

# PR01: Ambulating Patients

## Applicable To

■ EMR and higher

## Introduction

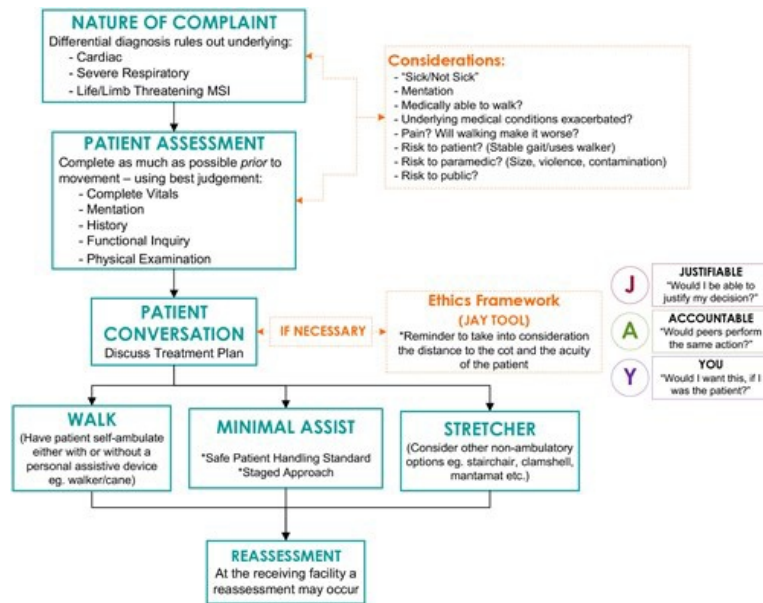
When it is clinically safe for both the patient and the paramedic or EMR, patients should ambulate on their own, or with appropriate support. There are, however, clinical situations in which a stretcher or non-ambulatory method of patient movement should be utilized. Proper assessment will reduce the risk of patient falls and associated risk of injury to patients and paramedics and EMRs/FRs.

The following criteria can be used as a tool to assist in deciding which patients should be conveyed via stretcher, or other non-ambulatory method, and which patients can safely self-ambulate.

Although these guidelines are meant to provide support in the decision about what to do and how to do it, there can be extenuating or unforeseen issues that complicate circumstances. If a situation arises where there is uncertainty about the correct course of action, pause and reflect for a moment. Consider the BCEHS Ethics Framework; specifically, the use of the [JAY Decision Making Tool](#) (page 12) for in-the-moment decision-making. The JAY Tool can help individuals to consider all the factors involved before they make a final decision about what to do.

## Procedure

### The BCEHS Patient Movement Assessment Tool



### Steps for Applying the BCEHS Patient Movement Assessment Tool

The paramedic or EMR may consider some or all of these points when applying the BCEHS Patient Movement Assessment Tool:

#### STEP 1: Nature of the Complaint/General Impression

- Differential Diagnosis (consider Mechanism of Injury)
  - When the differential diagnosis indicates one of the following, these patients warrant a stretcher:
    - Cardiac in nature
    - Severe respiratory complaint with clinical indicator(s) (e.g., shortness of breath with audible wheezes, decreased SpO<sub>2</sub> saturations, etc.)
    - Life/Limb threatening MSI
- **Considerations** – these considerations may warrant a stretcher or be mitigated by other assistive devices:

1. *Consider the patient's acuity:*
  - "Well" or "Not well"
  - Mentation: Is the patient able to follow a conversation? Is the patient cooperative? Is eye movement consistent with intentional cooperation?
  - Are they medically able to walk?
  - Are there underlying medical conditions that may be exacerbated?
  - Is the patient in pain and will walking the patient make the pain worse?
2. *Consider the risks:*
  - Risk to the patient; stable gait; do they normally use a walker?
  - Risk to the paramedic or EMR/FR; size of the patient; potential for violence or contamination?
  - Risk to the public?

#### STEP 2: Patient Assessment

- Complete as much as possible prior to movement to help confirm or deny your thoughts formulated during Step 1 – using best judgement:
  - Complete vital signs (are they normal for THIS patient?)
  - Assessment of mentation: GCS and/or LOC x3 (Time, Place, Person) to help determine suitability of ambulation
  - History
  - Functional inquiry
  - Physical examination

#### STEP 3: Patient Conversation

- A discussion with the patient about the treatment plan allowing them to be part of the decision making process
- Reminder: In this situation the distance to the stretcher is taken into consideration based on the acuity of the patient

#### Ethics framework (JAY tool)

- Depending on the situation, paramedics and EMRs may need to use this tool

#### STEP 4: Walk, Minimal Assist, Stretcher

- Walk – self ambulate with or without an aid
- Minimal assist
  - PHSA Safe Patient Handling Standard and FAQ
    - If it is assumed the patient will need more than minimal assistance, it is recommended the patient be moved using a non-ambulatory method.
  - See the Staged Approach to Safe Patient Movement graphic below

#### STEP 5: Reassessment

- At the receiving facility, a reassessment may occur as the patient's condition and/or abilities may have changed

## Notes

#### Staged Approach to Safe Patient Movement

- **Safe Patient Handling Standard:** Please note that this assessment tool works in accordance with the PHSA Safe Patient Handling Standard which states that patients should not be manually lifted if it can be avoided and is not detrimental to the patient's health. Please review the [standard](#) and associated [FAQ](#).
- Manually lifting a patient who can safely walk is not a desirable option. However, a high risk of injury to patient and paramedic or EMR/FR is associated with ambulating a patient at risk of falling. Proper assessment is critical in reducing the risk of falls.
- Do not rely on the patient's spoken communication to determine if it is safe for them to ambulate. Upon completion of your assessment (as outlined in the Patient Movement Assessment Tool above), proceed to assess the patient's ability to move. From the patient's starting position, use the Staged Approach to Safe Patient Movement to guide your decision-making on how to move the patient; this assessment stops when the patient is not able to move on to the next level with no more than minimal assistance. At this point, stop and consider a stretcher or assistive device.

#### Patient Assessment:

- **Before ambulating a patient, be sure the patient:**

- Has passed the **Patient Movement Assessment Tool (see above)** and no contraindications are indicated
- Is cooperative, alert, and able to follow directions
- Can move from lying to sitting and balance while sitting independently or with minimal assistance
- Can stand up and balance independently or with minimal assistance
- Can step in place while maintaining balance independently or with minimal assistance
- Has the ability to self-transfer the distance required (do not over-estimate the patient's capabilities)
- **Important points:**
  - Clear the environment – ensure no tripping hazards
  - Ensure mobility aids, if used, are within reach – on their strong side if possible
  - Ensure patient is wearing non-slip footwear if available
  - *Do not attempt to catch a falling patient; attempt to control the direction of the fall and protect the patient's head*

### Procedure for Staged Approach:

Assist the patient from lying to sitting. If the patient cannot do this independently or with minimal assistance, do not walk the patient.

With patient sitting up:

- Check that patient's feet are flat on the floor and knees and hips are approximately 90 degrees (sitting surface should not be too low), with feet behind knees
- Have patient move to the edge of sitting surface
- Cue patient for proper hand placement (e.g., push on mattress or chair armrests)

Stand to the side of the patient and support the patient at the back (option to hold the patient's belt if present to stabilize). Use a walker or other mobility device if this is standard practice for the patient.

Assist patient to standing position by reminding patient to have "nose over toes" and to lean into standing (cue patient to push down to get up). The paramedic or EMR should direct the movement and may provide minimal assistance by supporting the patient under their belt, elbow, or wrist. The patient should not grasp the paramedic or EMR/FR and should not be in a position to pull the paramedic or EMR/FR down at the shoulders should they fall.

Ensure patient is able to maintain balance in a standing position. If balance is questionable, sit the patient back down and re-evaluate or proceed with non-ambulatory methods of transfer.

Once the patient is clearly maintaining balance in standing, check that the patient is able to step on the spot while continuing to maintain balance prior to ambulating, using a mobility aid as applicable. If balance is questionable while stepping, sit the patient back down and re-evaluate or proceed with non-ambulatory methods of transfer.





If the patient can step in place and you feel safe to proceed, assist the patient (by guiding and or cuing) to ambulate to the destination. If walking in a hallway, stay close to the wall.

Once the patient has completed their trip, ensure seating surface is positioned squarely behind the patient's knees, the device is locked as applicable, the device is adjusted to an appropriate height when possible, and then instruct the patient to sit down.

- Provide a verbal reminder to patient: "Can you feel the seat behind your knees?"
- Verbally cue the patient to reach behind to help guide and support themselves while lowering: "Reach behind yourself with one hand to the seat to help let yourself down."
- Minimally assist the patient as needed to an appropriate sitting or lying position.

## Resources

### Staged Approach to Safe Patient Movement

Patient Starting Position	Patient Ability			
	YES ↓	Can patient move to and maintain balance in a seated position independently, or with minimal assistance?	NO ⇒	<b>Patient Non-Ambulatory</b> <i>Use available equipment to safely transfer patient to stretcher.</i>
	YES ↓	Can patient stand, pause in standing and maintain balance independently or with minimal assistance?	NO ⇒	
	YES ↓	Can patient step in place and maintain balance independently or with minimal assistance?	NO ⇒	
	YES ↓	Can patient take steps and maintain balance to walk independently or with minimal assistance?	NO ⇒	
	✓	<b>Patient Appropriate to Walk</b>		

Edited May 20/2023 to remove broken links

## References

BCEHS. Ethics Framework. 2017. [\[Link\]](#)

Provincial Health Services Agency. Workplace Health - Safe Patient Handling. [\[Link\]](#)

## PR02: Pelvic Binders

### Applicable To

■ FR and higher

### Introduction

If a pelvic injury is suspected, or there is a high mechanism of injury in an unconscious patient, the pelvis should be bound with a T-POD or KED. Binding the pelvis reduces overall pelvic volume and creates a tamponade effect, stabilizes fracture fragments reducing hemorrhage from the fracture sites, and improves patient comfort.

Pelvic binders should not be used for isolated neck-of-femur (NOF) fractures (also known as "hip" fractures).

### Indications

Major mechanism suggestive of pelvic fracture with **any** of the following:

- Hemodynamic instability (heart rate > 100 or systolic blood pressure < 90 mmHg)
- Pelvic pain on exam
- Pelvic instability
- Decreased level of consciousness
- Major injury distracting from pelvic exam

### Contraindications

- Neck-of-femur ("hip") fractures
- Falls from standing height or other simple falls

### Procedure

1. Remove the patient's clothing. The T-POD should be in direct contact with the skin.
2. Slide the belt under the supine patient and into position under the pelvis, aligning the centre of the belt with the greater trochanter.
3. Trim the belt leaving a 15 to 20 cm gap over the centre of the pubic symphysis.
4. Apply the Velcro tension straps.
5. Slowly draw tension creating simultaneous, circumferential compression.
6. Record the date and time of application.
7. Secure the belts to ensure constant pressure without accidental release.
8. If release is required, or occurs accidentally, the time of this event should also be noted.
9. Document the application of the T-POD on the ePCR under 'Major Trauma: Intervention: Circulation.'

### Notes

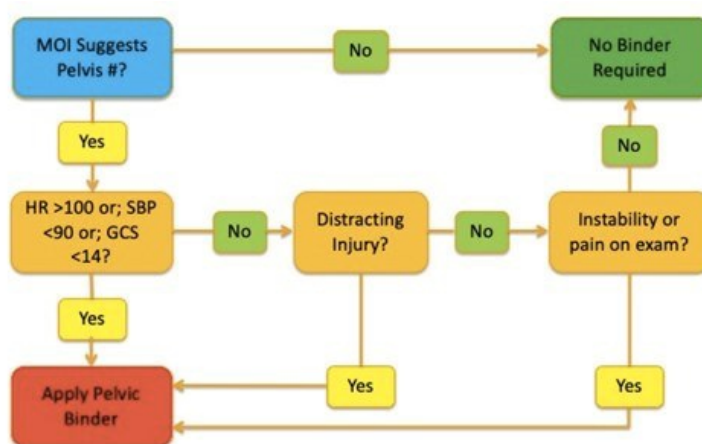
## **T-POD®** Explained



Pre-application  
of **T-POD®**



Post-application  
of **T-POD®**



## **Resources**

Numerous tutorial videos available online.

## PR03: Tourniquets

### Applicable To

■ FR and higher

### Introduction

Tourniquets are indicated for severe bleeding from trauma to extremities where other methods of bleeding control have proven ineffective. Most bleeding can be controlled through direct pressure, elevation, and immobilization, but occasionally injuries can be significant enough to require tourniquet use.

### Indications

- Bleeding from an extremity that cannot be controlled through direct pressure or wound packing
- Consider application for extremity crush syndrome \*CliniCall consult required\*

### Procedure

1. Identify uncontrolled external bleeding.
2. Make one attempt at control with direct pressure.
3. If unable to control bleeding with direct pressure and the wound is on an extremity: position the tourniquet 5 – 8 cm above the injury, or as high on the limb as possible. Do not apply over joints. Remove clothing and ensure tourniquet is in direct contact with skin.
4. Secure tourniquet strap through the buckle, pull the strap until it is snug, and apply tension using the windlass until all bleeding has stopped. Lock the windlass into position and secure using the strap.
5. Note the time of application. Document the procedure in the ePCR.
6. Consider providing analgesia to the patient in accordance with [CPG E08](#).

### Notes

Tourniquets should not be in place for more than 2 hours. Contact CliniCall if scene management and/or transport times may exceed this timeframe.

### Resources

## PR04: Wound Packing

### Applicable To

■ FR and higher

### Introduction

Wound packing is a technique of internal direct pressure that places gauze material directly on the lacerated blood vessels in an attempt to control bleeding.

### Indications

- Wound packing is indicated for penetrating wounds where bleeding cannot be controlled using direct pressure alone. It is an ideal technique for injuries to junctional areas of the body, including the groin and axilla, where tourniquets are ineffective and direct pressure can be difficult to maintain.

### Contraindications

- Do not pack wounds on the neck, chest, or abdomen. There is a risk of airway compromise when packing neck wounds. Wound packing is unlikely to be effective on the chest or in the abdomen due to the nature of these injuries.

### Procedure

1. Ensure appropriate protective equipment is used, including eye protection or face shields.
2. Obtain and open multiple packages of gauze. Sponges may be used if roll gauze is not available.
3. Insert fingers into the wound to provide direct pressure on the target blood vessels; ideally, the artery or vein (or both) should be compressed against a bone while packing material is being readied.
4. Pack the wound tightly with gauze. Continue applying pressure during the packing process, alternating fingers if necessary. Ensure the packing material reaches as deeply into the wound cavity as possible.
5. When the wound cannot accommodate any more packing material, apply very firm direct pressure to the wound and packing material for at least three minutes to allow the clotting process to begin. If bleeding continues, consider packing more material into the wound.
6. Secure the wound packing with a pressure dressing and convey immediately (if not already en route). Immobilization of the injury may help to limit recurrence of bleeding.

### Resources

### References





## PR05: Patient Decontamination

Rob MacMillan

### Applicable To

■ FR and higher

### Introduction

Patient decontamination is any process, method, or action that leads to a reduction, removal, or neutralization of an agent. This can be accomplished by partitioning, binding, or inactivating a contaminant on, or within, a patient. It is intended to prevent or mitigate adverse health effects to a patient as well as aid in protecting emergency first responders, health care facility first receivers, and other patients from secondary contamination. Decontamination also facilitates access to medical care and reduces the potential for secondary contamination of incident response and health care infrastructure.

When required, decontamination is a specific medical countermeasure to toxic or chemical exposures. It should be considered a first aid measure that can be explained to patients as such.

#### Scene Management

It is critically important to control the environment of a hazardous materials incident. Isolate the scene and deny access to the public, media, and unnecessary responders to prevent needless contamination. Hazardous materials scenes have three concentric control zones:

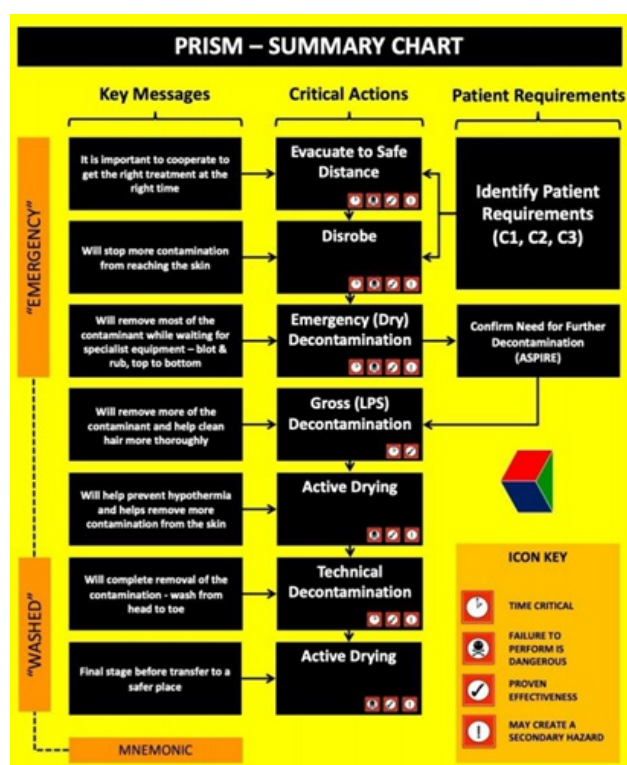
- The **hot zone**, or red zone, is an exclusion or restricted area. Chemical protective equipment is required.
- The **warm zone**, or yellow zone, is an area for decontamination or contamination reduction. Chemical protective equipment is also required here.
- The **cold zone**, or green zone, is a support zone and is the location in which BCEHS will conduct assessment and treatment. No chemical protective equipment is required in this zone.

All paramedics and EMRs [must contact ClinCall to speak with paramedic specialists](#) prior to assessing patients from a hazardous materials incident or chemical exposure. BCEHS does not provide equipment to protect against exposures or to work in hot or warm zones.

It is vitally important that BCEHS paramedics and EMRs work collaboratively with other agencies at the scene to manage hazardous materials incidents and perform appropriate decontamination.

### Procedure

- Evacuate patients to a safe distance prior to decontaminating. Segregate individuals by gender whenever possible.
- Have patients remove all clothing and jewelry prior to performing an emergency (dry) decontamination: this is the most important step and may remove 80-90% of contaminants.
- When conducting a wet decontamination, wash with water and mild soap. Pay close attention to exposed skin folds, axillae, genitals, and feet. Use warm water to reduce the risk of hypothermia and work systematically from head to toe.
- The optimal water rinse time is 15 minutes per person. In cases with large numbers of contaminated patients, a 3 minute water rinse irrigation is permissible to prevent secondary contamination and downstream contamination of health care providers.
- All removed clothing items are considered hazardous and must be properly collected, double bagged, and marked as such for disposal.
- A majority of patients involved in a chemical exposure will not stay at the scene and may find alternative means of transport to hospitals. Surrounding health care facilities should be notified as soon as possible of potentially contaminated patients self-presenting.



### The Three Pillars of the Primary Operational Response (POR)

Adapted from "Decontamination Guidance for Chemical Incidents," at 'medicalcountermeasures.gov'

The overriding objectives of the POR are to maximize initial survivability and minimize long term sequelae in individuals who have been accidentally or deliberately exposed to toxic chemicals. The three "pillars" that support these objectives are an understanding of individual needs (patient requirements), an effective communication/management strategy, and clinically effective patient-focused actions.

#### Patient Requirements

A proportion of patients may be unable to comply with instructions issued by emergency responders. For example, they may be unresponsive, have life-threatening injuries, or may not be able to understand instructions or perform activities without accommodations or assistance. In order to maintain operational effectiveness, all patients need to be rapidly categorized to ensure they are on the appropriate treatment pathway. This guidance document defines three patient categories (C1, C2, C3).

#### Definition of Patient Categories:

- C1: Patients who are able to understand instructions and perform activities without assistance.
- C2: Patients who are either unable to understand instructions, or who are unable to perform activities without accommodations or assistance.
- C3: Patients who are unresponsive, have life-threatening injuries, or require extensive accommodations or assistance.

Assistance with this form of triage is available from the ASPIRE tool, available from the National Library of Medicine's CHEMM website.

#### Communication and Patient Management

Good communication is key to acquiring the trust and cooperation of patients and will maximize the overall efficiency of the initial response phase. Failure to adequately interact with patients may lead to unnecessary anxiety, non-compliance, and security issues at the scene of an incident.

#### Patient-Focused Action

The goal of the POR is to save lives and improve the clinical outcome of chemically contaminated patients. It is imperative that the following four actions are performed as soon as practically possible:

- Evacuation: Immediate, orderly movement upwind from hazardous areas is a key component of the initial operational response. Inappropriate or delayed evacuation may exacerbate the clinical effects of exposure to hazardous materials and will hamper the effectiveness of subsequent operations.
- Disrobe: The critical, urgent need to safely remove contaminated clothing cannot be overemphasized and is a process

that requires effective communication to facilitate patient compliance. The golden rule is that no form of decontamination should be undertaken before disrobing.

