  - 1.7.18 Given a list of airway adjuncts, advantages, and disadvantages, the student should be able to match the airway adjuncts with the advantages and disadvantages.

- S1.7.19 Given an adult manikin, oropharyngeal and nasopharyngeal airways, pocket mask, oxygen cylinder, and bag-valve-mask, the student should be able to demonstrate the procedure for administering intermittent positive pressure ventilation using:
- Pocket mask
  - Bag-valve-mask and oropharyngeal airway
  - Bag-valve-mask with oxygen
  - Nasopharyngeal airway with bag-valve-mask
- S1.7.20 Given a bag-valve mask, the student should be able to demonstrate the assembly, disassembly, and cleaning of the bag-valve-mask unit.
- S1.7.21 Given an adult manikin, an oropharyngeal airway, and a demand-valve unit, the student should be able to demonstrate the procedure for performing intermittent positive-pressure ventilation.
- S1.7.22 Given a demand-valve unit, the student should be able to demonstrate the assembly, disassembly, and cleaning of the unit.
- 1.7.23 Given a list of disadvantages, the student should be able to identify the disadvantages of using the esophageal obturator airway over other methods of airway control.
- 1.7.24 Given a diagram of the esophageal obturator airway, the student should be able to label and describe the function of all component parts.
- 1.7.25 Given a list of equipment and materials, the student should be able to identify those items that must be available before esophageal obturation is begun.
- 1.7.26 Given that a patient requires an esophageal obturator airway, the student should be able to list the procedures for insertion of the esophageal airway, including all steps in the proper sequence.
- 1.7.27 Given a list of errors, the student should be able to identify common errors involved in the use of the esophageal obturator airway.
- \*1.7.28 Describe laryngoscope, suction, endotracheal tube and bag-valve mask.
- \*1.7.29 Discuss indications and contraindications of endotracheal intubation.
- \*1.7.30 Discuss alternatives to endotracheal intubation.
- \*1.7.31 Discuss skill deterioration and methods of prevention.
- \*1.7.32 Discuss need for rapid placement of ET tube.
- \*1.7.33 Discuss methods of assuring and maintaining correct placement of ET tube.
- \*1.7.34 Given that a patient needs suctioning and already has an endotracheal tube in place, the student should be able to describe the difference between endotracheal suctioning and oropharyngeal suctioning, including:
- Dangers
  - Precautions
- \*S1.7.35 Given an adult intubation manikin, an esophageal obturator airway, 30-cc syringe, and a bag-valve unit, the student should be able to demonstrate the technique for the insertion of an esophageal obturator airway. He should further be able to demonstrate endotracheal

intubation with the esophageal obturator in place and subsequent correct removal of the obturator.

- \*S1.7.36 Demonstrate placement of an ET within 45 seconds.
- \*S1.7.37 Demonstrate ventilation with bag valve and endotracheal tube.
- \*S1.7.38 Demonstrate method by assuring and maintaining correct placement of ET tube.
- \*S1.7.39 Demonstrate reventilation for missed intubation.
- \*S1.7.40 Demonstrate skills described above both on manikin and a live patient.



**Introduction**

- A. Need for oxygenation
- B. Major prehospital causes of death
- C. Most neglected of prehospital skills
- D. Fick Principle (Aerobic Metabolism plus RBC Oxygenation = RBC Delivery)

*Airway Anatomy and Physiology***Anatomy of Upper Airway**

- A. Nasopharynx
  - 1. Nares
  - 2. Cartilage
  - 3. Nasal bones
  - 4. Maxilla
  - 5. Vascular supply
- B. Oropharynx
  - 1. Lips
  - 2. Cheeks
  - 3. Tongue
  - 4. Hard palate
  - 5. Soft palate
  - 6. Tonsillar pillows
  - 7. Teeth
  - 8. Vascular supply
  - 9. Mandible
  - 10. Mandible/tongue relationship and association
- C. Hypopharynx
  - 1. Epiglottis
  - 2. Tongue-epiglottis relationship
  - 3. Posterior pharyngeal wall
  - 4. Lateral pharyngeal wall
  - 5. Anterior pharyngeal wall
  - 6. Pyramidal sinus
- D. Larynx
  - 1. Thyroid cartilage
  - 2. Cricothyroid cartilage
  - 3. Trachea
  - 4. Esophagus
  - 5. Trachea-esophagus relationship
  - 6. Vocal cords
  - 7. Arytenoid folds

**Anatomy of Lower Airway**

- A. Trachea
  - 1. C-shaped, incomplete rings
  - 2. 10–12 centimeters
  - 3. Respiratory epithelium contains ciliated and mucus-producing cells



- B. Right and left mainstem bronchi
  - 1. Carina
  - 2. Length and position of bronchi
- C. Secondary bronchi
- D. Bronchioles
- E. Respiratory bronchioles
- F. Alveolar ducts
- G. Alveolar sacs
- H. Alveoli
  - 1. Most important functional unit of system
  - 2. O<sub>2</sub>, CO<sub>2</sub> exchange occur
  - 3. Hollow, thin-walled
  - 4. Capillary system covers the outer surface via terminal branches of the pulmonary artery
- I. Lungs
  - 1. Comprised of the respiratory bronchioles and alveoli
  - 2. Position in thoracic cavity
  - 3. Visceral pleura
  - 4. Parietal pleura
  - 5. Pleural space
  - 6. Right lung
    - a. Upper lobe
    - b. Middle lobe
    - c. Lower lobe
  - 7. Left lung
    - a. Upper lobe
    - b. Lower lobe
  - 8. Blood supply
    - a. Pulmonary artery and veins
    - b. Bronchial artery and veins

**Mechanics of Respiration/  
Ventilation**

- A. Definition
  - 1. Respiration—exchange of gases between a living organism and its environment
  - 2. Pulmonary ventilation— process that moves air into and out of the lungs
- B. Respiratory cycle
  - 1. Involves respiratory system, central nervous system, musculoskeletal system
  - 2. Begins from midpoint or position of thorax after a normal expiration; air pressure inside lungs is equal to atmospheric pressure
  - 3. Inspiration
    - a. Initiated by contraction of diaphragm and intercostal muscles
    - b. Flattening of diaphragm toward the abdomen with resulting increase in the vertical dimensions of the thoracic cavity





- c. Elevation of the ribs upward and outward to increase the horizontal and transverse dimension of the thoracic cavity
- d. The highly elastic lungs assume the contour change resulting in larger lung dimensions
  - i. The same air volume in the lung occupies a larger space
  - ii. Air pressure in the lung decreases rapidly
  - iii. Air flows in through respiratory passage since pressure in the airways is less than atmospheric pressure
- 4. Expiration
  - a. Occurs as inspiratory muscles relax
  - b. Decreasing thoracic volume and increasing intrathoracic pressure
  - c. Air is thereby forced out of the lungs
  - d. Normal expiration is a passive process
- 5. In respiratory inadequacy accessory muscles aid inspiration and expiration
  - a. Abdominal wall muscles
  - b. Neck muscles
- C. Pulmonary circulation
  - 1. Body cells take oxygen from the blood and return carbon dioxide to the blood
  - 2. The venous system returns oxygen-poor, carbon dioxide-rich blood to the right side of the heart
  - 3. The right ventricle pumps that blood into the pulmonary artery
    - a. The artery bifurcates into left and right bronchi supplying the respective lungs
    - b. Both branches rapidly split into smaller vessels and eventually into microscopic pulmonary capillaries that:
      - i. Spread over the surface of the air sacs, where the blood picks up oxygen
      - ii. Recombine into sequentially larger vessels forming the pulmonary veins
  - 4. Pulmonary veins empty into the left atrium and then into the left ventricle from which oxygen-rich blood is pumped and circulated through the systemic arterial system
- D. Gas exchange in the lungs
  - 1. Process opposite to that normally occurring in the body, i.e., blood returning from the body is low in oxygen, high in carbon dioxide
  - 2. Measurement of oxygen and carbon dioxide
    - a. Definition
      - i. Partial pressure describes the amount of gas in a mixture
        - (a) Sum of all gases present must equal the total gas pressure
        - (b) Any partial pressure of any one gas is a fractional concentration of the total gas mixture
    - b. Total gas pressure (sea level) equals atmospheric pressure or 760 mmHg
      - i. Torr equals 1 mmHg

**INSTRUCTOR'S NOTES**

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Above atmospheric pressure.

Arterial system.

Venous system.

- ii. One atmosphere equals 14.7 lb/sq.in.
- c. Concentrations
  - i. Room air contains 21% oxygen and 0.03% carbon dioxide
  - ii. Breathing room air produces  $PO_2$  ( $PaO_2$ ) of 140 torr and  $PCO_2$  ( $PaCO_2$ ) close to zero in the alveoli
  - iii. Venous blood from tissues contains  $PO_2$  of 40 torr and  $PCO_2$  of 46 torr
  - iv. Room air also contains 79% nitrogen
    - (a) No metabolic function
    - (b) Necessary for maintaining inflation of body cavities that are gas filled
- d. Diffusion
  - i. Gases diffuse from areas of higher partial pressure concentrations to areas of lower partial pressure concentrations
  - ii. Rate of gas diffusion across pulmonary membranes depends on solubility in water
  - iii. Oxygen diffuses into blood plasma and combines with hemoglobin
    - (a) Each gram of saturated hemoglobin carries 1.34 ml of  $O_2$
    - (b) Hemoglobin is close to being fully saturated at  $PO_2$  of 50–100 mmHg
    - (c) Normal arterial  $PO_2$  (sea level) is 80–100 mmHg
- e. Carbon dioxide concentrations
  - i. Carried as:
    - (a) 66% bicarbonate
    - (b) 33% combines with hemoglobin
    - (c) Small amount dissolves in plasma
  - ii. Arterial  $PCO_2$  35–40 torr
- E. Regulation of respiration
  - 1. Voluntary control versus involuntary control
    - a. Action is mainly involuntary
    - b. Chemical, physical and nervous reflexes monitor body oxygen needs
  - 2. Respiratory center located in the brain stem
    - a. Nerve impulses sent to the diaphragm and intercostal muscles
    - b. Inspiration initiated
  - 3. Microscopic stretch receptors stop inspiration
    - a. Inspiratory stretching activates the stretch receptors
    - b. Nerve impulses follow afferent pathways and return to the brain stem
    - c. Inspiratory act is curtailed, allowing elastic recoil of the lung
    - d. Stretch receptors of the lung cease to send impulses to the brain stem

**INSTRUCTOR'S NOTES**

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CO<sub>2</sub> is 21 times more soluble in water than O<sub>2</sub>.

Pneumotaxic center.

Located in the lung and pleura.

