The Greater Miami Valley EMS Council, Inc.
& State of Ohio EMS Region 2

Standing Orders
Optional Skills Training Manual

This document includes the training materials and skills sheets for those procedures that are considered optional components of the Standing Orders. Prior to implementing any of the Departmental Options in the Standing Orders, Council strongly recommends the following:

- Evaluation and approval by the Chief of the Department, including assessment of cost and training requirements.
- Evaluation and approval by Department Medical Director.
- Develop and implement a training plan (specific recommendations are included here for some procedures). Training plans must include any other required components (e.g., paramedics training for "Sedate to Intubate" administration must also be trained in use of a rescue cricothyrotomy device).
- Deliver annual training and competency (written and skills) evaluation of those optional skills/procedures
- Have a defined Quality Improvement Plan.

According to the Standing Orders, "No procedures, techniques, or drugs will be used without the proper equipment or beyond the training or capabilities of the pre-hospital personnel. Nothing may be used without specific pre-approval of the Medical Advisor for the local department or agency." "**Items that are enclosed in braces ({}) are at the option of the Department, and its Medical Director.**"

Departments are strongly encouraged to reproduce the sections of this document that apply to the optional skills, items, and procedures they intend to use. Materials for items not used by your Department may be deleted.

Listed on the next page are the optional items in the 2010 GMVEMSC Standing Orders.

Table of Contents

Optional Procedures

Optional Procedures	FR	EMT-B	EMT-I	EMT-P
AED	X	X	X	X
Amyl Nitrite (pearls)				X
BAAM				X
BiPAP				X
CANA Auto-Injector		X	X	X
Carbon Monoxide Monitoring		X	X	X
Combi-Tube		X	X	X
CPAP		X	X	X
Cyanide Kits (Cyano-kit or traditional)		X	X	X
Dawn Soap	X	X	X	X
Digital Intubation			X	X
Endotracheal Intubation		X	X	X
End-tidal CO2 Detection		X	X	X
Esophageal Detection Device		X	X	X
Flow-Restricted Oxygen Powered Ventilation Device				X
Glucometer		X	X	X
IO Devices			X	X
IV Pressure Bags			X	X
IV Pump				X
King Airway		X	X	X
Lighted Stylet Intubation			X	X
LMA		X	X	X
MAD Device			X	X
Magnesium (Maalox or Mylanta)				X
Magnesium Sulfate (Epsom Salt)				X
Morgan Lens				X
Nitroglycerin Drip				X
12-Lead ECG Acquisition		X	X	X
12-Lead ECG Interpretation				X
Oral Glucose		X	X	X
Pulse Oximetry		X	X	X
Sedate to Intubate				X
Sodium Nitrite				X
Spinal Clearance		X	X	X
Stockpile (Cipro or Doxy)				X
Sudecon Wipes	X	X	X	X
Triage Ribbons	X	X	X	X
Warmed IV Fluids			X	X

Optional Skill
King Airway

Scope of Practice EMT-Basic, Intermediate, and Paramedic

Indications
1. Need for tracheal intubation
2. Inability to tracheally intubate
3. Unconscious, Apneic, no gag reflex
* for EMT-Basics, the patient must also be pulseless

Contra-Indications
1. Less than 4 feet tall
2. Known history of esophageal disease
3. Ingestion of caustics

Complications
stimulation of gag reflex
soft tissue trauma
tube extraction under high airway pressures

Procedure

	Yes	No
Takes or verbalizes appropriate BSI precautions		
Places the patient in the "sniffing" position (consider c-spine precautions)		
Pre-oxygenates		
Choose the correct size * Size 3 for patients 4 to 5 feet tall * Size 4 for patients 5 to 6 feet tall * Size 5 for patients over 6 feet tall		
Applies a water-soluble lubricant to the distal tip		
Without exerting excessive force, advance the tube until the base of the connector is aligned with the patient's teeth or gums		
Inflate the pilot balloon with the appropriate amount of air * Size 3 = 50ml * Size 4 = 70ml * Size 5 = 80ml		
Attach the Bag-Valve Mask; while ventilating the patient, gently withdraw the tube until ventilation becomes easy and free-flowing.		
Adjust cuff inflation if necessary to obtain a seal		
Confirm placement * utilize multiple methods		
Ventilate patient at the proper rate and tidal volume		

Greater Miami Valley EMS Council, Inc. & Ohio EMS Region 2 Protocol
COMBITUBE

Indications:

- Can only be used by trained personnel at the EMT-B, EMT-I, or EMT-P level with Medical Director Approval...
- Patient must be adult and in respiratory arrest or have an absent gag reflex.
- After two failed attempts to intubate patient with an endotracheal tube.

Contraindication

- Patient under the age of 16 and/or under 5 feet tall.
- Responsive patients with an intact gag reflex.
- Patients with known esophageal disease.
- Patients who have ingested caustic substances.
- Patient with inhalation burns.

Application

- Pre-oxygenate patient with a BVM at high flow Oxygen.
- Prior to insertion, test cuff integrity by inflating each cuff with prescribed volume of air. Remove air and preset syringes at proper volume.
- Lubricate distal end of Combitube with KY or other water-soluble jelly.
- Remove the oropharyngeal airway.
- If a non-trauma patient, pre-position the head.
- Perform a tongue-jaw lift.
- Following the natural anatomical curvature, insert the Combitube until the upper teeth are between the two black lines on the tube.
- Inflate the blue pharyngeal cuff to 100 cc. Expect the tube to move slightly upward. Remove syringe.
- Inflate the white esophageal cuff to 15 cc. Remove syringe.
- Ventilate with a BVM through blue tube. Auscultate for air at the epigastrium and then the lungs. Watch for chest rise. If equal breath sounds are heard and the chest rises equally, continue to ventilate through the blue tube.
- If upon auscultation, air is heard at the epigastrium, immediately disconnect the BVM from the blue tube and attach it to the clear tube. Ventilate and reassess for breath sounds and chest rise.
- If air is not heard at the epigastrium but chest rise or breath sounds do not occur, insert 10 cc more air into the pharyngeal (blue) cuff.
- Ventilate patient with BVM at appropriate rate.
- If ventilation is achieved through the blue tube, placement is in the esophagus. The stomach can be suctioned through the clear tube. A diverter is provided to direct any vomitus that may come up the tube away from the operator.

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Caution

- Do not force the Combitube. If resistance is met, redirect or withdraw and reinsert.
- When facial trauma has resulted in sharp, broken teeth or dentures, remove dentures and exercise extreme caution when passing the tube to prevent the cuff from tearing.
- If the Combitube is to be removed, first deflate the blue pilot balloon and then the white.
- If you elect to intubate past the Combitube, deflate the blue pilot balloon and move the tube to the left side of the mouth while keeping the white balloon inflated.
- Medications can be given through the Combitube only if the tube has been placed into the trachea. Then medications are injected into the clear tube. .

ADULT PROTOCOL SKILL EVALUATION
SUBJECT: COMBITUBE INSERTION

NAME_____ DATE_____

LEVEL: _____Paramedic _____Intermediate _____Basic

STEPS	1st Testing Comments	2nd Testing Comments
A. List the indications for use of the Combitube.		
B. List the contraindications for use of the Combitube.		
C. List the equipment required to perform Combitube insertion.		
D. Pre-oxygenate patient.		
E. Assemble/check/prepare airway device & other equipment..		
F. Lubricate distal end of Combitube with water-soluble jelly.		
G. Position patient's head properly.		
H. Perform tongue-jaw lift.		
I. Insert device in the mid-line & to the depth that the printed ring is at the level of the teeth.		
J. Inflate the blue pharyngeal cuff with the proper volume & remove syringe.		
K. Inflate the distal white esophageal cuff with the proper volume & remove syringe.		
L. Attach BVM to blue pharyngeal tube and begin ventilations.		
M. If auscultation of breath sounds is positive and auscultation of gastric insufflation is negative, continue ventilation.		
N. If auscultation of breath sounds is negative and auscultation of gastric insufflation is positive, immediately disconnect the BVM from the blue tube and attach it to the clear tube.		
O. Ventilate & reassess for breath sounds & chest rise. If air is not heard at the epigastrium but chest rise or breath sounds do not occur, insert 10 cc more air in the pharyngeal (blue) cuff.		
P. If auscultation of breath sounds is positive and auscultation of gastric insufflation is negative, confirm tube placement, using the End Tidal CO2 Detector for patients with a perfusing rhythm, or the Esophageal Detection Device for patients in cardiac arrest. Be able to discuss the indications and limitations of each device		
Q. Secure device in place & reassess placement after any movement of patient.		

ADULT PROTOCOL SKILL EVALUATION
SUBJECT: LARYNGEAL MASK AIRWAY (OPTIONAL)

NAME_____ DATE_____

LEVEL: _____Paramedic _____ Intermediate _____Basic

STEPS	1st Test	2nd Test	3rd Test
A. List the indications for insertion of an LMA			
B. Select correct size LMA (See guidelines below)			
C. Check cuff by inserting air, then withdraw air.			
D. Deflate the cuff so that it forms a smooth "Spoon-Shape"			
E. Lubricate the posterior surface of the mask with water-soluble lubricant.			
F. Hold the LMA like a pen, with the index finger placed at the junction of the cuff and tube.			
G. NonTrauma Patient - With the head extended and the neck flexed, carefully flatten the LMA tip against the hard palate. Trauma Patient - With second person maintaining inline stabilization, carefully flatten the LMA tip against the hard palate.			
H. Use the index finger to push cranially, maintaining pressure on the tube with the finger.			
I. Advance the mask until definite resistance is felt at the base of the hypopharynx.			
J. Gently maintain cranial pressure with the non-dominant hand while removing the index finger.			
K. Without holding the tube, inflate the cuff with just enough air to obtain a seal (to a pressure of approximately 60 cm. H2O). See the instructions for appropriate volumes. Never overinflate the cuff.			
L. Ventilate & check breath sounds			
M. Confirm sufficient cuff inflation using the End Tidal CO2 Detector (EDD cannot be used) CAUTION: Do Not give medications via the LMA.			

EQUIPMENT

1. LMA (correct size)
2. Water-Soluble Lubricant
3. 50 ml. Syringe
4. Bag-valve-Mask
5. Stethoscope
6. End Tidal CO2 Detector
7. Suction

LMA SELECTION GUIDELINES		
LMA Airway Size	Patient Size	Maximum Cuff Inflation Volumes
1	Neonates/Infants up to 5 kg. (11 lb.)	4 ml. air
1.5	Infants 5 - 10 kg. (22lb.)	7 ml. air
2	Infants/Children 10 - 20 kg. (44 lb.)	10 ml. air
2.5	Children 20 - 30 kg. (66 lb.)	14 ml. air
3	Children 30 - 50 kg. (110 lb.)	20 ml. air
4	Adults 50 - 70 kg. (154 lb.)	30 ml. air
5	Adults 70 - 100 kg. (220 lb.)	40 ml. air
6	Adults > 100 kg. (>220 lb.)	50 ml. air

“Sedate to Intubate” Training Outline

“Sedate to Intubate” (StI) Overview
- What is StI?
- How does it differ from RSI?
- Indications
- Benefits
- **Risks**
- Contraindications

StI Pharmacology
- Etomidate
- Midazolam
- Lidocaine

Pre-Requirements
- EKG monitoring
- IV
- PulsOx
- Oxygenation
- Must be convinced that you will be able to intubate!
- Must be trained on, approved on, and have the equipment to perform a surgical cricothyrotomy technique (e.g., PerTrach)

Recognition of the Difficult/Impossible Intubation Patient
- Advanced Airway Assessment (e.g., Mallampati or Samsoon Airway Classes)

Review of Intubation Techniques
- Review of PerTrach

StI Use and Sequence

Practice Stations:
- Intubation
- Difficult Intubation Situations
- Rescue Airway Devices
- StI Use and Sequence
- Cricoid pressure to control vomiting, prevent gastric insufflation/distention
- Management of esophageal intubation
- Management of laryngospasm

Practical Testing:
- Intubation
- Difficult Intubation Situations
- PerTrach
- StI Use and Sequence

Written Testing

Course to be objective based (see below). Agenda and time spent on objectives must be approved by Department’s Medical Director. QI should be accomplished through Departmental QI and intubation sheets already in use by hospital respiratory therapists.