- Decontamination: While disrobing will remove the vast majority of a contaminant, exposed areas will require decontamination to remove hazardous material from the hair and skin. There are three forms of decontamination: emergency, gross, and technical.
  1. Emergency decontamination is the phrase used to emphasize the time-critical process for the immediate removal of hair or skin contamination by any available means and can be divided into “dry” and “wet.”
    - Emergency dry decontamination is the default option and should be performed with any available absorbent material.
    - Emergency wet decontamination should only be used when the contaminant is caustic (e.g., provokes immediate skin irritation) or is particulate in nature and should be performed using any immediately available source of water at an appropriate temperature (i.e. not exceeding 40° C or 104° F).
  2. Gross decontamination includes the Ladder Pipe System: two fire engines are parked parallel to form a corridor through which patients pass while being sprayed with a high volume of low-pressure water mist. Alternatively, patients can be sprayed directly with hosepipes using a fogging nozzle.
  3. Technical decontamination requires the use of specialist decontamination units and associated resources that need to be transported and subsequently deployed at the scene of an incident. In some jurisdictions, technical decontamination is performed at a hospital and so requires conveyance of patients from the scene of the incident. Either way, there will be a delay before technical decontamination can be performed.

Early emergency and gross decontamination compensates for the delayed availability of technical decontamination. It should be noted that the clinical benefits of emergency, gross, and technical decontamination are synergistic: such a “triple protocol” is most effective when performed as one continuous process.

- Active Drying: The act of drying the skin after any form of wet decontamination is a key step. This simple but effective process assists in the removal of contaminants from the hair and skin surfaces, inhibiting further spread of contamination.

## References

1. US Department of Health & Human Services. MedicalCountermeasures.gov. [\[Link\]](#)
2. US Department of Health & Human Services. Patient Decontamination in a Mass Chemical Exposure Incident: National Planning Guidance for Communities. 2014. [\[Link\]](#)
3. US Department of Health & Human Services. PRISM: Primary Response Incident Scene Management. [\[Link\]](#)

## PR06: High Performance CPR

### Applicable To

■ FR and higher

### Introduction

The 2020 AHA CPR Guidelines emphasized the importance of providing high quality CPR. The quality and timing of CPR is critical to successful resuscitation in patients who have experienced a sudden cardiac arrest. High performance CPR should be used in all cases of cardiac arrest from a presumed cardiac cause (i.e., not in traumatic arrests).

### Procedure

- Paramedics and EMRs/FRs should adhere to the five principles of high quality CPR by focusing on providing:
  1. Compressions at optimal rates: 100 to 120 compressions per minute.
    - For patients without an advanced airway (supraglottic airway or endotracheal tube), perform compressions and ventilations at a ratio of 30:2.
    - For patients with an advanced airway in place, perform continuous chest compressions, ventilating every 6 seconds.
  2. Compressions at an optimal depth of 5 centimetres (2 inches).
  3. Complete chest recoil during compressions: after each compression, a negative pressure develops in the chest that pulls blood into the thorax for the next compression. (This is also when coronary arteries are perfused.) Maintaining pressure on the chest wall that results in incomplete chest recoil diminishes or prevents the return of blood into the thorax.
  4. When providing ventilations, be aware of appropriate volumes; in adult patients, no more than 500-600 mL should be given during CPR.
  5. Minimally interrupted compressions. Pauses during compressions should be limited to 10 seconds or less. Perform pulse checks only while analyzing rhythms, or if signs of spontaneous circulation become evident.
- When charging monitors and defibrillators prior to delivering shocks:
  1. For AEDs: pause compressions only as long as required to conduct the analysis. Immediately resume compressions once the AED has completed the analysis, even if a shockable rhythm is detected.
  2. With compressions ongoing, verify the presence of a central pulse.
  3. Charge the defibrillator (or allow the AED to charge).
  4. Once the defibrillator is charged, stop compressions. Confirm the absence of central pulses.
  5. Clear the patient and deliver the shock.
  6. Immediately resume compressions *without* checking for pulses.
- Clear delegation of roles and effective intra-team communication and leadership are fundamental to success in resuscitation efforts.

### References

American Heart Association. 2020 American Heart Association Guidelines for CPR and ECC. 2020. [\[Link\]](#)

## PR07: Nasopharyngeal Airway

### Applicable To

- EMR and higher

### Introduction

Nasopharyngeal airways can provide significant airway protection for patients whose level of consciousness is decreased, but who maintain some airway reflexes and for whom oropharyngeal airways would prompt gagging or vomiting. They are also useful for patients who exhibit trismus or have injuries to the mouth or jaw.

### Indications

- Patients who require an airway adjunct but who are unable to tolerate an oropharyngeal airway, or where an oropharyngeal airway is unable to be placed

### Contraindications

- Significant maxillofacial trauma, particularly Le Fort fractures that include the zygoma(s)

### Procedure

1. Select an appropriate size of nasopharyngeal airway by measuring a candidate airway against the patient's face: measure the distance from the nostril to the tragus of the ear, holding the nasopharyngeal airway in its neutral position. Do not straighten the airway to measure it.
2. Lubricate the barrel of the nasopharyngeal airway. Avoid getting lubricant in the lumen.
3. Unless anatomy or injury dictates otherwise, select the largest nostril on the patient and insert the nasopharyngeal airway perpendicularly to the plane of the face. Advance the airway straight back with a gentle but firm motion. Some rotation may be necessary to overcome obstacles in the turbinate. Do not use force to overcome resistance.
4. A jaw thrust is needed to ensure the epiglottis lifts off the laryngeal inlet.

### Notes

- Epistaxis is the most common complication of nasopharyngeal airway placement. This risk is higher in individuals who are taking anticoagulant medications. If bleeding develops, leave the nasopharyngeal airway in place so long as it does not cause airway obstruction or compromise; otherwise, remove the airway and place the patient in a protective position.
- PCPs may not suction down the lumen of the nasopharyngeal airway.

### Resources

## PR08: Supraglottic Airway

### Applicable To

■ PCP and higher

■ PCP requires completion of AIME BLS II **and** CPD 2019, or its equivalent (NEO post-February 2019), or PPEd sign-off for use outside of cardiac arrest

### Introduction

*This procedure reference contains changes related to COVID-19.*

The iGel supraglottic airway device is a tool used to provide a higher degree of airway protection that can be obtained through the use of a pharyngeal airway. It transfers the working interface between the bag-valve mask from the face to the laryngeal inlet. Paramedics may use supraglottic devices in the setting of cardiac arrest or in patients who are obtunded and breathing spontaneously.

When preparing for SGA insertion, a pre-connected viral filter must be used.

Reversion to bag-valve mask ventilation with a tight seal and viral filter should be used if SGA placement fails.

### Indications

- Patients who are unable to protect their airways due to a decreased level of consciousness
- **PCPs who have not completed AIME BLS II and CPD 2019 (NEO completed February 2019 or later is considered equivalent) may only use supraglottic airway devices in cardiac arrest**

### Contraindications

- Inability to place device due to difficulties with mouth opening
- Known or suspected pathological or foreign-body airway obstruction, including epiglottitis
- Trauma to the trachea, neck, or oropharynx
- Caustic ingestion
- Active vomiting
- Relative: Anticipated requirement for high inspiratory pressures during ventilation

### Procedure

1. Select an appropriately-sized supraglottic airway and remove it from its packaging and cradle. EGD sizing is based on patient weight.
2. Place lubricant on the cradle. Lubricate the supraglottic airway on all sides, taking care to avoid the lumen.
3. Open the patient's mouth and introduce the soft tip towards the hard palette.
4. Allow the supraglottic airway to glide along the hard palette and advance the device until resistance is felt.
5. Confirm placement by ventilating with a bag-valve mask.
6. Secure the supraglottic airway using the included tube holder. Do not use Thomas tube holders for this purpose as they are not designed to accommodate a supraglottic airway.

If it becomes necessary to remove a supraglottic device:

1. Where possible, raise the patient to a semi-recumbent position (30°).
2. Prepare suction, bag-valve mask, and oxygen delivery devices.
3. Cut or remove ties or tube holders.
4. Ask the patient to take a deep breath, then blow out firmly. While the patient is blowing out, pull the airway smoothly out of the mouth.
5. Suction the oropharynx as needed.
6. Monitor oxygen saturation.
7. Support respirations as needed.

## Notes

- Airway obstructions are an absolute contraindication to the use of a supraglottic airway. Paramedics **must**, therefore, confirm they are able to ventilate the patient with a bag-valve mask prior to placing a supraglottic airway.
- The supraglottic airway is a tool to solve problems relating to oxygenation and ventilation. Paramedics should apply a staged approach to airway problem solving prior to using a supraglottic airway.
- PCPs are permitted to use a modified approach to the in-built suction port available on all iGel SGAs to provide pharyngeal suction during cardiac arrest.
- Do not occlude the suction port of the supraglottic airway.

## Changelog

- 2023-01-04: changed references to devices used to secure SGA

## Resources



## PR09: Continuous Positive Airway Pressure

Mike Sugimoto

### Applicable To

■ PCP with AIME CPAP training and higher

■ [CliniCall consultation recommended](#) for PCPs prior to use of continuous positive airway pressure

### Introduction

Continuous positive airway pressure (CPAP) devices provide a non-invasive method of improving oxygenation in patients who are experiencing significant respiratory distress. The use of CPAP eases work of breathing, supports alveolar recruitment, decreases overall mortality, and reduces the need for intubation.

### Indications

Patients who are:

- Awake and able to follow commands
- Able to maintain an open airway
- Age 13 years of age and up
- Exhibiting respiratory distress with **all** of the following:
  - Respiratory rate > 24/minute
  - SpO<sub>2</sub> < 94% on supplemental oxygen
  - Use of accessory muscles
- Consider the use of CPAP in adult patients with respiratory distress, including but not limited to:
  - Congestive heart failure or acute cardiogenic pulmonary edema
  - Asthma
  - Submersion injuries
  - Pneumonia
  - Chronic obstructive pulmonary disease

### Contraindications

- Patient age 12 years and less
- Decreased level of consciousness, or inability to follow commands
- Respiratory arrest or hypoventilation
  - Patients who are in imminent or actual respiratory failure (i.e., whose respirations are slow, feature shallow tidal volumes, and whose level of consciousness is falling) are not candidates for CPAP; these patients *must* be ventilated with a bag-valve mask (and may benefit from PEEP use)
- Unable to fit mask to patient's face
- Vomiting or any other risk of aspiration
- Traumatic cause of respiratory distress
- Tracheostomy
- Suspected or known pneumothorax
- Systolic blood pressure < 90 mmHg

### Procedure

**BCEHS** | BC Emergency Health Services

### CPAP BLS Guidelines

**Indications**

Any adult patient ≥13 years of age in significant respiratory distress

- + Awake and follows commands
- + Maintains a patent airway
- + Exhibits all of the following:
  - R/R >24
  - SpO<sub>2</sub> <94 % (on O<sub>2</sub>)
  - Accessory muscle use

**Contraindications**

- Decreased LOC
- Resp. Arrest – Hypoventilation
- Vomiting – risk of aspiration
- Unable to fit mask
- Traumatic cause of SOB
- Pneumothorax
- SBP <90

**Call CliniciCall**

**CPAP Use**

1. Start at 5 L/min
2. Obtain facial seal
3. Reassess patient and vitals
4. Increase flow to 7 L/min
5. Reassess patient and vitals
6. Repeat to max of 8 L/min

**If patient deteriorates**

Remove CPAP and use BVM with assisted ventilations (consider PEEP valve if needed)

CPAP Reading (cmH <sub>2</sub> O)	5	6	7.5	10	12.5	15
Set Oxygen Flow (LPM)	5	6	7	8	9	10

**CliniciCall consultation recommended for PCPs prior to initiating CPAP therapy.**

1. Assemble appropriate equipment. Verify mask sizing by comparing the mask to the patient's face.
2. Explain the procedure and obtain consent.
3. Position the patient in an upright, sitting position. Attach pulse oximeter.
4. Connect the CPAP mask to the oxygen source. Set the flow to 5 LPM if possible (otherwise use 6 LPM).
5. Have the patient hold the CPAP mask over their nose and mouth. A progressive application of pressure to obtain a seal may be required to maximize the acceptance of the mask. Paramedics should be calm and reassuring.
6. Once the patient appears to be able to tolerate the mask, position the bonnet over the back of the head and attach the straps to the side of the mask. Adjust the Velcro and headpiece for optimal seal.
7. Examine the mask seal for leaks. Reassess the patient.
8. If SpO<sub>2</sub> remains below 92%, follow the manufacturer's flow rate chart. Incrementally raise the oxygen flow to increase both FiO<sub>2</sub> and CPAP pressure. Do not exceed 10 cmH<sub>2</sub>O.

## Notes

- Do not attempt to use the CPAP mask for bag-valve ventilations.
- Oxygen saturations may transiently fall during initial CPAP use. Allow time for the mask to work before adjusting the therapy.
- Do not delay the administration of medications to apply a CPAP mask.
- Use conventional therapies (e.g., bronchodilators) first in patients with audible wheezing. Nebulizers, connected to the mask with a T-piece, may be attached to the auxiliary port on the CPAP mask; in this case, increase the oxygen flow rate by 7-8 LPM.
- A do-not-resuscitate order or MOST does not preclude the use of CPAP for relief from shortness of breath.

## Resources

## References

1. BLS Systems. Rescuer II Compact CPAP System. [\[Link\]](#)

## PR10: Positive End Expiratory Pressure (PEEP)

Mike Sugimoto

### Applicable To

- PCP and higher

### Introduction

The addition of a Positive End-Expiratory Pressure (PEEP) valve to a bag-valve mask is a non-invasive means of increasing oxygenation in patients who are in significant respiratory distress or respiratory arrest where assisted ventilations are not able to maintain oxygen saturation. It maintains air pressure in the alveoli, "splinting" them open to increase the surface area involved in gas exchange.

### Indications

- Patients who remain hypoxemic ( $SpO_2 < 90\%$ ) despite good bag-valve mask ventilation techniques and airway management; it can be combined with high-flow nasal cannula oxygenation to maximize oxygen delivery

### Contraindications

- Patients in cardiac arrest
- Patients over 12 years of age: Systolic blood pressure  $\leq 90$  mmHg
- Patients under 12 years of age: Systolic blood pressure  $\leq$  lower limit for age range as per [pediatric vital signs](#)
- Known or suspected pneumothorax
- Traumatic cause of respiratory arrest

### Procedure

1. Attach the PEEP valve to the exhaust port on the bag-valve mask.
2. Set the dial on the PEEP valve to 5 cmH<sub>2</sub>O.
3. Establish and maintain a good mask seal. Begin ventilating at an appropriate rate, usually no more than 8-10 breaths per minute.
4. Monitor oxygen saturation and blood pressure for changes.
5. PEEP may be increased in increments of 2.5 cmH<sub>2</sub>O to a maximum of 10 cmH<sub>2</sub>O.
  - **ClinCall consultation required** if patients remain hypoxemic despite maximal oxygen therapy.
6. Continue with medications as appropriate to correct cause of respiratory distress or arrest.

### Notes

- To be effective, PEEP requires a complete mask seal (the "closed circuit"). Removing the mask from the patient's face will release the end-expiratory pressure and allow alveoli to collapse. For critically ill patients, paramedics should seek to minimize the amount of time the mask is not firmly sealed to the patient's face.
- Discontinue PEEP if any of the following occur:
  - The patient's systolic blood pressure drops below 90 mmHg
  - Any contraindication arises
  - Equipment failure or concerns

## PR11: Intranasal Medication Administration

Mike Sugimoto

### Applicable To

■ PCP and higher

### Introduction

Some medications in the BCEHS pharmacopeia can be administered intranasally. This is a relatively rapid route of delivery that can offer significant safety benefits over parenteral drug administration and may be preferred in some circumstances.

### Procedure

1. Using a blunt 3 mL syringe, draw up half the dose of medication. Note that the atomizer contains 0.1 mL of dead space: having calculated the volume of medication required for a given dose, draw an additional 0.1 mL into the syringe.
2. Remove the blunt or fill tip and attach the mucosal atomizer device to the syringe.
3. Verify that the nostrils are not obstructed by blood or mucous.
4. If the patient is sitting upright, tilt the patient's head back slightly. Otherwise, position the patient supine.
5. Dispense the volume into each nostril; this allows for more effective absorption. The maximum volume per nostril is 1 mL; if higher volumes are required, consider alternative routes of administration.
6. Repeat procedures 1-5 for the second half of the medication dose. (Drawing up half the dose of medication and administering twice ensures that the medication is delivered at the appropriate speed for proper atomization.)

### Resources

## PR12: Intraosseous Cannulation

Mike Sugimoto

### Applicable To

■ □ □ **PCP: requires completion of scope expansion education**

■ ACP and higher

### Introduction

Intraosseous cannulation is available as an option for paramedics requiring vascular access when peripheral attempts have failed.

### Indications

■ PCP

- □ □ **Requires completion of PCP scope expansion education:**
  - Following two unsuccessful peripheral IV attempts or an inability to visualize peripheral veins
  - PCPs may attempt IO cannulation in patients **in cardiac arrest ≥ 12 years old** where there is a **clear clinical history of hypovolemia**, where fluid administration is a critical component of the resuscitation plan.
  - **-OR-**
  - IO's may also be placed under direct supervision of a BCEHS ACP or higher
- The tibial site is the only site approved for PCP use. PCPs are limited to two collective attempts per patient only. Do not attempt to re-cannulate a site that has failed or been dislodged.

■ ACP

- Following two unsuccessful peripheral IV attempts or an inability to visualize peripheral veins (including external jugular vein)
- Unstable patient requiring medications or fluid replacement
- Important considerations:
  - The ACP (or higher) remains responsible for any anesthesia or pain management requirements.
  - Intraosseous placement must **not** delay or impair the delivery of high-quality CPR, effective airway management, or defibrillation. Placement should be deferred until at least three rounds of chest compressions, with AED analyses, have been completed.

### Contraindications

- Skeletal or tissue damage in the extremity to be used
- Prior proximal tibial surgery or knee joint replacement
- Signs of infection around the site
- Intraosseous placement at the same site in previous 48 hours
- ■ PCP: Not authorized for use in patients under 12 years of age (aligns with restrictions on IV initiation)

### Procedure

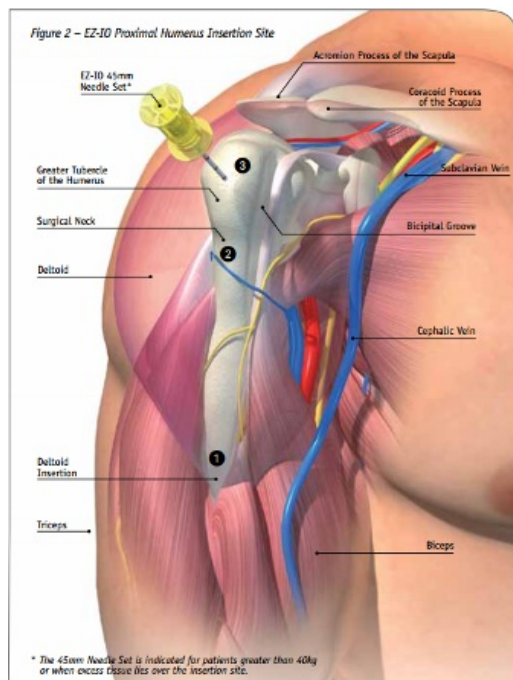
1. Assemble equipment, including EZ-IO driver, needle, primed EZ-Connect extension, infusion fluid and line set, and 10 mL syringe of normal saline.
2. Select the site of needle insertion and clean the skin.
3. Using aseptic techniques, drive the needle into the bone. Press gently: let the drill do most of the work.
4. Remove the stylet and securely discard the sharp. Place the stabilizer dressing over the needle hub.
5. Connect a primed EZ-Connect extension.
  - ■ **ACP (or PCP under direction of an on-scene ACP):** In patients who are conscious, prime the EZ-Connect extension with lidocaine

- see step 7.

6. Aspirate for the presence of bone marrow or blood to confirm the placement. If patent, connect the IV tubing to the EZ-Connect extension set. If unsuccessful, change to another site on a different limb. Do not reuse the same limb.
7. ■ **ACP (or PCP under direction of an on-scene ACP):** In patients who are conscious, administer [lidocaine](#), 40 mg (0.5 mg/kg in children to a maximum of 40 mg)
  - Instill the lidocaine slowly, over 120 seconds, making sure to administer the appropriate amount of lidocaine through the extension, and allow it to dwell in the bone marrow for 60 seconds.
  - Slowly flush the IO with 5-10 mL normal saline (2-5 mL in children) following the administration of lidocaine.
8. Connect the 10 mL syringe to the proximal access port on the IV tubing. Flush the line and the extension set, pushing *firmly* and *briskly* on the syringe plunger.
9. Set the appropriate flow rate. Pressure infusers or intermittent boluses may be required.
10. Protect the site and monitor for signs of extravasation.