- e. The cycle begins again with inspiratory impulses originating in the brain stem
- 4. Regulation by chemoreceptors
  - a. Central chemoreceptors located in the medulla; peripheral chemoreceptors located in the aortic arch and carotid bodies
  - b. Chemoreceptors are stimulated by increased  $PO_2$ , decreased  $PCO_2$ , or decreased pH
- 5. Carbon dioxide concentration in the blood results in a decrease or increase in respiratory activity
  - a. High  $CO_2$  concentration increases respiratory activity
  - b. Low  $CO_2$  concentration decreases respiratory activity
  - c. Hypoxemia is the most profound stimulus to respiration in the normal individual
- 6. Hypoxic drive
  - a. Individuals with chronic respiratory disease have decreased ability to eliminate  $CO_2$  and respiratory centers accommodate to high  $PCO_2$  levels
  - b. Respiratory rate and depth respond to  $PO_2$  levels below 60 torr
  - c. Dominant control of respiration in these individuals are changes in  $PO_2$
- F. Modified forms of respiration
  - 1. Coughing—forceful exhalation of a large volume of air.—serves protective function
  - 2. Sneezing—a sudden forceful exhalation from the nose, usually caused by nasal irritation
  - 3. Hiccup—sudden inspiration caused by spasmodic contraction of the diaphragm.—serves no useful purpose
  - 4. Sighing—slow, deep inspiration followed by prolonged expiration—Hyperinflates lungs re-expanding atelectatic areas
- G. Measures of respiratory function
  - 1. Respiratory rate
    - a. Normal adults, 10–14 per minute
    - b. Infants, 40–60 per minute
    - c. Children, 24 per minute
  - 2. Factors affecting respiratory rate
    - a. Fever—increases
    - b. Anxiety—increases
    - c. Insufficient oxygen—increases
    - d. Depressant drugs— decreases
    - e. Sleep—decreases
  - 3. Lung capacity—adult male, 6 liters
  - 4. Tidal volume—volume of gas inhaled or exhaled during a single respiratory cycle—500 cc normally
  - 5. Dead space air—air remaining in air passageways, unavailable for gas exchange.—approximately 150 cc
  - 6. Alveolar air—the air reaching the alveoli for gas exchange—approximately 350 cc



7. Minute volume—the amount of gas moved in and out of the respiratory tract per minute. Determined by:
  - a. The tidal volume times
  - b. The respiratory rate
8. Vital capacity—forced exhaled volume
- H. Factors altering carbon dioxide levels in the blood
  1. Arterial carbon dioxide ( $\text{PaCO}_2$ ) represents a balance between  $\text{CO}_2$  produced during metabolism and  $\text{CO}_2$  eliminated through respiration
  2. Causes of elevated  $\text{PaCO}_2$ 
    - a. Increased  $\text{CO}_2$  production
      - i. Fever
      - ii. Muscular exertion
      - iii. Shivering
      - iv. Metabolic processes resulting in formation of acids
    - b. Decreased  $\text{CO}_2$  elimination (hypoventilation)
      - i. Respiratory suppression by drugs
      - ii. Airway obstruction
      - iii. Mechanical problems
    - c. Causes of decreased  $\text{PCO}_2$ —hyperventilation
- I. Factors altering oxygen levels in the blood
  1. Causes of decreased oxygen levels in the blood
    - a. Fluid in alveolar interstitial spaces
    - b. Alveolar collapse causing atelectasis
      - i. I.e., pneumothorax
      - ii. Poor coughing
    - c. Shunting—blood flow to nonfunctional alveoli
  2. Management
    - a. Supplemental oxygen
    - b. Intermittent positive pressure ventilation

## Pathophysiology

- A. Obstruction
  1. Tongue
    - a. Occluding posterior pharynx
    - b. Most common cause of obstruction
  2. Foreign body
    - a. Aspirated while eating
    - b. From mouth
      - i. Loose teeth
      - ii. Child “eating” inanimate object
    - c. Trauma
      - i. Facial bones
      - ii. Teeth
      - iii. Nasal bones
      - iv. Clotted blood
  3. Laryngeal spasm





- a. Cord edema
  - b. Cord spasm
- 4. Fractured larynx
  - a. Nonsupport of cords
  - b. Collapse into tracheal/laryngeal lumen
- B. Aspiration
  - 1. Vomitus
  - 2. Blood
  - 3. Liquid drink
- C. Inadequate ventilation
  - 1. Rate
    - a. Hyperventilation
    - b. Hypoventilation
  - 2. Depth
    - a. Shallow
    - b. Deep
  - 3. Trauma
    - a. Flail chest
    - b. Open pneumothorax
    - c. Other obstructions
  - 4. Disease
    - a. Chronic obstructive pulmonary disease
    - b. Asthma
    - c. Other

*Assessment*

**Visual Techniques**

- A. Rise and fall of chest
- B. Color of skin
- C. Flaring of nares
- D. Retraction
  - 1. Intracostal
  - 2. Suprasternal notch
  - 3. Supraclavicular fossa
  - 4. Subcostal

**Auscultation Techniques**

- A. Air movement at mouth and nose
- B. Bilateral lung field
  - 1. Most accurate method
  - 2. Anterior and lateral chest wall
    - a. Excellent for pneumothorax
    - b. Experience necessary to prevent confusion of tracheal sounds from parenchymal sounds

**Palpation Techniques**

- A. Air movement at mouth and nose
  - 1. Back of hand

**INSTRUCTOR'S NOTES**

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Viral pneumonia.

Listen.

Feel.

- 2. Cheek
- B. Chest wall
  - 1. Direct palpation
  - 2. Practice required
- C. Bag
  - 1. Rate of emptying
  - 2. Compliance of lungs
  - 3. Air leak
- D. Pulse technique
  - 1. Tachycardia occurs with hypoxemia
  - 2. Bradycardia signifies severe anoxia cardiac arrest imminent

**History Technique**

- A. Past medical history
- B. History of present complication
- C. Mechanism of injury

*Management***Manual**

- A. Chin lift
  - 1. Thumb on anterior mandible
  - 2. Index finger on inferior mandible
  - 3. Anterior traction lift
- B. Jaw lift
  - 1. Thumb on lower incisor
  - 2. Index finger on inferior mandible
  - 3. "Thrust" jaw anteriorly
- C. Jaw thrust
  - 1. Two hands
  - 2. Thumbs on zygoma bilaterally
  - 3. Fingers beneath symphysis of mandible
  - 4. "Thrust" jaw anteriorly
- D. Head tilt
  - 1. Head hyperextended backward
  - 2. Hand on forehead
  - 3. Hand on cervical neck-left
  - 4. Should not be done on trauma patient

**Mechanical**

- A. Nasal airway
  - 1. Description of devices
    - a. Length 17–20 cm
    - b. Diameter 20–36 french
    - c. Gentle curve
    - d. Flair at outer end
  - 2. Advantages
    - a. Rapid insertion

**INSTRUCTOR'S NOTES**

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No resistance.

Without changing neutral neck position.

Without changing neutral neck position.

Without changing neutral neck position.

Not on trauma patient.

- b. Bypasses tongue
  - c. May be used when gag reflex present
  - 3. Disadvantages
    - a. Small size
    - b. May not go behind tongue
    - c. Difficult to insert if nasal damage present
    - d. Does not isolate trachea
    - e. Difficult to suction through
  - 4. Method
    - a. Insert into naris
    - b. Convex side caudad
    - c. Gentle pressure
    - d. If unable to pass use other naris
    - e. Do not force
- B. Oral airway
- 1. Description of device
    - a. Length
    - b. Shape
      - i. Hollow oblong cylinder
      - ii. "H" shape
    - c. Gentle curve
    - d. Flair on outside end
  - 2. Advantages
    - a. Holds tongue forward and down
    - b. Large suction will pass on either side
    - c. Effective bite block
      - i. Convulsions
      - ii. Protection for ET tube
  - 3. Disadvantages
    - a. Does not isolate trachea
    - b. May obstruct airway with tongue if not properly inserted
    - c. Cannot be inserted when:
      - i. Gag reflex present
      - ii. Teeth tightly clenched
  - 4. Size selection
    - a. Device measurement
      - i. Corner of mouth
      - ii. Tip of earlobe
  - 5. Method
    - a. Straight insertion
      - i. Convexity caudad
      - ii. Tongue blade pushes tongue caudad and anterior
      - iii. Airway slips along tongue into hypopharynx
    - b. Reverse insertion
      - i. Convexity cephalod



- ii. Airway inserted gently to soft palate
    - iii. Airway rotated 180 degrees into hypopharynx
  - c. Evaluate placement
    - i. Air movement from mouth
    - ii. Skin color
    - iii. Pulse
    - iv. Auscultation
- C. Esophageal intubation device
  - 1. Description of device
    - a. Approximately 15 inch-flexible tube
    - b. Mask adaptor at proximal end
    - c. Closed distal end
    - d. Detachable face mask
    - e. Mask has one port
    - f. Perforations in upper third of tube
  - 2. Necessary equipment
    - a. 35-cc syringe
    - b. Lubricant
    - c. Bag-valve-mask or demand valve
    - d. Oxygen source with O<sub>2</sub> tubing
    - e. Suction equipment/device
    - f. Stethoscope
    - g. Oral airway
  - 3. Advantages
    - a. Rapid insertion
    - b. Prevents regurgitation/aspiration
    - c. High concentration O<sub>2</sub> delivery
    - d. Blind insertion
    - e. Allows endotracheal intubation placement
    - f. Requires less training than endotracheal intubation
    - g. Insertion without neck flexion/hyperextension
  - 4. Disadvantages
    - a. Requires patient to be unresponsive/gag reflex absent
    - b. Removal when patient becomes responsive
    - c. Esophageal laceration
    - d. Tracheal intubation
    - e. Used for short periods of time
    - f. Requires tight seal with mask
  - 5. Contraindication
    - a. Known/suspected esophageal disease
    - b. Caustic poisoning ingestion
    - c. Gag reflex present
    - d. Height under 5.0 feet/over 7.0 feet
  - 6. Insertion method
    - a. Suction equipment/device available



**INSTRUCTOR'S NOTES**

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5–20 seconds.

2.0 hours.

Esophageal varices,  
esophageal strictures or  
diverticuli.

- b. Test balloon cuff/inlet port integrity
  - c. Assemble mask and tube
  - d. Lubricate tube
  - e. Maintain patient's head in neutral position
  - f. Preoxygenate
  - g. Grasp tongue and lower jaw and pull forward
  - h. Advance tube into esophagus until mask flush against face
  - i. Establish mask seal
  - j. Auscultate lung fields bilaterally with oral ventilation
  - k. Auscultate over epigastrium
  - l. Inflate 35 cc cuff if positioned properly
  - m. Ventilate and check for chest rise
  - n. Reauscultate lung fields bilaterally/epigastrium
  - o. Reoxygenate
7. Removal method
- a. Not indicated in the field with unconscious patient
  - b. Have suction available/working
  - c. Turn patient on side
  - d. Detach mask from tube
  - e. Deflate cuff
  - f. Gently and quickly remove tube
  - g. Expect regurgitation
  - h. Suction oropharynx/mouth well
  - i. Assess respiratory status
  - j. Oxygenate
- D. Esophageal gastric tube
- 1. Description of device
    - a. Modification of esophageal obturator
    - b. Approximately 15 inch flexible tube
    - c. Mask adaptor at proximal end
    - d. Mask has two ports
    - e. Distal end of tube ports has one-way valve
    - f. Interior accomodates nasogastric tube
  - 2. Necessary equipment
    - a. Same equipment as esophageal obturator
    - b. Nasogastric tube
  - 3. Advantages
    - a. Same as esophageal obturator
    - b. Permits passage of nasogastric tube
    - c. Permits gastric decompression
  - 4. Disadvantages
    - a. Same as for esophageal obturator
    - b. Requires suction equipment application
  - 5. Contraindications
  - 6. Insertion method

**INSTRUCTOR'S NOTES**

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Chin-lift maneuver, do not force.

