EMT-Paramedic Curriculum for Additional Advanced Life Support Skills

Course Overview

Organization

The EMT-Paramedic Critical Care curriculum is the minimum acceptable content that must be included in any EMT-Paramedic educational program with the exception of the "HEMODYNAMIC PROFICIENCY" and the "VENTILATOR COMPONENT" which should only be included in the educational programs for services implementing Hemodynamic Monitoring. For programs that elect to perform Hemodynamic Monitoring it will be considered as a Category II Skill. This educational program is divided into two parts with a total of five modules. This organizational plan was chosen to begin a process of standardization.

A. General EMT-Paramedic Curriculum – 26 hours minimum
   I. Rapid Sequence Intubation – 8 hours minimum
   II. 12 Lead ECG – 12 hours minimum
   III. Hemodynamics Overview – 6 hours minimum

B. EMT-Paramedic Critical Care Curriculum – 34 hours minimum
   I. Hemodynamics Proficiency – 18 hours minimum
   II. Ventilators – 16 hours minimum

This course is competency based and the specific number of hours to complete each module has been included. Students who successfully complete this course must demonstrate competency over the knowledge and skills outlines in this educational program.

The first part of each module lists the specific patient care task in a bold font. Immediately below the listed task are the cognitive learning objectives, which correspond to the specific task. The list of tasks indicates the minimum level of proficiency required of the student to assure safe and effective practice. The psychomotor and affective objectives relate to the overall content of the module.

Instructors

For the EMT-Paramedic Critical Care curriculum it is recommended the "Critical Care Educator/Instructor" will have demonstrated competency with a minimum of three years experience in the critical care field and routinely performs the component and skills being taught.

Implementation

For the EMT-Paramedic Critical Care curriculum it is recommended that new EMT-Paramedic educational programs should implement the new requirements by August 1, 1999. All existing EMT-Paramedic educational programs must implement the new requirements by January 1, 2001.
GENERAL PARAMEDIC CURRICULUM

RAPID SEQUENCE INTUBATION

Minimum hour requirement: **8 hours**

PREREQUISITES:
None

OBJECTIVES

Objectives Legend
C=Cognitive  P=Psychomotor  A=Affective
1 = Knowledge
2 = Application level
3 = Problem-solving level

COGNITIVE OBJECTIVES

2-1.1 Differentiate endotracheal intubation from other methods of advanced airway management. (C3)
2-1.2 Describe the indications, contraindications, advantages, disadvantages and complications of endotracheal intubation. (C1)
2-1.3 Describe the use of cricoid pressure during intubation. (C1)
2-1.4 Describe the indications, contraindications, advantages, disadvantages, complications and equipment for rapid sequence intubation with neuromuscular blockade. (C1)
2-1.5 Identify neuromuscular blocking drugs and other agents used in rapid sequence intubation. (C1)
2-1.6 Describe the indications, contraindications, advantages, disadvantages, complications and equipment for sedation during intubation. (C1)
2-1.7 Describe the indications, contraindications, advantages, disadvantages, complications, equipment and technique for nasotracheal intubation. (C1)
2-1.8 Describe methods of assessment for confirming correct placement of an endotracheal tube. (C1)
2-1.9 Describe methods for securing an endotracheal tube. (C1)
2-1.10 Describe the indications, contraindications, advantages, disadvantages, complications, equipment and technique for extubation. (C1)
2-1.11 Describe the methods of endotracheal intubation in the pediatric patient. (C1)

AFFECTIVE OBJECTIVES

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

2-1.17 Defend the necessity of establishing and/or maintaining patency of a patient's airway using rapid sequence intubation techniques. (A1)

PSYCHOMOTOR OBJECTIVES

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

2-1.18 Perform an anatomic assessment. (P2)
2-1.19 Prepare necessary equipment and medications for RSI. (P2)
2-1.20 Perform necessary steps for Rapid Sequence Intubation. (P2)
2-1.21 Perform Sellick's maneuver. (P2)
2-1.22 Intubate the trachea by the following methods: (P2)
   a. Orotracheal intubation
   b. Nasotracheal intubation
2-1.23 Perform assessment to confirm correct placement of the endotracheal tube. (P2)
2-1.24 Perform endotracheal intubation in the pediatric patient. (P2)