## Notes

- Needle placement in the proximal humerus has been demonstrated to have significantly improved infusion rates compared to the tibial plateau. It should be considered as the preferred IO site in patients **under ACP care**. If using the humerus, choose the larger (yellow) needle. To review anatomy and landmarks, see video below.



- Tibial placement is the only permissible insertion site for PCPs.

### Proximal Tibia

- Extend the leg. Find the tibial tuberosity. Insertion site is approximately 2 cm medial or the mid-point between the medial and lateral portion along the flat aspect of the anterior tibia (depending on patient anatomy).
- If unable to palpate the tibial tuberosity, the insertion site is approximately 3 cm below the inferior border of the patella at the same site if tuberosity were palpated.
- Aim needle at a 90-degree angle to the bone for insertion.

- Paramedics should review [this educational material](#) for additional information about intraosseous site selection. Contact a

Paramedic Practice Educator for specific questions or concerns.

- Intraosseous catheters are approved for use in patients for up to 24 hours when placed in the proximal humerus and both the proximal and distal tibia. It may be extended for up to 48 hours in patients over the age of 12 under exceptional circumstances.

## Resources

Arrow®  
EZ-IO®  
Intraosseous Vascular Access System

### Proximal Humerus

#### Arm Positioning

Using either method below, adduct elbow, rotate humerus internally.



Place the patient's hand over the abdomen with arm tight to the body.



Place the arm tight against the body, rotate the hand so the palm is facing outward, thumb pointing down.

#### Landmarking



Place your palm on the patient's shoulder anteriorly.

- The area that feels like a "ball" under your palm is the general target area.
- You should be able to feel this ball, even on obese patients, by pushing deeply.



Place the ulnar aspect of one hand vertically over the axilla. Place the ulnar aspect of the opposite hand along the midline of the upper arm laterally.



Place your thumbs together over the arm.

- This identifies the vertical line of insertion on the proximal humerus.



Palpate deeply as you climb up the humerus to the surgical neck.

- It will feel like a golf ball on a tee – the spot where the "ball" meets the "tee" is the surgical neck.

The insertion site is on the most prominent aspect of the greater tubercle, 1 to 2 cm above the surgical neck.



Point the needle tip at a 45-degree angle to the anterior plane and posteromedial.



24 Hour Clinical Support: 1-888-413-3104

### Tibial placement:

### Humeral landmarking:



## References

- 2024-05-01: updated PCP scope information
- 2023-09-29: added PCP scope information

## PR13: External Jugular Cannulation

Mike Sugimoto

### Applicable To

- ACP and higher

### Introduction

External jugular cannulation is a vascular access option that allows for relatively large bore devices and the delivery of larger volumes of fluid than might otherwise be possible through a peripheral vein.

### Indications

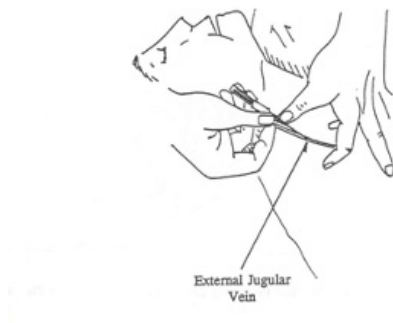
- A need for vascular access where peripheral access is not possible and intraosseous access is unavailable

### Contraindications

- No absolute contraindications. This can be a time-consuming procedure; if speed is a requirement, consider [PR12: Intraosseous Cannulation](#).

### Procedure

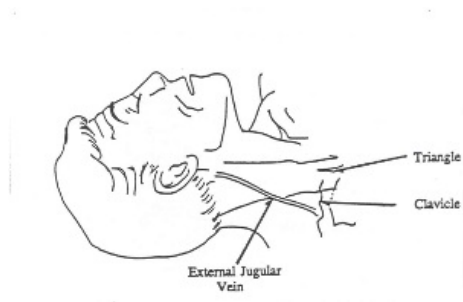
1. Place the patient in a supine, head-down position to fill the jugular vein. Turn the patient's head to the opposite side (i.e., looking away from the proposed cannulation site).
2. Clean the skin with alcohol.
3. Align the cannula with the vein and the point of the needle aimed at the shoulder on the same side.
4. While applying pressure to the vein above the clavicle to provide a tourniquet effect, make the venipuncture midway between the angle of the jaw and the clavicle.



### Notes

#### Anatomy

The external jugular vein is formed below the ear and behind the angle of the mandible, where a branch of the posterior facial vein joins the posterior auricular vein. The external jugular vein then passes downward, and obliquely backward, across the surface of the sternomastoid muscle before piercing the deep fascia of the neck just above the middle of the clavicle, ending in the subclavian vein lateral to the anterior scalene muscle. Valves are present in this vein at the entrance to the subclavian vein and about four centimeters above the clavicle.



## PR14: Orogastric Tube Placement

Mike Sugimoto

### Applicable To

- ACP and higher

### Introduction

High volumes of air or fluid in the stomach can significantly affect a patient's ability to be ventilated by bag-valve mask and limit the effectiveness of chest compressions by inhibiting the return of venous blood to the thorax. In these cases, the stomach should be decompressed by placement of an orogastric tube.

### Indications

- Cardiac arrest
- Gastric distension interfering with effective ventilations

### Contraindications

- Use extreme caution if there is a history of caustic ingestion or esophageal varices

### Procedure

1. Assemble and prepare equipment:
  - Gastric tube (14 Fr or 16 Fr)
  - Water soluble lubricating gel
  - Laryngoscope
  - 30–60 mL catheter-tip syringe (not Luer lock)
  - Stethoscope
  - Personal protective equipment, including gloves and face shield
  - Suction tubing
  - Tape
2. Estimate the length of tube required: measure the distance from the epigastrium to the corner of the mouth or nose, passing by the earlobe.
3. Using aseptic technique, lubricate the distal 7.5 to 10 cm of the tube.
4. Visualize the esophagus using a laryngoscope.
5. Insert the tube and advance to the desired depth.
6. Check tube placement by auscultating over the epigastrium while injecting 20–30 mL of air down the tube. Bubbling or “whooshing” sounds should be heard. If sounds are not heard, advance the tube by another 2.5–5 cm and re-check.
7. Once tube placement has been confirmed, secure the tube with tape. Connect to suction at low vacuum.

## PR15: Tracheal Tube Introducer

Mike Sugimoto

### Applicable To

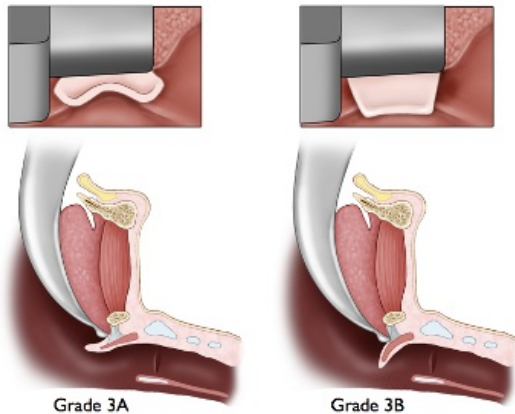
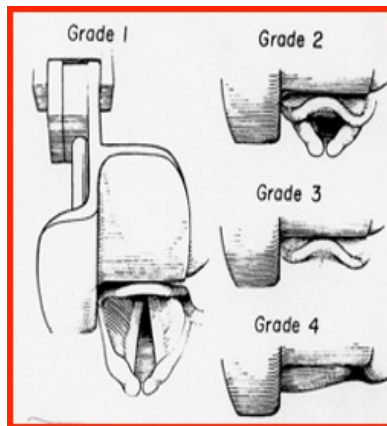
■ ACP and higher

### Introduction

The tracheal tube introducer (bougie) is a tool to assist with the placement of an endotracheal tube into the trachea in cases where an optimal view cannot be obtained on direct laryngoscopy after lifting the head, performing extralaryngeal manipulation, or both.

### Indications

Although bougies may be used in virtually all scenarios, they are intended primarily for patients who demonstrate a Grade 3A Cormack-Lehane view on laryngoscopy: the epiglottis is upturned and the arytenoid cartilages may or may not be visible. They can also be helpful in patients with Grade 2 views to assist in tube placement.



### Contraindications

Patients with Grade 3B or 4 views; paramedics should not "fish" with the bougie in search for the glottic opening and the trachea.

### Procedure

1. Introduce the coude tip of the bougie from the right corner of the patient's mouth.
2. Advance the bougie towards the midline, beneath the epiglottis, while attempting to keep the distal tip in contact with the posterior surface of the epiglottis.

3. A slight “pop” or distinct tactile change may be felt when the bougie passes through the glottic opening. Two separate tactile phenomena will allow paramedics to confirm the bougie is in the trachea rather than the esophagus:
  - Once the bougie has passed through the vocal cords, a fine “clicking” sensation may be felt as the bougie tip rubs against the cartilage rings in the trachea. (Some operators describe this as a “sandpaper” feeling of the bougie.)
  - With continued advancement, the bougie will eventually “hang up” in a smaller distal airway. In most patients, this will occur around the 30 cm mark. If the bougie can be advanced further than 30 or 35 cm, it is very likely in the esophagus. Once “hold up” has been achieved, the bougie should be withdrawn to around the 25 cm mark (i.e., out of the smaller distal airways and bronchi and back into the trachea).
4. The endotracheal tube can be advanced over the bougie and into the trachea. Hold the laryngoscope in position during this process; do not remove the blade until the cuff on the endotracheal tube is inflated. Continued laryngoscopy will help the endotracheal tube to advance into the trachea.
5. Common problems with bougie use include:
  - Failure to access the trachea. This is often the result of the bougie becoming caught on a vocal fold. To resolve, rotate the bougie to the left or right while maintaining forward pressure.
  - Failure to advance the endotracheal tube. This is often caused by the bevel of the endotracheal tube catching on the right vocal fold. Hold the laryngoscope in position and rotate the tube counter-clockwise by 90°; this will direct the bevel away from the right fold and allow smoother passage. If this fails to allow the tube to advance, consider a smaller tube size.

## Resources

## References

1. Kovacs G, et al. Airway Management in Emergencies. Second Edition. 2011.
2. Levitan R. Tips for Handling the Bougie Airway Management Device. 2014. [\[Link\]](#)
3. The Resus Room. Why I Use a Bougie on Every Airway. 2017. [\[Link\]](#)

## PR16: 12-Lead ECG Acquisition

### Applicable To

- PCP as trained and authorized, or under direction
- PCPs require completion of online and face-to-face training **and** endorsement from EMALB
- ACP and higher

### Introduction

The 12-lead electrocardiogram is one of the most useful diagnostic tests in medicine and is a critical component in out-of-hospital care and decision-making. It allows paramedics to view the rhythm of the heart and provides important information about the state of blood flow to various regions of the heart.

### Indications

- Suspicion of cardiac ischemia or rhythm disturbance

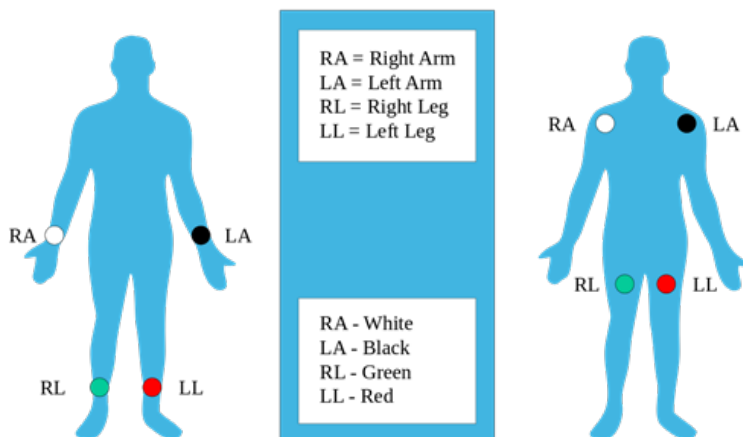
### Contraindications

- As a diagnostic procedure, there are few absolute contraindications to 12-lead ECG acquisition; paramedics must ensure that the time needed to acquire a 12-lead ECG does not interfere with priority patient management tasks

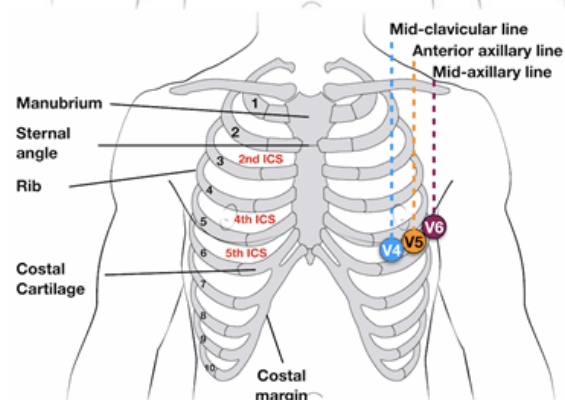
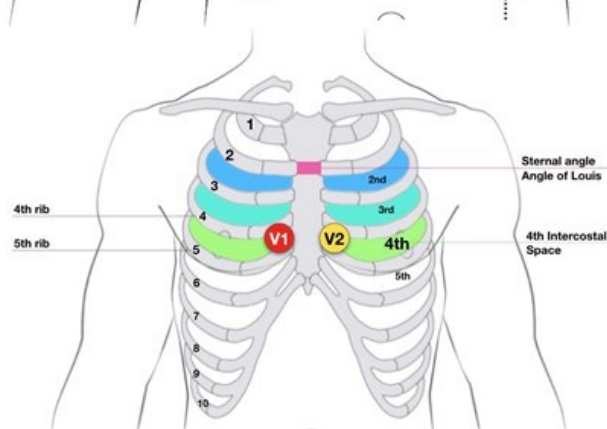
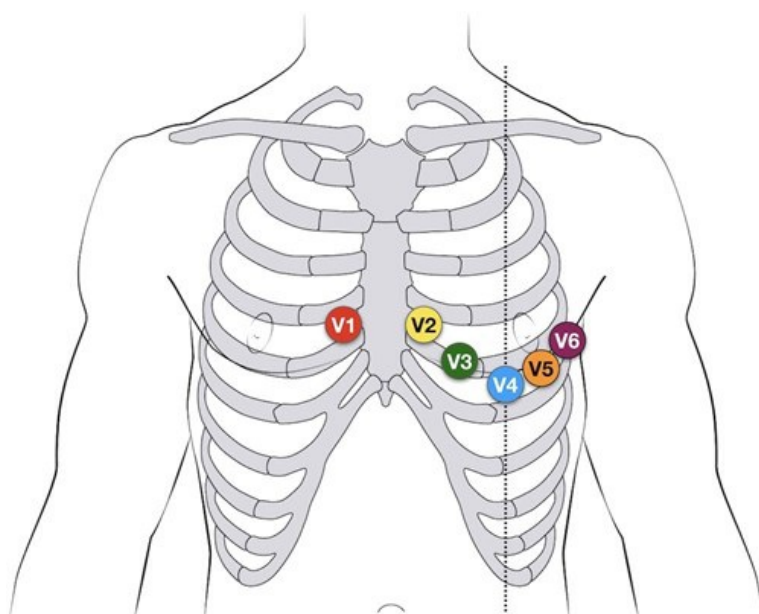
### Procedure

#### Procedure: Standard 12-Lead ECG

1. Assemble required equipment. Connect electrodes to lead wires before placing them on the patient and connect the cables to the monitor. Ensure cables are not tangled.
2. Prepare the patient's skin as discussed below in 'Notes.'
3. Place the limb leads in the appropriate locations. RA and LA leads can be placed on the deltoids or wrists. RL and LL should be placed near the ankles (or alternatively, on the lower left leg). In all cases, ensure the leads are not positioned over bone.



4. Landmark and place the precordial leads in their appropriate locations. Find the clavicle and identify the Angle of Louis as illustrated.



- V1 is located at the fourth intercostal space on the right of the sternum.
  - V2 is also at the fourth intercostal space, but on the left side of the sternum.
  - V3 is located between V2 and V4. For ease of placement, inexperienced operators should place V3 *after* V4 has been positioned.
  - V4 is placed at the fifth intercostal space on the mid-clavicular line. Generally, this will be inferior to the left nipple.
  - V5 is also at the fifth intercostal space, but on the anterior axillary line.
  - V6 is level with V5 on the mid-axillary line.
5. Ask the patient to remain still, relax their body, not talk, and to breathe calmly. Press the "12 Lead" button on the LifePak 15. The monitor will prompt for an age and gender. Use the scroll wheel to enter the requested information and push the wheel to confirm each entry. (This information is critical for the machine interpretation algorithm and can also affect the processing of ECG signals by the LifePak 15. Paramedics must make every effort to enter this information accurately.)

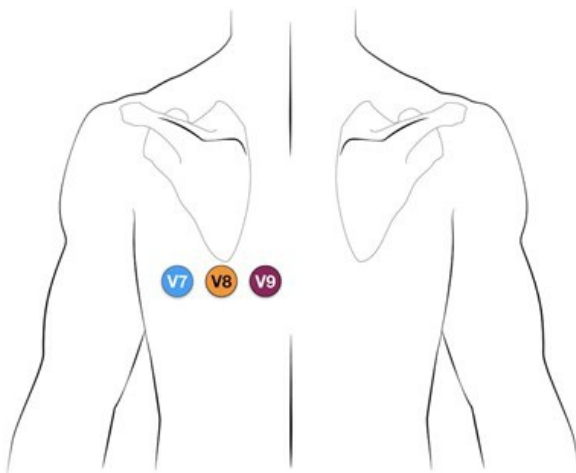


6. The monitor will attempt to acquire the ECG. If '**NOISY DATA – PRESS 12 LEAD TO ACCEPT**' appears, attempt to identify the source of the problem (e.g., loose electrode contact, patient movement, tension on the lead wires, etc.) and correct the issue. The LifePak 15 will abandon the ECG recording if the noisy data persists for more than 30 seconds ('**EXCESSIVE NOISE – 12 LEAD CANCELLED**'); in this case, restart the acquisition process by pressing "12 Lead" again. If the noise persists, the LifePak 15 can be forced to acquire an ECG at the discretion of the ACP – press the "12 Lead" button when prompted to override.
7. If the ECG is to be transmitted, press the "Options" button and select "Patient" from the menu. The patient's name, PHN, or date of birth (in the "Patient ID" field), and the onset of pain (in the "Incident ID" field), can then be entered using the scroll wheel. The inclusion of this information is very important to minimize delays on arrival at hospital.
8. To transmit the ECG, press the "Transmit" button. Select the desired ECG record and destination site, then select "Send" from the menu.
9. ECGs may be re-printed by pressing "Options," selecting "Print," and then choosing the appropriate record.

#### Procedure: Posterior Leads

In some cases, a view of the posterior heart is needed, particularly in patients with marked precordial ST depression.

1. Acquire a standard 12-lead ECG.
2. Disconnect V4, V5, and V6 from their traditional placements.
3. Using new electrodes, with the patient leaning forward:

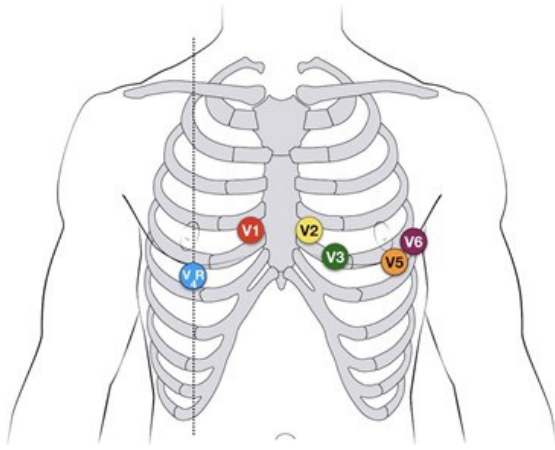


- Place the V4 electrode on the left posterior axillary line in the same plane as V6. This electrode becomes V7.
  - Place the V5 electrode at the tip of the left scapula, in the same horizontal plane as V6. This electrode becomes V8.
  - Place the V6 in the left paraspinal region, in the same plane as the other electrodes. This electrode becomes V9.
4. Acquire the ECG.
  5. Once the LifePak 15 prints the ECG, mark V4, V5, and V6 with their new designations of V7, V8, and V9 on the rhythm strip.

#### Procedure: Right-Sided Leads

The right-sided chest lead is very helpful in diagnosing right ventricular infarctions.

1. Acquire a standard 12-lead ECG.
2. Disconnect V4 from its traditional placement.
3. Using a new electrode, place V4 at the fifth intercostal space on the mid-clavicular line. This becomes V4R and is essentially the "mirror image" of V4 on the left chest.



4. Acquire the ECG.
5. Once the ECG is printed, mark V4 as V4R on the rhythm strip.

#### Procedure: Lewis Leads

The Lewis Lead ECG is used in order to have a specific and detailed view of atrial activity. This may be clinically useful when atrial flutter is suspected but not clearly demonstrated, or to detect P waves in a wide complex tachycardia.