15-20 seconds maximum time lapse for insertion between ventilations.

If patient intubated, turning is not necessary.

Ventilation and suction ports.

Further reduces opportunity for regurgitation.

Same as for esophageal obturator device.

- a. Same as for esophageal obturator
  - b. Measure proper length of nasogastric tube
  - c. Lubricate end of nasogastric tubing
  - d. Preoxygenate patient
  - e. Insert to measured length
  - f. Reoxygenate
  - g. Apply suction to nasogastric adaptor
7. Removal method
- a. Same for esophageal intubation
  - b. Expect regurgitation/suction
  - c. Reassess respiratory status
  - d. Oxygenate
- E. Pharyngeal Tracheal Lumen Multiple Balloon System

**Ventilation**

- A. Mouth to mouth
- 1. Benefits
    - a. No equipment required
    - b. Immediate ventilation
  - 2. Limitations
    - a. Difficult to clear obstruction
    - b. Disease
    - c. Training required
  - 3. Method of administration
    - a. Mouth to mouth
    - b. Mouth to nose
    - c. Mouth to stoma
- B. Mouth to mask
- 1. Construction
    - a. Pocket type flexible mask
    - b. Oxygen port
  - 2. Benefits
    - a. Ease of use
    - b. Rapid oxygenated ventilation
  - 3. Limitations
    - a. Inadequate seal
    - b. Training required
  - 4. Method of use
    - a. Position of patient
    - b. Open/clear airway
    - c. Oxygen applied
    - d. Position mask/seal
- C. Bag-valve-mask
- 1. Construction
    - a. Bag with one-way valve and mask
    - b. Oxygen port



2. Benefits
    - a. High oxygen concentration delivery
    - b. Provides positive pressure ventilation
    - c. Assists slow respiratory rates
  3. Limitations
    - a. Training/skill
    - b. Difficult to use
    - c. Inadequate seal
  4. Method of use
    - a. Position patient
    - b. Open clear airway
    - c. Placement oral pharyngeal airway
    - d. Oxygen source attached
    - e. Position mask on face
    - f. Create seal
    - g. Grasp mask between web of thumb and fingers
    - h. Fingertips grasp mandible
    - i. Deflate bag by manually squeezing
- D. Demand valve
1. Benefits
    - a. Connects to mask, ET or esophageal intubation device
    - b. Provides 100% oxygenation
    - c. Can ventilate past minor obstruction
    - d. Ease of operation
    - e. Slight inspiratory triggering
  2. Limitations
    - a. Gastric distension
    - b. Nonhumidified oxygen
    - c. Potential pulmonary rupture
    - d. Adult patients only
    - e. Dependent on oxygen source
    - f. Compliance of lungs not detectable
    - g. Effectiveness gauged by chest expansion only
    - h. Inspiratory volume control
  3. Method of administration
    - a. Explain to conscious patient
    - b. Appropriate mask size
    - c. Position head
    - d. Seal mask
    - e. Manually/automatic triggering
    - f. Assess chest rise
    - g. Expiration passive
- E. Evaluation of effectiveness
1. Chest movement
  2. Auscultation



- a. Left lung field
- b. Right lung field
- c. Stomach

**Suction**

- A. Airway
- B. Physiology
- C. Pathophysiology
  - 1. Vomitus
    - a. Contents
      - i. Partially digested chunks of food
      - ii. Protein dissolving enzymes
      - iii. Hydrochloric acid
    - b. Results
      - i. Increased interstitial fluid
      - ii. Obliteration of alveolae
      - iii. Marked increased alveolar-opillary distance partial aeration of segments of extracting  $O_2$  or off loading  $CO_2$
      - iv. Bronchular obstruction by food particles
      - v. Several types of respiratory initiators
      - vi. 50%–80% mortality rate
  - 2. Saliva
    - a. Contents
      - i. Digestive enzymes for starches
    - b. Results
      - i. Fill alveolus
      - ii. Reduction of alveoli for ventilation
  - 3. Food
    - a. Contents
    - b. Results
  - 4. Blood
    - a. Contents
      - i. Protein
      - ii. Fibrin
      - iii. Water
      - iv. Electrolytes
    - b. Results
      - i. Clogging of alveoli and bronchi
      - ii. Chemical reaction to hypertonic fluid
- D. Assessment
  - 1. Visualization
  - 2. Auscultation
    - a. Lungs
    - b. Trachea
- E. Management
  - 1. Whistle tip suction



**INSTRUCTOR'S NOTES**

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Epigastrium.

See airway and ventilation.

Varies.

Large particles obstruct  
airways.

Presence of liquid and solid  
particles in hypopharynx and  
mouth.

- a. Construction
    - i. Flexible tube
    - ii. Thumb hold
  - b. Advantages
    - i. Small
    - ii. Easy to use
  - c. Disadvantages
    - i. Unable to move large volumes of fluid quickly
    - ii. Unable to retrieve even small food particles
    - iii. Long suction periods will deplete inspired O<sub>2</sub> available for the lungs
  - d. Method
    - i. Insert into:
      - (a) Nasal airway or endotracheal tube
      - (b) Close side hole with thumb
      - (c) Aspiration for 20 seconds while removing tube slowly
    - ii. Insert beside oral airway
      - (a) Use above technique
2. Tonsil tip suction
- a. Construction
    - i. Rigid
    - ii. Large tip
  - b. Advantages
    - i. Large size
    - ii. Can remove food particles that are sucked onto tip
  - c. Disadvantages
    - i. Size will only fit beside oral airway
    - ii. Vigorous insertion can produce lacerations or other injuries to oropharynx
  - d. Method
    - i. Insert along side of oral airway into mouth and back into hypopharynx
    - ii. Slowly remove while suction still activated to remove large particles

### Endotracheal Intubation (Optional)

- A. Endotracheal intubation (ET)
  - 1. Device description
    - a. Endotracheal tube
      - i. Flexible tube
      - ii. Balloon cuff on distal end
      - iii. 15 mm adaptor on proximal end
      - iv. Tube length proportioned to internal diameter
  - 2. Necessary equipment
    - a. Laryngoscope/blade
      - i. Used to expose glottis

**INSTRUCTOR'S NOTES**

Children up to 8 years w/o cuff.  
Average adult takes 8 mm ET

- ii. Interchangeable handles
- iii. Curved blades placed in vallecula
- iv. Straight blades placed under epiglottis
- v. Light on blade or handle
- vi. Traction is extended upward on handle
- b. Stylet
  - i. Flexible/malleable
  - ii. Types of construction
  - iii. ET conforms to desirable configuration
  - iv. Tip recessed at least 2 cm from tip of ET
  - v. Right angle hook over adaptor end
  - vi. Lubricate to assure removal
- c. Magell forceps
  - i. Scissor style clamp
  - ii. Circle-shaped tips
- d. Suction
  - i. Flow rate
  - ii. Mechanism of creating suction
  - iii. Types
- e. Bag-Valve device
  - i. Attachment to ET tube adaptor
  - ii. Accumulator
  - iii. Methods of squeezing bag
  - iv. Construction and cleaning of valve
- f. Mask
  - i. Construction
  - ii. Face mask seal
  - iii. Connection to valve
- g. Lubricant
- h. Stethoscope
- i. Oral airway
- j. Syringe
- k. Oxygen source/tubing
- 3. Advantages
  - a. Complete control of airway
  - b. Prevents aspiration
  - c. Intermittent positive pressure
  - d. Tracheal suctioning
  - e. Prevents gastric distention
  - f. High volume ventilation
  - g. Medication administration
  - h. Placement around esophageal intubation devices
- 4. Disadvantages
  - a. Requires training/ experience
  - b. Requires direct visualization



- c. Requires equipment
- d. Tissue damage
- e. Esophageal intubation
- f. Laryngospasm upon attempt
- g. Intubation of pyriform sinus
- h. Foreign body
- i. Delays in oxygenation prior to success

5. Contraindications

- a. Trauma: hyperextension of flexion required
- b. Prolonged attempt increases hypoxemia

6. Method of insertion

- a. Establish ventilation
  - i. Mouth to mask
  - ii. Bag-valve-mask
  - iii. FiO<sub>2</sub> 0.90–1.0
  - iv. Assure adequate ventilation
    - (a) Chest rise
    - (b) Auscultation lungs
    - (c) Auscultation stomach
    - (d) Color
- b. Estimate correct ET size
  - i. Adult
  - ii. Pediatric
- c. Check balloon
  - i. Inflation
  - ii. Leaks
  - iii. Inlet port integrity
- d. Hyperventilate patient with bag-valve-mask (BVM)
- e. Position head and neck
  - i. Nontrauma
    - (a) “Sniffing” position
    - (b) Flex at C5 C6
    - (c) Extend at C1 C2
  - ii. Trauma
    - (a) In-line stabilization by partner
    - (b) Maintain neutral position
    - (c) Mandible and tongue only move during intubation
    - (d) Patient frequently flat on ground or asphalt
    - (e) Proper body position of the EMT-P to see cords with patient on the ground
- f. Remove BVM
- g. Insert laryngoscope, right side of mouth, tongue to the left
- h. Visualize epiglottis, larynx, and vocal cords
  - i. Lift tongue and mandible with scope
  - ii. Do not rotate scope

**INSTRUCTOR'S NOTES**

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Vocal cords, trachea, teeth,  
clips, pharynx.

Foreign body must be  
removed.

Neutral positioning AHA-  
ACLS 15-20 second for  
attempt.

90-100% oxygen.

5-10 seconds  
hyperventilation.

Prone or straddling patient's  
head.