DECLARATIVE

I. Ventilation

1. Cricoid pressure - Sellick’s maneuver
   a. Pressure on cricoid Ring
   b. Occludes esophagus
   c. Facilitates intubation by moving the larynx posteriorly
   d. Helps to prevent passive emesis
   e. Can help minimize gastric distention during bag-valve-mask ventilation
   f. Indications
      1. Vomiting is imminent or occurring
      2. Patient cannot protect own airway
   g. Contraindications
      1. Use with caution in cervical spine injury
   h. Advantages
      1. Noninvasive
      2. Protects from aspiration as long as pressure is maintained
   i. Disadvantages
      1. May have extreme emesis if pressure is removed
      2. Second rescuer required for bag-valve-mask ventilation
      3. May further compromise injured cervical spine
   j. Complications
      1. Laryngeal trauma with excessive force
      2. Esophageal rupture from unrelied high gastric pressure
      3. Excessive rupture from unrelied high gastric pressure
   k. Method
      1. Locate the anterior aspect of the cricoid ring
      2. Apply firm, posterior pressure
      3. Maintain pressure until the airway is secured with an endotracheal tube

2. Endotracheal
   a. Indications
   b. Contraindications
   c. Advantages
   d. Disadvantages
   e. Complications
   g. Techniques of insertion
      1. Orotracheal Intubation
      2. Nasotracheal Intubation
   h. Confirming placement
   i. Corrective measures
   j. Securing the tube
   k. Pediatric endotracheal Intubation

II. Pharmacological adjuncts to airway management and Ventilation
1. Sedation in emergency intubation
   a. Sedatives are used in airway management to
      1. Reduce anxiety
2. Induce amnesia
3. Decrease the gag reflex

b. Indications
   1. Combative patients
   2. Patients who require aggressive airway management but who are too conscious to tolerate intubation
   3. Agitated patients
c. Contraindications
   1. Known sensitivity to the medications
d. Advantages
   1. Decrease anxiety
   2. Induces amnesia
e. Disadvantages
   1. Respiratory depression
   2. Vomiting/aspiration
f. Pharmacology
   1. Decreases anxiety
   2. Increases patient compliance
   3. Often produce amnesia to procedure
   4. Enhances ease of intubation
   5. Types of medications used
      a. Haloperidol
      b. Barbiturates
      c. Benzodiazepines
      d. Etomidate
      e. Narcotics
      f. Ketamine
g. Complications
   1. Airway compromise
   2. Regurgitation/aspiration
   3. Loss of protective reflexes
   4. Sedating patient with tenuous airway may completely collapse what airway they have
h. Method

2. Neuromuscular blockade in emergency intubation
   a. The use of neuromuscular blocking agents to induce skeletal muscle paralysis
   b. The patient is much easier to intubate once paralyzed
c. Indications
   1. Combative patients who need to be intubated
d. Contraindications
   1. Absolute
      a. Inability to ventilate once paralyzed
   2. Relative
      a. Patients who will be difficult to ventilate (i.e. facial hair, etc.)
      b. Patients who will be difficult to intubate (short necks, etc.)
e. Advantages
   1. Enables the paramedic to intubate some patients who need aggressive airway management (i.e. head injury, etc.) but may be otherwise uncooperative
f. Disadvantages
   1. Paralysis of the diaphragm/apnea
   2. Inability of the patient to protect their own airway
g. Pharmacology
   1. Skeletal muscles contract in response to nerve stimulus
   2. Junction of muscle and nerve fiber is neuromuscular junction
   3. Acetylcholine (ACH) allows nerve impulse to cross-neuromuscular junction
   4. Neuromuscular blockade relaxes muscle by impeding the action of ACH
5. Does not provide sedation
6. Types
   a. Depolarizing agents
      1. Substitute themselves into neuromuscular junction
      2. May cause fasciculation (uncontrollable muscle twitching)
      3. Examples
         a. Succinylcholine
            1. Rapid onset/short duration (90 seconds/5-10 minutes)
            2. Use with caution in burns, crush, blunt trauma (hyperkalemia)
   b. Non-depolarizing agents
      1. Block uptake of ACh into junction
      2. Do not cause fasciculations
      3. Examples
         a. Vecuronium
            1. Rapid onset - 2 minutes
            2. Short duration - 45 minutes
         b. Pancuronium
            1. Rapid onset - 3-5 minutes
            2. Longer duration - 1 hour

h. Complications
   1. Inability to intubate
   2. Inability to ventilate
   3. Vomiting
   4. Airway compromise

i. Method for rapid sequence intubation

**CLINICAL**

EMT-Paramedic providers implementing the Rapid Sequence Intubation skill found in 21NCAC32H-.402 shall complete this component

The North Carolina State EMS Advisory Council replaced the previous clinical education requirement of “the EMT-Paramedic student shall participate as a team member in Rapid Sequence Intubation procedure by intubating or administering medicine on THREE real patients” with the following.