1. To create the Lewis Lead, move the right arm electrode to the 2nd intercostal space, right of the sternum. Move the left arm electrode to the 4th intercostal space, right of the sternum (traditionally the landmark for V1).
2. Leave the lower limb leads in place.
3. To read the Lewis Lead, print rhythm strip in 'Lead I'.

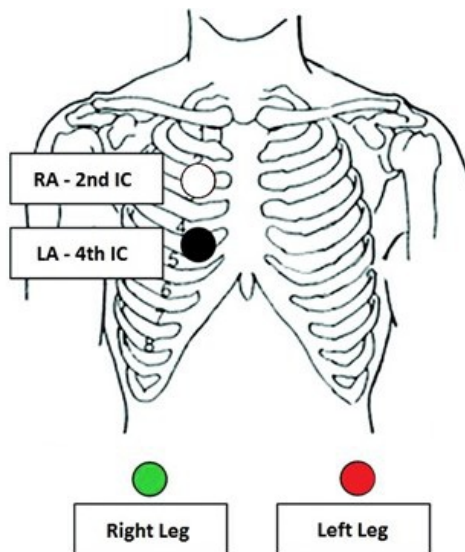


Image Credit: [Life in the Fast Lane ECG Library](#)

#### Notes

- 12-lead ECG acquisition is a relatively intimate procedure. Paramedics should strive to preserve patient dignity whenever possible by using gowns or towels.
- Tips for improved ECG quality:
  - Skin preparation can significantly improve the quality of the ECG signal. Shave hair at the site of electrode placement whenever possible. An alcohol wipe can be used to help dry the skin when it is sweaty and a gauze pad can be used to rub the skin briskly to remove sweat, oil, and dead skin cells, improving contact.
  - The conduction of ECG electrodes is improved as they warm. Consider ensuring that electrodes are stored at room temperature (up to body temperature is ideal).
  - Do not press on the center of the electrode while applying it to the patient. Press around the circumference of the electrode to ensure proper adhesion.

- Patients should be supine or semi-recumbent during ECG acquisition. Their limbs should be fully supported.
- The Angle of Louis can be identified by placing a finger in the notch at the top of the sternum. Move the finger downward until a slight ridge or bump is felt, then slide the finger laterally to the patient's right side to locate the second rib and the second intercostal space immediately below. Count down two more intercostal spaces; this is the fourth intercostal space and V1 is placed immediately adjacent to the sternum.
- V4 may be placed under the breast if necessary.
- In patients who have been resuscitated from cardiac arrest, wait at least ten minutes following sustained return of spontaneous circulation before attempting to record a 12-lead ECG.

## References

1. BCEHS STEMI Program Manual (link forthcoming)
2. Life in the FastLane. ECG Lead Positioning Basics. [\[Link\]](#)

# Wolff-Parkinson-White (WPW) Syndrome

## Definition

Pre-excitation disorder of the cardiac conduction system, predisposing one to re-entrant tachyarrhythmias.

## History and Physical Exam

Often asymptomatic, but may have history suggestive of tachyarrhythmias: palpitations, chest pain, SOB, dizziness and/or syncope.

## Key 12-Lead Features

Short PR interval and characteristic Delta wave.

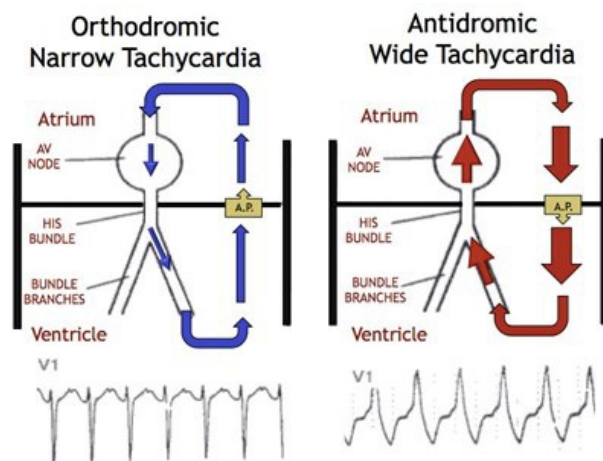
During captured AVRT episodes: orthodromic WPW is a Narrow Complex Tachycardia and looks like an SVT; antidromic WPW is a Wide Complex Tachycardia and looks like VT.

## Key Treatment Points

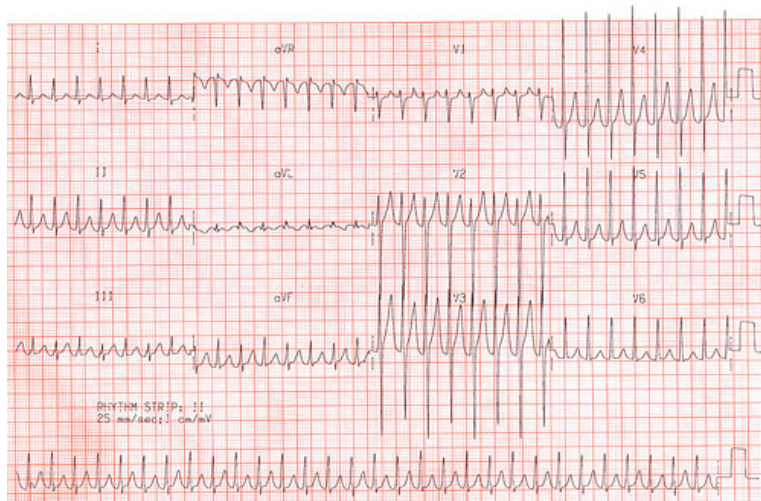
No adenosine with concurrent Atrial-Fibrillation (or any irregular rhythm)

If unstable, proceed directly to electrical cardioversion

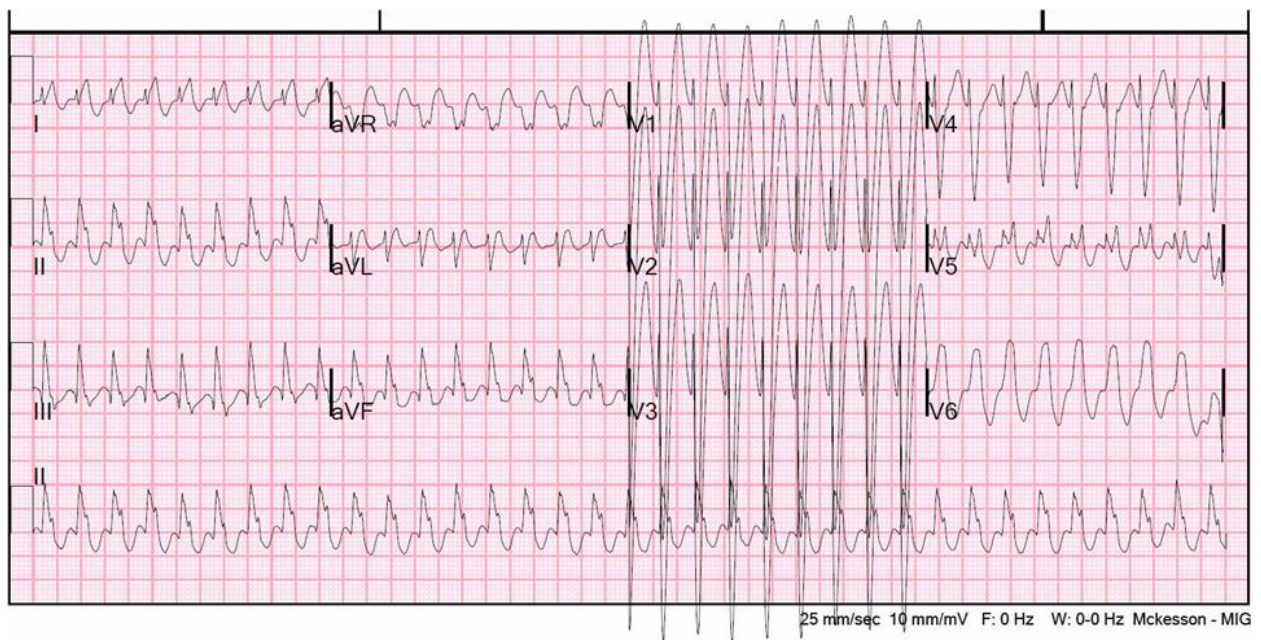
## 12 Lead ECG Samples



Orthodromic WPW tachycardia episode



Antidromic WPW tachycardia episode



Delta Wave





[Further Reading](#)

## Reference

1. Stroobandt RX, et al. ECG from Basics to Essentials: Step by Step. 2015. [[Link](#)]

# Pulmonary Embolism

## Definition

A sudden blockage in an artery of the lung.

## Wells Criteria for Suspected PE

Criterion	Points
Clinically suspected DVT (pain with palpation, unilateral edema, varicose veins)	3.0
PE Diagnosis is as likely or more likely than another differential	3.0
Tachycardia (HR > 100/min)	1.5
Immobilization/Surgery (in last 4 weeks)	1.5
Previous DVT/PE	1.5
Hemoptysis	1.0
Malignancy (treated within last 6 months)	1.0

Score	Risk	Probability of PE	% of Patients with this Score
> 6	High	66.7%	7%
3-6	Moderate	20.5%	53%
0-2	Low	3.6%	40%

## Key 12-Lead Features

Sinus tachycardia (73% sensitivity)

Prominent S-wave in Lead I (73%)

"Clockwise rotation" / late precordial transition (56%)

T-wave inversion in 2+ precordial leads (50%)

Incomplete or complete RBBB (20-68%)

P-pulmonale (28-33%)

Right axis deviation (23-30%)

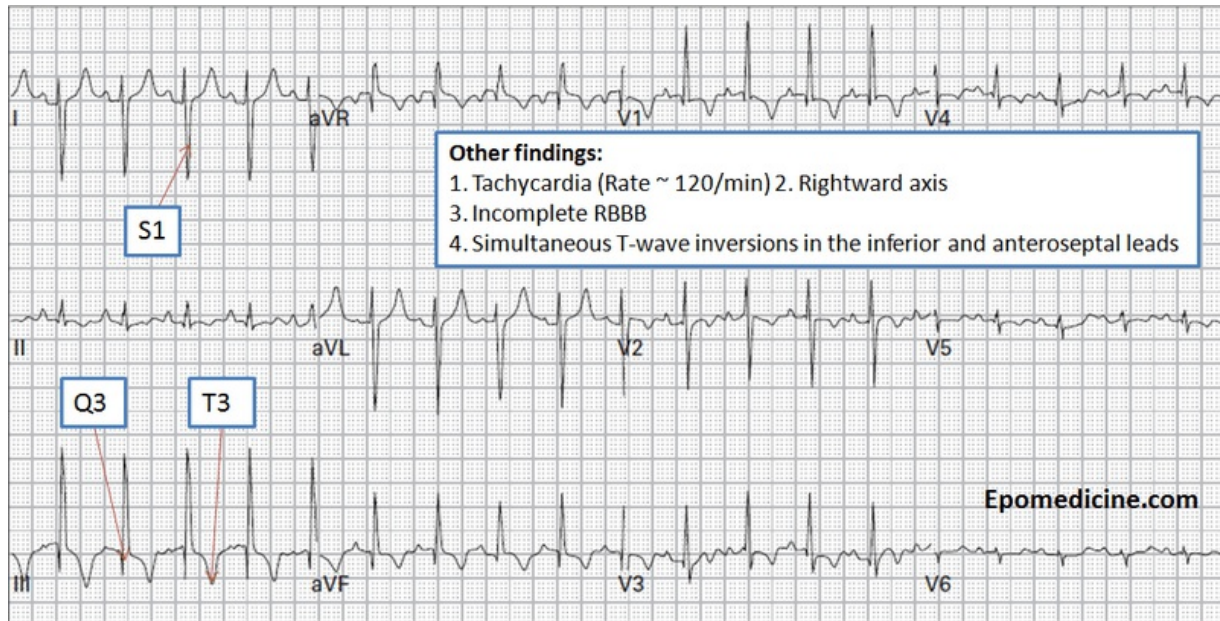
No significant findings (20-24%)

S1Q3T3 (12-25%) (pressure overload of the right ventricle)

## Key Treatment Points

Rapid conveyance to hospital, including in cardiac arrest

## 12 Lead ECG Samples



[Further Reading](#)

### Reference

Stein PD, Woodard PK, Weg JG, Wakefield TW, Tapson VF, Sostman HD, Sos TA, Quinn DA, Leeper KV, Hull RD, Hales CA, Gottschalk A, Goodman LR, Fowler SE, Buckley JD (2007). "Diagnostic pathways in acute pulmonary embolism: recommendations of the PIOPED II Investigators". *Radiology* 242 (1): 15-21.



# Long QT Syndrome

## Definition

Prolonged QT interval; a propensity to ventricular tachy-arrhythmias, syncope, cardiac arrest, or sudden death.

## History/Physical Exam

May be congenital or due to hypomagnesemia/kalemia (diuretics, malnourished), hypothermia, Rx (amiodarone, cipralex, methadone, etc). Family history of unexplained sudden death.

Presents with syncope from adrenergic stimuli - such as exercise, emotion, loud noise, swimming.

## Key 12-Lead Features

QTc > 0.46 (women)

QTc > 0.45 (men)

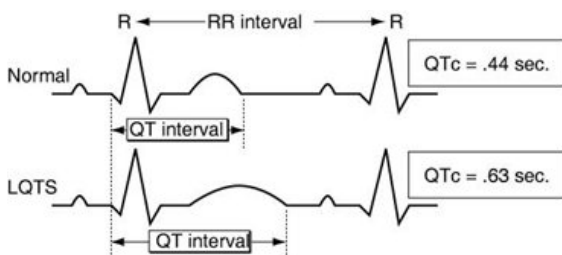
T-wave alternans

## Key Treatment Points

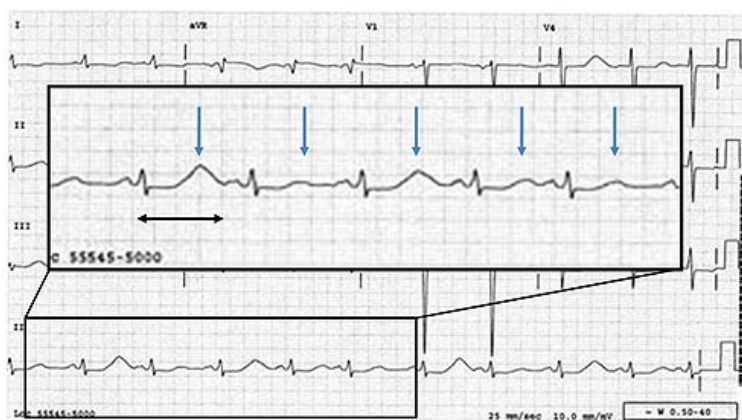
Watch for Torsade de Pointes

If patient arrests, Magnesium Sulfate is indicated

## 12 Lead ECG Samples



Notice the T-Wave alternans below



[Further Reading](#)

## References

El-Sherif, N., Turitto, G., & Boutjdir, M. (2017). Congenital Long QT syndrome and torsade de pointes. *Annals of Noninvasive Electrocardiology*. doi:10.1111/anec.12481.

# Hyperkalemia

## Definition

Serum potassium > 5.5mEq/L, associated with lethal arrhythmias and hemodynamic compromise.

## History/Physical Exam

Hx of renal failure, rhabdomyolysis, burns, potassium-sparing diuretics, NSAIDs,  $\beta$ -blockers.

Often presents with fatigue, weakness, or paresthesia. May present with paralysis, dyspnea, or chest pain.

## Key 12-Lead Features

Flattened P waves, prolonged PR intervals, borderline widened QRS complexes and pointed, narrow, and tall tented T waves.

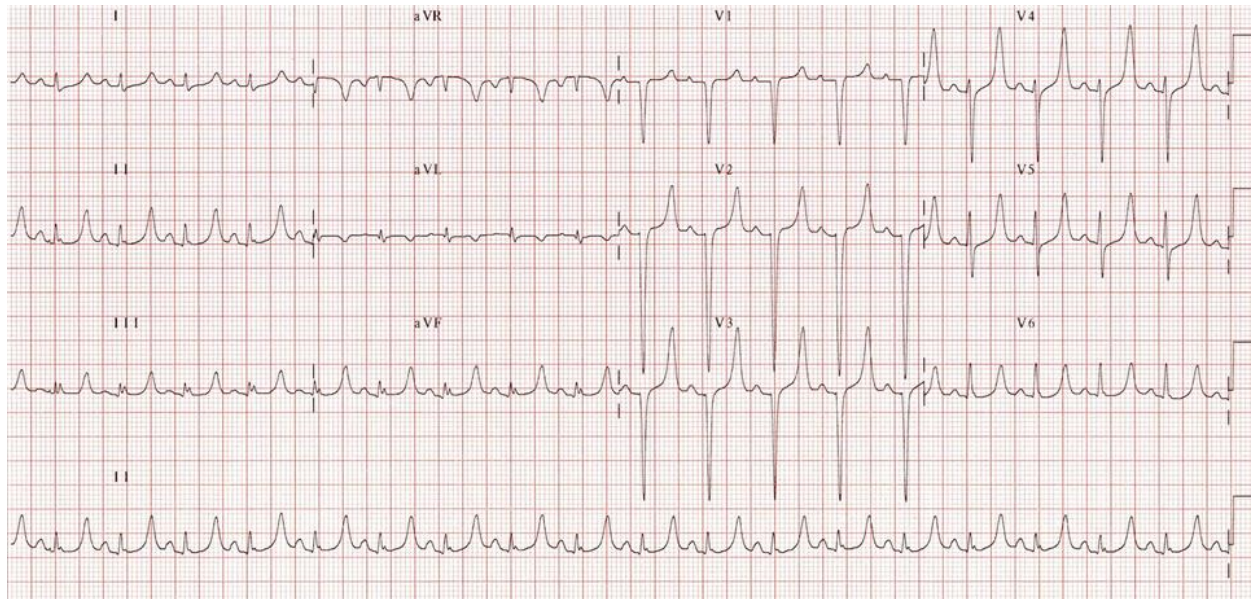
May progress to bradycardia, bizarre and wide QRS complexes, or sine waves.

## Key Treatment Points

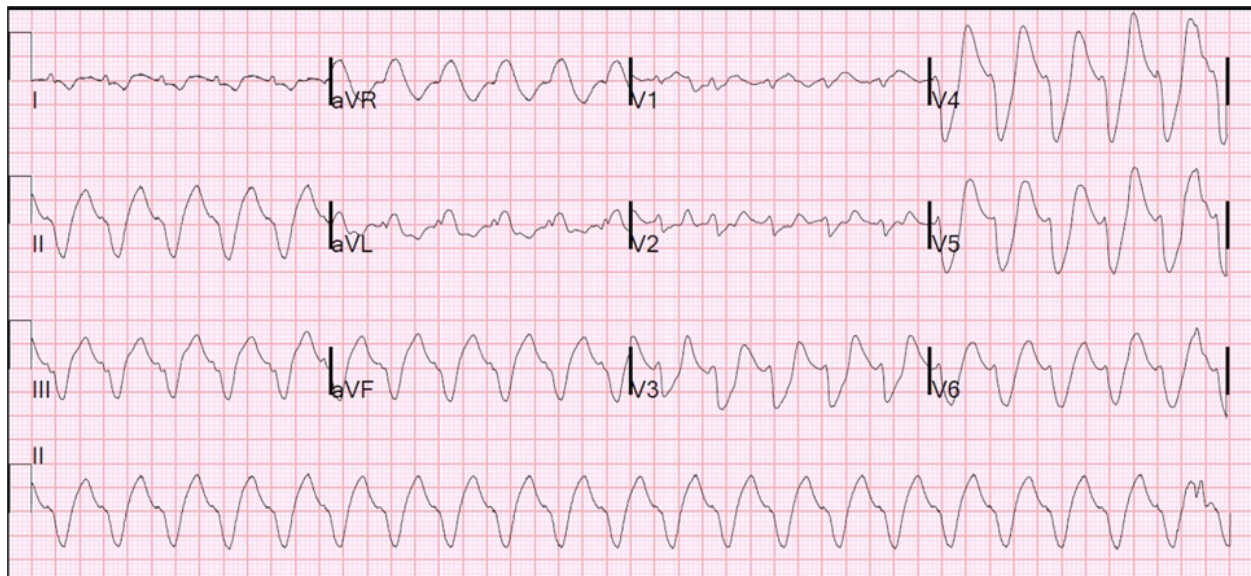
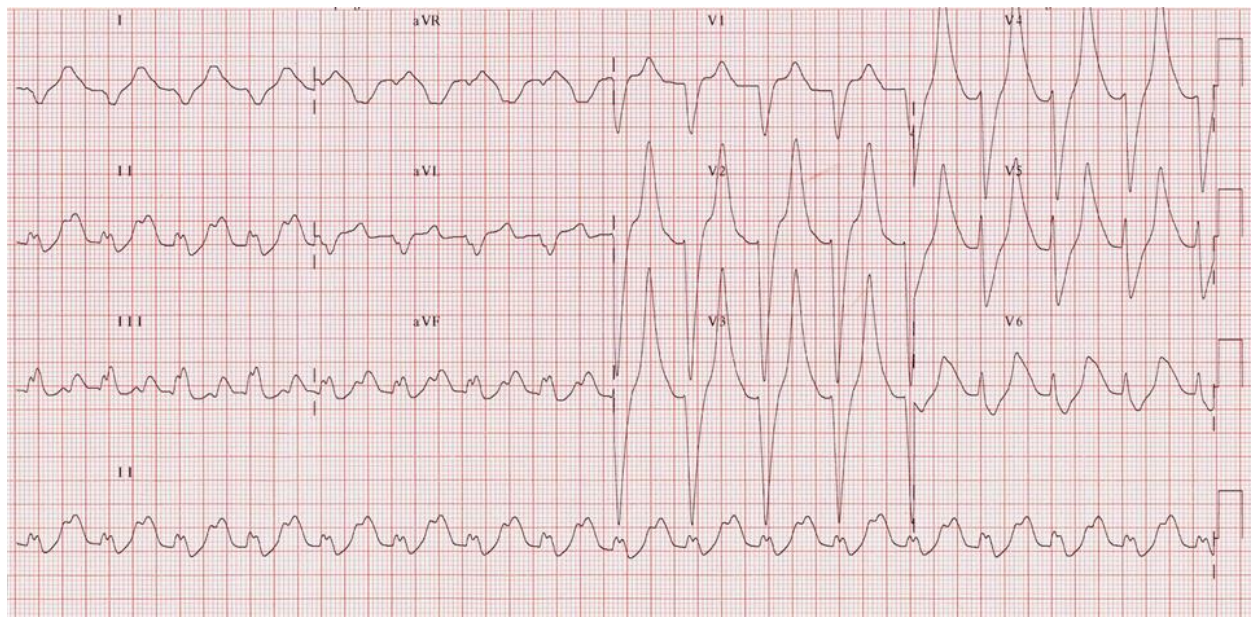
If patient is in arrest, front-load with Calcium Chloride and Sodium Bicarbonate

Salbutamol - 10-20mg nebulized may reduce serum K<sup>+</sup> 0.5-1.5mEq

## 12 Lead ECG Samples







[Further Reading](#)

## References

Heidari, S. F. (2016). Life-Threatening Severe Hyperkalemia Presenting Electrocardiographic Changes. *Journal of Intensive and Critical Care*, 02(03). doi:10.21767/2471-8505.100045.