- iii. Do not touch teeth with scope
- iv. Pressure on larynx sometimes helpful
- i. Insert ET tube between cords, visualize passage
- j. Remove laryngoscope
- k. Connect bag valve to ET adaptor
- l. Ventilate lungs
  - i. Assure chest rise
  - ii. Auscultate lungs
  - iii. Auscultate stomach
- m. Inflate cuff
- n. Secure tube to head and face
- o. Reassess lungs sounds/epigastrium
- p. Continue ventilation
- q. Return to BVM. ventilation when
  - i. ET tube in esophagus
  - ii. No breath sounds in lungs
  - iii. Air into stomach
  - iv. Unable to get ET tube in place
- r. Suction may be necessary
- s. Breath sounds on right only
  - i. Auscultate
  - ii. Withdraw tube slowly until breath sounds heard on laryngoscope
- t. Removal
  - i. Spontaneous respirations
  - ii. Patient's intolerance of tube
  - iii. Gag reflex present
  - iv. Suction available
  - v. Deflate cuff completely
  - vi. Withdraw on inspiration
  - vii. Suction airway
  - viii. Assess respiratory status
  - ix. Oxygenate patient







**Division 1:  
Prehospital  
Environment**

**Section 8: Assessment and Management of Shock**



**Introduction**

The student must have successfully completed the following sections prior to participating in this section:

Section 1. Roles and Responsibilities

Section 2. EMS Systems

Section 3. Medical/Legal Considerations

Section 4. Medical Terminology

Section 5. EMS Communications

Section 6. General Patient Assessment and Initial Management

Section 7. Airway Management and Ventilation

The understanding and management of shock or cellular oxygenation is the essence of all patient care. If the treatment is done inadequately or too late the patient will die immediately from cardiac failure or in a few days to a few weeks from other organ failure such as lung, kidney or liver, or may survive but without brain function.

The problem is not mystic either in etiology, pathophysiology or management, but the EMT must understand it and make this understanding work for him, not against him. For example: At times the best treatment may be airway, fluids, Pneumatic antishock garment (PASG), and rapid transportation to a hospital. At other times there may be intensive on scene care.

**Objectives**

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

- 1.8.1 Define shock based on aerobic and anaerobic metabolism.
- 1.8.2 Discuss the prevention of anaerobic metabolism.
- 1.8.3 Discuss red blood cell oxygenation in the lungs based on alveolar O<sub>2</sub> levels and transportation across the alveolar capillary wall.
- 1.8.4 Discuss tissue oxygenation based on tissue perfusion and release of oxygen.
- 1.8.5 Discuss the role played by respiration, inadequate ventilation in the management of shock.
- 1.8.6 Describe perfusion and the mechanisms of improvement of cardiac output based on the strength and rate of contractions.
- 1.8.7 Discuss the fluid component of the cardiovascular system and the relationship between the volume of the fluid and the size of the container.
- 1.8.8 Discuss systemic vascular resistance, the relationship of diastolic pressure to the SVR and the effect of diastolic pressure on coronary circulation.
- 1.8.9 Discuss the container size in its relationship to the fluid volume and the effect on blood returning to the heart.
- 1.8.10 Discuss body fluids based on total body water, intracellular fluid, and extracellular fluid.
- 1.8.11 Identify the significant anions and cations in the body.
- 1.8.12 Describe the role of protein.
- 1.8.13 Discuss osmosis. Define semi-permeable membranes, and discuss their function.
- 1.8.14 Define isotonic fluids, hypotonic fluids, and hypertonic fluids
- 1.8.15 Define and discuss diffusion.
- 1.8.16 Define active transport.

- 1.8.17 Describe the mechanisms of concentration of electrolytes.
- 1.8.18 Define acid-base balance.
- 1.8.19 Discuss acid-base balance based on hydrogenion concentration, pH, buffer systems.
- 1.8.20 Define and discuss the following:
  - a. Respiratory acidosis.
  - b. Respiratory alkalosis.
  - c. Metabolic acidosis.
  - d. Metabolic alkalosis.
- 1.8.21 Describe the mechanism of the body response to perfusion change.
- 1.8.22 Identify the role of the baroreceptor.
- 1.8.23 Describe how the actions of the baroreceptor affect blood pressure and perfusion.
- 1.8.24 Describe compensated shock.
- 1.8.25 Describe uncompensated shock, both cardiac and peripheral effects.
- 1.8.26 Discuss the assessment of the patient's perfusion status, based on physical observations within the primary survey, including pulse, skin, temperature, capillary refill.
- 1.8.27 Discuss the relationship of the neurological exam to assessment of hypoperfusion and oxygenation.
- 1.8.28 Describe the information provided by the following in physical examination: pulse, blood pressure, diastolic pressure, systolic pressure, skin color, appearance, temperature, and respiration.
- 1.8.29 Discuss management of a shocky patient. Include red cell oxygenation, tissue ischemic sensitivity, IV fluids, the pneumatic antishock garment.
- 1.8.30 Describe the beneficial and detrimental effects of the pneumatic antishock garment.
- 1.8.31 Describe the indication and contraindications for the pneumatic antishock garment.
- 1.8.32 Discuss fluid replacement, the types of fluid that are available, the benefits and detrimental effects of each.
- 1.8.33 Discuss how fluid replacement is monitored and controlled.
- 1.8.34 Discuss the routes of fluid replacement and the advantages and disadvantages of each.
- S1.8.35 Demonstrate in order of priority the steps of shock resuscitation.
- S1.8.36 Demonstrate the use of the pneumatic antishock garment (PASG)
- S1.8.37 Demonstrate the proper technique to insert an intravenous catheter.



**Definition**

- A. Parameters of measurement are not an adequate definition
  - 1. Blood pressure, pulse or respiration
- B. Inadequate cellular oxygenation produces anaerobic metabolism Anaerobic metabolism equals shock
  - 1. Aerobic metabolism is dependent upon
    - a. RBC oxygenation
      - i. Alveolar  $O_2$  levels
        - (a) Airway
        - (b) Ventilation
        - (c)  $FiO_2$
    - b. Transport of RBC, transport across alveolar/capillary wall. This is dependent on no edema to reduce passage, presence of RBC in capillary and ventilation of the alveolus
  - 2. Tissue oxygenation
    - a. Adequate number of RBC
    - b. Adequate tissue perfusion
    - c. Adequate release of oxygen

**Physiology of Perfusion**

- A. Heart output or effectiveness is dependent on three components
  - 1. Strength of contractions
  - 2. Rate of contractions
  - 3. Volume of blood
- B. Fluid
  - 1. Fluid volume
  - 2. Systemic vascular resistance (SVR) is another name for peripheral resistance. The diastolic pressure is an estimate of SVR. The amount of back pressure during diastole also determines the flow of blood through the coronary circulation
- C. Container
  - 1. Fluid volume and container size
    - a. 5 liter container and 5 liters of fluid = full container
    - b. 5 liter container and 3 liters of fluid = partially full container
    - c. 3 liter container and 3 liters of fluid = full container
    - d. 7 liter container and 5 liters of fluid = partially full container
- D. Cellular Physiology
  - 1. Body fluids
    - a. Total body water 60% adult weight divided into two components
    - b. Intracellular fluid inside the cell membrane 40% body weight
    - c. Extracellular fluid outside the cell 20% body weight
  - 2. Electrolytes ions
    - a. Cations sodium ( $Na^+$ ) Potassium ( $K^+$ ) Calcium ( $Ca^{++}$ )
    - b. Anions chloride ( $Cl^-$ ) bicarbonate ( $HCO_3^-$ )
  - 3. Protein
    - a. Albumin
    - b. Plasma
    - c. Lymph



**INSTRUCTOR'S NOTES**

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Prevention of anaerobic.

Pump.

Volume/size of container.

Standard normovolemic  
adult.

Hypovolemic adult. Blood  
loss from acute hemorrhage  
or severe dehydration.

TBW.

ICF, water & electrolytes.

ECF water & electrolytes.

Salt.

Positive charge.

Negative charge.

- d. Other
- 4. Osmosis
  - a. Semipermeable membrane
    - i. Water, freely interchangeable on both sides
    - ii. Electrolytes cannot actively cross to other side.
    - iii. Water crosses to equalize the concentration—higher concentration pulls fluid from lower concentrations
  - b. Isotonic fluids. Osmotic pressure is equal to normal body fluid
  - c. Hypotonic. Osmotic pressure less than that of normal body fluids
  - d. Hypertonic. Osmotic pressure greater than that of normal body fluids
- 5. Diffusion. Solute molecules can cross membranes but at a slower rate than water
- 6. Active transport
  - a. Larger molecules can be moved across membranes
  - b. Molecules can move toward higher concentrations
  - c. Energy is required
  - d. Faster than diffusion
- 7. Concentration of electrolytes
  - a. Water follows sodium
  - b. Potassium (K<sup>+</sup>) is the chief intracellular ion
  - c. Sodium (Na<sup>+</sup>) is the chief extracellular ion
  - d. Changes in ion concentrations affect skeletal and cardiac muscle cells ability to function (K<sup>+</sup>, Ca<sup>+</sup>, Mg<sup>+</sup>)
- 8. Acid-base balance
  - a. Definition: concentration of hydrogen ions in body fluids [H<sup>+</sup>]
  - b. pH expression of [H<sup>+</sup>]
    - i. pH = 7.35 to 7.45 ph below 7.35 is acidosis (excess [H<sup>+</sup>])
    - ii. pH above 7.45 is alkalosis (low [H<sup>+</sup>])
  - c. Buffer system offsets minor changes in pH
    - i. Carbonate buffer system can absorb 20/1 H<sup>+</sup> without a noticeable change in pH
    - ii. Change is as follows:  
 $\text{CO}_2 + \text{H}_2\text{O} \rightarrow \text{H}_2\text{CO}_3 \rightarrow \text{H}^+ + \text{HCO}_3^-$ —this process can proceed in either direction  $\text{H}^+ + \text{HCO}_3^- \rightarrow \text{H}_2\text{CO}_3 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$
  - d. Respiratory system pH changes not managed by the buffers
    - i. If the lungs cannot release CO<sub>2</sub>, the shift is toward H<sup>+</sup> HCO<sub>3</sub> or an excess [H<sup>+</sup>]
    - ii. If too much CO<sub>2</sub> is released from the lungs the [H<sup>+</sup>] is below normal. When the lungs are responsible for this change it is called respiratory alkalosis or acidosis
  - e. Kidneys are slowest but most efficient managers of pH changes.
    - i. If the etiology is built up at [H<sup>+</sup>] because of increased production of H<sup>+</sup> in the cells, it is known as metabolic acidosis

**INSTRUCTOR'S NOTES**

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Osmotic pressure.

Small molecules cross much faster than do larger (NaCl vs. protein).

Acidosis.

Alkalosis.

Result of anaerobic metabolism.