The following requirements must now be completed prior to an EMT-Paramedic being approved to perform Rapid Sequence Intubation:

The RSI clinical education requirements for the individual EMT-P are:

1. Successful completion of the RSI curriculum.

2. One-year experience as an EMT-P in the EMT-P program initiating the RSI program. The medical director may credit previous experience as an EMT-P in another North Carolina EMT-P program or an EMT-P program in another state. To execute this option, the medical director must have verification of previous experience from the medical director/training officer of the EMT-P program(s) where the experience was completed.

3. A minimum of six successful intubations with a minimum of three intubations out of the hospital.
The EMT-P program requirements for programs implementing RSI are:

1. An airway management protocol, approved by the Office of Emergency Medical Services, defining the circumstances airway management procedures such as bag-valve-mask resuscitation, suctioning, oxygen administration, RSI, etc. are to be performed.

2. A RSI protocol, approved by the Office of Emergency Medical Services, defining the circumstances RSI is to be performed, the medications to be used, and the specific equipment to perform the procedure.

3. Adoption of a quality management tool kit approved by the local EMS medical director and the medical advisor of the Office of Emergency Medical Services.

The medical director requirements for programs implementing RSI are:

1. Adherence to the “Medical Oversight Recommendations For Advanced Life Support EMS Programs And Critical Care Transport Programs” dated March 4, 1999. This document is available from the Office of Emergency Medical Services.

2. A medical director overseeing a program initiating RSI must meet the requirements before the program starts. For existing programs, the medical director must meet the requirements by January 1, 2000. If medical directors for an EMT-P program change, the new medical director must meet the requirements within six months.
12 LEAD ECG

Recommended minimum hours: 12 hours

PREREQUISITES:
None

OBJECTIVES

Objectives Legend
C=Cognitive  P=Psychomotor  A=Affective
1 = Knowledge
2 = Application level
3 = Problem-solving level

COGNITIVE OBJECTIVES
At the completion of this unit, the paramedic student will be able to:

1-1.1 Compare and contrast the coronary arterial distribution to the major portions of the cardiac conduction system. (C3)
1-1.2 Identify the structure and course of all divisions and subdivisions of the cardiac conduction system. (C1)
1-1.3 Identify and describe how the heart’s pacemaking control, rate, and rhythm are determined. (C2)
1-1.4 Explain the physiological basis of conduction delay in the AV node. (C3)
1-1.5 Correlate the electrophysiological and hemodynamic events occurring throughout the entire cardiac cycle with the various ECG wave forms, segments and intervals. (C2)
1-1.6 Relate the cardiac surfaces or areas represented by the ECG leads. (C2)
1-1.7 Describe the process of differentiating wide QRS complex tachycardia. (C3)
1-1.8 Recognize the pitfalls in the differentiation of wide QRS complex tachycardia. (C1)
1-1.9 Describe the phenomena of reentry, aberration and accessory pathways. (C1)
1-1.10 Recognize the changes on the ECG that may reflect evidence of myocardial ischemia and injury. (C1)
1-1.11 Recognize the limitations of the ECG in reflecting evidence of myocardial ischemia and injury. (C1)
1-1.12 Correlate abnormal ECG findings with clinical interpretation. (C2)
1-1.13 Identify the ECG findings in patients with angina pectoris. (C3)
1-1.14 List the mechanisms by which an MI may be produced by traumatic and non-traumatic events. (C2)
1-1.15 Identify the primary hemodynamic changes produced in myocardial infarction. (C1)
1-1.16 Identify the ECG changes characteristically seen during evolution of an acute myocardial infarction. (C2)
1-1.17 List the characteristics of a patient eligible for thrombolytic therapy. (C2)
1-1.18 Describe the “window of opportunity” as it pertains to reperfusion of a myocardial injury or infarction. (C3)
1-1.19 Synthesize patient history, assessment findings and ECG analysis to form a field impression for the patient with cardiovascular disease. (C3)
1-1.20 Synthesize patient history, assessment findings and ECG analysis to form a field impression for the patient in need of a pacemaker. (C3)
1-1.21 Synthesize patient history, assessment findings and ECG analysis to form a field impression for the patient with angina pectoris. (C3)
1-1.22 Synthesize patient history, assessment findings and ECG analysis to form a field impression for the patient with a suspected myocardial infarction. (C3)
1-1.23 Describe a systematic approach to 12 lead ECG interpretation. (C1)
AFFECTIVE OBJECTIVES
At the completion of this unit, the EMT-Paramedic student will be able to:

1-1.24 Define patient situations where ECG rhythm analysis is indicated. (A3)

PSYCHOMOTOR OBJECTIVES
At the completion of this unit, the paramedic student will be able to:

1-1.25 Demonstrate how to set and adjust the ECG monitor settings to varying patient situations. (P3)
1-1.26 Demonstrate a working knowledge of various ECG lead systems. (P3)
1-1.27 Demonstrate how to record an ECG. (P2)
1-1.28 Identify components of a standard 12 lead ECG.
1-1.29 Demonstrate correct lead placement for limb and chest leads on a 12 lead ECG.
1-1.30 Demonstrate how to interpret a 12 lead ECG.

DECLARATIVE

I. Electrocardiograph (ECG) monitoring
   A. Electrophysiology and wave forms
      1. Origination
      2. Production
      3. Relationship of cardiac events to wave forms
      4. Intervals
         a. Normal
         b. Clinical significance
      5. Segments
   B. Leads and electrodes
      1. Electrode
      2. Leads
         a. Anatomic positions
         b. Correct placement
      3. Surfaces of heart and lead systems
         a. Inferior
         b. Left lateral
         c. Anterior/ posterior
      4. Artifact
   C. Standardization
      1. Amplitude
      2. Height
      3. Rate
         a. Duration
         b. Wave form
         c. Segment
         d. Complex
         e. Interval
   D. Wave form analysis
      1. Isoelectric
      2. Positive
      3. Negative
      4. Calculation of ECG heart rate
         a. Regular rhythm
            1. ECG strip method
            2. “300” method
         b. Irregular rhythm
            1. ECG strip method
2. "300" method

E. Lead systems and heart surfaces
1. ECG rhythm analysis
   a. Value
   b. Limitations
2. Heart surfaces
   a. Inferior
   b. Left lateral
   c. Precordial
3. Acute signs of ischemia, injury and necrosis
   a. Rationale
      1. Possible early identification of patients with acute myocardial
         infarction for intervention (thrombolysis or PTCA)
      2. The role of out-of-hospital twelve-lead ECG is still unresolved
         and may not be appropriate in many EMS settings
      3. EMS medical directors will make decisions regarding the
         application and use of the 12-lead ECG in their specific EMS
         setting
   b. Advantages/ disadvantages
   c. ST segment elevation
4. Height, depth and contour
5. ST (acute changes)
   a. Anterior wall
      i. Significant ST elevation in V1- V4 may indicate
         anterior involvement
   b. Inferior wall
      i. Significant ST elevation in II, III and aVF may
         indicate inferior involvement
6. ST segment depression in eight or more leads
7. ST segment elevation in aVR and V1

d. Q waves
   1. Depth, duration and significance
      a. Greater than 5 mm, greater than .04 seconds
      b. May indicate necrosis
      c. May indicate extensive transient ischemia

F. Cardiac arrhythmia
1. Approach to analysis
   a. P wave
      1. Configuration
      2. Duration
      3. Atrial rate and rhythm
   b. P-R (P-Q) interval
      1. Duration
   c. QRS complex
      1. Configuration
      2. Duration
      3. Ventricular rate and rhythm
   d. S-T segment
      1. Contour
      2. Elevation
      3. Depression
   e. Q-T interval
      1. Duration
      2. Implication of prolongation
2. Abnormalities originating within the bundle branch system
a. Incomplete or complete
b. Right bundle branch block
c. Left bundle branch block