# Brugada Syndrome

## Definition

Patients prone to developing arrhythmias and sudden death.

## History/Physical Exam

Young, healthy patients - often males. May be of South Asian descent.

Family Hx of sudden cardiac death, often while sleeping. Syncope Hx, generally at rest without prodrome. Night terrors.

Normal Physical Exam.

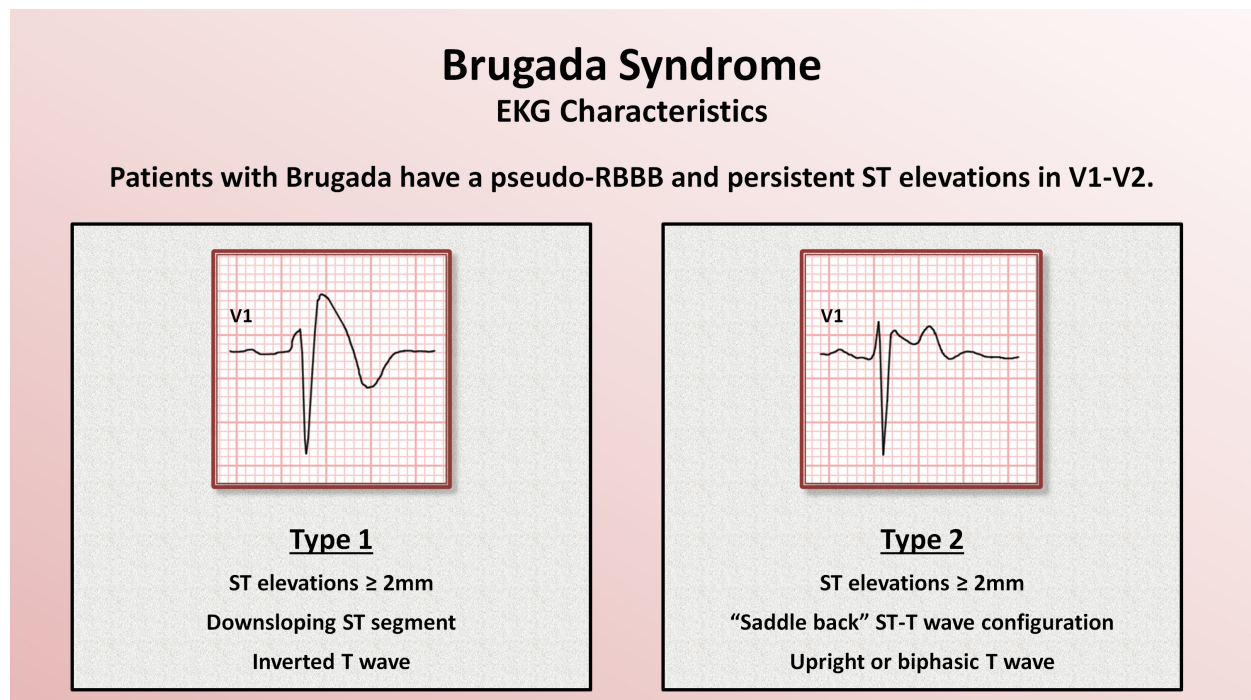
## Key 12-Lead Features

Incomplete right bundle-branch block and ST elevations in the anterior precordial leads.

## Key Treatment Points

Patient advocacy for a cardiology consult

## 12 Lead ECG Samples



[Further Reading](#)

## References

Tse, G., Liu, T., Li, K. H. C., Laxton, V., Chan, Y. W. F., Keung, W., Yan, B. P. (2016). Electrophysiological Mechanisms of Brugada Syndrome: Insights from Pre-clinical and Clinical Studies. *Frontiers in Physiology*, 7, 467. <http://doi.org/10.3389/fphys.2016.00467>.



# Hypertrophic Obstructive Cardiomyopathy

## Definition

Inherited genetic condition in which the heart muscle becomes abnormally thick and prone to tachy-arrhythmias.

## History/Physical Exam

Often presents in young, athletic patients.

May present with dyspnea, syncope/presyncope, angina, palpitations, orthopnea, paroxysmal nocturnal dyspnea (PND), CHF, and sudden cardiac death. Additionally, systolic crescendo-decrescendo murmur, decreasing on standing.

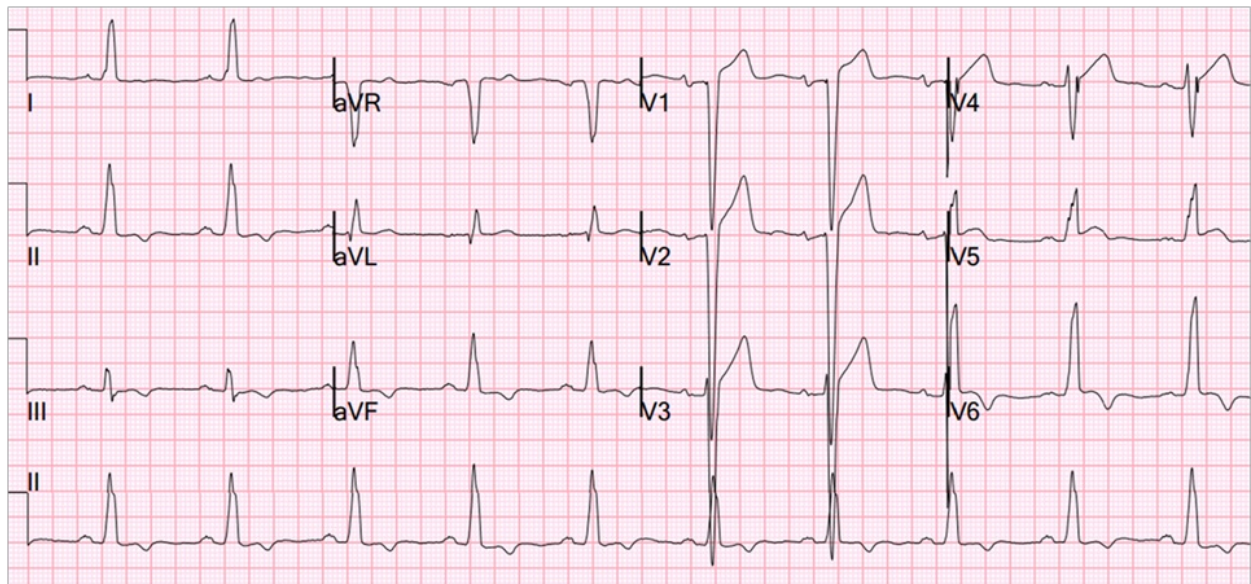
## Key 12-Lead Features

High Left Ventricular Volume, possibly w/ pathological Q-waves in lateral/anterior leads, ST changes and/or T wave inversions.

## Key Treatment Points

Patient advocacy for a cardiology consult

## 12 Lead ECG Samples



[Further Reading](#)

## References

Helmy, S. M., Maaouf, G. F., Shaaban, A. A., ElMaghraby, A. M., Anilkumar, S., Shawky, A. H. H., & Hajar, R. (2011). Hypertrophic Cardiomyopathy: Prevalence, Hypertrophy Patterns, and Their Clinical and ECG Findings in a Hospital at Qatar. *Heart Views: The Official Journal of the Gulf Heart Association*, 12(4), 143–149. <http://doi.org/10.4103/1995-705X.90900>.

# Wellens Syndrome

## Definition

Pre-infarction stage of coronary artery disease suggesting 80-90% LAD occlusion that often progresses to a devastating anterior wall MI.

## History/Physical Exam

Following an ischemic event suggestive of unstable angina. ECG findings are generally only visible once patient is pain free.

## Key 12-Lead Features

TYPE A: Biphasic T waves, most commonly in leads V2 and V3. Presents with upstroke/down-stroke. Approximately 25% of the time.

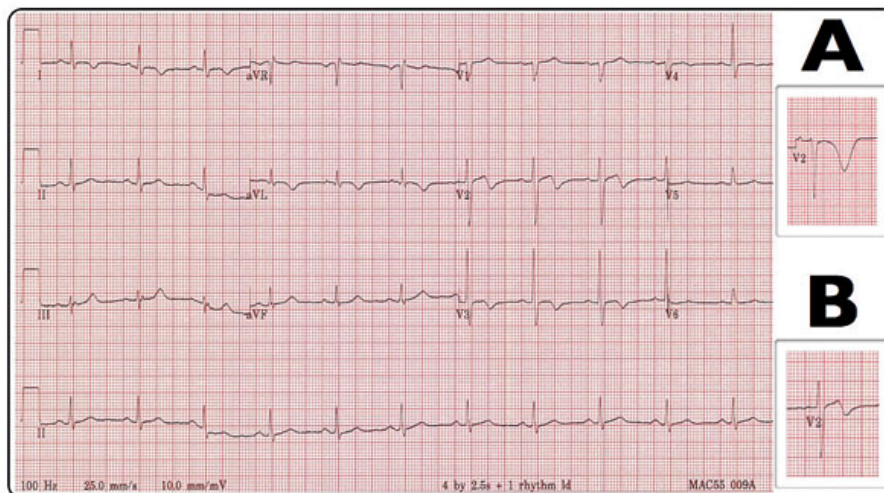
TYPE B: Deep inversion of the T-wave segment in the precordial leads, V1-V4. Approximately 75% of the time.

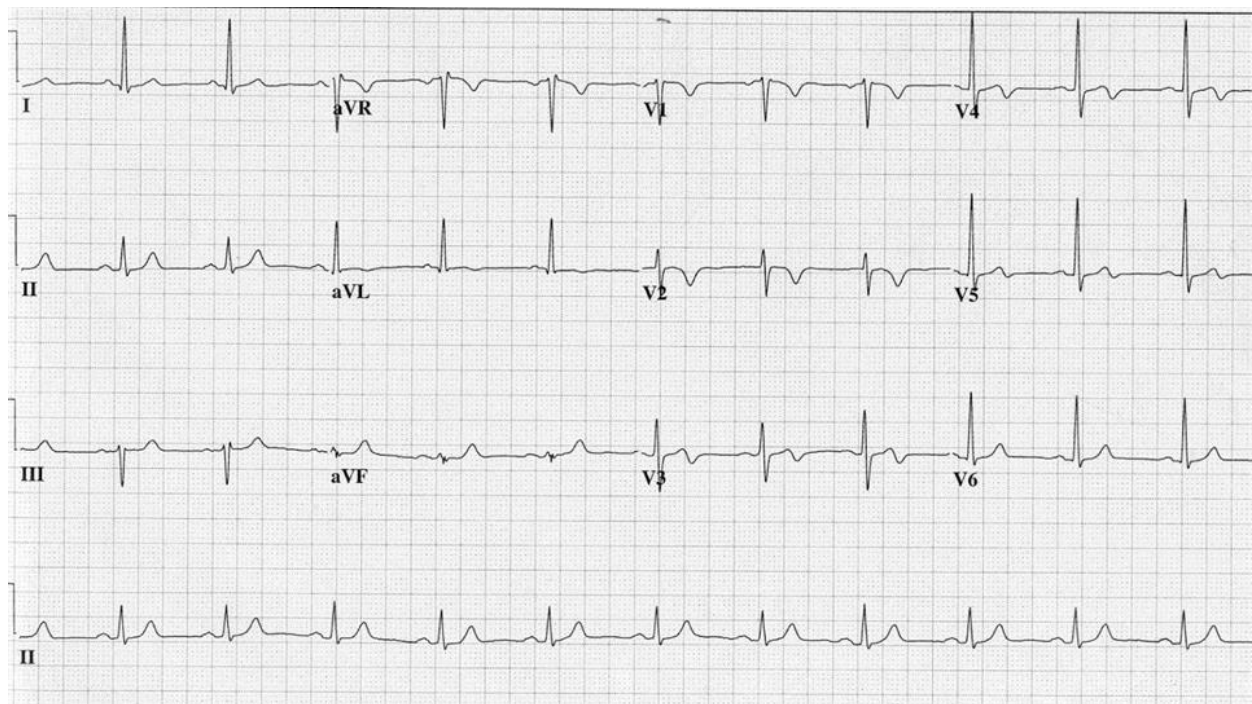
## Key Treatment Points

Patient advocacy for a cardiology consult

Monitor for potential emerging STEMI

## 12 Lead ECG Samples





[Further Reading](#)

## References

Rhinehardt J, Brady WJ, Perron AD, Mattu A. Electrocardiographic manifestations of Wellens' syndrome. *Am J Emerg Med*. 2002 Nov;20(7):638-43. PubMed PMID: 12442245.



## Left Bundle Branch Block

### Definition:

Conduction abnormality of the left ventricle, causing wide QRS complexes and ST changes mimicking STEMI.

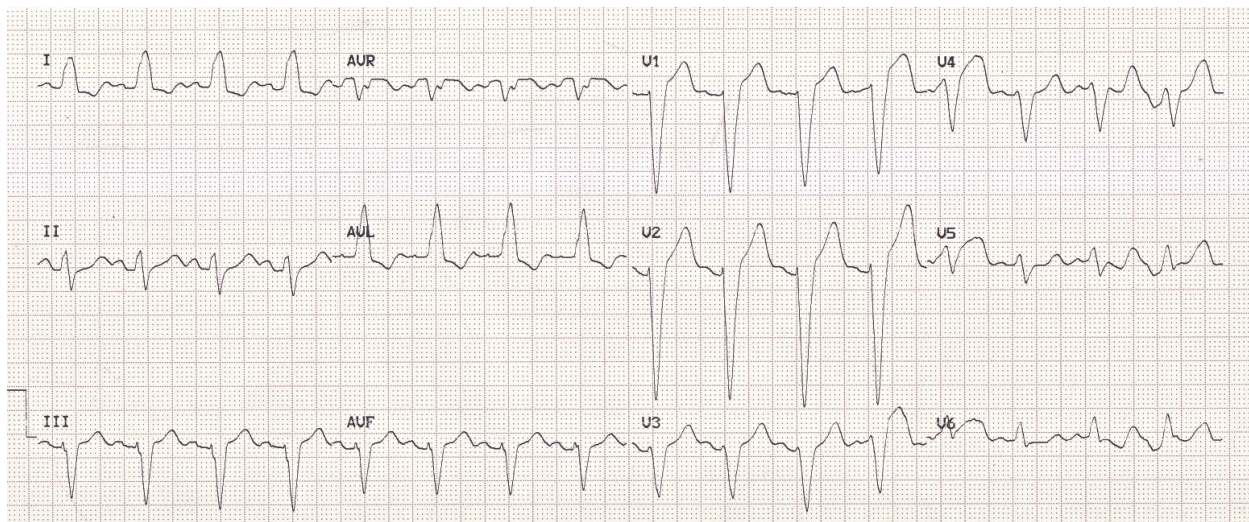
### History/Physical Exam:

History of CAD, hypertension, previous MI.

### Key 12-Lead Features:

- QRS > 120ms
- Prominent S (V1-3) / prominent R (V5/6, I/aVL)
- ST Elevation common in V1-4
- See [Sgarbossa Criteria](#) for Diagnosing MI in the presence of LBBB

### 12 Lead Sample



### References

1. Da Costa D, et al. Bradycardias and atrioventricular conduction block. 2002. [\[Link\]](#)

## Benign Early Repolarization

### Definition:

Benign ECG pattern mimicking STEMI.

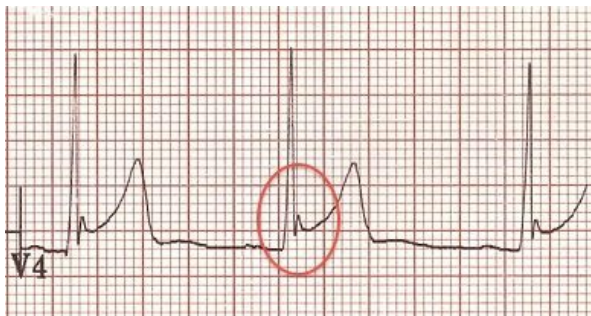
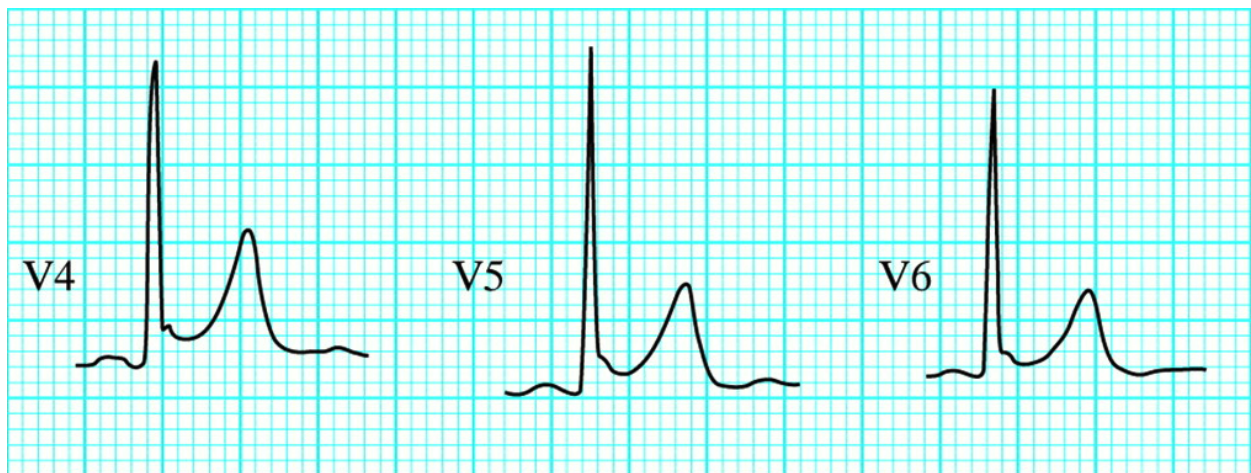
### History/Physical Exam:

Often young healthy males. May be found with concurrent chest pain. Common < 50 y/o, rare > 70 y/o.

### Key 12-Lead Features:

- Widespread concave ST elevation with J point elevation
- May have 'fish-hooked' Osborne wave
- No reciprocal ST depression to suggest STEMI (except in aVR)
- ST changes are relatively stable over time (no progression on serial ECG tracings)

### 12 Leads Samples



### References

1. Edhouse J, et al. ABC of clinical electrocardiography: Acute myocardial infarction-Part II. 2002. [\[Link\]](#)
2. Haissaguerre M, et al. Sudden cardiac arrest associated with early repolarization. 2008. [\[Link\]](#)

## Pericarditis

### Definition

Inflammation of the pericardium.