Sedate to Intubate Learning Objectives:

1. List the indications for rapid-sequence sedation
2. List the steps in performing rapid-sequence sedation
3. Describe and list the indications, contraindications, and dosages for Etomidate
4. Given a scenario, select the most effective means of providing a patent airway.

References:

1. Prehospital Emergency Pharmacology, 5th edition by Brady
2. PHTLS, 5th edition by Mosby}

ADULT PROTOCOL SKILL EVALUATION
SUBJECT: SEDATE TO INTUBATE (OPTIONAL)

NAME_____ DATE_____

LEVEL: _____Paramedic EVALUATOR_____

STEPS	**1st Test**	**2nd Test**	**3rd Test**
A. List indications for Sedate to Intubate Procedure			
B. List potential complications associated with STI			
C .Attempts at other methods			
D. Pre-oxygenate the patient, providing ventilatory support via BVM @ 100% Oxygen if needed. Monitor for risk of gastric distention.			
E. Establish: Cardiac Monitor, IV, and Pulse Oximetry. Have Suction, Intubation Equipment, and Rescue Airway assembled.			
F. If used in patients suspected of increased Intracranial Pressure, administer Lidocaine, 100mg IVP			
G. Etomidate, 0.3mg/kg IVP (Average dose 15-25 mg based on the average patient weighing between 50-100kg). If patient is still resistive to intubation, repeat initial Etomidate dose within two minutes. Follow witnessed waste procedures			
H. Cricoid Pressure			
I. Intubate			
J. Midazolam 2-4mg IV, if patient is resisting post intubation and SBP >100			
K. List procedure for failed attempt			
L. List approved Rescue Airways			

PerTrach

Attached is the PerTrach Evaluation Sheet. If your Department/Agency and Medical Director want you to use the PerTrach, you will then need to be trained and tested on this device, and retested during annually. Preceding initial testing, there should be a short videotape on the device, and a practical station. You will first practice the simulated placement of the device. Following that, you will be tested on its use.

The PerTrach is an instrument for establishing a temporary percutaneous airway via a cricothyroid puncture. The Adult version is used for patients age 12 and above. Since this is an emergency airway device, you do not need permission from Medical Control. If it is indicated, do it!

The PerTrach is to be used only when other means of establishing an airway in the emergency situation are impossible, or totally ineffective. Causes of upper airway obstruction include epiglottitis, fractured larynx, foreign body aspiration, airway burns, laryngeal edema, laryngospasms, and massive facial trauma.

No paramedic may utilize this device until after successful completion of the Skill Evaluation.

Indications for use of the PerTrach:

1. Complete airway obstruction not manageable with other airway techniques or devices.
2. Partial airway obstruction which is impeding oxygenation, or which is likely to progress (e.g., laryngeal edema or spasm), and which is not manageable with other airway techniques or devices.

Equipment required to place and ventilate with the PerTrach:

1. Betadine wipe
2. Scalpel
3. PerTrach Needle and Syringe
4. Dilator
5. Bag-valve-mask
6. Oxygen
7. Umbilical tape

Potential complications of PerTrach placement:

1. Bleeding
2. Puncture of the posterior tracheal wall, with esophageal insertion
3. Mainstem bronchus intubation

Methods of tube confirmation:

1. CO2 Detector for patients with a pulse.
2. Pulse oximetry
3. Esophageal detector device (EDD) for patients with no pulse.
4. Bilateral breath sounds - Many people have died following this method of detection.
5. Fogging of the tube.

PerTrach Training Materials Your Department Should Have on Hand

Cuffed PerTrach Tubes
Dilators
Trach blocks
Cric Simulator
"PerTrach Video"

PROTOCOL SKILL EVALUATION
SUBJECT: PerTrach Cricothyrotomy
Combined Adult and Pediatric Evaluation

NAME_____ DATE_____
LEVEL: _____Paramedic

STEPS	**1st Testing Comments**	**2nd Testing Comments**
A. List the indications for use of the PerTrach.		
B. List the equipment required to place and ventilate with the PerTrach.		
C. List the potential complications of PerTrach placement.		
D. Attempt to oxygenate patient during preparations to intubate.		
E. Assemble equipment, and test the cuff on the tube.		
F. Place patient in supine position, and palpate the cricothyroid membrane.		
G. If time permits, prep area with betadine wash.		
H. Pinch the skin over the cricothyroid membrane and make a one to two cm. vertical incision in the midline.		
I. Insert the needle with syringe attached through the incision, perpendicular to the airway. Draw air through the syringe simultaneously with needle insertion, until air is encountered, indicating entry in the trachea.		
J. Remove syringe, and incline needle to a 45^{o} angle towards the carina before threading the filiform portion of the dilator into the airway, through the needle. *The device is used with the thumb on the knob, while the second and third fingers are curved under the flange of the tube. Force is applied with the thumb.		
K. Squeeze the wings, then open them outward to split and remove the needle. It is helpful if a second rescuer holds the device in place while the operator uses both hands to split and remove the needle.		
L. Exert pressure, and force the dilator into the airway, placing the tube into a functional position, with the face plate against the skin.		
M. Remove the dilator.		
N. Inflate the cuff with 1 to 6 cc of air, and attach the BVM.		
O. Assess lung sounds, and use as many other methods of tube confirmation as are available. Check for leakage around the tube.		
P. Secure the tube in place with the umbilical tape that is provided.		
Q. List the sizes of PerTrachs, and the ages which are appropriate for each: • 3.0 mm Pediatric PerTrach: Ages 6 months to 1 year • 3.5 mm Pediatric PerTrach: Ages 1 to 4 years • 4.0 mm Pediatric PerTrach: Ages 3 to 10 years • Adult PerTrach		

CAUTIONS

1. Retracting the leader portion of the dilator back through the unsplit needle can result in sheering off the leader, with a resultant endotracheal foreign body. If in doubt about placement, remove leader and needle together.
2. Insertion of the device through the thyroid cartilage can injure the vocal cords and other structures.
3. This is a single use only device.
4. Use great caution to avoid inserting the needle through the back wall of the trachea, and into the esophagus.

When preparing for this skill evaluation, be sure that you are able to meet the objectives A, B, and C.
Paramedic must be able to insert the device, completing steps F through N, within 60 seconds.

QuickTrach

Attached is the QuickTrach Evaluation Sheet. If your Department/Agency and Medical Director want you to use the QuickTrach, they will first need to purchase the QuickTrachs (Adult, Pediatric, or both). You will then need to be trained and tested on this device, and retested during all annual Standing Orders Check-Offs. Preceding initial testing, there should be a short videotape on the device, and a practical station. You will first practice the simulated placement of the device. Following that, you will be tested on its use.

The QuickTrach is an instrument for establishing a temporary percutaneous airway via a cricothyroid puncture. The Adult version is used for patients age 12 and above. Since this is an emergency airway device, you do not need permission from Medical Control. If it is indicated, do it!

The QuickTrach is to be used only when other means of establishing an airway in the emergency situation are impossible, or totally ineffective. Causes of upper airway obstruction include epiglottitis, fractured larynx, foreign body aspiration, airway burns, laryngeal edema, laryngospasms, and massive facial trauma. No paramedic may utilize this device until after successful completion of the Skill Evaluation.

Indications for use of the QuickTrach:
1. Complete airway obstruction not manageable with other airway techniques or devices.
2. Partial airway obstruction which is impeding oxygenation, or which is likely to progress (e.g., laryngeal edema or spasm), and which is not manageable with other airway techniques or devices.

Equipment required to place and ventilate with the QuickTrach:
1. Betadine wipe
2. PerTrach Needle and Syringe
3. Bag-valve-mask
4. Oxygen
5. Attached securing device

Potential complications of QuickTrach placement:
1. Bleeding
2. Puncture of the posterior tracheal wall, with esophageal insertion
3. Mainstem bronchus intubation

Methods of tube confirmation:
1. CO2 Detector for patients who have a pulse.
2. Pulse oximetry
3. Esophageal detector device (EDD) for patients with no pulse.
4. Bilateral breath sounds - Many people have died following this method of detection.
5. Fogging of the tube.

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PROTOCOL SKILL EVALUATION
SUBJECT: QuickTrach Cricothyrotomy
Combined Adult and Pediatric Evaluation

NAME_____ DATE_____

LEVEL: _____Paramedic

STEPS	1ST Testing Comments	2ND Testing Comments
A. List the indications for use of the QuickTrach. *Do not use on patient under 3 years of age.		
B. List the equipment required to place & ventilate with the QuickTrach.		
C. List the potential complications with the use of the QuickTrach.		
D. Assemble Equipment and prep patient with Betadine.		
E. Place the patient in a supine position. Assure stable positioning of the neck and hyperextend the neck. (unless cervical spine injury suspected)		
F. Secure larynx laterally between thumb and forefinger. Find the cricothyroid ligament (in the midline between the thyroid cartilage and the cricoid cartilage). This is the puncture site.		
G. Firmly hold device and puncture cricothyroid ligament at a 90 degree angle.		
H. After puncturing the cricothyroid ligament, check the entry of the needle into the trachea by aspirating air through the syringe. If air is present, needle is within trachea.		
I. Now, change the angle of insertion to 60 degrees (from the head) and advance the device forward into the trachea to the level of the stopper. The stopper reduces the risk of over-insertion of the needle into the posterior wall of the trachea.		
J. Remove stopper. After the stopper is removed, be careful not to advance the device further with the needle still attached.		
K. Hold the needle and syringe firmly and slide only the plastic cannula along the needle into the trachea until the flange rests on the neck. Carefully remove the needle and syringe.		
L. Secure the connecting tube to the 15mm connection and connect the other end to the BVM with supplemental oxygen. Ventilate and use confirmation methods.		

CAUTIONS:

1. Do not use on patient under 3 years of age.
2. To determine when to use a Pediatric 2.0mm it is suggested that a patient needing a 4.0 - 6.5 ETT is appropriate for the Pediatric Quicktrach. The Adult 4.0mm would be based on a 6.5 ETT or >.

Optional Skill
CPAP

Scope of Practice EMT-Basic, Intermediate, and Paramedic

Indications
1. Acute Pulmonary Edema
2. COPD

Inclusion Criteria
1. Respiratory Distress
2. Respiratory Rate >24
3. SaO2 <92%

Contra-Indications
1. Lack of spontaneous airway control
2. Respiratory Arrest
3. Agonal Respiration
4. Unconscious
5. Cardiogenic shock
6. Pneumothorax
7. Facial injuries or malformations that prevent proper seal
8. Inability to tolerate

Complications
1. Anxiety
2. Respiratory secretions and/or vomiting
3. Hemodynamic instability, physiological deterioration are all indications of failure of the procedure.

Procedure	Yes	No
Takes or verbalizes appropriate BSI precautions		
Prepare equipment		
Explain the procedure to the patient		
Activate the system (see notes)		
Applies the mask to the patient		
Evaluate the patient's tolerance to the procedure		
Continuous re-evaluation of the patient's condition		

Notes Always follow the Manufacturer's recommendations

Electronic Capnography: End Tidal CO2 Monitors with Waveforms

For Departments that opt to purchase EtCO2 Monitors with waveforms, the following can be utilized to familiarize personnel with the process of reading these monitors.

Key Terms

PaCO2
Partial pressure of CO2 in arterial blood.

EtCO2
End-tidal carbon dioxide: measurement of the concentration of CO2 at the end of exhalation.

Capnometry
Measurement and numerical display of CO2 concentration at the patient's airway.

Capnography
Measurement and waveform display of CO2 concentration at the patient's airway.