3. Differentiation of wide QRS complex tachycardia
   a. Potential causes
      1. Supraventricular tachycardia with bundle branch block
      2. Accessory pathways
   b. Differentiation
      1. Physical evaluation
         a. Cannon “A” waves
         b. Vary intensity of first heart tone
         c. Beat to beat changes in blood pressure
      2. ECG differences
         a. Aberration as a result of premature Atrial complex
            1. Identify PAC in previous ST segment or T wave
            2. Sudden change in rate with bundle branch aberration
            3. Concealed retrograde conduction
            4. Right bundle branch refractoriness - may be time dependent
            5. Compare with previous ECG, when available
         b. RBBB aberration - V1 - positive
            1. Biphasic lead I with a broad terminal S-wave
            2. Triphasic QRS in V4
         c. LBBB aberration - V1 - negative
            1. Monophasic notched lead I
            2. Slurred, notched or RSR’ in lead V4, V5, or V6
         d. Concordant Pericardial pattern
            1. Totally negative Precordial pattern is diagnostic of ventricular tachycardia
            2. Totally positive Precordial pattern is suggestive of ventricular tachycardia
         e. Preexisting BBB prior to onset of tachycardia (by history)
   3. Other considerations
      a. When in doubt
         1. Cardioversion when hemodynamic state is compromised or changing
         2. Never use verapamil
         3. If hemodynamic state is stable - consider lidocaine
      b. Pitfalls
         1. Age is not a differential
         2. Slower rates may present with stable hemodynamic
         3. Preexisting BBB prior to onset of the tachycardia
      c. Regularity
         1. Monomorphic V-tach and SVT are usually very regular and SVT frequently is faster
         2. Polymorphic V-tach is irregular

I. Management of the patient with arrhythmia’s
   A. Detailed physical exam
   B. ECG findings
      1. ST segment elevation
         a. Height, depth and contour
         b. ST changes

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ST segment depression in reciprocal leads Q waves

2. Q waves
   a. Depth, duration and significance
      1. Greater than 5 mm, greater than .04 seconds
      2. May indicate necrosis
      3. May indicate extensive transient ischemia

3. ECG Rhythm analysis
   a. Criteria for patient selection for rapid transport and reperfusion
   b. Value
   c. Signs of acute ischemia, injury, and necrosis
   d. Criteria for patient selection for rapid transport and reperfusion
      1. Time of onset of pain
      2. Location of ischemia and infarction
      3. ST segment elevation
HEMODYNAMIC OVERVIEW

Minimum hours: 6 hours

OBJECTIVES

Objective Legend
C=Cognitive  P=Psychomotor  A=Affective
1=Knowledge
2=Application level
3=Problem-solving level

PREREQUISITES:
None

COGNITIVE OBJECTIVES
At the completion of this unit, the paramedic student will be able to:

4-1.10 Describe cardiac cycle and pulmonary circulation. (C1)
4-1.11 Describe concept of preload. (C1)
4-1.12 Describe concept of afterload. (C1)
4-1.13 Describe concept of cardiac output and stroke volume. (C1)
4-1.14 Describe the basics of waveform generation. (C1)
4-1.15 Describe the basics of Atrial waveforms. (C1)
4-1.16 Describe the basics of Ventricular waveforms. (C1)
4-1.17 Identify various types of Hemodynamic monitoring equipment. (C1)
4-1.18 Identify various components of Hemodynamic monitors. (C1)
4-1.19 Understand and interpret waveforms. (C1)
4-1.20 Describe clinical application of hemodynamic monitoring. (C2)

AFFECTIVE OBJECTIVES
At the completion of this unit, the EMT-Paramedic student will be able to:

4-1.21 Value and defend the use of hemodynamic monitoring in the critical patient. (A3)

PSYCHOMOTOR OBJECTIVES
No psychomotor objectives identified.

DECLARATIVE

I. Introduction to anatomy & physiology pertaining to hemodynamics
   a. Review of anatomy & physiology
      1. Cardiac cycle & pulmonary circulation
      2. Concept of preload
      3. Concept of afterload
      4. Concept of Cardiac output and stroke volume
   b. Basics of waveform generation
      1. Graph paper
      2. ECG with waveform interpretation
   c. Basics of Atrial waveforms
      1. ECG with ventricular waveform
      2. Reading CVP
      3. Interpreting PCWP
   d. Basics of Ventricular waveforms
      1. ECG with ventricular waveforms
      2. Basics of pulmonary artery waveforms
      3. Basics of systemic arterial waveforms

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II. Understanding Hemodynamic monitoring
   a. Equipment
      1. Zero balancing
      2. Leveling of transducer
      3. Concept of dampening
         > Concept of dampening or under dampening
         > "Square wave test"
   b. Various monitors
      1. Common attributes
      2. Issues relating to transporting patients

III. Understanding & Interpreting Waveforms
   a. Abnormal PCWP & CVP Waveforms
      1. Large A
      2. Loss of A
      3. Large V waveforms
   b. Mechanical Ventilation Artifact
      1. CVP
      2. PCWP
      3. PA
   c. Four most common errors in hemodynamic monitoring
      1. Failure to zero balance
      2. Improper leveling
      3. Inadequate tubing or catheter system characteristics
         > Overdampening
         > Underdampening
   d. Interpreting waveforms with artifact
HEMODYNAMIC PROFICIENCY COMPONENT
This component should be completed by EMT-Paramedic providers implementing the Critical Care skills found in 21NCAC32H-.0402. Recommended text is: Clinical Procedures For Emergency Care. Authors: Roberts & Hedges, Publisher: W. B. Saunders