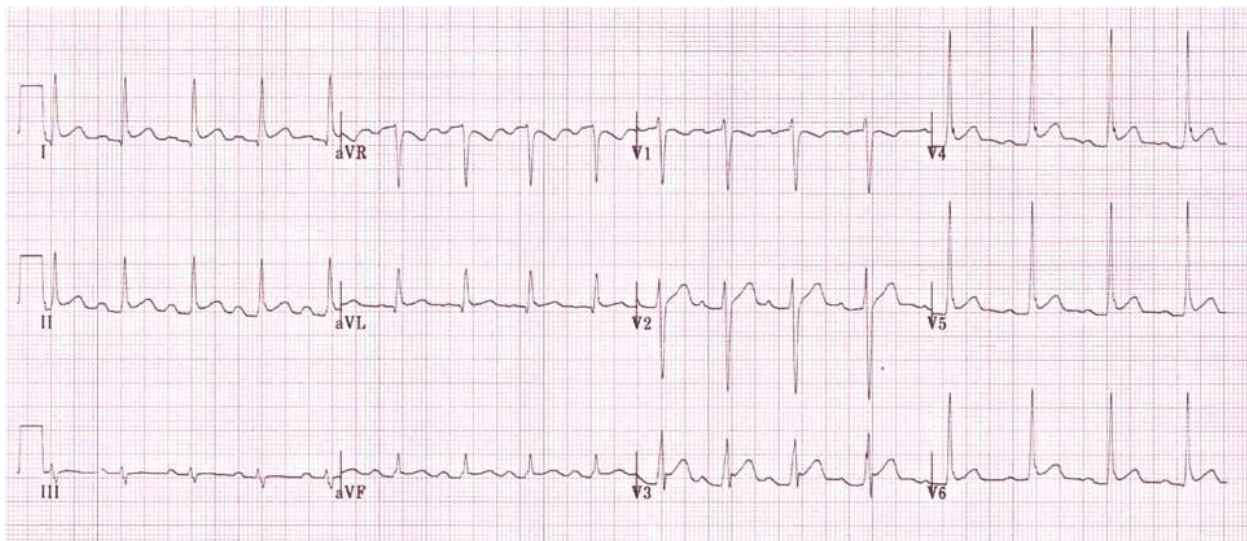
### History/Physical Exam

- Recent MI or CABG surgery, recent infection, recent chest trauma, chronic immune suppression, HIV. Sharp, pleuritic sub-sternal pain worsening when supine.
- May have a pleural friction rub. May demonstrate Beck's triad - hypotension, muffled heart sounds, and JVD.

### Key 12-Lead Features

- Widespread concave ST elevation and PR depression
- Reciprocal ST depression and PR elevation in lead aVR
- Measure baseline via TP Segment
- Sinus tachycardia is also common in acute pericarditis due to pain and/or pericardial effusion

### Sample 12 Lead



### References

1. Kinyasheva, N. Acute Pericarditis Within The Differential Diagnosis Of Chest Pain. 2017. [\[Link\]](#)



## Left Ventricular Hypertrophy

### Definition

Enlargement of the Left Ventricle of the heart, causing ECG changes that may mimic STEMI but which are generally benign.

### History/Physical Exam

History may include hypertension, aortic stenosis, hypertrophic cardiomyopathy.

### Key 12-Lead Features

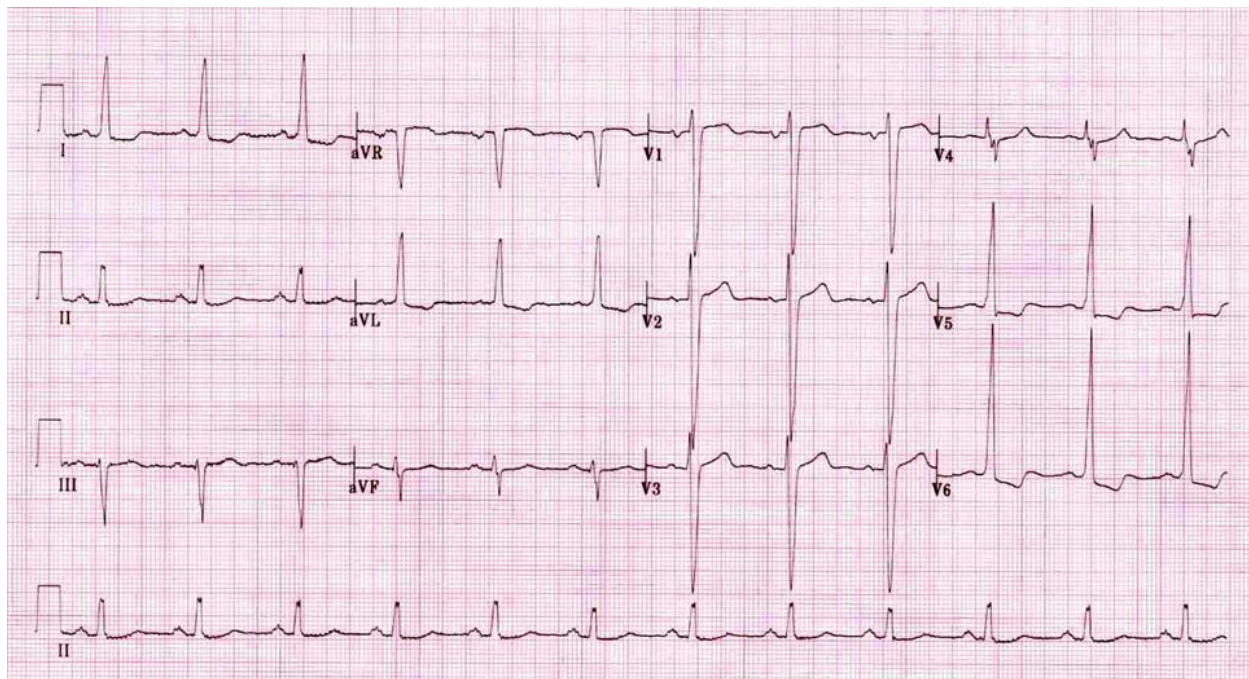
Presence of LVH

- $S(V1 \text{ or } V2) + R(V5 \text{ or } V6) > 35\text{mm}$

Strain Pattern

- ST Elevation V1-4
- ST Depression / Inverted T waves V5 and V6
- Generally proceeds from most elevated V1/2 to most depressed V6
- Consider utilizing LP15 measurements to help identify

### 12 Lead ECG Sample



[Further Reading](#)

### Reference

1. Ogah OS, et al. Electrocardiographic left ventricular hypertrophy with strain pattern: Prevalence, mechanisms and prognostic implications. 2008. [\[Link\]](#)

## DeWinter's T-Waves

### Definition

Early warning of an evolving STEMI.

### History/Physical Exam

History and findings suggestive of acute coronary syndrome.

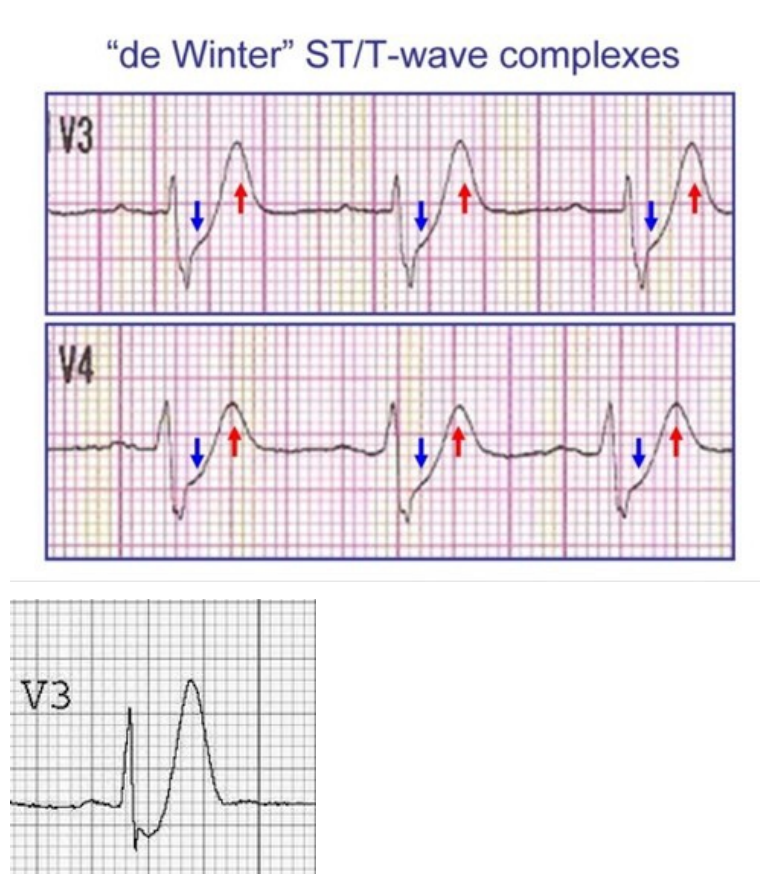
### Key 12-Lead Features

- J-Point depression with up-sloping ST segments.
- Tall, prominent, symmetric T waves in the precordial leads.
- Upsloping ST segment depression > 1mm at the J-point in the precordial leads.
- Absence of ST elevation in the precordial leads.
- ST segment elevation (0.5mm-1mm) in aVR.
- "Normal" STEMI morphology may precede or follow the DeWinter pattern.

### Key Treatment Points

- Patient advocacy for a cardiology consult
- Monitor for potential emerging STEMI

### 12 Lead ECG Samples



[Further Reading](#)

### References

1. DeWinter et al. A new ECG sign of proximal LAD occlusion. 2008. [\[Link\]](#)

## Sgarbossa Criteria

### Definition

Used to identify AMI in the presence of LBBB or a paced rhythm.

### History/Physical Exam

History and findings suggestive of acute coronary syndrome.

### Key 12-Lead Features

ST elevation $\geq 1$ mm in a lead with upward (concordant) QRS complex	5 pts
ST depression $\geq 1$ mm in lead V1, V2, or V3	3 pts
ST elevation $\geq 5$ mm in a lead with downward (discordant) QRS	2 pts

$\geq 3$  points = 90% specificity of STEMI (sensitivity of 36%)

## Smith's Modified Sgarbossa

Replacement of Rule III: discordant ST-elevation measurement of  $> 5$  mm with

Smith's Rule: ST/S ratio greater than 0.25 = STEMI

- Measure the ST Segment Elevation in mm [X]
- Measure the height/depth of the S/R wave in mm [Y]
- $X \div Y = Z$
- $Z > 0.25$  = STEMI

Sensitivity: 91%

Specificity: 90%

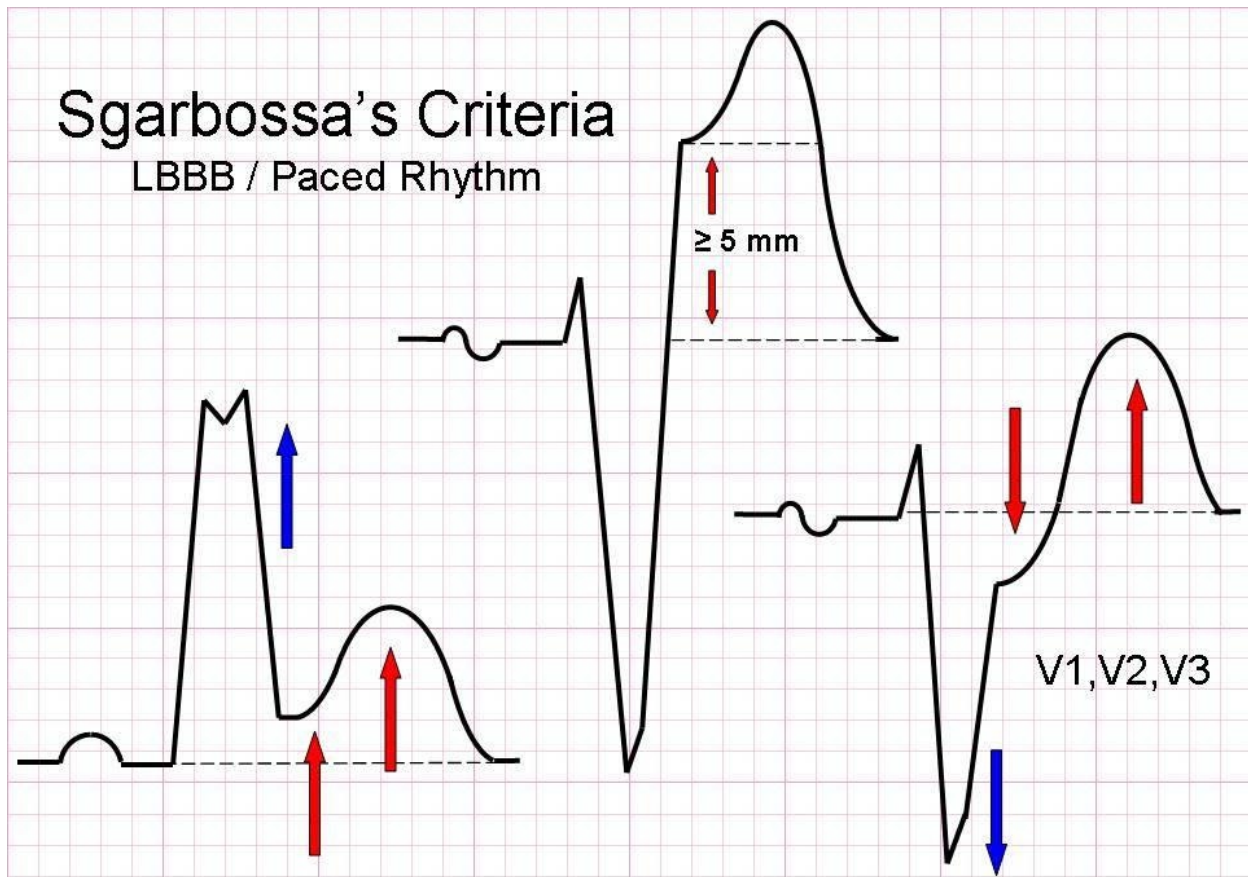
### Key Treatment Points

- Transmit as per current guidelines if believed ischemic
- Convey to PCI capable hospital
- Monitor for 12-lead changes and patient decompensation
- Treat as Acute Coronary Syndrome
- Patient advocacy at the hospital

### 12 Lead ECG Samples

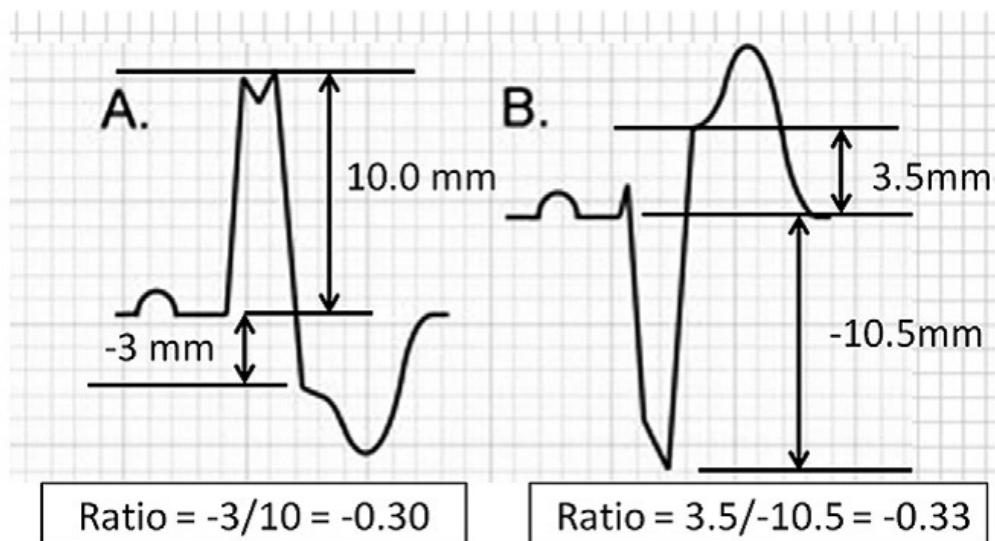
## Sgarbossa's Criteria

### LBBB / Paced Rhythm



#### Smith's Modified Sgarbossa

Despite lacking > 5 mm elevation, both complexes below shown are positive for STEMI, due to ratios exceeding 0.25



#### Further Reading

#### References

1. Rodriguez, RM. Electrocardiographic Criteria for Detecting Acute Myocardial Infarction in Patients With Left Bundle Branch Block: A Meta-analysis. 2006. [\[Link\]](#)



## Wellens Syndrome

### Definition

Pre-infarction stage of coronary artery disease suggesting 80-90% LAD occlusion that often progresses to a devastating anterior wall MI.

### History/Physical Exam

Following an ischemic event suggestive of unstable angina. ECG findings are generally only visible once patient is pain free.

### Key 12-Lead Features

TYPE A: Biphasic T waves, most commonly in leads V2 and V3. Presents with upstroke/down-stroke.

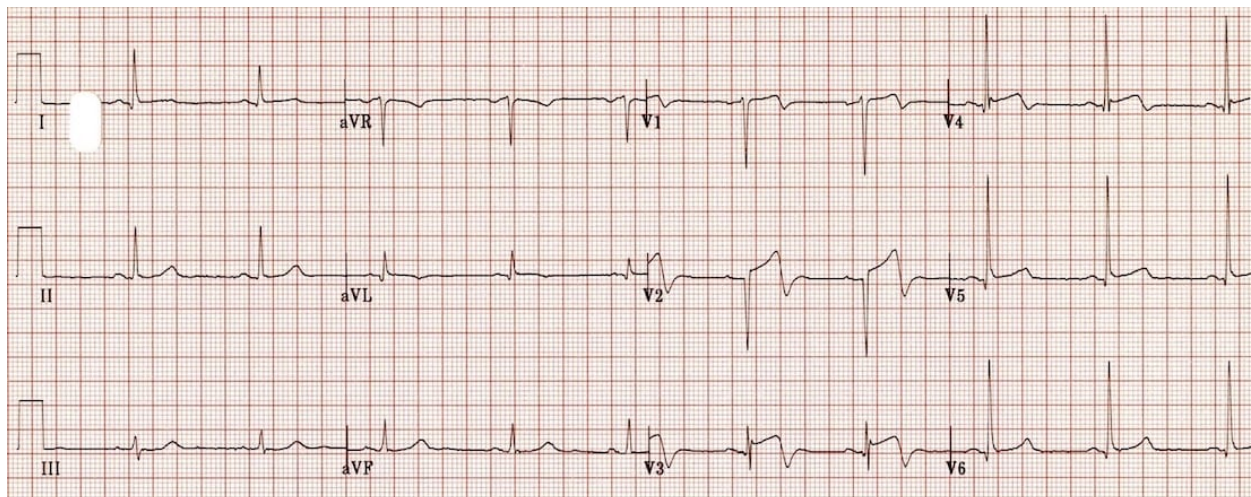
TYPE B: 76% of the time, deep inversion of the T-wave segment in the precordial leads, V1-V4.

### Key Treatment Points

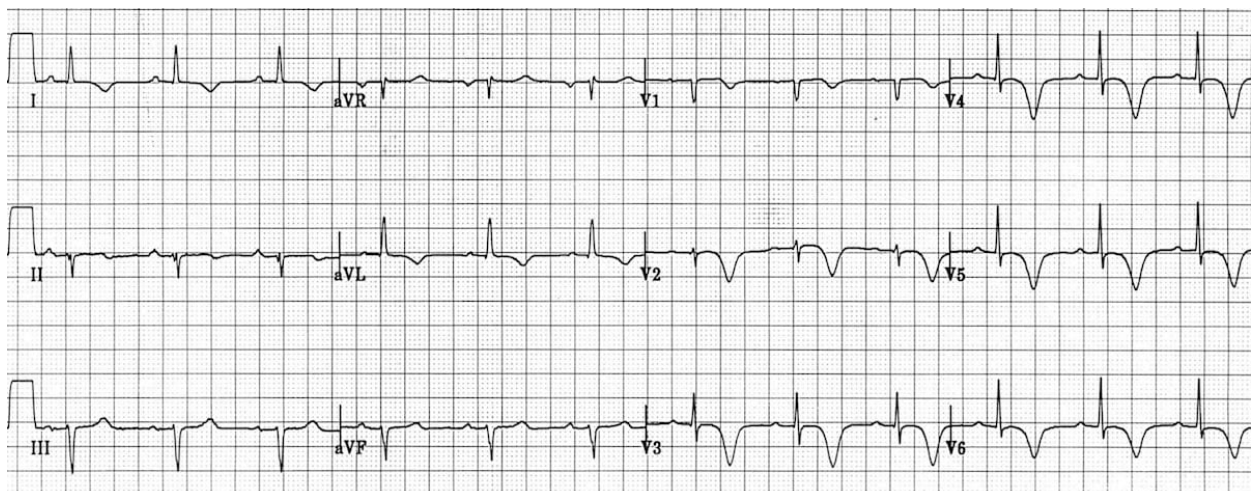
- Patient advocacy for a cardiology consult
- Monitor for potential emerging STEMI

### 12 Lead ECG Samples

#### TYPE A



#### TYPE B





[Further Reading](#)

#### References

1. Rhinehardt J, et al. Electrocardiographic manifestations of Wellens' syndrome. 2002. [[Link](#)]

## aVR STEMI

### Definition

Electrical activity from the right upper portion of the heart is recorded by aVR. Infarction in this area produces ST elevation in aVR and reciprocal changes in leads I, II, aVL, and V4-6.