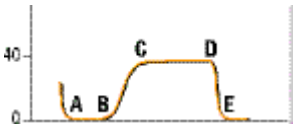
Capnogram
Waveform display of CO2 throughout respiration.

a-ADCO2
Difference between EtCO2 and PaCO2 normally 2-5 mmHg.

Anatomic Dead Space
The portion of inhaled gases that fills the conducting airways and never reaches the alveolar membrane to participate in gas exchange

A Normal Capnogram

The diagram below shows the shape of a normal capnogram.



A-B: A near zero baseline—Exhalation of CO2-free gas contained in dead space.
B-C: Rapid, sharp rise—Exhalation of mixed dead space and alveolar gas.
C-D: Alveolar plateau—Exhalation of mostly alveolar gas.
D: End-tidal value— Peak CO2 concentration—normally at the end of exhalation.
D-E: Rapid, sharp downstroke—Inhalation

Abnormal Capnograms

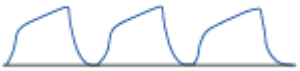
Sudden loss of EtCO2 to zero or near zero

Possible causes:
Airway disconnection
Dislodged ET tube/esophageal intubation
Totally obstructed/kinked ET tube
Complete ventilator malfunction

Sustained low EtCO2 with good alveolar plateau

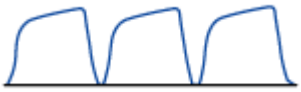
Possible causes:
Hyperventilation
Hypothermia
Sedation, anesthesia
Dead space ventilation

Sustained low EtCO2 without alveolar plateau



Possible causes:
Incomplete exhalation
Partially kinked ET tube
Brochospasm
Mucous plugging
Poor sampling techniques

Elevated EtCO2 with good alveolar plateau



Possible causes:
Inadequate minute ventilation/hypoventilation
Respiratory-depressant drugs
Hyperthermia, pain, shivering

Gradually increasing EtCO2

Possible causes:
Hypoventilation
Rising body temperature/malignant hyperthermia
Increased metabolism
Partial airway obstruction
Absorption of CO2 from exogenous source

Exponential decrease in EtCO2

Possible causes:
Cardiopulmonary arrest
Pulmonary embolism
Sudden hypotension; massive blood loss
Cardiopulmonary bypass

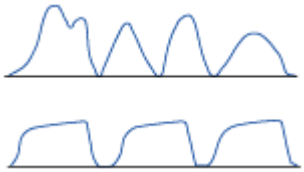
Sudden decrease in EtCO2 to low non-zero value

Possible Causes:
Leak in the airway system
ET tube in hypopharynx
Poorly fitting anesthetic mask
Partial airway obstruction
Partial disconnect from ventilator circuit

Rise in Baseline and EtCO2

Possible causes:
Defective exhalation valve
Rebreathing of previously exhaled CO2
Exhausted CO2 absorber

Spontaneous breathing during mechanical ventilation



Spontaneous breathing efforts may be evident on the CO2 waveform display. The patient on the top demonstrates poorer quality spontaneous breathing effort than the patient on the bottom.

Optional Skill
Acquisition & Transmission of 12-Lead ECG

Scope of Practice EMT-Basic and Intermediate

Indications

Patient ≥ 25 y/o
Suspected Cardiac/AMI Chest Pain or other signs/symptoms of AMI or any non-trauma cardiac event including:
Respiratory Distress
Syncope
Diaphoresis
Weakness
Post-arrest

Contra-Indications

Chest pain from trauma
Pleuritic chest pain

Complications There are no patient-related complications to this procedure

Procedure

	Yes	No
Takes or verbalizes appropriate BSI precautions		
Explain the procedure to the patient		
Prepare equipment		
Prepare the patient: expose chest, prep the skin (dry and shave if necessary)		
Apply electrodes		
Enter patient's age and identifiers (such as name, dob)		
Instruct the patient to lie as still as possible during acquisition		
Acquire ECG		
Transmit to the receiving Emergency Department		
During report (radio/phone), inform them of method of delivery used (fax, receiving station, e/mail, etc).		

Notes

When possible, acquire the 12-Lead ECG prior to moving the patient

Always follow the Manufacturer's recommendations

Paramedic Study Guide: 12 Lead EKGs

by David N. Gerstner, EMT-P

Expectations for Paramedics Performing 12-Lead EKGs

To perform 12-Lead EKGs in the field, you should be able to meet the following objectives:

- Be able to place 4 Limb Leads and 6 Precordial Leads within 90 Seconds
  - Limb Leads at proximal or distal limbs
  - Precordial Leads placed **precisely**, with **no deviation,** and with zero errors
- Be able to discuss when to acquire 12-Lead EKGs
- Be able to list issues relating to hospital care:
  - Notify if you or machine suspect **Acute** MI
    - Please note: if the LP-12 reads it as "MI, age indeterminate," this is less likely to be acute. You should still notify and treat appropriately, but tell the hospital what it says.
  - List documentation required **on** the EKG Strip
  - Rapid transport
  - Deliver EKG to ER physician!
- Understand need to note on chart and EKG if non-standard position (heart moves when patient sits up)
- Understand use of negative complex in aVR as "test" for lead placement
- Artifact, and what to do about it
- Be able to recognize the EKG findings which indicate an AMI
- Be able to localize the MI by the EKG findings
- Be able to recognize the MI "mimics" on the EKG
- Be able to list, from memory, which leads are "anterior leads," which are "inferior leads," which are "lateral leads," and which are the "septal leads."
- Be able to explain the significance of the lead groupings listed above.

More Information

For more information on any of the topics below, there are many resources available, including:

1. The 12-Lead ECG in Acute Myocardial Infarction, by Tim Phalen
2. Mosby's Paramedic Textbook, by Mick J. Sanders

Purpose and Benefits of Prehospital 12-Lead EKGs

In many cases, Acute Myocardial Infarction is now treatable. The treatments, however, are very time-dependent. The more quickly a patient is treated the better the chances for survival.

Performing a 12-Lead in the field can have a tremendous impact on patient care. You've heard the expression, "Time is muscle." Every minute that goes by after a patient starts having symptoms of myocardial ischemia increases the risk of permanent damage to the heart. It also increases the risk of death. There are two ways to deal with this: thrombolytic drugs, or clot busters (e.g., tPA, streptokinase, and others), and PCI, or balloon angioplasty. With either treatment, if you want it to work, you have to use it right away!

The new American Heart Association Guidelines for CPR and Emergency Cardiovascular Care (the basis for ACLS) strongly recommend prehospital 12-Lead EKGs. "We recommend implementation of out-of-hospital 12-lead ECG diagnostic programs in urban and suburban paramedic systems", and call it a Class I (the highest level) recommendation. They also state that the prehospital 12-Lead is cost-effective, and often underused.

If we get the 12-Lead, it may slightly increase the time we spend in the field, but it shortens the time the patient has to wait in the hospital for treatment. Typically, the 3 – 5 minutes (or less) we spend to get the 12-Lead saves 20 – 30 minutes in the hospital. The advantage comes from our being able to diagnose the MI, and call them with the information. The ER can then get medications ready, call in a cardiologist, prepare the Cath Lab, and take other steps to treat the MI patient as quickly as possible.

Even when you are only blocks from the hospital, the 12-Lead EKG is like airway management, defibrillation, CPR, or D50. It should not wait until you arrive at the hospital. **Do the 12-Lead at the scene, as quickly as possible, then notify the ER ASAP!**

12-Leads can also change the way we treat patients in the field. As just one example, patients with inferior MIs can be sensitive to nitroglycerine.

Definitions

Stenosis – constriction or narrowing of a passage or orifice. The narrowing of a coronary artery caused by plaque buildup is an example of stenosis. A stenotic artery is a narrowed artery.

Aggregation –clustering, or coming together, of a group of parts. When there is a plaque rupture in a coronary artery, platelets "aggregate" as one part of the clotting process, which may cause a blockage (occlusion) of the coronary artery. Since that blockage is the cause of a myocardial infarction, we want to reduce platelet aggregation, and one way to do that is with aspirin.

Thrombus – a blood clot that obstructs a blood vessel or a cavity of the heart.

Vasoconstriction – vaso refers to blood vessels. Constriction is narrowing. Vasoconstriction is a tightening or narrowing of a blood vessel. Severe vasoconstriction of the coronary arteries can result in a heart attack. That's partly how cocaine can cause myocardial infarctions.

Ischemia – temporary lack of blood supply to a part of the body because of obstructed circulation.

Injury – trauma or damage to some part of the body.

Infarct – an area of tissue that dies because of inadequate blood supply.

Pathophysiology of Myocardial Infarction, and In-Hospital Treatment

A "typical" myocardial infarction begins with an arteriosclerotic coronary artery. That artery may or may not be stenosed (see stenosis, above). A portion of the "plaque" lining the artery ruptures. That rupture leads to the formation of a clot, or thrombus.

At that point, the myocardium (heart muscle) becomes ischemic. The muscle is not injured yet, and no tissue has died (infarcted). It is simply not getting as much blood as it needs. In time, this will result in injury to the cardiac muscle, and later to tissue death (infarction).

Therefore, the **first** EKG changes are signs of ischemia, including hyperacute (big) T waves. Later, the T-waves may become inverted. The patient may also have brief ST depression.

As the ischemia becomes prolonged, some of the heart's muscle tissue is injured by the lack of blood supply. As a result, you'll begin to see **ST elevation in that part of the heart**. An EKG finding of injury in the presence of cardiac symptoms is good enough evidence to give clot-busting drugs. You should know the technical term for clot-busters: thrombolytics. The main thrombolytic drug is some form of tPA.

The idea of clot-busters is to prevent the next stage: infarction. If the patient doesn't get help in time, tissue starts to die, or infarct. At that point, the EKG may show Q-waves from that section of the heart. Eventually, the ST elevation goes away, and we're left with just the Q-waves. If we reach the patient before the ST elevation disappears, even if they have Q-waves, we may still be able to save some of the tissue with tPA or angioplasty.

Angioplasty is also called PTCA, which stands for Percutaneous Transluminal Coronary Angioplasty. The newer term is Percutaneous Coronary Interventions (PCI). (No, you don't need to memorize all that. Just know "angioplasty" and "PCI".) Angioplasty (PCI) is another method of treating an MI. The patient is taken to the Cath Lab, where a cardiologist inserts a catheter into the arteries of the heart. When the stenotic (narrowed) area of the artery is reached, the cardiologist inflates a balloon to push the plaque out of the way, and open up the artery. Many cardiologists think PCI is preferable to tPA. Equally importantly to us, PCI can be used to treat MI patients when tPA is contraindicated.

There are situations other than a thrombus that can result in MI. One example is cocaine use, where the heart is simply working too hard for the amount of blood, and oxygen, that is available. Unstable Angina can also require immediate treatment. The overall group of myocardial emergencies is now referred to as "Acute Coronary Syndromes", or ACS.

Signs and Symptoms of Acute Coronary Syndromes (ACS)

The "classic" MI patient complains of chest pain lasting more than 20 minutes. It is often (not always) described as a pressure pain. The pain may radiate to the left arm, right arm, or both. Pain may also radiate to the neck, jaw, or back. Dyspnea, and nausea (with or without vomiting) are often associated. Other symptoms include anxiety, a sense of doom, agitation, and palpitations. MI patients frequency experience "prodromal symptoms": milder pain or other symptoms that occur hours or days before the actual MI.