Minimum hours: **18 hours**

PREREQUISITES:
Hemodynamic overview

OBJECTIVES

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*C* = Cognitive  *P* = Psychomotor  *A* = Affective  
1 = Knowledge  
2 = Application level  
3 = Problem-solving level

**COGNITIVE OBJECTIVES**
At the completion of this unit, the EMT-Paramedic student will be able to:

4-1.21 Describe the Anatomy and Physiology of the arterial venous system. (C1)
4-1.22 Describe the indications for arterial puncture and invasive arterial monitoring. (C2)
4-1.23 Describe the complications of arterial punctures and arterial pressure monitoring. (C2)
4-1.24 Describe the components and functions of invasive arterial monitoring equipment. (C1)
4-1.25 Describe the procedure for maintaining, monitoring and troubleshooting arterial pressure monitoring.
4-1.26 Describe an Allen's test and when it is to be used. (C1)
4-1.27 Describe the anatomy and physiology of the brain. (C1)
4-1.28 Describe the indications for intracranial pressure monitoring.
4-1.29 Describe the complications of ventriculostomies and intracranial pressure monitoring as they relate to the transport arena. (C1)
4-1.30 Describe the procedure for maintaining, monitoring and troubleshooting intracranial pressure waveform, pressure lines and ventriculostomies. (C1)
4-1.31 Describe the principles of hyperventilation and oxygenation and role of sedation in neurological impaired patients. (C1)
4-1.32 Describe the components and functions of intracranial pressure monitoring equipment. (C1)
4-1.33 Describe the advantages and/or disadvantages of Central Venous Catheterization using the Femoral approach. (C1)
4-1.34 Describe the NAVEL technique to locate the femoral vein. (C1)
4-1.35 Define the concept of epidural analgesia. (C1)
4-1.36 Describe the possible side effects and complications of epidural analgesia. (C1)
4-1.37 Describe the appropriate interventions for the side effects and complications identified. (C3)
4-1.38 Describe the appropriate preparation for the patient receiving epidural analgesia. (C2)
4-1.39 Describe the procedure for monitoring and maintaining epidural analgesia on a patient. (C3)
AFFECTIVE OBJECTIVES
At the completion of this unit, the EMT-Paramedic student will be able to:

4-1.35 Value and defend the application of arterial pressure monitoring. (A3)
4-1.36 Value and Defend the application of Intracranial pressure monitoring. (A3)
4-1.37 Based on the pathophysiology and clinical evaluation of the patient with a ventriculostomy characterize the clinical problems according to their life-threatening potential. (A3)
4-1.38 Value and defend the role of hyperventilation, oxygenation and sedation in the neurological impaired patient. (A3)
4-1.39 Value and defend the use of Central Venous Catheterization. (A3)

PSYCHOMOTOR OBJECTIVES
At the completion of this unit, the EMT-Paramedic student will be able to:

4-1.40 Demonstrate selection and preparation of arterial puncture site. (P2)
4-1.41 Perform puncture of an artery on a cadaver/mannequin with successful return. (P2)
4-1.42 Obtain an aseptic, anaerobic blood sample from an arterial puncture. (P2)
4-1.43 Apply adequate pressure post arterial puncture. (P2)
4-1.44 Select appropriate equipment needed for arterial monitoring. (P2)
4-1.45 Demonstrate how to prepare for transducing of arterial lines. (P2)
4-1.46 Demonstrate correct transducing techniques for arterial lines. (P2)
4-1.46 Obtains arterial blood gas from existing arterial line. (P2)
4-1.48 Maintain arterial lines for monitoring of arterial blood pressure and withdrawal of arterial blood sample. (P2)
4-1.49 Perform Central Venous Catheterization in the femoral vein. (P2)
4-1.50 Perform Allen's Test. (P3)
4-1.51 Select appropriate equipment needed for intracranial pressure monitoring. (P2)
4-1.52 Demonstrate how to prepare for transducing of ICP lines. (P2)
4-1.53 Demonstrate correct transducing techniques for ICP lines. (P2)
4-1.54 Demonstrate selection and preparation of the femoral central venous catheterization site. (P2)
4-1.55 Perform puncture of femoral vein. (P1)

DECLARATIVE

I. Review of Anatomy & Physiology as they relate to critical care patients
   a. Abnormalities of cardiac cycle and pulmonary circulation.
   b. Detailed discussion of Preload and how it relates to specific disease processes
   c. Detailed discussion of Afterload and how it relates to specific disease processes.
   d. Detailed discussion of cardiac output and how it relates to specific disease processes.