- ii. If the etiology is excessive loss of  $[H^+]$  from the kidney or GI tract, the result is called metabolic alkalosis
- iii. The kidneys can retain or release  $H_2CO_3$  to balance  $[H^+]$  and influence pH

**Pathophysiology****A. Mechanism**

1. Baroreceptors
  - a. Detection
  - b. Transmission
2. Response to baroreceptors discharge
  - a. Sympathetic nervous system
    - i. Cardiac effects
      - (a) Increased strength of contractions
      - (b) Increased rate of contractions
    - ii. Peripheral effects
      - (a) Arteriolar constriction
      - (b) Decreased container size
      - (c) Increased peripheral resistance
  - b. Adrenal
    - i. Cardiac
    - ii. Peripheral

**B. Compensated shock**

1. Increased strength of contractions
2. Increased rate of contractions increase in heart rate
3. Increased systemic peripheral resistance, increase in diastolic pressure

**C. Uncompensated shock**

1. Pump unable to maintain pressure
  - a. Cardiac effects
    - i. Decreased volume
      - (a) Increased strength of contractions
      - (b) Increased rate contractions
    - ii. Decreased myocardial strength
      - (a) Ischemia
        - (i) Decreased RBC oxygenation
        - (ii) Decreased cardiac perfusion
          - (aa) Coronary blood flow
          - (bb) Diastolic pressure
      - (b) Necrosis of myocardium
        - (i) Infarction
        - (ii) Increased size of infarction secondary to decreased perfusion
  2. Peripheral effects
    - a. Peripheral vascular pooling
    - b. Cellular changes
      - i. Decreased perfusion means decreased oxygenation of tissue cells

**INSTRUCTOR'S NOTES**

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Carotid artery.  
Low pressure.  
To brain.

Norepinephrine.

Epinephrine.

Maintenance of systolic B/P.  
Not detectable by field  
evaluation.  
Pulse.  
Narrowing of pulse pressure.  
Decrease in systolic and  
diastolic pressure.

Availability of fluid.

- ii. Decreased available  $O_2$  changes aerobic metabolism to anaerobic metabolism

**Assessment**

- A. Primary survey
  - 1. Airway/ventilation adequacy
  - 2. Circulation
    - a. Pulse
      - i. Rate
      - ii. Character
      - iii. Location
    - b. Skin
      - i. Color
      - ii. Appearance
        - (a) Pale
        - (b) Cyanotic
        - (c) Mottled
      - iii. Temperature
        - (a) Warm
        - (b) Cool
      - iv. Moist/dry
    - c. Capillary refill
      - i. Less than 2 seconds
      - ii. More than 2 seconds
  - 3. Disability
    - a. Confusion, disorientation, agitation, may result from decreased cerebral perfusion and decreased oxygenation of brain cells
    - b. Mini-neurological survey
- B. Secondary survey
  - 1. Blood pressure
  - 2. Head to toe
- C. Monitoring
  - 1. Pulse
    - a. Normal rate even with 10% to 15% volume deficit
    - b. Detection altered by peripheral resistance
      - i. Radial pulse absent: systolic pressure  $<80$
      - ii. Femoral pulse absent: systolic pressure  $<70$
      - iii. Carotid systolic pressure  $>60$
    - c. Character of pulse may reflect circulatory status
  - 2. Diastolic pressure
    - a. Increase initially with increased peripheral resistance
    - b. Coronary blood flow
    - c. Normal with 15% to 20% volume deficit
  - 3. Systolic pressure
    - a. Normal with 20% volume deficit
    - b. Reflects cardiac contractility

**INSTRUCTOR'S NOTES**

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Good perfusion.  
Inadequate perfusion.

As to cause of shock.

4. Skin
  - a. Color—RBC oxygenation
  - b. Appearance
    - i. Pale—decreased perfusion (ischemia)
    - ii. Cyanotic—pooling
    - iii. Mottled—combination most common
  - c. Temperature
    - i. Perfusion
    - ii. Heat retention
5. Respiration. Acidosis produces increased  $[H^+]$ . The body responds by increasing the respiratory rate to remove  $CO_2$ . Removal of  $CO_2$  reduces  $[H^+]$   $[H^+] + HCO_3^- \rightarrow H_2O + CO_2$

## Management

- A. RBC oxygenation
  1. Airway
  2. Breathing
  3. Transport
- B. Tissue ischemic-sensitivity
  1. GI, liver, kidneys—45 to 60 minutes (without  $O_2$ )
  2. Muscle, skin—two to three hours
- C. Pneumatic anti-shock garment
  1. Container size reduction and/or increased vascular resistance beneath device
  2. Perfusion of very ischemia-sensitive tissues
  3. Effects
    - a. Capitanice vessels
      - i. Shifts pooled blood
      - ii. Increased upper body blood
      - iii. Part of blood volume may be translocated to upper portion of body
      - iv. Increased pressure of blood returning to the heart
    - b. Peripheral resistance increased
      - i. Decreased blood flow to ischemic resistance tissues
      - ii. No change in peripheral resistance of ishemic sensitive tissues
    - c. Diaphragmatic excursion
      - i. 50% movement reduction
      - ii. Increased intrathoracic pressure
      - iii.  $Pa, O_2, Ph, PaCO_2$  not compromised
    - d. Tissue pressure—Indirectly transmitted through the skin subcutaneously, and muscle tissue surrounding muscle
    - e. Rigid external stabilization
      - i. Pelvic fracture reduction/stabilization
      - ii. Femur stabilization
4. Clinical consequences
  - a. Increased upper body blood volume



**INSTRUCTOR'S NOTES**

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Ischemic.

Length of time an organ can remain viable.

PASG

At time of printing the exact mechanisms of action are under investigation.

Theoretical.

Selective.

Muscles and skin of legs.

Deep.

Traction splint superior without shock.

- i. Increased blood pressure
    - (a) Increased cardiac output
    - (b) Distended neck veins
  - ii. Increased pulmonary blood volume
    - (a) Increased cardiac output with intra-pulmonary pressure
  - iii. Increased lower body peripheral resistance
    - (a) Increased flow to upper body organs
    - (b) Decreased perfusion to lower body organs if systolic pressure is less than 80 mm Hg
  - iv. Increased tissue pressure
    - (a) Reduction of intra-abdominal hemorrhage
    - (b) Reduction of pelvic fracture hemorrhage
    - (c) Reduction of lower abdomen retroperitoneal hemorrhage
  - v. Decreased diaphragmatic excursion
    - (a) Observation for ventilation and oxygenation inadequacy
    - (b) Increased intrathoracic pressure
      - (i) Increased cardiac output with CPR
      - (ii) Increased cardiac output with respiration
5. Clinical applications
- a. Shock resuscitation
    - i. Increased blood return
    - ii. Increased vascular resistance
    - iii. Increased blood pressure
    - iv. Decreased heart rate
    - v. Increased perfusion of organs in upper half of body
  - b. Hemorrhage control
    - i. Intra-abdominal
      - (a) Aorta
      - (b) Liver, spleen
      - (c) Retroperitoneal
      - (d) Pelvic
    - ii. Lower extremities
      - (a) Skin, muscle
      - (b) Femur
  - c. Fracture stabilization
    - i. Rigid external immobilization
    - ii. Femur
    - iii. Pelvis
  - d. Cardiac arrest
    - i. Increased cardiac output
      - (a) Increased blood return
      - (b) Increased intrathoracic pressure
      - (c) Increased pulmonary blood volume
    - ii. Increased carotid blood flow
      - (a) Increased cardiac output



- (b) Selective increased peripheral resistance
  - iii. Increased cerebral blood flow
    - (a) 3% to 10%
    - (b) Increased but still deficient
- D. Fluid replacement
  - 1. Whole blood
  - 2. Crystalloid
    - a. Ringer's lactate
      - i. Isotonic
      - ii. Buffer when metabolized
    - b. normal saline
      - i. Isotonic
      - ii. No buffer
    - c. Volume expansion
      - i. Immediately effective
      - ii. 2/3 lost to intraatrial space in one hour
    - d. 2 to 3 liters maximum
  - 3. Glucose
    - a. Immediate volume expansion
    - b. Rapid loss
    - c. Resultant free H<sub>2</sub>O increase
  - 4. Plasma
    - a. Volume expansion not presently a prehospital fluid
    - b. Storage and cost reduce prehospital usefulness
  - 5. Dextran
    - a. Volume expansion
    - b. Type and cross match abnormality
    - c. Bleeding abnormalities
- E. Rate of replacement
  - 1. Monitoring parameters
    - a. Pulse
    - b. Blood pressure
    - c. Skin—color, temperature, capillary refill time
- F. Routes of fluid replacement
  - 1. Rational
    - a. Replacement as rapid as possible may be necessary
    - b. Rate of administration determined by
      - i. Length of catheter
      - ii. Internal diameter of catheter
        - (a) Small increase in radius equals large increase in area
        - (b) Area inside of lumen determines the rate of flow
        - (c) Maximum rate
        - (d) 22 gauge preferred for medical patient
        - (e) 16–14 gauge preferred for trauma patient
    - iii. Size of vein has no relationship to flow

**INSTRUCTOR'S NOTES**

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Most desirable because of O<sub>2</sub> carrying; however, is not a fluid which is available for prehospital use.

Because of rapid loss of crystalloid from the cardiovascular space the patient should be transported to the hospital as rapidly as possible.

5 to 15 min. as glucose metabolized.

Not a prehospital technique.

Inversely.  
Directly.

Are dependent upon size (gauge).

- iv. Central line has no prehospital use
- 2. Peripheral
  - a. Advantages
    - i. Rapid identification
    - ii. Minimal equipment
    - iii. Rapid insertion
    - iv. Can be accomplished while other things going on
    - v. Maintenance good
    - vi. Easily accessible
  - b. Disadvantages
    - i. In severe volume depletion is difficult to locate vessels
    - ii. Collapse and roll easily
- G. Steps in shock management for severely injured patients
  - 1. Extrication
  - 2. Pneumatic antishock garment application
  - 3. Stabilization
  - 4. Load for transportation
  - 5. Administration of IV fluids (en route to hospital)
    - a. Ambulance en route to hospital
      - i. Preliminary steps for IV
        - (a) Tourniquet
        - (b) Vein identified
        - (c) Tape torn
        - (d) IV set up
        - (e) Skin prepped
        - (f) Ambulance stopped
        - (g) Insert catheter
        - (h) Needle taped down
        - (i) Ambulance en route again
        - (j) Fluid rate adjusted







**Division 1:  
Prehospital  
Environment**

**Section 9. Defibrillation (Optional)**



**Introduction**

The student must have successfully completed the following sections prior to participating in this section:

Section 1. Roles and Responsibilities

Section 2. EMS Systems

Section 3. Medical/Legal Considerations

Section 4. Medical Terminology

Section 5. EMS Communications

Section 6. General Patient Assessment and Initial Management

Because of the high number of prehospital deaths attributed to coronary artery disease, this is a subject that continues to receive great emphasis in the training of the EMT-I. This is particularly true in light of recent data which suggests that early defibrillation makes a significant difference in the outcome of patients suffering from ventricular fibrillation. At the time of the submission of this training program to DOT, clear and definitive decisions had not been made as to what level of training information was to be added to give an individual the knowledge and skills necessary to intervene in such catastrophic events. Some systems reserved defibrillation for EMT-Paramedic level personnel, others for EMT-Intermediate, basic EMT, and some had initiated it at the First Responder level. It is for these reasons that this section is offered as an optional section. There is no doubt that early intervention has a great impact on survivability; however, it is up to the local system to determine at what level of training such intervention should be contained within. Therefore this section is presented as optional.