However, many patients having MI's do not have any significant chest pain. As many as 30% of MI patients do not have severe chest pain as their primary symptom. Those patients may complain only of abdominal pain, dyspnea, feeling faint, or confusion. They may also have any of the other associated symptoms described above. The majority of those patients fall into one of three categories:

Elderly
Women
Diabetics

Anginal equivalents are other signs and symptoms that should prompt you to consider performing a 12-Lead. They include:

Dyspnea	General weakness	Syncope or pre-syncope
Palpitations	DKA	

Although it can occur at any age, males over 35, and females over 40 are at significant risk for ACS. Risk increases as age increases. Vital signs vary widely from patient to patient. However, patients with inferior MI's are more likely to be bradycardic, and patients with anterior MI's are more likely to be tachycardic. Asking about the patient's medical and family history can also be helpful. The presence of Cardiac risk factors should increase your index of suspicion for ACS:

Diabetes	Family history of CAD
Smoking	Obesity
Hypertension	Stress
Age	Sedentary

Ischemia can cause dysrhythmias and varying degrees of ventricular failure. Symptoms of these complications may be the only presenting complaints when chest pain is absent. As we said, female, diabetic and/or elderly patients are most likely to present with atypical presentations which include atypical pain and anginal equivalents.

The elderly present more often with dyspnea secondary to sudden decompensated ventricular failure.
Diabetics frequently present with weakness and DKA.
Up to 40% of ACS patients will present with an anginal equivalent.
EMS personnel must learn to recognize these symptoms as potential ACS patients.

What is the value of checking BPs in both arms? It helps identify patients with dissecting thoracic aneurysm.

Pre-Hospital Care

As soon as you suspect a patient may have an Acute Coronary Syndrome (ACS), place the patient on Oxygen, and complete your assessment. Don't forget to ask the patient to rate his or her pain on the pain scale (1-10).

Ask about allergies, including specifically Nitro and Aspirin. As long as the BP is adequate, give one Nitro SL, and repeat that every 3-5 minutes as needed (as long as BP > 100) up to a total of three tablets, **except as noted below**. **Document the BP before and after each Nitro.**

NTG contraindications:

Systolic BP should be at least 100mmHg for NTG administration.
Ask about Viagra, Revatio, or similar drug use in private if possible.
Right ventricular infarct will be discussed in a later module, and is associated with hypotension.

The only absolute contraindication to aspirin (ASA) is known hypersensitivity. Asthmatics may have been instructed not to take aspirin; however they may receive ASA if they have not had an allergic reaction to it.

Put the patient on a cardiac monitor and pulse-ox. As quickly as you can, obtain a 12-Lead EKG, with the patient supine if that can be tolerated. It is important that you get 12-Leads on patients in any of the following categories:

Adults with potentially cardiac non-traumatic chest pain.
Any suspected AMI.
Be especially liberal with 12-Leads on women, diabetics, and elderly.

Generally, the 12-Lead EKG should be taken **before** moving to the Medic Unit. Give four baby aspirin, and notify the hospital if you think you have a possible MI patient. Transport as rapidly as is possible and safe, starting an IV or Saline Lock while en route.

Provide morphine sulfate or a fluid challenge if needed. Patients with evidence of an acute **inferior** MI may be sensitive to Nitroglycerin and Morphine administration: monitor BP frequently.

As you have the opportunity, obtain additional 12-Lead EKGs during transport, especially after Nitro or other meds. EKGs can change rapidly, and having a record of those changes can be invaluable for the patient's physician, and for the patient. Besides, it's simple to do: once the leads are in place, all that's required is to press the button (and maybe have your driver stop for a few seconds).

Finally, it is critical that you understand that some patients have MI's with NO EKG changes at all. A normal 12-Lead EKG does **not** rule out AMI.

Transport Destination

MI patients need to go to the right hospital. Generally, that means the hospital where the patient's physician practices, where the patient has insurance coverage, where the patient has medical records. Not to the closest hospital!

However, there can be other factors. **Evidence indicates that PCI is more effective than thrombolytics. And for patients with contraindications to thrombolytics, PCI is the only game in town. Without it, the patient can't get any treatment to remove the clock that's causing the MI.**

Many local hospitals perform emergency PCI. In Dayton, Childrens', Wright Patterson, and the VA do not. In our region, as of this writing, Interventional Facilities (i.e., hospitals that offer PCI around the clock) include:

Dayton Heart Hospital
Good Samaritan Hospital
Grandview Hospital
Kettering Memorial Hospital
Miami Valley Hospital
Springfield Mercy Hospital
Springfield Community Hospital

What are the contraindications to thrombolytic therapy?

Absolute and Relative Contraindications to Thrombolytic Therapy (Adapted from ACLS)		
Time Frame	**Absolute Contraindications**	**Relative Contraindications**
Right Now	Suspected aortic dissection Known intracranial neoplasm Pregnancy (certain lytic agents)	Severe, uncontrolled hypertension (BP > 200/120) Current anticoagulant use Prolonged (> 10 minutes) and potentially traumatic CPR
Past 2 – 4 Weeks	Active internal bleeding (except menses)	Trauma, especially head trauma Major surgery Noncompressible vascular punctures

		Internal bleeding
Past Year	Non-hemorrhagic stroke or TIA Prior exposure to specific lytic agent	Intracerebral pathology
Ever	Hemorrhagic stroke Prior allergic reaction to streptokinase	Known bleeding disorder

12-Lead Documentation Issues

When you arrive, give the 12-Lead EKG to ER personnel, preferably to the treating physician. Each 12-Lead should have the **patient's name, and the date and time** it was obtained. If you get multiple EKGs, number them, circling the sequential numbers. If you have to take an EKG in a non-standard position, note the patient's position on the EKG, since the heart moves when patient sits up. Make sure that you document all of your 12-Lead findings, whether they are on the same 12-Lead, or multiple tracings.

12-Lead EKGs

12-Lead EKGs are different! That is not only because they offer more views of the heart. They also provide "Diagnostic Quality" vs. "Monitor Quality." Diagnostic quality is needed to evaluate ST elevation. An ST segment that is absolutely flat when you're looking at Lead II, may show significant elevation in Lead II on the 12-Lead.

Obtaining the 12-Lead EKG

To make it quicker and easier to obtain a 12-Lead, and knowing that crews tend to put a monitor on patients very early in their care, we recommend going from a 3-lead monitoring system, to a 4-lead monitoring system. You can place the four leads on the patient's left and right shoulders, or anywhere on their arms, then place the two leg electrodes bilaterally anywhere below the waist, which saves you the need to replace electrodes if you decide to perform a 12-Lead.

If you do, all that is required beyond the four limb leads is the six "precordial" or chest leads. They are located as follows:

V1 – The Angle of Louis is the prominence on the sternum where the manubrium (top third), the sternal body (bottom two thirds), and the second rib all come together. Locate it by palpating the sternum, then move out along the second rib to the patient's right. Just below the second rib is the second intercostal space. Move down two more interspaces, and position electrode V1 in the fourth intercostal space, just to the right of the patient's sternum.

V2 – Place an electrode in the fourth intercostal space on the opposite side of the sternum for V2.

V3 – See V4.

V4 – From V2, move down to the fifth intercostal space on the patient's left, then move laterally to the mid-clavicular line. The mid-clavicular line is an imaginary line coming straight down the patient's chest from the mid-point of the clavicle. **V4** goes in the intersection of the fifth interspace, and the mid-clavicular line. Next, place an electrode halfway between V4 and V2, and that is V3.

V5 – Find the anterior axillary line by locating the crease where the arm joins the chest. Move down that line to a point just lateral to V4.

V6 – The midaxillary line is an imaginary line running down the body from the middle of the armpit. V6 is located on the midaxillary line, level with V5.

Skin preparation is important (see the discussion on artifact, below). It **is** appropriate to use Alcohol Preps to prep the skin for monitoring electrodes and for 12-Lead EKGs. Just remember, it is **not** appropriate to use Alcohol Preps with **therapeutic** electrodes, such as QuikCombo pads.

You must be able to recognize artifact, and know what to do about it. The primary ways that you can reduce artifact are:

Thorough skin preparation
Hair removal
Solid electrode attachments
Preventing patient movement
Preventing cable movement
Halting vehicle movement
Eliminating Electromagnetic Interference (EMI) (turn off or move away from electrical devices, do not allow patient cables to touch power cords, make sure patient cables and electrodes are in good shape)

Reading the 12-Lead EKG

One of the biggest changes in going from arrhythmia recognition to reading 12-Leads is that, instead of viewing an entire strip, with 12-Leads, we concentrate on just one good complex in each lead. Our primary interest in 12-Leads is MI, although it can be helpful in diagnosing many other conditions. As we discussed earlier, in most cases an MI occurs as a result of obstructed blood flow somewhere in the coronary arteries. The location of the clot determines which part of heart muscle is effected.

The heart, like everything else in the body, has arteries to supply the heart muscle with blood and oxygen. The Left Coronary Artery (sometimes called the Left Main), carries 85% of the myocardial blood supply. It branches into the Left Anterior Descending Artery (LAD), and the Circumflex Artery. The remainder of the heart's blood supply is provided by the Right Coronary Artery.

That means an obstruction in the Left Main Artery of the heart will effect a huge portion of heart muscle. On the other hand, if the obstruction is in a distal portion of the Right Coronary Artery, a much smaller portion of heart muscle will be knocked out, and the location of injured muscle will also be very different. A Left Main obstruction would cause big changes in the septal, anterior, and lateral leads (see below), and is called "the widow maker."

The muscle that is injured will usually cause changes on the EKG. However, those changes show up primarily in the lead(s) that looks at the location of the injury. So the first level of 12-lead interpretation is simply a matter of knowing two facts:

1. What changes an AMI can cause on the 12-lead {what to look for}, and
2. Knowing which part of the heart that each lead "sees" {where to look}.

You must know what EKG changes represent the three I's: ischemia, injury, and infarct. The first sign of an MI is the presence of ischemia, or ischemic changes. Ischemia is reduced blood flow to one portion of heart muscle. On the EKG, it is represented by ST depression, or by the so-called "Ischemic T", where the T-wave is inverted (upside down).

The next changes that occur are signs of injury. For the heart muscle to be injured, it has been deprived of blood flow for a longer period. Injury is worse than mere ischemia. ST elevation in two or more contiguous leads indicates injury, and is considered good evidence that the patient is having an MI. ST Elevation is presumptive evidence of an MI. It is the criteria used to start thrombolytics, or to take the patient for angioplasty.

ST elevation is measured in comparison to the EKG baseline, also called the "isoelectric line." We use the T-P segment, the line between the end of the T-wave and the start of the next P-wave, as that baseline. Do not use the P-R segment: it can be elevated or depressed, so it can't be compared to the ST segment.

Sometimes, the ST segment is not only elevated or depressed, but also tilted at an angle. To determine which part of the ST you compare to the T-P segment, look for the "J-Point." The J-Point is the junction between the end of the QRS and the beginning of the ST segment. The J-point is found by looking for the point where the QRS stops and makes a sudden sharp change of direction.

After you find the J-Point, ST segment, and the TP segment, you measure elevation or depression by counting the number of boxes that the ST is higher or lower than the TP. Each little box is 1 millimeter (mm.). When is ST Elevation significant?

1 mm. or more of elevation
Present in two or more <u>contiguous</u> leads

By the way, when we say "ST elevation is significant" (according to the two criteria just above), it means that we presume the patient is having an Acute Coronary Syndrome, and needs reperfusion (either tPA or PCI).

Finally, Q-waves indicate that the patient has actual tissue death, or infarction. If we restore blood flow while the heart is ischemic or injured (with PCI or tPA), then a true infarction never occurs. Even if Q-waves are present, it doesn't necessarily mean that the infarct is complete. It may still be possible to save some heart tissue, even though some has died. In fact, during the evolution of an infarct, Q waves, ST elevation, and T inversion may occur together.

There are, of course, times when people have Q-waves in their QRS complexes that are normal. How do you tell the difference? Pathologic (meaning produced by disease) Q-waves are wide. They are greater than or equal to (> or =) 40 ms. duration. Physiologic Q waves are < 40 ms.

Make sure you are able to convert seconds to milliseconds. One large block on the EKG paper is equal to 0.20 seconds, or 200 milliseconds (ms.).