Indicative of Left Main coronary artery occlusion, though can also reflect proximal LAD occlusion or severe triple-vessel disease.

### History/Physical Exam

History and findings suggestive of acute coronary syndrome.

### Key 12-Lead Features

- Widespread horizontal ST depression (often I, II, aVL, and V4-6)
- ST elevation in aVR  $\geq 1\text{mm}$
- ST elevation in aVR  $\geq \text{V1}$
- aVR elevation in the presence of a tachycardia is often rate related and not suggestive of LMCA occlusion

### Key Treatment Points

- Transmit as per current guidelines if believed ischemic
- Convey to PCI capable hospital
- Monitor for 12-lead changes and patient decompensation
- Treat as Acute Coronary Syndrome
- Patient advocacy at the hospital

### Predictive Value of aVR Elevation

In the context of widespread ST depression + symptoms of myocardial ischemia:

- STE in aVR  $\geq 1\text{mm}$  indicates proximal LAD / LMCA occlusion or severe 3VD
- STE in aVR  $\geq 1\text{mm}$  predicts the need for CABG
- STE in aVR  $\geq \text{V1}$  differentiates LMCA from proximal LAD occlusion
- Absence of ST elevation in aVR almost entirely excludes a significant LMCA lesion

In the context of anterior STEMI:

- STE in aVR  $\geq 1\text{mm}$  is highly specific for LAD occlusion proximal to the first septal branch

Magnitude of ST elevation in aVR is correlated with mortality in patients with acute coronary syndromes:

- STE in aVR  $\geq 0.5\text{mm}$  was associated with a 4-fold increase in mortality
- STE in aVR  $\geq 1\text{mm}$  was associated with a 6- to 7-fold increase in mortality
- STE in aVR  $\geq 1.5\text{mm}$  has been associated with mortalities ranging from 20-75%

### 12 Lead ECG Sample



[Further Reading](#)

#### References

1. Aygul N, et al. Value of lead aVR in predicting acute occlusion of proximal left anterior descending coronary artery and in-hospital outcome in ST-elevation myocardial infarction: An electrocardiographic predictor of poor prognosis. 2008. [\[Link\]](#)
2. Barrabes JA, et al. Prognostic value of lead aVR in patients with a first non-ST-segment elevation acute myocardial infarction. 2003. [\[Link\]](#)
3. Nabati M, et al.. ST-segment elevation in lead aVR in the setting of acute coronary syndrome. 2016. [\[Link\]](#)

## Posterior STEMI

### Definition

History and findings suggestive of acute coronary syndrome.

### History/Physical Exam

History and findings suggestive of acute coronary syndrome.

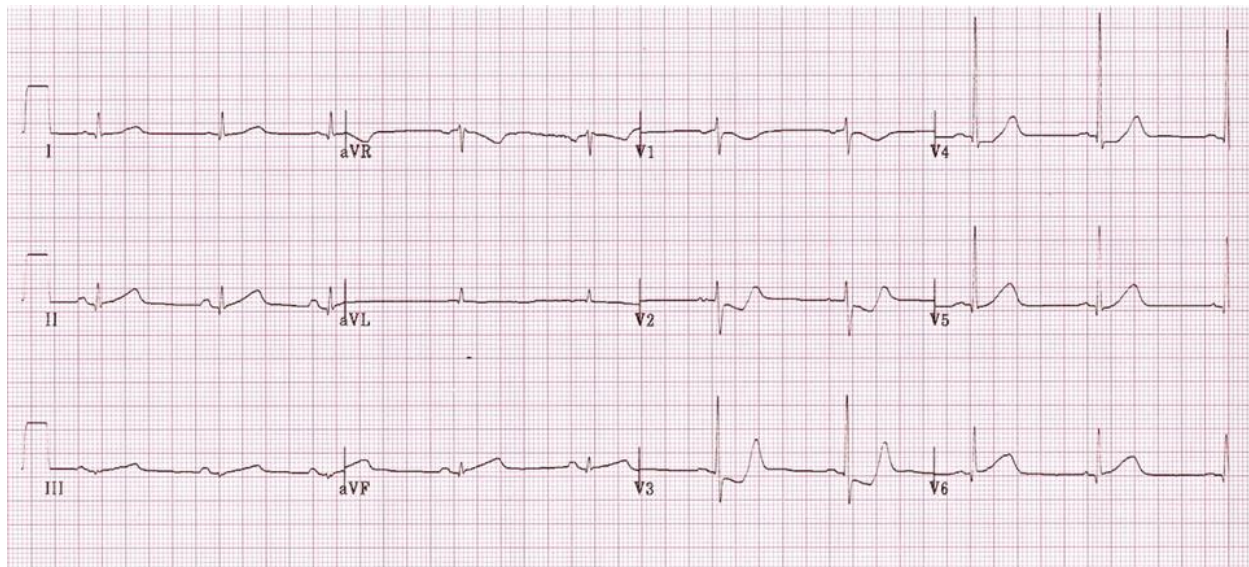
### Key 12-Lead Features

- Suspect Posterior MI with marked Precordial ST Depression V1-4 > 1mm (sensitive)
- ST Elevation in V7/8/9 > 0.5mm adds specificity

### Key Treatment Points

- Transmit as per current guidelines if believed ischemic
- Convey to PCI capable hospital
- Monitor for 12-lead changes and patient decompensation
- Treat as Acute Coronary Syndrome
- Patient advocacy at the hospital

### 12 Lead ECG Sample



### [Further Reading](#)

### References

1. Van Gorselen, EOF, et al. Posterior myocardial infarction: The dark side of the moon. 2007. [\[Link\]](#)

## STEMI Patterns

### AHA Guidelines for Classifying STEMI

ST-elevation in 2 anatomically contiguous leads measuring:

- Men < 40 years of age: 2.5 mm in V2-V3 and 1 mm in all other leads
- Men ≥ 40 years of age: 2 mm in V2-V3 and 1 mm in all other leads
- Women: 1.5 mm in V2-V3 and 1 mm in all other leads

70% sensitivity, 85% specificity for acute coronary occlusion

### Localizing STEMI

<b>I</b> HIGH LATERAL LCX	<b>aVR</b> (MAINSTEM) Suspect Proximal LAD or Severe 3VD	<b>V1</b> SEPTAL LAD	<b>V4</b> ANTERIOR LAD
<b>II</b> INFERIOR RCA	<b>aVL</b> HIGH LATERAL LCX	<b>V2</b> SEPTAL LAD	<b>V5</b> LATERAL LAD / LCX
<b>III</b> INFERIOR RCA	<b>aVF</b> INFERIOR RCA	<b>V3</b> ANTERIOR LAD	<b>V6</b> LATERAL LAD / LCX

### Further Reading

### References

1. O'Gara PT, et al. 2013 ACCF/AHA Guideline for the Management of ST-Elevation Myocardial Infarction: Executive Summary: A Report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. 2012. [\[Link\]](#)

## PR17: Procedural Sedation

Mike Sugimoto

### Applicable To

- ACP and higher

### Introduction

Procedural sedation and analgesia (PSA) is a medication administration strategy that uses several small serial doses of a medication to produce analgesia, sedation, and amnesia to allow paramedics to accomplish patient care tasks.

### Indications

Any instance where analgesia, sedation, and amnesia are required to allow paramedics to accomplish patient care tasks. Examples of these tasks include extrication, fracture management, cardioversion, and airway management.

### Contraindications

- ABSOLUTE: INABILITY TO MONITOR OXYGENATION AND VENTILATION
- ABSOLUTE: INABILITY TO PERFORM AIRWAY INTERVENTIONS
- Relative: traumatic brain injuries
- Relative: hypotension and shock

### Procedure

**OnCall consultation required** prior to undertaking procedure on patients under 12 years of age.

**OnCall consultation recommended** to discuss care planning options for all other patients, where possible.

1. Ensure adequate oxygenation and ventilation at all times. Consider use of high-flow nasal cannula with PEEP and bag-valve mask as necessary. Monitor oxygen saturation and ventilation closely.
2. If not already in place, establish vascular access with running fluid.
3. Choose dosing strategy for ketamine:
  - Initial dose: 0.5 mg/kg
  - Subsequent doses: 0.25 mg/kg
  - Give ketamine slowly, waiting 60 seconds between doses, until the desired level of sedation is reached.
  - In patients who are hypotensive or in shock, consider lower doses.
    - **OnCall consultation recommended** to discuss care planning options.
4. Some patients will experience emergence reactions from ketamine sedation and analgesia. These include hallucinations, vocalizations, and can have physical manifestations. Treat emergence reactions only if they occur and are sustained:
  - In adults: midazolam 1-2 mg IV/IO every 2-5 minutes as required.
  - In children: midazolam 0.05 mg/kg IV/IO every 2-5 minutes as required.

## PR19: Transcutaneous Pacing

Mike Sugimoto

### Applicable To

- ACP and higher

### Indications

- Symptomatic bradycardia unresponsive to atropine and epinephrine infusions

### Contraindications

Paramedics should be aware of the distinction between pacing modes: demand pacing paces only when the patient's intrinsic heart beat is less than a specified threshold, while non-demand paces at a set rate regardless of intrinsic activity. The monitor/defibrillator only detects electrical activity: under some circumstances, patients may have electrical activity that exceeds the pacing threshold but no mechanical output. In these cases, the patient will not be paced if the monitor is in demand mode. BCEHS monitor/defibrillators default to demand mode and, in general, should not be operated in non-demand mode.

### Procedure

1. Transcutaneous pacing requires placement of limb leads and therapy electrodes. Ensure that limb leads are on and connected to the LifePak 15.
2. Position therapy electrodes. Either anterior-lateral or anterior-posterior electrode placement is acceptable.
3. Consider the need for sedation. Pacing is painful and patients who are conscious will require sedation and analgesia. Ketamine is the preferred agent in this case.
4. Enable pacing mode on the LifePak by pushing the "Pacing" button. The monitor will prompt for a rate (the default is 60 BPM) and a current (the default is 0 mA).
5. Slowly increase the current using the selector wheel until electrical capture is identified.
6. Confirm a mechanical output with each captured paced beat. Femoral pulses may be more useful as they are further away from the muscle groups being stimulated by the pacemaker. If mechanical output is confirmed, add 10% to the current setting.
7. Reassess blood pressure and clinical status. If the patient remains hypotensive despite effective pacing, consider increasing the rate.

### Notes

#### CAUTION

- When conducting handovers of pacing-dependent patients at hospitals, clear communication and coordination of the transfer of pacemaking equipment is critical. Do not disconnect monitor components, *including limb leads*, until hospital staff confirms the patient is attached to their equipment and ready to take over pacing.
- Never attempt to resolve tachydysrhythmias using non-demand or "overdrive" pacing.
- When using non-demand pacing, there is a risk of causing an R-on-T event resulting in ventricular fibrillation or ventricular tachycardia, as the monitor will deliver pacing impulses regardless of intrinsic electrical activity. In situations where the patient is bradycardic but has electrical activity that exceeds the rate limit for demand pacing, [OniCall consultation is recommended](#) to discuss care planning options, which may include higher pacing rates or pharmacological therapy.

## PR20: Synchronized Cardioversion

Mike Sugimoto

### Applicable To

- ACP and higher

### Indications

- Termination of tachydysrhythmias in symptomatic patients who have failed less invasive therapies
  - It is often more effective and consistent than pharmacological therapies and is generally safer for unstable patients when the precise nature of the tachydysrhythmia is not known.

### Procedure

1. Consider the need for procedural sedation (see [PR17: Procedural Sedation](#)).
2. Attach therapy electrodes. Either anterior-posterior or anterior-lateral positioning may be used. Synchronized cardioversion may be performed with therapy electrodes alone, however limb leads are strongly suggested.
3. Enable synchronized mode: press the **SYNC** button on the monitor. Observe the display screen and confirm the flagging symbol (a downward-pointing triangle) appears above each QRS complex.
  - On LifePak 15s that have been configured for primary care paramedic use, pressing **SYNC** or **LEAD** will not disable the advisory monitoring system, and will not provide access to synchronization functions. To enable synchronization on these devices, press **ENERGY SELECT** to exit the advisory mode and enable full manual operation. **CAUTION:** This is a slight change from previous workflows, and is only required on LifePak 15s that have been configured for primary care paramedic use. A patient safety risk exists where energy levels may be set for cardioversion, but synchronization has not occurred. **Always visually verify the presence of synchronization markers above the QRS complexes before charging the defibrillator for cardioversion or attempting to deliver energy.**
4. Select the appropriate energy level using the **ENERGY SELECT** buttons.
5. Charge the monitor/defibrillator and clear the patient.
6. Push **and hold** the **SHOCK** button until the energy is delivered. There will be a slight delay as the monitor attempts to time the shock with a detected R wave.
7. Reassess the patient and re-evaluate required treatment options, including supportive care or energy escalation.
8. If the patient deteriorates to ventricular fibrillation or unstable polymorphic ventricular tachycardia:
  - Confirm synchronization is off (push **SYNC** button again if necessary) and that flags have disappeared. Verify patient pulses; if no pulse, begin chest compressions.
  - Reset the energy level to 200 J.
  - Charge the monitor.
  - Clear the patient and deliver the shock.

### Notes

- Recommended initial energy levels:
  - Unstable atrial fibrillation with rapid ventricular response: 200 J.
  - Unstable monomorphic ventricular tachycardia: 100 J.
  - Unstable supraventricular tachycardia or atrial flutter: 100 J.
- If several synchronized shocks have been delivered and the rhythm fails to convert, consider switching pad placement: if the therapy electrodes were anterior-lateral, place them anteriorly-posteriorly (or vice versa) and attempt to cardiovert again at the last energy level used.

#### Changelog

- 2023-01-05: added supplemental information on use of PCP-configured monitor/defibrillators



## PR21: Needle Thoracentesis

Mike Sugimoto

### Applicable To

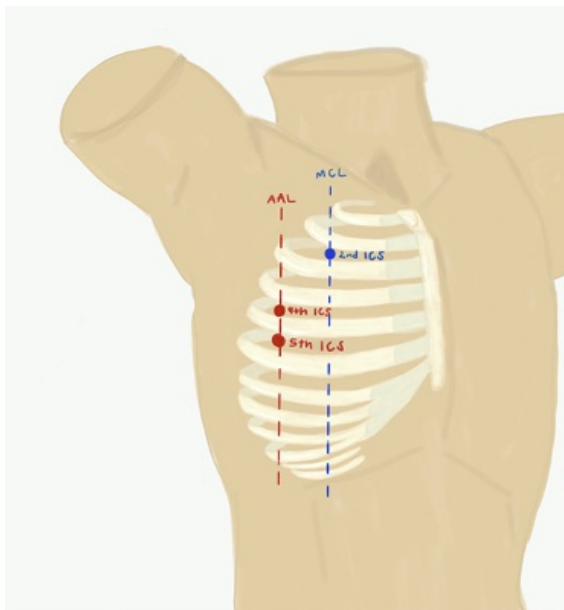
■ ACP and higher

### Indications

- Needle thoracentesis is indicated for the decompression of tension pneumothorax with deteriorating vital signs indicating markedly decreased cardiac output, profound shock, or cardiac arrest. Bilateral decompression is also indicated in cases of blunt traumatic cardiac arrest.

### Procedure

1. Identify the insertion sites. The preferred site is the fifth intercostal space on the mid-axillary line (in the diagram, this is the red line incorrectly labelled "AAL"). An alternative placement is the second intercostal space on the mid-clavicular line. The ARS needles used by BCEHS will be effective at either site.
2. Prepare the skin by cleaning it with an alcohol swab.
3. Remove the ARS needle and catheter from its protective case. Puncture the skin, directing the needle above the inferior rib (blood vessels and nerves underlie the inferior border of each rib). Air may be heard hissing as the needle passes into the pleural space.
4. Advance the catheter into the pleural space and remove the needle.
5. Leave the catheter open to air. It is not necessary to place a chest seal over the catheter



## PR22: Surgical Airways

Mike Sugimoto

### Applicable To

- ACP and higher

### Introduction

A surgical airway is indicated in a patient who cannot be oxygenated or ventilated through other means. Paramedics may also consider preparing for surgical airways based on predicted clinical course, or in cases where endotracheal intubation is required and predicted to be difficult.

In patients over the age of 8, the bougie-assisted cricothyrotomy is the preferred approach. In patients under 8, needle cricothyrotomy can be used.

These procedures can be intimidating. Paramedics should have a thorough understanding of the circumstances under which they may be required and have a low threshold for their use. They can also be logistically challenging and frequently require more space (and personnel) than anticipated. In most cases, paramedics will want to approach a surgical airway with their non-dominant hand towards the patient's head.

### Indications

- Inability to ventilate, oxygenate, or intubate a patient

### Contraindications

- **ABSOLUTE: INABILITY TO IDENTIFY LANDMARKS OR AIRWAY STRUCTURES**
- Relative: trauma to the neck
- Relative: history of perithyroid tumors or radiation to the neck
- Relative: expanding hematomas or other pathologies distorting structures in the neck

### Procedure

#### Procedure: Bougie-Assisted Cricothyrotomy

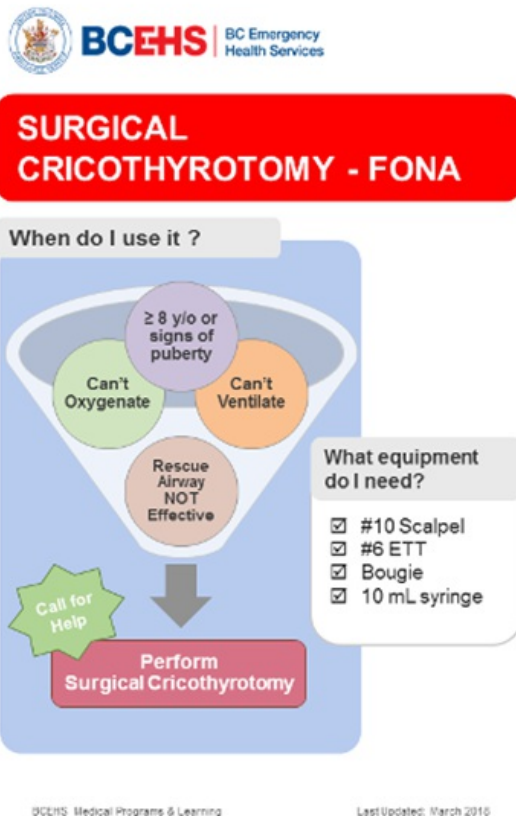
1. Personal protective equipment is required for this procedure. Face shields are critically important: upon puncturing the cricothyroid membrane, a spray of blood is frequently produced.
2. Assemble required equipment: scalpel blade, bougie, and 6.0 ETT.
3. Identify the landmarks as required.
4. Stabilize the thyroid cartilage with the non-dominant hand. The dominant hand will hold the scalpel and rest on the patient's sternum for stability.
5. Make a 4 cm vertical incision through the skin over the cricothyroid membrane. In cases where the anatomy cannot be palpated or identified prior to making the incision, it may be necessary to extend the incision from the mandible to the sternum.
6. Palpate the cricothyroid membrane and bluntly dissect through the subcutaneous tissue using a finger until the membrane is readily identifiable. Puncture the membrane with the scalpel held horizontally.
7. Remove the scalpel and place a little finger in the incision in the membrane to dilate and to identify the posterior wall cartilage. Ignore any bleeding at this point.
8. Slide the bougie alongside the little finger into the trachea.
9. Remove the finger and pass the endotracheal tube over the bougie and into the trachea. Only advance the endotracheal tube until the balloon is within the airway and no longer visible. Inflate the balloon.
10. Holding the endotracheal tube firmly, remove the bougie and connect a bag-valve mask. Confirm endotracheal tube placement with end-tidal CO<sub>2</sub> monitoring, auscultation, bilateral chest rise and fall, and misting of the tube.

#### Procedure: Needle Cricothyrotomy

Children under the age of 8 should not have open cricothyrotomies as there is an unacceptable risk of causing damage to poorly-developed structures in the airway. Needle cricothyrotomy is an option in these cases. Paramedics must remember this procedure is a bridge to definitive airway management: it is possible, using this technique, to oxygenate (but not ventilate) a patient for a brief period of time, typically 15 to 20 minutes.