II. In-depth discussion of utilization of hemodynamic monitoring as they relate to the following disease processes:
   a. Cardiogenic shock
   b. Multisystem organ failure
   c. CHF
   d. Respiratory failure
   e. CHD-pediatric
   f. Septic shock

III. Transport issues relating to hemodynamic monitoring
   a. Basic problems
   b. As it relates to basic transport
   c. As it relates to altitude physiology

IV. History of arterial lines and purpose of arterial lines/monitoring
   1. History focus and background of personnel implementing this procedure.
   2. Purposes of arterial puncture/monitoring:

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> Obtaining multiple blood samples in patients with compromised access
> Monitoring blood pressure in a more efficient manner.
> Titration of certain vasopressors.
> Trigger mechanisms for Intra-Aortic Balloon Pump Counter-pulsation therapy.

b. Review of anatomy & physiology and the interrelationship of the arterial/venous system.
   1. The arterial circulation
   2. The venous circulation
   3. Common sites for arterial puncture vs. monitoring.
      > Radial
      > Brachial
      > Femoral
      > Axially
      > Pressure gradients

c. Understand equipment used for arterial puncture and invasive arterial monitoring.
   1. Equipment for arterial puncture
      > Heparinized syringe
      > 4x4 gauze
      > alcohol prep
      > PPE
      > towels
   2. Equipment for transducing arterial line.
      > PPE
      > Pressurized tubing
      > Prep set
      > Tape
      > Monitoring device
      > Towels
      > heparinized saline

d. Arterial waveforms and their use in hemodynamic monitoring and troubleshooting
   waveforms.
   1. Normal waveform with dictotic notch
   2. Dampened waveform and troubleshooting
   3. Artifact and troubleshooting
   4. Proper measuring of waveform and inaccurate pressure and troubleshooting
   5. Zeroing the waveform and the various scales encountered and Blood Pressure
cuff correlation.

e. Complications of arterial puncture and arterial monitoring.
   1. Cardiovascular collapse and shock states
   2. Thrombus/embolus
   3. Infection
   4. Hematoma/rupture

f. Acid Base Balance
   1. Metabolic acidosis
   2. Metabolic alkalosis
   3. Respiratory acidosis
   4. Respiratory alkalosis

V. Intracranial Pressure Monitoring (ICP)
a. Review of anatomy & physiology of the brain
b. Placement of catheters by physicians
c. Indications for ICP monitoring
d. Equipment
   1. Pressure lines
   2. Ventriculostomies
   3. Maintaining
   4. Monitoring
   5. Troubleshooting
e. Complications
   1. Troubleshooting
   2. Ventriculostomies
   3. ICP monitors
f. Transporting
   1. Issues
   2. Complications

VI. Epidural Analgesia
a. The use of epidural analgesia in rapid sequence intubation
b. Indications
c. Contraindications
d. Advantages
e. Disadvantages
f. Pharmacology agents
   1. Morphine
   2. Fentanyl
g. Complications
   1. Respiratory Depression
   2. Catheter migration
   3. Nausea and vomiting
   4. Pruritus
   5. Urinary retention
   6. Infection

**CLINICAL**

Before successful completion of this component, the EMT-Paramedic student shall successfully complete a minimum 16 hours of intensive care contact time. In addition to the hospital Intensive Care Unit, the following are approved clinical education sites: Emergency Department, Cardiac Care Unit, Operating Room and Recovery Room. The student must successfully perform the following skills during the clinical education experience:

<table>
<thead>
<tr>
<th>SKILL</th>
<th>SUCCESSFUL ATTEMPTS</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Femoral Sticks</td>
<td>5</td>
<td>ONE on real patient</td>
</tr>
<tr>
<td></td>
<td></td>
<td>four on mannequin</td>
</tr>
<tr>
<td>2. Arterial Blood Samples</td>
<td>3</td>
<td>From arterial lines</td>
</tr>
<tr>
<td>3. Arterial Lines</td>
<td>3</td>
<td>Maintenance of arterial lines</td>
</tr>
<tr>
<td>4. Arterial Sticks</td>
<td>10</td>
<td>No mannequin sticks, must be on real patients</td>
</tr>
</tbody>
</table>
VENTILATORS