A mnemonic to remember the EKG changes for the three I's is "alphabetical order." Infarction, injury, and ischemia are in alphabetical order, and so are the changes: Q-waves (infarct); ST elevation (injury); and ST depression or inverted T-waves (ischemia). Just remember, though, that the signs occur over time, and in reverse order: first ischemia, then injury, and finally infarct.

"Contiguous leads" simply means the leads are anatomically located next to each other. Here are the groups of contiguous leads:

Leads II, III, and aVF look at the "bottom" of the heart. They are called the "inferior leads."
Leads I, aVL, V5, and V6 all look at the left side, or left lateral heart wall. They are called the four "lateral leads."
Leads V3 and V4 look at the front or anterior heart. They are called the two "anterior leads."
Leads V1 and V2 are located on the sternal borders. They look at the septum or dividing wall of the heart. They are called the two "septal leads."

A mnemonic for the precordial leads is "SAL":

V1 & 2 – **S**ternal
V3 & 4 – **A**nterior
V5 & 6 – **L**ateral

Given a lead, you should be able to name the portion of the heart that it coincides with. Given an area of the myocardium, you should be able to say which leads would view it.

Don't forget that higher blockages will hit more of the heart. That means you can have combinations of the groups, such as an "inferolateral" MI (involving some or all of the inferior and lateral leads). A posterior MI is usually associated with an inferior MI.

Reciprocal changes

We have been looking for infarct based upon the presence of ST elevation. As mentioned, not every lead is elevated when AMI is present, only the leads looking at the infarct site. In fact, those leads which look at the infarct site from the opposite perspective tend to produce opposite changes. When a lead "sees" the AMI directly, the segment becomes elevated in that lead. However, when a lead "sees" the infarct from the opposite perspective, the ST segment may be depressed in that lead. Those are called reciprocal changes.

Because of the way the leads are oriented on the patients body, II, III and aVF are on the bottom looking up. All the other leads are on the top, looking in. Therefore, when AMI produces elevation in II, III, and aVF, it also tends to produce depression in the opposing leads:

II, III, aVF **vs**. I, aVL

NOTE: Not every lead on each side of the seesaw must be elevated or depressed in order to assume reciprocal changes. It is more a matter of some leads on one end of the seesaw being elevated and some being depressed. Also, not all AMIs with ST elevation produce reciprocal depression. Quite simply… some do and some don't. When reciprocal depression *is* noted, the likelihood of AMI is dramatically increased.

You may have noticed that one lead, aVR, is not in any of the contiguous lead groups. Our principle use for aVR is to "test" lead placement (though it's not perfect). Lead aVR is normally negative. If you look at aVR on a 12-Lead, and the QRS is predominantly **upright**, it means one of two things:

- some limb leads are misplaced, or
- the patient has altered cardiac conduction

MI Mimics

There are conditions other than AMI that can cause ST elevation on the ECG. Some imitators of infarct include:

Left ventricular hypertrophy (LVH)
Bundle Branch Block (BBB)
Ventricular beats
Pericarditis
Early repolarization
Other causes

LVH

Left Ventricular Hypertrophy (LVH) can be the result of an enlarged left ventricle, pumping against increased resistance, or chronic overfilling of the ventricles. Unlike BBB and ventricular rhythms, LVH does NOT usually widen the QRS to 120ms or more. Instead of abnormally widening the QRS, LVH increases its amplitude. There are many formulas for suspecting the presence of LVH. The three step method described here is one of the simpler means of suspecting LVH.

STEP 1

Compare V1 and V2.
Determine which is the deepest negative deflection.
In the deepest lead, count the millimeters of negative deflection.

STEP 2

Compare V5 and V6.
Determine which is the tallest.
In the tallest lead, count the millimeters of positive deflection.

STEP 3

Add the two numbers together.
If their sum equals 35 or more, suspect LVH is present.

Bundle Branch Blocks (BBB)

For decades the presence of BBB has made it tough to identify AMI, because BBB can both mimic and mask ECG changes used to identify AMI. For now, it is sufficient to know that when a patient's clinical presentation suggests an ACS, and the ECG shows a new, or presumed new, BBB the patient is a candidate for acute reperfusion therapy.

The QRS is widened in BBB due to asynchronous firing of the ventricles. Asynchronous firing of the ventricles also occurs with beats of ventricular origin. It is important to distinguish supraventricular beats from ventricular beats. Evidence of supraventricular activity is needed to differentiate BBB from beats of ventricular origin.

BBB Identification Supraventricular rhythm

BBB widens the QRS (120ms or more). This widening is due to the fact that the ventricles are forced to contract sequentially, thus requiring more time. Other conditions widen the QRS; a common one would be ventricular rhythms, either paced or spontaneous. A differentiating factor between BBB and ventricular rhythms would be the presence of an underlying supraventricular rhythm. Therefore, when a QRS of 120ms or more is produced by a supraventricular rhythm, think BBB. This rule applies in all leads.

The "classic" pattern for RBBB in V1 is an RSR ("rabbit ears"). The "classic" pattern of LBBB in V1 is a QS complex. There are many variations to these classic patterns, complicating the process of distinguishing RBBB from LBBB. In addition, each form of BBB produces a different set of changes in V6. A commonly held misconception is that any notch or distortion of the QRS indicates a BBB. While BBB can cause a notch, a notch does not ensure the presence of a BBB. Therefore, other criteria for BBB recognition are needed. Fortunately, a simple approach does exist.

Always remember, the following rules for differentiating RBBB from LBBB apply **only to V1**.

Differentiation of LBBB from RBBB

After BBB has been determined to exist, look at lead V1. Identify the terminal force of the QRS in V1, and determine if it is positive or negative. To identify the terminal force, first locate the J-point. From the J-point, back up about 40 ms into the QRS. Now determine if the terminal force (tail end) is pointing up or down.

After BBB has been determined to exist, look at terminal force of QRS in V1

Positive = RBBB

Negative = LBBB

Turn signal mnemonic – up is right, and down is left

Ventricular Rhythms

Like BBB, ventricular rhythms can not only imitate an ACS, but can mask the evidence as well.

Pericarditis

There are numerous causes of pericarditis, including viral and bacterial infections, and metabolic causes. The purpose of the following description is not to rule out AMI, but to help the care provider suspect the possibility of pericarditis. The "classic" pericarditis presentation has some distinguishing features.

Classic presentation:

- Sharp chest pain
  (meaning a stabbing nature, not meaning intense)
- Pain can often be localized with one finger
- Pain may radiate to the base of the neck or between the shoulder blades
  (trapezius area)
- Pain is affected by patient movement and respiration
- Pain is affected by patient position

One of the tricks to suspect pericarditis is to lean them forward and see if the pain improves. Another is to see if the pain worsens when they take a drink of fluids. Pericarditis can occur post MI and post cardiac surgery. Also have a high index of suspicion if the patient has had a recent viral or bacterial infection, or IV drug abuse is suspected.

EKG findings can include ST elevation in any lead, and can be in all leads. The ST elevation of pericarditis is caused by inflammation of the epicardium secondary to inflammation of the pericardium. This process is not related to coronary artery disease and, **therefore, ST changes do <u>not</u> tend to follow anatomical groups typically seen with ACS.**

ST elevation in pericarditis may not be anatomically grouped. J-point notching with a "fish hook" appearance is often present, as it is with BER.

Benign Early Repolarization

Benign Early Repolarization (BER) is an example of a normal variant, which produces ST elevation and tall T waves. Changes can occur **in any lead**, but are more common in the *lateral and anterior* chest leads (sometimes lead II and other limb leads).

Anyone, male or female, of any ethnic background can have this pattern on their ECG. However, this pattern is most commonly seen in young adult African-American males.

One ECG sign that should make you consider BER is the notched J-point, creating a fish hook like appearance of the ST segment.

Other Causes

Finally, there are many other factors that can increase the difficulty of 12-Lead interpretation. Numerous medications impact the EKG. One of the most common is digitalis, which causes ST depression with sag.

Conclusion

This has been a short primer/refresher on 12-Lead EKGs. It is not a complete course. We hope you will spend some time with the many books and videos available, and learn more.

Good luck!

12-Lead EKG Format

I	**aVR**	**V1**	**V4**
II	**aVL**	**V2**	**V5**
III	**aVF**	**V3**	**V6**

AMI Recognition/Lead Localization

Lateral	**I, aVL, V5, & V6**
Inferior	**II, III, & aVF**
Septal	**V1 & V2**
Anterior	**V3 & V4**

Lead Localization

I: Lateral	**aVR**	**V1: Septal**	**V4: Anterior**
II: Inferior	**aVL: Lateral**	**V2: Septal**	**V5: Lateral**
III: Inferior	**aVF: Inferior**	**V3: Anterior**	**V6: Lateral**

PCI vs. Thrombolytics: How Far Should You Transport a Patient?

Research shows Angioplasty is superior to Thrombolytics as a reperfusion strategy. Patients with 12 Lead EKG findings consistent with AMI must be treated in an aggressive manner to reduce damage to the myocardium.

The Danish Multicenter Randomized Trial on Thrombolytic Therapy versus Acute Coronary Angioplasty in Acute Myocardial Infarction ("DANAMI-2") compared thrombolysis to Percutaneous Coronary Intervention (PCI, or angioplasty) for MI patients. One question the study tried to answer was whether ambulance transport to an Interventional Facility would be associated with improved outcomes, despite the treatment delay.

The study included 1,572 patients. Patients who presented to hospitals without PCI facilities were randomly assigned to receive a thrombolytic, or to be transferred by ambulance **up to 100 miles** to an Interventional Facility. The results of the study suggest patients were better served to be transported up to 100 miles to an Interventional Facility, rather than receive earlier thrombolysis.

These findings are comparable to what we already know about trauma patients. Trauma patients also do better if they are transported to the right facility that is further away, than to be transported to a hospital without full capabilities that is closer.

Finally, as important as such transports are for the "typical" AMI patient, they are even more critical for patients with contraindications to thrombolytics. Those patients will receive no treatment to restore myocardial blood flow until they arrive in an Interventional Facility.

ADULT PROTOCOL SKILL EVALUATION
SUBJECT: 12-Lead EKG Acquisition

NAME_____ DATE_____

LEVEL: _____Paramedic

STEPS	**1st Testing Comments**	**2nd Testing Comments**
Student will demonstrate how to acquire a 12-Lead EKG, completing the following steps within two minutes:		
Expose chest		
Limb lead placement, and placement options		
Precordial (chest) lead placement, with **no deviation**		
Speed (all ten leads must be placed within two minutes)		
While student is acquiring EKG, ask questions on four to five of the following topics at random. Student should be able to answer roughly 75% correctly to pass the station.		
When to acquire according to optional Standing Orders		
Interface with hospital: Notify if you or machine suspect MI Rapid transport Deliver EKG to ER physician		
Monitor quality vs. Diagnostic quality		
Frequency response Must use **printed** EKG for ST segment analysis		
Calibration		
Paper speeds		
Various limb lead placements		
Importance of anatomical uniformity with precordial leads		
Need for note on chart and EKG if non-standard position (heart moves)		
Negative complex in aVR as “test” for lead placement (though not perfect)		
Hair removal		
Artifact, and what to do about it Skin prep Electrode attachment Patient movement Cable movement Vehicle movement EMI		

ADULT PROTOCOL SKILL EVALUATION
SUBJECT: 12-Lead EKG Interpretation

NAME_____ DATE_____

LEVEL: _____Paramedic

STEPS	**1st Testing Comments**	**2nd Testing Comments**
Show each paramedic five to ten EKGs. In response to your questions, each paramedic should be able to identify the Components of the ECG following with 90% accuracy or better: P-R segment, Q waves, R waves, and S waves J-point, ST segment, T waves, TP segment, etc. QRS complexes Q waves Pathologic (> or = 40 ms.) vs. physiologic (< 40 ms.) ST elevation		
Paramedics should be able to measure time on the EKG using either seconds or milliseconds, and converting from one to the other with 80% accuracy or better.		
Given a series of EKGs with ST elevation, each paramedic should be able to identify the leads with ST elevation, and localize the area infarct as Anterior, Inferior, Lateral, or Septal with 80% accuracy or better.		
Given a series of EKGs with ST elevation, each paramedic should be able to recognize reciprocal changes (ST depression) with 70% accuracy or better.		
Given examples, the paramedic should be able to discuss the evolution of a myocardial infarction and the EKG changes over time, including the following phases: Hyperacute Acute Indeterminate		
Given a series of three to five EKGs, each paramedic should be able to recognize the following with 60% accuracy or better. You may give the paramedic a clinical presentation along with the EKG. LBBB RBBB Ventricular rhythms LVH Ventricular aneurysm Benign early repolarization Pericarditis (S&S: sharp, localizable chest pain, radiates to base of neck, between scapulas) Digitalis (ST depression with sag)		

Cardiac Alert Program

The Intent of the Cardiac Alert Program is to decrease the "Door to Balloon" time for Pre-Hospital AMI Patients. EMS Providers who have patients experiencing symptoms of an AMI, and confirm the AMI with Diagnostic 12 Lead will make early notification to the receiving facility. The receiving facility in return will activate a Cardiac Alert, prompting the response of the On-Call Cath Lab team members.