**Overview**

I. Anatomy and Physiology of the Cardiovascular System

A. Anatomy of the Heart

B. Physiology of the Heart

C. Electrophysiology (Basics)

II. Assessment of the Cardiac Patient

A. Common Chief Complaints and History

B. Significant Past Medical History

C. Physical Examination Pertinent to the Cardiac Patient

III. Pathophysiology and Management

A. Pathophysiology of Atherosclerosis

B. Specific Conditions Resulting from Atherosclerotic Heart Disease

1. Angina Pectoris

2. Acute Myocardial Infarction

5. Cardiac Arrest/Sudden Death

IV. Dysrhythmia Recognition

A. Introduction to ECG Monitoring

B. Rhythm Strip Analysis

C. Introduction to Dysrhythmias

D. Dysrhythmias Originating in the Ventricles

VI. Techniques of Management

A. CPR

B. ECG Monitoring

C. Defibrillation

**Objectives**

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

- 1.9.1. Describe the size, shape, and location/orientation (in regard to other body structures) of the heart muscle.
- 1.9.2 Identify the location of the following structures on a diagram of the normal heart:
  - .. Pericardium
  - .. Myocardium
  - .. Epicardium
  - .. Right and left atria
  - .. Interatrial Septum
  - .. Right and left ventricles
  - .. Intraventricular septua
  - .. Superior and inferior vena cava
  - .. Aorta
  - .. Pulmonary vessels
  - .. Coronary arteries
  - .. Tricuspid valve
  - .. Mitral valve
  - .. Aortic valve
  - .. Pulmonic valve
  - .. Papillary muscles
  - .. Chordae tendinae
- 1.9.3 Describe the function of each structure listed in Objective #2.
- 1.9.4. Describe the distribution of the coronary arteries and the parts of the heart supplied by each artery.
- 1.9.5 Differentiate the structural and functional aspects of arterial and venous blood vessels.
- 1.9.6 Define the following terms that refer to cardiac physiology:
  - .. Stroke volume
  - .. Starling's Law
  - .. Preload
  - .. Afterload
  - .. Cardiac output
  - .. Blood pressure
- 1.9.7 Describe the electrical properties of the heart.
- 1.9.8 Describe the normal sequence of electrical conduction through the heart and state the purpose of this conduction system.
- 1.9.9 Describe the location and function of the following structures of the electrical conduction system:
  - .. SA node
  - .. Internodal and interatrial tracts
  - .. AV node
  - .. Bundle of His
  - .. Bundle branches
  - .. Purkinje fibers

- 1.9.10 Define cardiac depolarization and repolarization and describe the major electrolyte changes that occur in each process.
- 1.9.11 Describe an ECG.
- 1.9.12 Define the following terms as they relate to the electrical activity of the heart:
  - .. Isoelectric line
  - .. QRS complex
  - .. P wave
- 1.9.13 Name the common chief complaints of cardiac patients.
- 1.9.14 Describe why the following occur in patients with cardiac problems:
  - .. Chest pain or discomfort
  - .. Shoulder, arm, neck, or jaw pain/discomfort
  - .. Dyspnea
  - .. Syncope
  - .. Palpitations/abnormal heart beat
- 1.9.15 Describe those questions to be asked during history taking for each of the common cardiac chief complaints.
- 1.9.16 Describe the four most pertinent aspects of the past medical history in a patient with a suspected cardiac problem.
- 1.9.17 Describe those aspects of the physical examination that should be given special attention in the patient with suspected cardiac problems.
- 1.9.18 Describe the significance of the following physical exam findings in a cardiac patient:
  - .. Altered level of consciousness
  - .. Peripheal edema
  - .. Cyanosis
  - .. Poor capillary refill
  - .. Cool, clammy skin
- 1.9.19 State the numerical values assigned to each small and each large box on the ECG graph paper for each axis.
- 1.9.20 Define ECG artifact and name the causes.
- 1.9.21 State the steps in the analysis format of ECG rhythm strips.
- 1.9.22 Describe two common methods for calculating heart rate on an ECG rhythm strip and the indications for using each method.
- 1.9.23 Name 8 causes of dysrhythmias.
- S1.9.24 Demonstrate on an adult mannequin, the techniques for single and two-person CPR according to American Heart Association standards.
- S1.9.25 Demonstrate on an infant mannequin, the technique for infant CPR according to American Heart Association standards.
- S1.9.26 Demonstrate proper application of ECG chest electrodes and obtain a sample Lead II.
- S1.9.27 Demonstrate the proper use of the defibrillator paddles electrodes to obtain a sample Lead II rhythm strip.
- S1.9.28 Demonstrate how to properly assess the cause of poor ECG tracing.
- S1.9.29 Demonstrate correct operation of a monitor-defibrillator to perform defibrillation on an adult and infant.

**Anatomy of the Heart**

- A. Location, orientation
- B. Size and dimensions
- C. Shape
  - 1. Base—top part
  - 2. Apex—bottom pointed part
- D. Organ layers
  - 1. Pericardium—double-walled protective sac surrounding heart
    - a. Visceral—(inner) serous layer
    - b. Parietal—(outer) fibrous layer
    - c. Pericardial fluid is lubricant
  - 2. Epicardium—outermost layer of heart wall muscle
  - 3. Myocardium—thick middle layer of heart wall muscle
  - 4. Endocardium—smooth, inner layer of connective tissue
- E. Myocardial muscle
  - 1. Specialized muscle cells found only in the heart
  - 2. Striated like skeletal muscle, but similar electrical properties as smooth muscle
  - 3. Composed of contractile proteins arranged in parallel bands—slide together to cause contraction
  - 4. Very dependent on calcium for contraction
- F. Heart chambers
  - 1. Atria
    - a. Right and left superior chambers of heart
    - b. Less muscular collecting chambers
  - 2. Ventricles
    - a. Right and left inferior chambers of heart
    - b. More muscular; left thicker than right
  - 3. Separation of chambers internally
    - a. Interatrial septum separates atria
    - b. Intraventricular septum separates ventricles
    - c. Both composed of connective tissue as well as muscle
- G. Heart valves
  - 1. Two sets composed of endocardial and connective tissue
  - 2. Atrioventricular (AV) valves
    - a. Tricuspid valve: between left atrium and ventricle
    - b. Bicuspid (mitral) valve: Between left atrium and ventricle
    - c. Controlled by papillary muscles at apex of ventricles
    - d. Chordae tendinae: String-like fibers connecting valve leaflets to papillary muscles
  - 3. Semilunar valves
    - a. Pulmonic valve: between right ventricle and pulmonary artery
    - b. Aortic valve: between left ventricle and aorta
- H. Great vessels: Collective name for large vessels that attach to base of heart
  - 1. Vena cava—inferior, superior
  - 2. Pulmonary artery—main artery and two branches



3. Pulmonary veins—four

4. Aorta

I. Coronary arteries

1. Exclusive arterial blood supply to heart muscle and electrical conduction system

2. Originate in aorta just above leaflets of aortic valve

3. Left coronary artery

a. Supplies left ventricle, intraventricular septum, and part of right ventricle

b. Anterior descending branch

c. Circumflex branch

4. Right coronary artery

a. Supplies right atrium and ventricle and part of left ventricle

b. Posterior descending branch

5. Many anastomoses exist between arterioles of coronary arteries, allowing for development of collateral circulation

6. Coronary veins

a. Correspond to arterial distribution and drain into right atrium

b. Coronary sinus: major vein draining left ventricle

**Physiology of the Heart**

A. Normal blood flow

1. Superior and inferior vena cava return blood to

2. Right atrium, through tricuspid valve to

3. Right ventricle, through pulmonary valve to

4. Pulmonary artery, to

5. Pulmonary capillaries in lungs to

6. Pulmonary veins to

7. Left atrium, through mitral valve to

8. Left ventricle, through aortic valve to

9. Aorta, coronary arteries, and peripheral circulation

B. The cardiac cycle

1. Right and left atria contract together

2. Atrial contraction serves to fill ventricles to maximum

3. Ventricular contraction pumps blood to pulmonary or systemic circulation: Pressure of contraction produces closure of AV valves and opens aortic and pulmonic valves

4. Systole: contraction phase, usually referring to ventricular contraction

5. Diastole: relaxation phase, usually referring to ventricles

a. Much longer than systole (.52 seconds versus .28 seconds)

b. As rate increases, length of diastole decreases with less reduction in length of systole

c. Phase during which most coronary artery filling occurs (about 70%)

C. Pumping action

1. Right-sided versus Left-sided pump





- a. Right atria and ventricles pumping against pulmonary resistance—low pressure system
- b. Left atria and ventricles pumping against systemic resistance—high pressure system
2. Stroke volume—amount of blood ejected from ventricle with one contraction
  - a. 60–100 milliliters; however capacity to increase is great in healthy heart
  - b. Starling's Law of the Heart: up to a limit, the more a myocardial muscle is stretched (by chamber filling), the greater will be its force of contraction (and therefore, stroke volume)
3. Cardiac output—the amount of blood pumped through the circulatory system per minute.
  - a. Cardiac output = heart rate  $\times$  stroke volume
  - b. Normal heart rate = 60–100 beats/minute
  - c. Normal heart can increase cardiac output three times by increasing rate alone
4. Systemic blood pressure = cardiac output  $\times$  peripheral resistance

## Electro-Physiology

- A. Electrical properties of the heart
  1. Automaticity: ability to generate an electrical impulse without stimulation from another source—property of pacemaker cells
  2. Excitability: ability to respond to an electrical stimulus—property of all myocardial cells
  3. Conductivity: ability to propagate an impulse from cell to cell
- B. Electrical conduction system of the heart
  1. Function: allows electrical impulses to spread through the heart six times faster than through muscle alone
  2. Sequence of normal electrical conduction
    - a. SA node
    - b. Internodal and interatrial tracts
    - c. AV node
    - d. Bundle of His
    - e. Bundle branches
    - f. Purkinje fibers
- C. Function of electrical conduction structures
  1. Sinoatrial (SA) node
    - a. Located in right atrium near entrance of superior vena cava
    - b. Usually heart's dominant pacemaker
  2. Internodal and interatrial tracts
    - a. Pathways that carry impulse between SA node and AV node and spread it across atrial muscle
    - b. Impulse travel time: 0.08 seconds
  3. Atrioventricular (AV) node:
    - a. Part of area called the "AV junctional tissue" along with some surrounding tissue and the nonbranching portion of the Bundle of His