Minimum hours: 16 hours

PREREQUISITES:
None

OBJECTIVES

Objectives Legend
C=Cognitive  P=Psychomotor  A=Affective

1 = Knowledge
2 = Application level
3 = Problem-solving level

COGNITIVE OBJECTIVES

3-1.1 Describe indications, contraindications, advantages, disadvantages, complications, and
techniques in transporting a ventilated patient. (C1)
3-1.2 Describe indications, contraindications, advantages, disadvantages, complications, and
techniques for ventilating a patient with an automatic transport ventilator (ATV). (C1)
3-1.3 Describe indications, contraindications, advantages, disadvantages, complications, and
techniques for ventilating a patient with an mechanical ventilator. (C1)
3-1.4 Describe indications, contraindications, advantages, disadvantages, complications, and
techniques for removing a patient from the ventilator for transport. (C1)
3-1.5 Identify the various components of a mechanical ventilator. (C1)
3-1.6 Identify types of mechanical ventilators. (C1)
3-1.7 Identify various modes of ventilation as they apply to both the adult and pediatric patient, with
emphasis on transport situations. (C1)
3-1.8 Identify and discuss specific diseases/disorders that impact the respiratory system. (C1)
3-1.9 Identify ventilatory considerations given the pathophysiology of the disease process or injury for
both the adult and pediatric patients. (C1)
3-1.10 Describe physiological/hemodynamic effects and complications of the use of ventilatory support.
(C1)

AFFECTIVE OBJECTIVES
At the completion of this unit, the EMT-Paramedic student will be able to:

3-1.11 Value and defend the use of mechanical ventilators in the critical patient. (A3)

PSYCHOMOTOR OBJECTIVES

3-1.12 Demonstrate the proper use and capabilities of various ventilators to include the proper setup of
settings, alarms, and modes as well as covering troubleshooting methods for ventilators. (P2)

DECLARATIVE

I. Ventilators
   1. Modes of Ventilation
      a. A/C
      b. Simon
      c. PS

May 11, 1999
d. PC
e. CPAP
f. PEEP
g. Automatic transport ventilators

2. Terminology associated with Ventilators
a. PIP
b. TV
c. Flow rates
d. FIO2
e. I:E ratios
f. I-time
g. E-time

3. Adult Ventilation
a. Appropriate setting based on patients needs
b. Respiratory Disorders and considerations for Ventilator Therapy
c. Effects and Complications of mechanical ventilation
d. Transporting ventilated patients
e. Discontinuation of ventilator

4. Pediatric Ventilation
a. Appropriate modes specific to the patients needs
b. Pediatric Respiratory Disorders commonly transported
   1. RDS
   2. RSV pneumonia
   3. Asthma
   4. BPD
   5. Cardiac defects
   6. Neurological
c. Effects and Complications of mechanical ventilation
d. Transporting ventilated patients
e. Discontinuation of ventilator

5. Concerns
a. Cuff Pressure
b. Pilot balloons
c. Air leaks
d. Securing the ETT
e. Suctioning
f. Changing the ETT
g. Tension Pneumothorax
h. Barotrauma
i. Oxygen toxicity
j. Chest tubes

6. Setting up the Ventilator
a. Overview of capabilities
b. Oxygen connections
c. Settings
d. Alarms
e. Sensitivity

7. Troubleshooting
a. Systematic troubleshooting

8. Automatic transport ventilators
a. Volume/rate controlled
b. Indications
   1. Extended ventilation of intubated patients
2. In situations in which a BVM is used
3. Can be used during CPR

c. Contraindications
1. Awake patients
2. Obstructed airway
3. Increased airway resistance
   a. Pneumothorax (after needle decompression)
   b. Asthma
   c. Pulmonary edema
d. Advantages
1. Frees personnel to perform other tasks
2. Lightweight
3. Portable
4. Durable
5. Mechanically simple
6. Adjustable tidal volume
7. Adjustable rate
8. Adapts to portable Oxygen tank
e. Disadvantages
1. Cannot detect tube displacement
2. Does not detect increasing airway resistance
3. Difficult to secure
4. Dependent on Oxygen tank pressure

CLINICAL

Before successful completion of the Ventilator course, the EMT-Paramedic student shall have participated in patient rounds with a Respiratory Therapist in a Critical Care environment, assessing and troubleshooting TEN patients on ventilators.