To have an effective "Team Approach" to the AMI patient, it is essential that EMS Providers have the trust of the In-Hospital professionals. The program must have a built in system to monitor the accuracy of the field interpretation. If the Field Provider cannot maintain a high percentage of accurate 12 lead interpretations, the program could quickly become a burden on an already tight hospital budget.

Inclusion Criteria

All patients presenting with anginal-type chest pain or an equivalent anginal event may be candidates. The paramedic will perform an initial 12 lead ECG to determine the presence of an Acute Myocardial Infarction.

All patients with evidence of an Acute Myocardial Infarction after performing a diagnostic 12 lead ECG will be considered an included patient for the Cardiac Alert Program. (>1mm ST elevation in 2 contiguous leads)

The EMS Provider will complete the Cardiac Alert Checklist and contact the receiving facility as soon as possible. The EMS Provider must speak directly with the Emergency Department Physician.

Exclusion Criteria for the Cardiac Alert Program:

Patient with a LBBB will not be included

Patients with a Pacemaker rhythm

Greater Miami Valley EMS Council & Ohio EMS Region 2
Quality Improvement Program
EMS CHECKLIST: 12-LEAD EKG USAGE

Patient Name:_____ EMS Agency/Unit:_____

Date:_____ Run #_____ Time of Pain Onset:_____

This form is to be completed by the paramedic for each patient on whom a 12-Lead EKG is performed, regardless of whether the EKG is normal or abnormal.

_____ 1. If patient has 12-Lead EKG evidence of Acute MI, consider transport to an Interventional Facility.

- **Presently, those facilities include DHH, GSH, GvH, KMH, MVH, Springfield Mercy & Springfield Community.**

_____ 2.	**CARDIAC ALERT CHECKLIST**	
INCLUSION CRITERIA		
	YES	**NO**
Anginal Chest Pain or Equivalent (weakness, diaphoresis, SOB, syncope, nausea, back or jaw pain, abdominal pain)	☐	☐
Evidence of AMI on 12 Lead: (1 mm of ST elevation in 2 or more contiguous leads)	☐	☐
EXCLUSION CRITERIA		
Is the QRS Greater than 120 ms (LBBB)?	☐	☐
Does the Patient have a Pacemaker Rhythm?	☐	☐
If all boxes in shaded areas are checked, the patient qualifies for a Cardiac Alert. Make contact with Medical Control Physician at receiving facility as soon as practical to relay information.		

_____ 3. Contact hospital by radio or phone when transporting any suspected MI patient. NOTIFY of the following:

- **_____ a) Speak directly to the medical control physician (MCP) whenever possible.**
- **_____ b) Advise MCP ASAP that you are transporting a CARDIC ALERT patient.**
- **_____ c) Give patient report with vitals, history, PE, and other pertinent information.**
- **_____ d) Give your interpretation of 12-Lead EKG, and/or machine interpretation**
- **_____ e) Give name of patient's cardiologist (if known) _____**

_____ 4. On arrival at hospital with a suspected MI patient:

- **_____ a) Give verbal report, speaking directly to the physician when possible, including your evaluation of the 12-Lead EKG.**
- **_____ b) Attach a copy of 12-Lead EKG to this form.**
- **_____ c) Attach a copy of 12-Lead EKG to hospital copy of EMS runsheet.**
  - **Label all copies of EKG/12-Lead EKG with patient name, date, and time.**
  - **Document Name of Medical Control Physician: _____**
  - **Document Name of patient's cardiologist (as above).**

Hospitals expect the paramedic to read the 12-Lead EKG! Do not simply depend on the computer chip in the LifePak 12 to read it for you. If you are uncertain about your EKG interpretation skills, please do two things:

- ✓ First, resolve to improve those skills! More than ever, they make a difference for your patients.
- ✓ Second, if you simply must depend on the computer readout, read it carefully. Old myocardial infarctions, often labeled as "MI of indeterminate age" or similar phrasing, **do not** warrant calling in a very expensive team of physicians, nurses, and other health professionals via a "**Cardiac Alert**." Make certain that the computer says, "**Acute** MI."
- ✓ If *you* read the strip one way, and the *computer* reads it another, give both pieces of information to the Medical Control Physician when you call in. But have the courage of your convictions. You may well be right and the computer wrong.

Patients with Anterior Wall Acute Myocardial Infarctions, especially with ST elevation in three leads are at higher risk for Cardiac Arrest. They are also at high risk for developing CHF or cardiogenic shock, and may develop BBB's, PVC's or 3° blocks.

Performance Improvement/Quality Improvement (PI/QI) is an important part of a 12-Lead EKG program, as it is with every aspect of EMS.

Paramedics should be able to interpret 12-Lead EKGs to the level of the Cardiac Alert Checklist with at least 80% accuracy. The single most important element of the Cardiac Alert program is recognition of an AMI patient by EMS.

Right Ventricular Infarcts

According to the "Treatment Considerations for Inferior Wall AMI (IWMI)" section of the Standing Orders, paramedics should attempt to capture Lead V4R to check for the possibility of a right ventricular infarction (RVI) in all patients with IWMI. Some paramedics may be unfamiliar with V4R.

Lead V4R is simply Lead V4 on the patient's **R**ight side, instead of his left. It provides a better picture of the right side of the heart.

Capturing Lead V4R is very simple. Just complete the following steps:

1. Perform a normal 12-Lead EKG.
2. If there is 12-Lead evidence of an Inferior MI, place one additional electrode on the patient's right side, in the same anatomical location as V4 on the patient's left.
   - ➢ (Locate the fifth intercostal space on the patient's right, then move laterally to the mid-clavicular line. Remember that the mid-clavicular line is an imaginary line coming straight down the patient's chest from the mid-point of the clavicle. **V4R goes in the intersection of the fifth interspace, and the right mid-clavicular line.)**
3. Move the **V4** Lead from the left, to your new electrode on the **right**.
4. Complete another 12-Lead EKG.
5. **Label** this EKG with the patient's name, and the time. **Label V4 prominently as V4R**.

ADULT PROTOCOL SKILL EVALUATION
SUBJECT: Spinal Clearance

NAME_____ DATE_____

LEVEL: _____Paramedic _____EMT-I _____EMT-B

STEPS	**1st Testing Comments**	**2nd Testing Comments**
The participant will be able to list, from memory, and **in proper order**, the twelve steps of the Spinal Clearance protocol. 1. Unconscious with potential mechanism of injury: Immobilize. 2. Not alert, disoriented, or has GCS < 15: Immobilize. 3. Had loss of consciousness: Immobilize. 4. Suspicion of ETOH or drug intoxication: Immobilize. 5. Possible acute stress reaction: Immobilize. 6. Other painful or distracting injury: Immobilize. 7. Cervical or other spinal column pain (patient complaint) is present: Immobilize. 8. Neurological deficit (motor or sensory): Immobilize. 9. Cervical tenderness (on palpation) or deformity: Immobilize. 10. Pain with cervical motion: Immobilize. 11. **{If <u>none</u>** of the above are present, may opt to transport the patient without spinal immobilization.**}** If any doubt, patient is to be fully and effectively immobilized. 12. Document!		
The participant will discuss the risks of inappropriately clearing a patient's spine following an injury.		
The participant will explain what procedures will be used to provide spinal protection for the patient during the evaluation for clearance of the spine.		
The participant will discuss the benefits of the Spinal Clearance protocol.		
Given a series of scenarios (minimum of two) with simulated patients, the participant will proceed through the steps of the Spinal Clearance protocol, voicing the participant's decision on whether or not to clear the patient's spine.		
When given a scenario and simulated patient in whom Spinal Clearance is inappropriate, the participant will follow the appropriate steps of evaluation, and take correct protective action at the point that the patient "fails" spinal clearance.		
Participant will discuss documentation of Spinal Clearance procedures, both for patients who are "cleared," and for patients who "fail" Spinal Clearance.		

STANDING ORDERS – {SPINAL INJURY CLEARANCE}

EMS personnel immobilize thousands of patients each year on backboards and other cervical spine immobilization equipment. In many cases, that immobilization is not necessary. It is uncomfortable, and occasionally even harmful.

Research has proven prehospital providers can effectively evaluate patients, and safely rule out the need for spinal immobilization in many cases. Our purpose is not to determine if spinal injury is present. It is to determine if there is the reasonable possibility of injury to the spinal column (in which case, we immobilize), or the absence of that reasonable possibility (in which case, we will not immobilize).

Note well: In any case where there is the slightest doubt about the possible need for spinal immobilization, the patient is to be fully and effectively immobilized.

THE ALGORITHM

{EMS personnel who have been checked off and approved may utilize this algorithm, with the stipulations that follow.
Limited to use with patients age 16 and over.}
It is critical that each step be evaluated in sequence, since the steps proceed from the least to the greatest risk for the patient. It is just as critical that the patient be manually immobilized until the evaluation is complete.

1. If patient unconscious with potential mechanism of injury: Immobilize.
2. If patient not alert, is disoriented, or has GCS < 15: Immobilize.
3. If patient had loss of consciousness: Immobilize.
4. If suspicion of ETOH or drug intoxication: Immobilize.
5. If possible acute stress reaction: Immobilize.
6. If other painful or distracting injury: Immobilize.
7. If cervical pain or other spinal column pain (patient complaint) is present: Immobilize.
8. If neurological deficit (motor or sensory): Immobilize.
9. If cervical tenderness (on palpation) or deformity: Immobilize.
10. If pain with cervical motion: Immobilize.
11. **{If <u>none</u>** of the above are present, personnel who have been <u>appropriately trained</u>, and who are <u>specifically authorized</u> by their Department and Medical Director, may opt to transport the patient without spinal immobilization.**}** In any case where there is the slightest doubt about the possible need for spinal immobilization, the patient is to be fully and effectively immobilized.
12. All of the above items **must** be documented, and the EMS agency <u>must</u> have a mechanism in place for <u>Quality Improvement</u> monitoring of each run where this procedure is employed.

Spinal Injury Clearance: All personnel need to realize that this protocol is designed for the patient's safety. This will only permit avoidance of spinal immobilization in a relatively small number of patients. 80 - 90% of the patients we currently immobilize will still require a backboard and associated equipment under this protocol.

Begin by establishing manual cervical spine immobilization! It is important to prevent movement of the spine during your clearance examination. When considering when to immobilize a patient, remember the following:

<u>Numbers 1, 2, 3, and 4</u> in the protocol are all about **Altered Mental Status**: Any patient with an altered sensorium, including intoxication, drug use, closed head injury, Alzheimers Disease, etc., **must** be immobilized. Whenever there are language/speech barriers to communicating with the patient, immobilize.