- b. Responsible for creating slight delay in conduction before sending impulse to ventricles
- c. Impulse travel time: 0.08–0.16 seconds
- d. No pacemaking properties in node itself
- 4. Bundle of His
  - a. Bundle of fibers coming off AV node, located at top of interventricular septum
  - b. Considered part of the AV junction
  - c. Makes electrical connection between atria and ventricles
- 5. Bundle branches
  - a. Created by bifurcation of Bundle of His into right and left
  - b. Carry electrical impulse at high velocity to interventricular septum and each ventricle simultaneously
- 6. Purkinje fibers
  - a. Terminal ends of bundle branches
  - b. Network of fibers helping to spread impulse throughout ventricular walls
  - c. Rapid impulse spread through ventricles: 0.08–0.09 seconds
- D. Depolarization
  - 1. Definition: process by which muscle fibers are stimulated to contract by the alteration of electrical charge of the cell. Accomplished by changes in electrolyte concentrations across the cell membrane
  - 3. Spontaneous diastolic depolarization of pacemaker cells
    - a. Pacemaker cells capable of self initiated depolarization
    - b. Found throughout conduction system except in AV node
    - d. Location of cells with pacemaker capabilities and rates of spontaneous discharge (inherent or intrinsic rates)
      - i. SA node: 60–100/minute intrinsic rate
      - ii. AV junctional tissue: 40–60/minute intrinsic rate
      - iii. Ventricles (bundle branches and Purkinje fibers): 20–40/minute intrinsic rate
    - e. SA node usual pacemaker because it discharges the fastest; pacemaker cells below SA node normally suppressed by it
- E. Repolarization
  - 1. Process by which cells re-establish internal negativity and are readied for stimulation—return to resting or polarized state
- F. Relationship of ECG to electrical activity
  - 1. ECG is record of electrical activity of heart as sensed by electrodes on body surface
  - 2. ECG gives information only about electrical activity; tells us nothing about pump function
  - 3. Isoelectric line: a flat line on the ECG indicating absence of net electrical activity
  - 4. P wave
    - a. Rounded wave preceding QRS: usually upright (positive) in Lead II
    - b. Indicates depolarization of atrial muscle



5. QRS complex
  - a. Collective term for three deflections following the P wave
    - i. Q wave—first negative deflection after P wave
    - ii. R wave—first positive deflection after P wave
    - iii. S wave—first negative deflection after R wave
  - b. All three waves not always present—QRS has many shapes
  - c. Indicates depolarization of the ventricular muscle
6. T wave
  - a. Rounded wave following QRS complex; usually in same direction as QRS
  - b. Indicates repolarization of ventricles
  - c. Atrial T wave (atrial repolarization) usually not visible—buried within QRS complex

*Assessment of the Cardiac Patient*

**Common Chief Complaints and History**

- A. Chest pain/discomfort
  1. Most common symptom of myocardial infarction
  2. Significant history of the chief complaint (history of present illness)—try to determine:
    - a. Location of pain
    - b. Radiation, if present
    - c. Duration
    - d. Factors that precipitated
    - e. Type or quality of pain
    - f. Associated symptoms
    - g. Anything that relieves or aggravates pain
    - h. Previous episodes
  3. Many causes of chest pain besides cardiac—history important
- B. Shoulder, arm, neck, or jaw pain/discomfort
  1. May occur with or without any chest pain
  2. Significant history of chief complaint—same as for chest pain
- C. Dyspnea
  1. Often an associated symptom of myocardial infarction or primary symptom of pulmonary fluid congestion due to failing pump
  2. Is subjective; difficult to assess severity
  3. Significant history of chief complaint—try to determine;
    - a. Duration, circumstances of onset
    - b. Anything that aggravates or relieves (including meds)
    - c. Previous episodes
    - d. Associated symptoms
    - e. Prior cardiac problems
  4. Many causes of dyspnea besides cardiac—attempt to determine history of COPD, cold, fever, etc.
- D. Syncope



1. May be the only symptom of cardiac problems, particularly in elderly patients
2. May be caused by transient or prolonged decrease in heart rate causing drastic reduction in cardiac output and cerebral perfusion
3. Significant history of chief complaint—try to determine:
  - a. Circumstances of occurrence (position, etc.)
  - b. Duration
  - c. Any symptoms prior to syncope
  - d. Other associated symptoms
  - e. Previous episodes
- E. Abnormal heart beat/palpitations
  1. Patient's awareness of own heartbeat—usually related to irregularity (“skipping beats”) or rapid heart rate
  2. Significant history of chief complaint—try to determine:
    - a. Circumstances of occurrence
    - b. Duration
    - c. Associated symptoms
    - d. Previous episodes/frequency

**Significant Past Medical History in the Cardiac Patient**

- A. Do not waste a lot of time with past history, as patient is treated based on his/her current symptoms regardless of past history
- B. Attempt to determine the following:
  1. Is patient taking prescription medications regularly, particularly cardiac medications?—examples:
  2. Is the patient being treated for any serious illness?
  3. Has the patient ever been known to have:
    - a. A heart attack or angina
    - b. Heart failure
    - c. Hypertension
    - d. Diabetes
    - e. Chronic lung disease
  4. Does the patient have any allergies?

**Physical Examination of the Cardiac Patient**

- A. Primary survey
- B. Vital signs and mini-neuro exam:
  1. Blood pressure
  2. Respiratory rate
  3. Rate and regularity of pulse; may be first indication of dysrhythmia
  4. Level of consciousness
    - a. Determine what is normal for this patient, if possible
    - b. Alteration may indicate decreased brain perfusion due to poor cardiac output
- C. Secondary survey
  1. Look—special emphasis on
    - a. Skin color, capillary refill
      - i. Indication of adequacy of RBC oxygenation





- ii. Indication of pump adequacy
- b. Peripheral/presacral edema
  - i. Caused by chronic back-pressure in systemic venous circulation
  - ii. Most obvious in dependent parts—check sacral region in bedridden patients
  - iii. Mild versus pitting edema
- c. Be observant for things that indicate patient is being treated for cardiac problems
  - i. Nitro patch on skin
  - ii. Implanted pacemaker
- 2. Listen—special attention to
  - a. Breathing
- 3. Feel—special attention to
  - a. Pulse
    - i. Rate
    - ii. Regularity
    - iii. Equality
    - iv. Pulse deficit
  - b. Skin

## Management

- A. The uncomplicated MI
  - 1. Obtain full history *while* conducting a physical exam and initiating treatment
  - 2. Place patient physically at rest and reassure to decrease anxiety
    - a. Reduces heart rate and therefore myocardial oxygen demand
    - b. Position of comfort—ideally, reclining with head elevated at least 30 degrees—do not allow to walk
  - 3. Administer oxygen (high FiO<sub>2</sub>) to increase oxygen delivery to myocardium
  - 4. Take vital signs for baseline reading—repeat frequently
  - 5. Establish IV as soon as possible with D5W and microdrip to keep vein open
  - 6. Calm transport without lights or siren if patient is stable
- B. Cardiac arrest/sudden death
  - 1. Pathophysiology:
    - a. One of the major clinical syndromes of coronary artery disease; accounts for 60% of all deaths from this disease
    - b. Sudden death defined as death within one hour of onset of symptoms
    - c. Actual infarction often not present, but severe atherosclerotic disease common
    - e. Cardiac arrest may be the first manifestation of cardiac disease in significant number of patients
    - f. Causes of cardiac arrest other than ASHD:
      - i. Drowning



- ii. Electrocutation
- iii. Electrolyte imbalance
- iv. Hypothermia
- v. Trauma
- vi. Acid-base imbalance
- vii. Drug toxicity
- viii. Hypoxia
- g. Rhythm disturbances causing cardiac arrest
  - i. Ventricular fibrillation (V-fib) majority of cases (60–70%)
    - primary
    - secondary
  - ii. Ventricular tachycardia
  - iii. Asystole
- 2. Basic considerations in management of cardiac arrest
  - a. Basic life support is essential; paramedic must monitor performance of CPR if delegated to others
  - b. Primary V-fib easier to abolish than secondary V-fib
  - c. Defibrillate patient in V-fib as soon as possible—best chance for successful resuscitation
  - e. Airway can be managed by a number of methods; most sophisticated not always needed immediately
  - g. Some cardiac arrests managed differently from those secondary to ASHD:
    - i. Drownings
    - ii. Hypothermia
    - iii. Traumatic arrest
  - h. Anti-shock garment may be useful in cardiac arrests other than those secondary to trauma
    - i. Cardiac arrest in infants and children rarely a primary event—often due to hypoxia
- 3. Management of unwitnessed arrest—ventricular fibrillation
- 4. Management of cardiac arrest secondary to ventricular tachycardia
- 5. Management of cardiac arrest secondary to asystole
  - a. Prognosis for resuscitation poor
  - b. May be the end result of V-fib or electromechanical dissociation
  - c. Presence of asystole usually indicates
    - i. Extensive myocardial damage and/or
    - ii. Severe metabolic deficit, or
    - iii. High parasympathetic tone
  - d. If any question as to whether rhythm is asystole or fine V-fib, defibrillation is indicated

**Dysrhythmia Recognition**

- A. Dysrhythmias are most common complication in first few hours
  - 1. Life-threatening—usually ventricular fibrillation
  - 2. Non-life-threatening—may not require prehospital intervention



3. Warning dysrhythmias—may be forerunners of life-threatening dysrhythmias—require prehospital intervention

### **Introduction to ECG Monitoring**

- A. Review electrical conduction pathway of normal heart
  1. SA node
  2. Internodal and interatrial tracts
  3. AV node
  4. Bundle of His
  5. Bundle branches
  6. Purkinje fibers
- B. Basic concepts of ECG monitoring
  1. ECG is graphic display of heart's electrical activity
  2. Body acts as a giant conductor of electrical current
  3. ECG obtained by applying electrodes on body surface which detect changes in voltage of cells between sites of the electrodes
    - a. Voltage may be positive going (upward deflection) or negative going (downward deflection)
    - b. These changes are input to ECG machine, amplified, and displayed visually on scope and/or graphically on ECG paper
    - c. Recorded as a continuous curve of waves and deflections called the electrocardiogram
    - d. Monitoring lead: any lead that shows very clear wave forms, very often, Lead II
    - e. Information that can be gained from a monitoring lead or rhythm strip:
      - i. How fast the heart is beating
      - ii. How regular the heartbeat is
  4. ECG graph paper
    - a. Standardized to allow comparative analysis of ECG wave patterns; paper moves past stylus at constant, standard speed
    - b. Horizontal lines on graph measure time:
      - i. 1 small box = .04 seconds
      - ii. 1 large box (5 small) = .20 seconds
      - iii. Used to measure duration of complexes and intervals
    - c. Vertical lines on graph measure voltage
      - i. 1 small box—1 millivolt
      - ii. Only pertinent in evaluating calibrated tracings, such as from 12-lead ECG
  5. Review of relationship of ECG to electrical events in the heart
    - a. Single cardiac cycle on ECG includes everything from depolarization of atria up to and including repolarization of ventricles
    - b. P wave
    - c. QRS complex
    - d. PR interval
    - e. T wave

**INSTRUCTOR'S NOTES**

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A rhythm strip is the paper tracing obtained from a non-calibrated monitoring lead.

Usually 25 mm/sec.

See previous Anatomy and Physiology in Cardiovascular Section.

Review refractory period—relative and absolute.