<u>Trauma Center</u>: If the patient meets any other criteria for transport to a trauma center, you must immobilize.

Number 6 is to remind you that patients can have so much pain from one injury (e.g., a severed finger) that they are unaware of a more serious injury, such as a spinal fracture. If this might apply, immobilize.

In Number 7, you ask the patient about pain. A patient's subjective assessment of cervical or other spinal column pain prior to palpation by EMS personnel requires immobilization.

Number 8 includes all neurological deficits, not just paralysis. If the patient complains of lightning bolts running down their legs, that should instantly signal you of the need to immobilize. Likewise, any numbness or tingling in their extremities may be a result of spinal cord compression. Immobilize!

> Test motor function with finger abduction, hand extension, and plantar and dorsiflexion of the foot. Test sensory function by asking about any weakness, numbness, paresthesia (tingling), or radicular ("electric" or "shooting") pain. Then test the patient's ability to differentiate sharp and dull sensation, using both the rounded and sharp ends of a paper clip on each extremity. Test the same site bilaterally, asking the patient also to compare the two sides.

When performing this procedure, ask about signs and symptoms first. If they have spinal pain, you're done! You have to immobilize the patient.

If not, you then begin to palpate the entire spinal column (Number 9). Any tenderness or deformity means that the patient must be immobilized.

Finally, after everything else has been ruled out, ask the patient to gradually move their head and neck (Number 10).

> You are testing pain with Range of Motion by asking the patient to move their head. Have them twist their neck, flex their head, extend their head, and move it side to side. If any motion causes pain, you must use full spinal immobilization.

If, **and only if**, there is still no pain or tenderness, you've cleared the spine, and the patient will not need to be backboarded.

You must remember that the potential consequences of this are severe. If a patient has a spinal fracture which is even mildly unstable, that patient can go from being able to walk and talk and breathe to being utterly paralyzed in a few seconds. That catastrophe is what we aim to prevent every time we perform spinal immobilization.

The bottom line, therefore, is: be careful! Personnel will be held responsible for bad outcomes if they do not follow the protocol. And if the patient might need it, do it!

Questions and Answers

If I don't backboard a patient who later becomes a quadriplegic, won't I be liable?
It is impossible to guarantee a good outcome for every patient. If you follow your training, and the clinical guidelines contained in this SOP and other standing orders, you are meeting the standard of care, which provides a great deal of legal protection. These are the same procedures that would be followed in the ER. However following the guidelines only protects you if you follow them precisely, and document all that you did.

You might be reassured to know that many other locations are using the same procedures. They have been found to be very safe if every aspect of the guidelines is followed.

If I follow this SOP, isn't there a risk that I will miss an "occult" spine injury in a patient who does not have pain or tenderness?
No. There are several safeguards built into this protocol. The rare patient with a spinal injury and no spine pain or tenderness will be picked up in the assessments for Positive MOI, distracting injuries, altered mental status, motor or sensory deficits, and range of motion testing. The most likely reason to miss an injury is by not performing an adequate exam, especially of the mental status.

Isn't having the patient go through the neck's full range of motion dangerous?
It is the last test that you perform before definitely deciding not to immobilize the patient. Although there is a very small risk of injury, it is better to discover that injury while you still have the ability to control it with spinal immobilization, than to have the patient walk to the Medic Unit, and then discover that his neck is injured.

What if I'm not sure if the patient's spine should be cleared?
If you are uncertain, always err on the side of safety by immobilizing the patient.

If the patient cannot be cleared, but only because of pain in the thoracic spine, is it alright to skip the cervical collar and only immobilize the thorax?
No. Patients often do not localize spinal pain well. Tenderness in one area may be different from the level of injury. Immobilize the entire spinal column.

Once I clear the patient's cervical spine, does that mean the patient does not need to be transported?
Prehospital spinal injury clearance is not the same as authorization to refuse treatment or transport. It simply means that you may transport the patient without placing her on a backboard. Follow your department's guidelines on other refusal procedures.

When the paramedic is performing the spinal clearance assessment, who is responsible for maintaining spinal immobilization.
Any qualified person can maintain manual spinal immobilization. Usually that will be a first responder. However, it is the responsibility of the EMT or paramedic doing the clearance to see that it is done properly, just as it is that person's responsibility to assure proper backboarding if it is indicated.

What about injuries to the face and head? Don't they automatically mean that spinal immobilization is necessary?
Maybe, maybe not. Research has shown that those injuries, if <u>all</u> other aspects of the assessment can be cleared, do not increase the risk of spinal injury. However, the severity of head or neck injuries may guide your assessment of a Positive MOI.

SPINAL CLEARANCE CHECKLIST (optional)

Patient Name _____

NOTE: You **MUST** complete all sections of this checklist!

1. Is patient unconscious with a potential mechanism of injury?
   ___ Yes ___ No

2. Is patient disoriented and/or has a GCS <15?
   ___ Yes ___ No

3. Has patient experienced a loss of consciousness?
   ___ Yes ___ No

4. Is there a suspicion of ETOH or drug intoxication with the patient?
   ___ Yes ___ No

5. Is this a possible acute stress reaction?
   ___ Yes ___ No

6. Does the patient have a painful or distracting injury?
   ___ Yes ___ No

7. Does the patient complain of cervical pain or other spinal pain?
   ___ Yes ___ No

8. Is there a motor and/or sensory deficit?
   ___ Yes ___ No

9. Is cervical tenderness or deformity present?
   ___ Yes ___ No

10. Is there pain with cervical motion?
    ___ Yes ___ No

If you checked YES to any of the above questions, then the patient must be fully and effectively immobilized.

This form must be completed by an EMS certified member. Only one member should question the patient in order to complete this. This checklist MUST be submitted to the ER staff with the patient care report; a copy must be made for our records.

_____

Signature of member completing form Date

_____

Printed name of above member Certification level ID No.

ADULT PROTOCOL SKILL EVALUATION
MORGAN EYE LENS

Indication

- For eye irrigation by paramedics after administration of Tetracaine.

Contraindications

- Penetrating eye injuries
- Suspected or actual rupture of the globe.
- When patient is allergic to Tetracaine

Insertion

- Instill two drops of Tetracaine into the affected eye(s).
- Attach a macro drip set to a 1000 cc bag of NS. Attach the Morgan Eye Lens and flush the line.
- Start minimal flow of irrigation solution.
- Have your patient look down; insert the lens under the upper lid.
- Have your patient look up, retract the lower lid and drop the lens in place.
- Release lower lid over lens.
- If both eyes must be flushed at the same time, insert second lens using steps above.
- Adjust flow rate
- If both eyes must be flushed at the same time, attach a Y tubing to a single bag of NS or use two bags.
- Turn the infusion line(s) on wide open; at least 1000 cc NS should be run into each eye. Medical Control may order a second liter of NS for each affected eye.
- If the patient's medical condition permits, it is helpful to place the patient in a slight Trendelenberg position. This will allow the outflow to run off the end of your gurney.
- Place a container under the head of the gurney to catch the outflow.

Removal

- Continue flow
- Have your patient look up, retract the lower lid and hold position.
- Slide the lens out.
- Terminate flow.
- Documentation
  - Administration of topical anesthetic
  - Type, amount, and length of time for irrigation
  - Which eye/eyes were irrigated
  - Patient tolerance to procedure

ADULT PROTOCOL SKILL EVALUATION
SUBJECT: EYE IRRIGATION WITH MORGAN EYE LENS

NAME_____ DATE_____

LEVEL: _____Paramedic

STEPS	1st Testing Comments	2nd Testing Comments
A. List the indications for use of Morgan Eye Lens.		
B. List contraindications for use of Morgan Eye Lens		
INSERTION		
C. Instill two drops of Tetracaine into the affected eye(s).		
D. Attach a macro drip set to a 1000 cc bag of NS.		
E. Attach the Morgan Eye Lens and flush the line.		
F. Start minimal flow of irrigation solution.		
G. Have patient look down; insert the lens under the upper lid.		
H. Release lower lid over lens.		
I. If both eyes must be flushed at the same time, insert second lens using steps above.		
J If both eyes must be flushed, use second bag of NS or Y connector.		
I. Turn the infusion line(s) on wide open. At least 1000 cc should be run into each eye.		
J. Place in slight Trendelenberg position if patient's medical condition permits to allow outflow to run off end of gurney.		
K. Place a container under the head of the gurney to catch the outflow.		
REMOVAL		
L. Continue flow		
M. Have patient look up, retract the lower lid, and hold position.		
N. Slide lens out.		
O. Terminate flow		
P. Document administration of topical anesthetic, type, amount, and length of time for irrigation, which eye/eyes were irrigated, patient tolerance to procedure.		

ADULT PROTOCOL SKILL EVALUATION
USE OF MAD FOR INTRANASAL (IN) ADMINISTRATION OF NALOXONE (NARCAN)

Indications

- For use on patients suspected of opiate overdose.

Procedure

- Assess ABC's – Airway, Breathing, Circulation
- For pulseless patients, proceed to ACLS guidelines
- For apneic patients with pulse, establish oral airway and begin bag ventilations with 100% O2.
- Load syringe with 2 mg (2 ml) of Narcan and attach MAD nasal atomizer. An alternative method would utilize two syringes, each loaded with half the dose (1 ml) to administer to each nostril.
- Place atomizer within the nostril.
- Briskly compress syringe to administer 1 ml of atomized spray.
- Remove and repeat in other nostril, so all 2 ml (2 mg) of medication are administered.
- Continue ventilating patient as needed.
- Proceed down standard unconscious protocol:
  - Ventilate, oxygenate
  - Check blood sugar and treat if low
  - Secure airway if necessary.
  - If no arousal occurs after 3 minutes, establish an IV and administer IV Narcan, then
  - Continue with altered mental status protocol.

USE OF MAD FOR INTRANASAL(IN) ADMINISTRATION OF MIDAZOLAM (VERSED)

Indications

- For persistent seizure activity in adult patient.

Procedure

- Assess ABC's – Airway, Breathing, Circulation
- For pulseless patients, proceed to ACLS guidelines
- Apply 100% oxygen NRB mask to seizing patient.
- Load syringe with 10 mg (2 ml) of Versed and attach MAD nasal atomizer.
- Place atomizer within the nostril.
- Briskly compress syringe to administer 1 ml of atomized spray.
- Remove and repeat in other nostril, so all 2 ml (10 mg) of medication are administered. An alternative method would utilize two syringes, each loaded with half the dose (1 ml) to administer to each nostril.
- Continue ventilating patient as needed.
- If seizures persist 5 minutes after treatment, consider repeating 1/2 dose of Versed.
- Secure airway if necessary.

ADULT PROTOCOL SKILL EVALUATION
SUBJECT: USE OF MAD (MUCOSAL ATOMIZATION DEVICE)

NAME_____ DATE_____

LEVEL: _____Paramedic

STEPS	1st Testing Comments	2nd Testing Comments
A. List the indications for use of the MAD.		
B. List the IN doses of Narcan & Versed for the adult patient.		
C. Draw up 2 cc of solution into a 3 cc luer lock syringe.		
D. Expel all air from the syringe.		
E. Connect the MAD tip to the syringe.		
F. Hold the "patient" (manikin) head with one hand.		
G. Place atomizer 1.5 cm within one nostril with the other hand.		
H. Briskly compress syringe to administer 1 ml of atomized spray. Have towel ready to catch any secretions.		
I. Remove and repeat in other nostril so that all 2 cc of solution are administered.		
J. Properly dispose of equipment and note effects.		

Optional Skill
EZ IO Insertion

Scope of Practice EMT-Intermediate and Paramedic

Indications
When there is an established need for vascular access, an inability to do so and any one (or more)of the following:
Altered Mental Status (GCS ≤ 8)
Respiratory Compromise
Hemodynamic Instability

Contra-Indications
Fracture of the target extremity
Previous orthopedic procedures (such as a knee replacement)
Infection at the insertion site
Excessive tissue at the insertion site (obesity)
Inability to locate landmarks (significant edema)

Complications
Pain
Infiltration
Decreased flow rates

Procedure

	Yes	No
Takes or verbalizes appropriate BSI precautions		
Select insertion site (humoral head, distal femur, proximal or distal tibia		
Prepare the site		
Insert the needle (confirm 5mm mark)		
Remove the driver & stylet		
Confirm placement		
Attach primed extension set		
Administer Lidocaine (2%) * Adult = 80mg * Pediatric = 0.5mg/kg		
Start infusion with pressure		
Stabilize catheter as needed		

BAYER GLUCOMETER TESTING PROCEDURE

Take the Test:

- With the meter off, hold the round end and insert the Test Strip fully into the meter. You will hear a beep.
- Cleanse site that blood will be drawn from with alcohol prep. Let site dry completely before puncturing skin.
- Press microlet firmly against puncture site and push button to release. Form a small round drop of blood.
- Touch and hold the TEST END (tip) of the Test Strip to the drop of blood until the meter beeps.
- The test strip is filled and the time begins counting down from 29 seconds.
- After 29 seconds, your test result is displayed. Do not remove strip until results are displayed.
- Remove the Test Strip. The meter turns off and the test result is stored.
- Discard used Microlet and Test Strip into a sharps container.

BAYER GLUCOMETER WEEKLY TESTING PROCEDURE

Check Strip Test

Check your meter on same day of every week.

- Remove the check strip from the package (save the package)
- Insert the check strip ("check" side up) fully into the meter until you hear a beep. A full display * shows followed by another beep and then the check strip result.
- The check strip result must be within the range listed on the check strip package insert. If not, see the problem-solving chart in Section 11 of user guide.
- At the end of the test, carefully remove the check strip from the meter and return it to its package.
- Record your results in the Check Strip column Test Sheet.

Control Test

A control test is to be run on same day of every week and recorded on the Glucometer Control Test Sheet.

- To open the test strip foil packet, carefully peel the foil back until the test strip is completely exposed. Save the foil packet.
- Holding the round end of the test strip, insert the strip into the meter until it stops.
- A beep sounds. A full display, followed by the code number (F#) and previous test result appears. The code number and previous test result flash alternately.
- To mark a control test, pull the test strip out and reinsert quickly (within 2 seconds). When the "C-" and code number (F#) begin flashing, you know the test will be marked.
- Squeeze a small drop of control solution onto the inside of the foil packet you saved.
- Touch and hold the TEST END of the test strip to the strop until the meter beeps (the control solution has now been drawn into the test strip). The time begins to count down from 29 seconds.
- Remove the test strip. The meter turns off and the result is stored as a control.
- Record your results on the Glucometer Control Column Test Sheet.

Code the Meter

Code the meter whenever a new box of test strips is opened. This will match the meter to the Test Strip reactivity.

You will need the code strip found in the new box of strips.

- Tear open the package found in the new carton of test strips and remove the code strip (save the packet).
- Insert the code strip into the test slot. A beep sound and a full display appears briefly. Another beep sounds and the code number (for example F-5) appears in the display.
- Remove the code strip and store in packet.

*You do not need to code the meter if the new code strip number matches the previous code strip number.

BAYER GLUCOMETER CONTROL TEST SHEET

Control Levels: Low (L) Normal (N) High (H)

Date	**Check Strip Level**	**Control Level**	**Control Test Results (mg/dl)**

If you receive an error message and/or results that fall out of the accepted ranges:

- Go to the problem-solving chart in Section 11 of user guide to correct the problem.
- If you are unable to correct the abnormal findings, then take the glucometer out of service and replace with back up unit (if available). Send glucometer to the department EMS Coordinator with a written explanation of what the problem was and what attempt was made to correct it, if any.

PULSE OXIMETRY

General Considerations

Pulse oximetry is used in conjunction with other assessment processes to determine the actual available oxygen in the blood for use by body tissue. Pulse oximetry measures the oxygen saturation of the red blood cells (%SpO2).

Studies have shown that EMS personnel are fairly accurate in the assessment and treatment of patients in profound hypoxia. However in mild to moderate hypoxic states, EMS personnel sometimes do not react until the patient has progressed to profound hypoxia. Signs of progressive hypoxia need to be identified rapidly and the condition treated before profound hypoxia occurs.

Use of pulse oximetry in conjunction with other assessment processes may sometimes identify those patients in mild to moderate hypoxia, and with proper intervention profound hypoxia can be prevented.

If available, pulse oximetry should be used on all appropriate patients. Pulse oximetry should be maintained and evaluated until the patient is delivered to the Emergency Department.

***REMEMBER, INITIATE NORMAL AIRWAY AND OXYGENATION SUPPORT REGARDLESS OF THE AVAILABILITY OF PULSE OXIMETRY.**
***NEVER BASE ANY TREATMENT OR OXYGEN THERAPY SOLELY ON THE READING FROM THE PULSE OXIMETER.**

Procedure

A. Select sensor and apply according to manufacturer's recommendations. The following should be noted:

1. Finger Clip Sensors – These are designed for spot-check monitoring of older pediatric and adult patients and/or continuous monitoring of less than 30 minutes where patient movement is not expected.

- Insert finger (preferably left or right index finger) completely into sensor, keeping fingernail side facing the sensor top. It is specifically recommended that the thumb not be used in the finger clip sensor.
- For best results, when using the finger clip in longer term monitoring or with active patients, secure the sensor cable independently from the sensor, preferably around the base of the finger. Make sure blood supply to the finger is not impaired by the application of the tape.

2. Flex Sensor – This sensor is designed for monitoring pediatric and adult patients in which moderate patient movement is expected.

- Position the sensor on the top and bottom of the end of the finger or toe. Place the light emitter portion on the finger/toe-nail side and the detector of the side opposite of the nail, making sure to align the emitter and detector through the tissue.
- Secure the sensor with 3M Micropore tape, making sure not to restrict blood flow. Attach the sensor cable independently at the base of the finger, again being careful not to restrict blood flow.

3. Infant and Neonatal Sensors - These sensors are designed for continuous monitoring of infants and neonates since fingertip monitoring is impractical.
   - The infant sensor is designed for application on the big toe of infants greater than 2 kg (5 pounds).
   - The neonatal sensor is designed for application on the foot of infants less than 2 kg in weight.
   - Apply and secure these sensors as described for the flex sensor, being sure not to restrict blood supply to the monitored area.

4. Ear Clip Sensor - This sensor is used when finger clip sensing is not possible. Be sure to clean the ear lobe with alcohol before applying the sensor. Be aware pierced ears may allow some light to pass directly to the detector and result in an inaccurate reading.

5. Reflectance Sensor - This sensor is used on well vascularized skin surfaces in adult patients only. This method is not preferred in the prehospital setting.

B. Turn oximeter on and verify operation according to manufacturer's operating procedure.

C. A relative operation check can be achieved by applying the sensor to your own finger.

D. Always cleanse sensor site of blood and dirt for reliable reading. Some fingernail polishes may have to be removed to obtain a reading.

E. Apply sensor to patient and obtain reading.

Interpretation of Reading

100% to 96%	Ideal Range - Maintain oxygen and airway support methods being used.
95% to 90%	Mild to Moderate Hypoxemia - Check airway and increase oxygen support until ideal range is achieved.
89% to 85%	Severe Hypoxemia - Aggressive airway and oxygen support is essential. Look for and treat cause: i.e. COPD, metabolic imbalance, peripheral vascular shutdown.
Below 85%	BE PREPARED TO INTUBATE AND/OR ASSIST VENTILATION

Considerations

A. Hypovolemic, hypothermic, and peripheral vascular disease patients may not be suitable candidates for pulse oximetry due to peripheral shutdown.

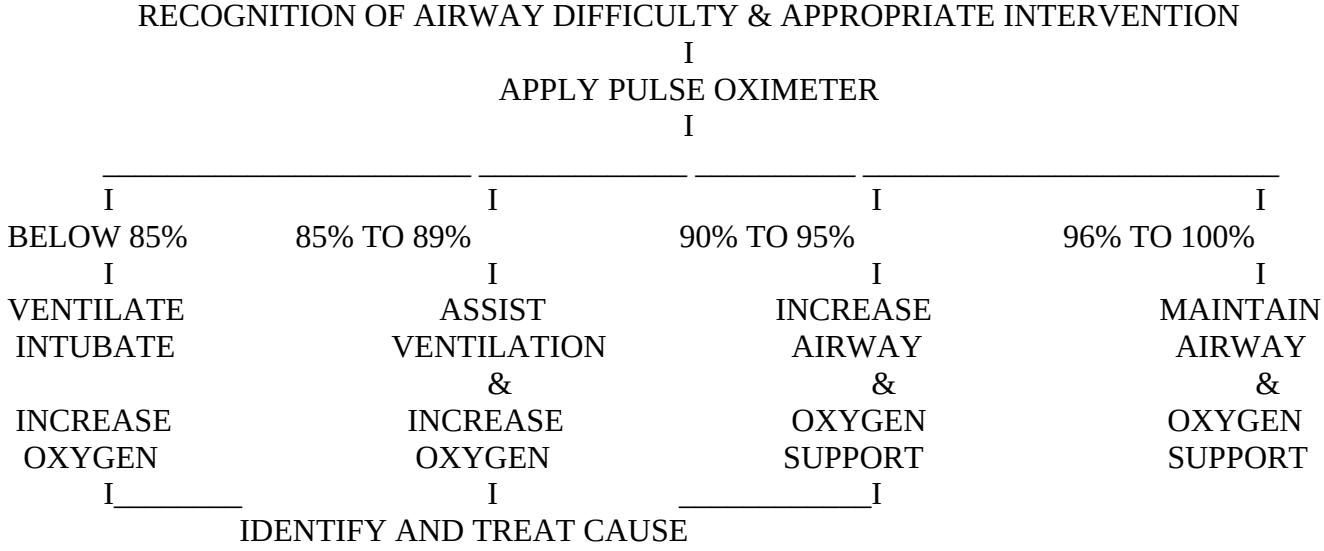
B. Be aware that there may be a 30 to 60 second delay between changes in %SpO2 conditions and pulse oximetry readings.

C. A pulse must be detected by the oximeter to determine the %SpO2

D. **Pulse oximetry is not indicated in carbon monoxide poisoning.**

E. COPD patients will normally have a low %SpO2 and should not be treated in accordance

with this guideline.



GREATER MIAMI VALLEY EMS COUNCIL
EMT- BASIC OPTIONAL SKILLS
2007 EMT-BASIC ALS ASSIST SKILLS TESTING

EMT-BASICS: Use these skill sheets and protocol to study for Skills Testing.

SKILLS TESTERS: Record Pass/Fail.

EMT-B Name_____ Date_____

EMT-Basic	First Test			Second Test		
Skills	Pass	Fail	Instructor/Date	Pass	Fail	Instructor/Date
Assisting with Intubations *(Not used if EMT-B Intubates)						
1. Equipment set-up 2. Preoxygenate and position head 3. Cricoid pressure on request 4. Inflate cuff 5. Use of confirmation equipment 6. Tie-down or securing the tube						
{Placement of Pulse-ox}						
IV Preparation Permitted only under supervision of EMT-Intermediate or Paramedic						
1. Selecting Bag (250 ml vs. 1,000 ml), 2. Selecting Tubing 3. Opening Bag and Tubing 4. "Spiking" Bag 5. Sterile Technique 6. Pinching tubing to fill chamber 7. Filling tubing 8. Recap to maintain sterility 9. Taping down IV						
Preparation of Saline Lock Permitted only under supervision of EMT-Intermediate or Paramedic						
1. Equipment 2. Draw up Saline 3. Sterile Technique 4. Inject into Lock 5. Recap to maintain sterility 6. Taping down IV						
Placement of EKG Leads						
1. Placement of three or four electrodes for cardiac monitoring 2. Options (arms vs. chest; legs vs. torso below navel)						