- f. Artifact: deflections on the ECG display produced by factors other than the heart's electrical activity such as:
  - i. Standardization (calibration) mark
  - ii. Muscle tremors/shivering
  - iii. patient movement
  - iv. Loose electrodes
  - v. 60-cycle interference
  - vi. Machine malfunction
- F. Ventricular fibrillation
  - 1. Description: chaotic ventricular rhythm, probably due to many re-entry circuits in the ventricles, with absence of any organized ventricular depolarization or contraction
  - 2. Etiology:
    - a. Wide variety of causes
    - b. Most commonly associated with advanced coronary artery disease
  - 3. Rules for interpretation: totally chaotic undulations of varying amplitude and shape with no discernible waves or complexes
  - 4. Clinical significance: produces no organized contraction or pulse, resulting in cardiac arrest
  - 5. Treatment:
    - a. CPR
    - b. Immediate defibrillation
- G. Asystole (cardiac standstill)
  - 1. Description: absence of all ventricular electrical activity
  - 2. Etiology:
    - a. May be primary event in cardiac arrest; usually associated with massive myocardial ischemia and necrosis
    - b. End result of ventricular fibrillation
  - 3. Rules for interpretation: no discernible waves or complexes; only an isoelectric line
  - 4. Clinical significance:
    - a. Produces cardiac arrest
    - b. Prognosis for resuscitation dismal
  - 5. Treatment:
    - a. CPR
    - b. Immediate defibrillation
      - i. May be fine V-fib
      - ii. May have no effect or may convert

*Review of Management*

- Basic Life Support (CPR)**
  - A. Single person adult unwitnessed arrest
  - B. Two-person adult unwitnessed arrest
  - C. Infant resuscitation





**ECG Monitoring**

- A. Review parts of portable monitor/defibrillator:
  1. Paddle electrodes
  2. Controls for defibrillator
  3. Synchronizer switch
  4. Oscilloscope
  5. Paper strip recorder
  6. Patient cable and lead wires
  7. Controls for monitoring
  8. Any special features
- B. Monitoring lead uses three electrodes
  1. Positive
  2. Negative
  3. Ground
- C. Most common monitoring leads
  1. Lead II—best view of P waves, most common in field
- D. Monitoring through paddle electrodes
  1. Used for “quick-look” in cardiac arrest
  2. May be used when patient cable inoperable
  3. Picks up more artifact than chest electrodes; place chest electrodes at earliest convenience
  4. Procedure
    - a. Turn on oscilloscope power
    - b. Apply conducting medium liberally to paddle surfaces or position saline or gel pads
    - c. Hold paddles firmly on chest wall at right upper chest (negative electrode) and left lower chest (positive electrode)
    - d. Observe monitor and obtain tracings if desired
- E. Monitoring using chest electrodes
  1. Review type of electrode used locally
  2. Chest electrode placement for Lead II
    - a. Positive—left lower chest wall
    - b. Negative—right upper chest wall
    - c. Ground—variable; placement not critical—place away from other electrodes
  4. Avoid placing electrodes over large muscle masses, over large quantities of chest hair, or anyplace that prohibits electrode from lying flat on skin
  5. Avoid placing electrodes in same spot that you would place paddles for defibrillation
  6. Cleanse skin with alcohol swab and/or abrasive pad
    - a. Removes dirt and body oil for better adhesion, better electrode-to-skin contact (clearer tracing)
    - b. Shave small areas of chest hair if necessary
    - c. Dry skin well—alcohol breaks down electrode adhesive
  7. Apply electrodes to skin surface
  8. Attach ends of lead wires to electrodes



- a. Explain marking of lead wires for proper placement
- 9. Plug in patient cable to monitor
- 10. Adjust gain or sensitivity to proper level
- 11. Use of audio control optional—be sensitive to patient's response to QRS "beeper"
- F. Causes of poor ECG signal
  - 1. Most common cause is poor electrode contact with skin; check for:
    - a. Excessive hair
    - b. Loose or dislodged, especially in electrode diaphoretic patients
    - c. Dried conductive gel on disposable electrodes
    - d. Poor placement over bony area
  - 2. An initially poor tracing may improve with time as conductive gel breaks down skin resistance
  - 3. Other causes of poor tracing:
    - a. Patient movement or muscle tremor
    - b. Broken patient cable
    - c. Broken lead wire
    - d. Faulty grounding
    - e. Faulty monitor
- G. Obtaining a paper write-out
  - 1. Technique for placing graph paper in strip writer
  - 2. Adjustment of stylus heat

## Defibrillation

- A. Definition: The process of passing a current through a fibrillating heart to depolarize the cells and allow them to repolarize uniformly, restoring organized, coordinated contractions
  - 1. "Critical mass" of myocardium must be depolarized, not necessarily entire heart
  - 2. Critical mass related to size of heart, but cannot be calculated for a given individual or situation.
- B. Components of the defibrillator
  - 1. Adjustable, high-voltage DC power supply
  - 2. Energy storage capacitor
  - 3. Capacitor connected to paddles by current-limiting inductor
  - 4. Paddles
- C. Characteristics of the electrical charge
  - 2. Direct current (DC)
    - a. More effective
    - b. Less muscle damage
    - c. DC defibrillators more portable
  - 3. On the order of several thousand volts
  - 4. Lasts 4–12 milliseconds
  - 5. Strength of shock commonly expressed in energy (joules or watt seconds);  $\text{Energy (joules)} = \text{power (watts)} \times \text{duration (seconds)}$
- D. Chest wall resistance to electrical charge
  - 1. Lowers the electrical charge actually delivered to heart



2. Important to lower resistance pathway between defibrillator paddles
3. Factors that influence/vary chest wall resistance:
  - a. Paddle pressure
  - b. Paddle-skin interface
  - c. Paddle surface area
  - d. Number of previous countershocks

E. Factors that influence success of defibrillation

1. Duration of ventricular fibrillation
2. Condition of the myocardium
  - a. More difficult to defibrillate in presence of hypoxia, acidosis, hypothermia, electrolyte imbalance, drug toxicity
  - b. Secondary V-fib (from pre-existing pathology) more difficult to treat
3. Heart size and body weight
  - a. Pediatric and adult energy requirements different
  - b. Controversial whether size/energy requirement direct relationship exists in adults
4. Previous countershocks
5. Paddle size
  - b. Ideal size for adults not established; recommended have equivalent surface area of 10–13 cm diameter circular paddles
  - c. Infants: 4.5 cm diameter paddles are adequate; may desire a larger size for older children
6. Paddle placement
  - a. Transthoracic placement recommended for emergency situation for adult and pediatric patients
  - b. One paddle positioned to the right of upper sternum just below clavicle
    - i. Do not place directly over sternum
    - ii. Placement over large vessels facilitates current flow
  - c. Other paddle positioned to the left of left nipple in anterior axillary line (over apex of heart)
  - d. Paddles may be marked for placement.
    - i. Apex (positive electrode) and sternum (negative electrode)
    - ii. Reversing the paddles does not affect defibrillation, only inverts resulting ECG tracing
  - e. Anterior-posterior placement:
    - i. One paddle positioned anteriorly over precordium, other behind heart under back
    - ii. No evidence of superiority of this method at present in emergency situations
    - iii. May be useful when defibrillating infants with adult-sized paddles
7. Paddle-skin interface:
  - a. Many types of interface material acceptable
    - i. Cream

**INSTRUCTOR'S NOTES**

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Eisenberg study: CPR in <4 minutes defibrillation in <8 minutes yields significantly higher resuscitation rate.

Pediatric size paddles are preferable.

- ii. Paste
    - iii. Saline-soaked pads
    - iv. Pre-packaged gelled pads
  - c. Creams must be those made specifically for defibrillation, not for ECG monitoring
  - d. Exercise care with creams and saline pads to avoid “bridging” of charge due to smearing/running of conductive medium
- 8. Paddle contact pressure
  - a. Use firm downward pressure to decrease transthoracic resistance maximally
  - b. Do not lean on paddles—they may slip
  - c. Pressure also helps to deflate lungs, decreasing resistance
- 9. Proper functioning of defibrillator
  - a. Must actually be delivering energy indicated by machine; routine checks with suitable testing equipment mandatory
  - b. Routine exercising of nicad batteries if applicable
- F. Energy recommendations for defibrillation
  - 2. Generally agreed that 360 joules sufficient to terminate V-fib in most patients
  - 3. Initial defibrillation attempt should be at 200–300 joules; Should be repeated immediately if unsuccessful due to lowered resistance with second shock
  - 5. Pediatric energy dose recommendations
    - a. Initial: 2 joules/kg.
    - b. Second attempt: 4 joules/kg.
    - c. Further energy increase only with physician order
- G. Procedure for defibrillation
  - 1. To be accomplished at earliest opportunity in V-fib
  - 2. Delegate CPR responsibilities, but monitor effectiveness throughout
  - 3. Use “quick-look” paddles with conductive medium to evaluate rhythm; stop CPR while observing monitor—5 seconds only
  - 4. If V-fib present, continue CPR while preparing to defibrillate
  - 5. Turn on defib power, select energy setting, and charge paddles
  - 6. Place paddles on chest in correct positions with slight twisting motion to distribute conductive medium
  - 7. Stop CPR and re-verify rhythm
  - 8. Clear area and check that no personnel (including self) in direct or indirect contact with patient
  - 9. Apply firm pressure on paddles
  - 10. Deliver shock by depressing both paddle discharge buttons simultaneously—observe for skeletal muscle contraction
  - 11. Leave paddles on chest and immediately reassess rhythm
  - 12. If any kind of organized rhythm appears on monitor, immediately check carotid pulse
  - 13. If no pulse or V-fib persists, continue CPR and prepare to repeat defibrillation





**Other Considerations**

- A. ECG telemetry
  - 1. Extent of use of telemetry varies—determined by medical control personnel in a given system
  - 2. Use of telemetry alone without field interpretation of ECG not appropriate
    - a. EMT-I should always verify his interpretation with base physician; ECG may be distorted during transmission
    - b. Field interpretation alone without telemetry *is* acceptable
  - 3. Continuous telemetry transmission not advisable
    - a. Uses excessive air time
    - b. Depletes batteries
    - c. 15–30 seconds of telemetry is usually adequate



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## BIBLIOGRAPHY

Andreoli, Kathleen G., Virginia Hunn Fowkes, Douglas P. Zipes, and Andrew G. Wallace. *Comprehensive Cardiac Care*, 4th Edition, St. Louis: C.V. Mosby, 1979.

Conover, Mary Boudreau. *Understanding Electrocardiography*, 3rd Edition, St. Louis: C.V. Mosby, 1980.

Johnson, Robert Arnold, M.D., Haber, Edgar, M.D., Austen, W. Gerald, M.D., eds. *The Practice of Cardiology*; Boston: Little, Brown and Co., 1980.

McIntyre, Kevin M., M.D., J.D. and A. James Lewis, M.D., ed. *Textbook of Advanced Cardiac Life Support*; American Heart Association, 1981.

Walraven, Gail. *Basic Arrhythmias*; Robert J. Brady, 1980.



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