1. Assemble required equipment:
  - 14-gauge Angiocath; remove flash cap
  - 10 mL syringe
  - Number 3 endotracheal tube; remove the universal connector from the endotracheal tube
2. Identify landmarks: the cricothyroid membrane in children is located in the same position as adults and should be palpable through the skin below the thyroid cartilage.
3. Attach 10 mL syringe to 14-gauge Angiocath. Hold the syringe in the dominant hand, which is stabilized on the patient's mandible.
4. Puncture the skin over the cricothyroid membrane. Once through the skin, direct the needle tip caudally. At the same time, gradually retract the plunger on the 10 mL syringe until the plunger retracts freely, signaling entry into the trachea. Remove the plunger.
5. Advance the needle slightly, then withdraw the needle while threading the catheter into the trachea.
6. Insert the size 3 endotracheal tube connector in the catheter.
7. Secure the catheter and endotracheal tube connector with an occlusive dressing (e.g., Tegaderm). Form a hole in the occlusive dressing for the endotracheal tube connector.
8. Connect a bag-valve mask attached to high-flow oxygen.
9. Ventilate, being aware that higher pressures may be required and that chest rise may not be seen. The pressure relief valve will likely need to be locked down.

## Notes



**What are some key landmarks?****Need support?**

Please contact  
[Learning@bcehs.ca](mailto:Learning@bcehs.ca)  
or your **Regional  
Advanced Practice  
Educator**

**How do I use it?**

1. Landmark
2. Make incision
3. Place finger
4. Place bougie
5. Pass ETT
6. Secure and Confirm

**Personal Protection**

Adapt PPE based on your risk assessment, patient's condition e.g. infectious diseases.

Best practice: full face shield, gloves, N95

**What can make it difficult?**

<b>Distortion</b>	Trauma, expanding hematoma, infection or other pathology
<b>Access</b>	Obesity, extreme neck flexion (i.e. ankylosing spondylitis)
<b>Radiation</b>	Therapy in area
<b>Tumors</b>	Around cricothyroid membrane

BCEHS Medical Programs &amp; Learning

Last Updated: March 2018

**Resources**



## PR23: Awake Intubation

Mike Sugimoto

### Applicable To

■ ACP and higher

### Introduction

Awake intubation is a tracheal intubation technique that uses topical anesthesia to blunt airway reflexes, coupled with small doses of intravenous anesthetic for sedation. Patients undergoing an awake intubation are not necessarily fully "awake"; the technique refers to the limited use of sedation or induction to achieve optimal intubating conditions.

### Indications

- Paramedics should consider the use of awake intubation as a primary intubation technique when doubt exists as to the ability to successfully intubate a patient while protecting the patient's intrinsic respiratory drive and gas exchange physiology; these scenarios can be broken into two broad categories:
  1. Patients with predicted difficult airway anatomy. These are based either on normal variations or pathological changes in airway structures.
  2. Predicted difficult physiology. Hemodynamic instability (or an inability to obtain hemodynamic stability) may not allow for the use of induction agents at full dose. Patients may also have a physiological need for high minute ventilation and may not tolerate even brief interruptions to their respiratory activity.

### Contraindications

- Awake intubation is relatively contraindicated in patients who require emergent airway management as it can be a time-consuming procedure
- Patients who are actively or passively uncooperative may not benefit from an awake approach and, where possible, should be managed using other techniques

### Procedure

Awake intubation is a relatively complex procedure. This procedure summarizes the steps required for awake intubation, but paramedics should not rely solely on this information for education and training in this technique.

1. Provide appropriate supplemental oxygen during application of topical anesthesia. Ensure appropriate monitoring is attached to the patient and that all vascular access devices are flowing properly.
2. Explain the rationale for the procedure to the patient. Provide information on what can be expected during the procedure; patient cooperation during the topicalization phase of the procedure results in improved intubating conditions.
3. Have the patient stick their tongue out and begin applying topical anesthesia to airway structures. The soft palate, posterior pharynx, and tonsillar pillars should be anesthetized using a "spray as you go" approach. Consider the judicious use of sedation during this phase, respecting physiological limitations.
  - When using direct laryngoscopy, additional local anesthetic can be applied to distal structures as they are exposed by the blade.
4. Using precision laryngoscopy techniques, slowly advance the blade of the laryngoscope until it is in position.
5. Intubate the patient.
6. Confirm tube placement using traditional and proven techniques.
7. Administer additional sedation as required for patient comfort based upon clinical condition and hemodynamic status.

### Resources

[Awake airway management and flexible endoscopic intubation](#), by J. Adam Law, Ian Morris, and George Kovacs.

## References

Morris IR, Law JA. How to do awake tracheal intubations -- oral and nasal. In: Kovacs G, Law JA, editors. *Airway management in emergencies*. 2nd ed. Shelton: People's Medical Publishing House USA; c2011. p. 181-208.

# PR24: Subcutaneous Butterfly Placement

Michelle Haig

## Applicable To

- ACP and higher

## Introduction

To provide guidelines to paramedics for the establishment of a subcutaneous (SQ) injection site and for the safe, accurate, and intermittent administration of medications via a subcutaneous injection site to the palliative care population for pain and symptom management when other routes are not possible or established.

## Procedure

1. **On-Call consultation required** prior to establishing a SQ butterfly and prior to administering medications via a SQ line.
2. Gather required equipment, perform hand hygiene, and don clean gloves.
3. Select the SQ site.
  - Note: site must be changed every seven days to maintain patency and sites must be rotated to avoid tissue damage
4. Cleanse site (circular area 5-8 cm) with chlorhexidine/alcohol swab; allow to dry.
5. Remove slide clamp from the SQ butterfly if preferred as clamp is not required after insertion.
6. Remove the vent plug and attach a needleless connector/LuerLock to the side Y port.
7. Prime the set with medication (additional 0.4 mL for priming the set, including the LuerLock).
8. Rotate the white safety shield 360° to loosen the needle. Ensure the bevel is up and catheter is not extended over the needle tip/bevel.
9. Pinch the textured yellow wings together, textured side down.
10. Gently pinch the skin fold and insert the needle at a 30-45 degree angle to the full length of the needle.
11. Hold the wings flat on the skin firmly (do not hold the centre bar). Pull back on the white safety shield in a straight continuous motion until the safety shield separates, leaving the cap.
12. Apply an Opsite sterile transparent dressing. Loop the extension set and secure in place.
  - Optional: place gauze under the port to protect the skin from pressure
13. Label the dressing:
  - Name of medication and concentration
  - Date and time of insertion
  - Administrator initials
  - Administrator clinical designation
14. Record insertion on ePCR with the following:
  - Date and time; drug; concentration; dose; route
  - Injection site and catheter size
  - Site assessment
  - Patient's response to procedure, any patient/family education, or any other pertinent actions or observations
  - Individual who inserted the catheter and administered the medication

## Notes

### General Directives:

- Do NOT flush tubing (medication remaining in tubing will be given during the next administration).
- **On-Call consultation required** prior to establishing a SQ butterfly and prior to administering medications via a SQ line.
- The site should be assessed for redness, bruising, swelling, tenderness, leakage, or discharge. Re-site if any of these are present.
- The SQ site is to be changed every seven days or sooner to maintain patency. If two sites are being used, then two separate locations should be used (rotate sites).
- To help optimize medication absorption and patient comfort, the maximum amount of medication to be administered at one time/site is 2 mL. If greater volume is required, two sites can be used to deliver the required amount. A minimum of 30 minutes must be adhered to



between doses at the same site.

- Note: more than one SQ site is required for multiple medications.
- Sites for catheter insertion are to be rotated to avoid tissue damage.
- If blood appears in the tubing, remove and discard the SQ set and select a new injection site.

#### Equipment & Materials

- #24 gauge butterfly needle
- Chlorhexidine 2% or 70% isopropyl alcohol swab
- Transparent dressing (e.g., Opsite or Tegaderm)
- Tape
- Non sterile gloves, latex free
- Needleless butterfly syringe with LuerLock containing the medication dose ordered, plus an additional 0.4 mL of the medication for priming the needle and tubing set at the time of initial dose administration
  - Volume may be different if using product other than Saf-T-Intima or Baxter One-Link Needle-free IV connector

#### Preferred Injection Sites

- Upper arms
- Abdomen
- Anterior aspect of thighs
- Above scapula
- Subclavicular chest wall

Note: site should be easily accessible; free of lesions; clear from large vessels, joints, and bones; and away from edematous tissue that may alter medication absorption.

## References

Provincial Health Services Authority (2013). BC Cancer Agency: Intermittent and Continuous medication administration via an established Subcutaneous Injection Site.

Provincial Health Services Authority (2009). BC Children's Hospital Child and Youth Health Policy and Procedure manual: Continuous Subcutaneous Medication or Fluid Infusion.

## PR26: Venipuncture - Ethical Decision Making

Ross Chute

### Applicable To

■ PCP and higher

### Introduction

Initiating out-of-hospital intravenous (IV) access, “just in case it is needed in hospital,” is not a justifiable reason.

When should paramedics initiate peripheral IV access? What questions do we need to ask ourselves to help us make an ethical and clinical appropriate decision?

The criteria can be found in the BCEHS Ethics Framework Manual. Paramedics can also utilize the “JAY” tool to evaluate the risk versus benefit of out-of-hospital IV access.

### Indications

The clinical requirements for out-of-hospital IV access:

1. To provide a saline bolus to treat hypotension, severe dehydration, or shock; to keep vein open (TKVO) is not generally a reasonable requirement
2. As a route to provide IV medication bolus administration (e.g., dimenhydrinate)
3. As a route to provide an IV infusion of medications (e.g., 10% dextrose or TXA)
4. As directed by Clinical Practice Guidelines (e.g., FAST-VAN positive patients)
5. For PCPs, in preparation for on-scene or en route rendezvous of ACPs or CCPs when it is expected that IV medications will be administered (e.g., epinephrine for cardiac arrest)

Additional considerations for PCP intraosseous cannulation:

- The tibial site is the only site approved for PCP use. PCPs are limited to two collective attempts per patient only. Do not attempt to re-cannulate a site that has failed or been dislodged.
- IOs **may** be placed under **direct** supervision by ACPs or higher. The ACP (or higher) remains responsible for any anesthesia or pain management requirements.
- PCPs may place intraosseous devices in patients **in cardiac arrest** where there is a **clinical history of intravascular volume depletion**, where fluid administration is a component of the resuscitation plan.
- Review → [PR12: Intraosseous Cannulation](#) for additional information.

### Procedure

#### Ethical Decisions: Establishing Out-of-Hospital Intravenous Access

When consolidating the care plan, paramedics should consider:

1. Does the patient require IV access for treatments within the out-of-hospital care plan?
  - Yes.** For reasons of fluid administration, medication administration, or CPG requirement.
  - No.** Then don't attempt an IV in the field.
2. Why am I initiating this IV start?
  - For patient care that requires fluid administration, medication administration, or CPG direction – (Apply the JAY tool)
    - JUSTIFIABLE:
      - The patient is hypovolemic, severely dehydrated, in shock, and requires fluid administration.
      - The patient is actively vomiting and requires dimenhydrinate.
      - The patient has significant blunt or penetrating trauma and requires TXA.
      - The patient is hypoglycemic and requires IV dextrose.
    - ACCOUNTABLE:
      - This procedure will benefit the patient and my peers would offer the same or similar care to this patient.
    - YOU:

- If I were the patient, I would appreciate the benefit of fluid replacement and the relief the medication offers for my dignity and comfort.
- Skill maintenance or learning purposes – (Apply the JAY tool)
  - JUSTIFIABLE:
    - Skill maintenance would not be defensible in an adverse patient event.
    - Out-of-hospital IV access increases the patient's risk to harm due to preventable infection and potential for embolism or thrombosis.
    - Did you inform the patient of the reason(s) and the risks associated with the IV start? (Informed consent for skill maintenance or learning only purposes.)
    - Did you ask the patient for permission to start the IV?
  - ACCOUNTABLE:
    - Practicing skills on patients are poor arguments for skill maintenance or learning. We don't practice chest compressions on a patient that has a pulse. We have simulators available for skill maintenance purposes.
  - YOU:
    - Would you want an unnecessary IV insertion if you didn't require one? Knowing the evidence of infection rates, increased ED stays, and other complications of out-of-hospital IV access, I would want to avoid this risk.
- The hospital might need an IV – (Apply the JAY tool)
  - JUSTIFIABLE:
    - There is no written direction from clinical and medical programs or the receiving hospital to have an out-of-hospital IV in place.
  - ACCOUNTABLE:
    - The practitioner who places the out-of-hospital IV catheter is responsible for any adverse events that may happen if treatment is not justifiable.
  - YOU:
    - If I were the patient, and knowing the evidence, I would not want an out-of-hospital IV insertion done if the paramedic was not going to utilize it.

## Notes

The risks or adverse events which can occur with out-of-hospital IV access include:

- Pain/anxiety
- Infection
- Infiltration
- Hematoma
- Air embolism
- Catheter tip or thromboembolism
- Phlebitis

## Resources

1. BC Emergency Health Services. BCEHS Ethics Framework Manual. [\[Link\]](#)
2. BC Emergency Health Services. JAY Tool. [\[Link\]](#)

## PR27: iGel Pharyngeal Suctioning

### Applicable To

- PCP and higher

### Introduction

The seal of an iGel supraglottic airway may be affected by passive gastric secretions or the undetected accumulation of emesis during resuscitation. Because PCPs are not authorized to perform gastric intubation, a modified approach is required to provide on-going suctioning of the pharynx to ensure an effective seal.

### Indications

- Significant suctioning of emesis or gastric secretions was required prior to iGel placement
- Known or suspected presence of gastric secretions following placement of iGel
- Persistent difficult ventilation despite best efforts to manipulate the iGel

### Contraindications

- Active vomiting with iGel in place, or difficulty in ventilating following an episode of active vomiting; the iGel should be removed in these cases; suction the oropharynx and replace the device as required

### Procedure

1. Ensure the iGel is appropriately sized and inserted in accordance with [PR08: Supraglottic Airway](#).
2. Secure the iGel using the included neoprene strap.
3. Unravel the suction catheter included with the Resus Pack, ensuring there are no significant kinks.
4. Using the flat (label) side of the clear plastic outer iGel as a measuring guide, straighten the suction catheter and measure along the length of the package with the distal tip of the suction catheter on one edge.
5. Add approximately 2 cm to this length and apply tape around the suction catheter to mark the depth.
6. Apply lubricant (Muko gel) over the proximal end of the gastric channel of the iGel.
7. Insert the suction catheter through the lubricant and into the gastric channel of the iGel until the taped depth indicator reaches the outer edge of the channel. Do not advance any further.
8. Attach the suction catheter to the suction tubing using the connector.
9. Apply suction and watch for the presence of fluid.
10. Once fluid has been cleared, or if no fluid appears after 15-20 seconds, turn the suction unit off (but leave the tubing attached). Continuous suction is not appropriate and may be harmful.
11. If additional secretions are suspected, or the iGel seal becomes impaired, repeat suction as required.

#### Caution:

- Ensure the airway is appropriately decontaminated prior to placing the iGel.
- Consider other causes of difficult ventilation (e.g., improper device size, incorrect depth, lack of posterior/inferior pressure, or airway obstruction) prior to attempting pharyngeal suctioning.
- If the iGel becomes dislodged with a suction catheter in place, do not attempt to re-insert the iGel with the suction catheter beyond the distal tip of the iGel.
- Suction should be applied at 80 mmHg and not generally exceed 160 mmHg.

### Resources



## PR28: Modified Valsalva

### Applicable To

- ACP and higher

### Introduction

The Valsalva manoeuvre should be the first line of treatment for the management of narrow complex supraventricular tachycardia (SVT) in the hemodynamically stable patient. Although there are other vagal stimulation methods available, the Valsalva is the safest and most effective technique for terminating SVT of an unknown mechanism.

The modified Valsalva manoeuvre, with supine repositioning and legs elevated, has been shown to be significantly more likely to restore sinus rhythm than the standard Valsalva manoeuvre. It should be performed over the standard Valsalva whenever possible, given the greater likelihood of success.

### Indications

- Hemodynamically stable supraventricular tachycardia (SVT)

### Contraindications

- Requirement for immediate cardioversion (hemodynamic instability)
- Hypotension (SBP < 90 mmHG)
- Atrial fibrillation/flutter
- Aortic Stenosis
- Recent myocardial infarction (within 3 months)
- Glaucoma
- Retinopathy
- Third trimester of pregnancy

### Procedure

1. Obtain a baseline 12-lead ECG.
2. Explain the procedure to the patient.
3. Position the patient in a semi-recumbent position.
4. Press print on the cardiac monitor.
5. Instruct the patient to perform a forced expiration into a sterile 10 mL syringe for 15 seconds.
6. At the end of the forced expiration, remove the syringe and lay the patient supine with the legs raised straight to 45° for 15 seconds.
7. Reposition the patient to a semi-recumbent position for 45 seconds.
8. Stop printing the on the cardiac monitor once cardioversion is achieved or 45 seconds has elapsed.
9. Repeat 12-lead ECG if cardioversion was achieved.
10. If the procedure was not successful and the SVT has failed to revert, consider repeating the procedure to a maximum of 3 attempts.
  - If repeated attempts are required, ensure the patient has returned to a hemodynamically stable presentation prior to repeating

### Notes

- Patients taking beta blockers often demonstrate a blunter blood pressure response to the Valsalva manoeuvre.

### Resources

## References

1. Appelboam A, et al. Postural modification to the standard Valsalva manoeuvre for emergency treatment of supraventricular tachycardias (REVERT): A randomised controlled trial. 2015. [\[Link\]](#)
2. Page RL, et al. 2015 ACC/AHA/HRS Guideline for the management of adult patients with supraventricular tachycardia. 2015. [\[Link\]](#)
3. Queensland Ambulance Service. Clinical practice procedures: Cardiac/modified Valsalva manoeuvre. 2017. [\[Link\]](#)



## PR29: Mechanical Ventilation

### Applicable To

■ CCP only

### Introduction

Patients in out-of-hospital settings may benefit from mechanical ventilation. In cases where mechanical ventilation represents a component of a treatment plan (such as hypoxemic respiratory failure secondary to pneumonia), it should be initiated as early as practicable. For other patients requiring mechanical support, the use of a ventilator provides consistent ventilation, allows close monitoring of ventilatory parameters, and frees paramedics from the need to ventilate by hand.

Despite these benefits, patients with time-dependent emergencies, such as traumatic injuries, should not have their conveyance delayed. Paramedics must make the decision to initiate mechanical ventilation based on clinical presentation, anticipated complications, and logistical factors (including availability of assistance and conveyance time).

### Procedure

#### General approach

1. Determine type of ventilator (LTV 1000 / LTV 1200, Hamilton T1).
  - PEEP compensated
  - Non-PEEP compensated
2. Connect power source.
3. Assemble ventilator circuit:
  - Circuit
  - $E_tCO_2$  detector
  - HME filter
  - Tracheal suction
4. Perform initial checks:
  - Start up
  - Leak test

#### Basic approach to ventilation

1. Select Assist Control -- Volume or (S)CMV+.
2. Select tidal volume ( $V_T$ ) of 6-8 mL/kg.
  - May select higher volumes in patients without lung injury as required
  - Monitor for elevated Pplats ( $> 30$  cmH<sub>2</sub>O)
3. Set respiratory rate:
  - Rate and  $V_T$  must provide a minute volume ( $V_E$ ) that adequately meets the patient's metabolic demands unless a permissive hypercapnia strategy is being used
  - Monitor for presence of auto-PEEP
4. Set desired  $FiO_2$ :
  - For patients with any degree of hypoxia, an initial  $FiO_2$  of 1.0 is appropriate
  - $FiO_2$  should be titrated down as soon as practical, assuming adequate oxygenation can be maintained in the context of the patient's condition and metabolic demands
5. Set desired PEEP:
  - Set initial PEEP with consideration of the physiological context; 5-10 cmH<sub>2</sub>O is appropriate for most patients
  - Hypoxemic patients will likely require higher levels of PEEP; titrate as required
  - Ensure plateau pressures ( $P_{plat}$ ) are  $\leq 30$  cmH<sub>2</sub>O
6. Set inspiratory time ( $T_i$ ):
  - Adjust  $T_i$  for flows ( $V_{calc}$ ) of 40-60 liters/minute
7. Set sensitivity to allow for patient-triggered breaths, if desired.

8. Set appropriate initial alarm parameters:
  - High pressure limit: 10 cmH<sub>2</sub>O above current peak inspiratory pressure (PIP)
  - Low pressure: 5 cmH<sub>2</sub>O above set PEEP
  - Low minute volume: 10-20% below set minute volume
  - Monitor the patient's vital signs including SpO<sub>2</sub>, EtCO<sub>2</sub>, vital signs, arterial blood gas, and P<sub>plat</sub> and adjust ventilator settings appropriately
9. In case of refractory hypoxia, consider:
  - Increasing PEEP and FiO<sub>2</sub>, with due consideration of trans-pulmonary pressures and/or P<sub>plat</sub>
  - Performing a recruitment maneuver if indicated (e.g., inspiratory hold at 40 cmH<sub>2</sub>O for 40 seconds); use caution in cases of hemodynamic compromise
  - Adjusting mode of ventilation
  - Switching to pressure control ventilation
    - If changing to pressure control, monitor for auto-PEEP and adjust alarm parameters to appropriate settings:
      - High pressure limit: 10 cmH<sub>2</sub>O above set total pressure
      - Low pressure: 5 cmH<sub>2</sub>O above set PEEP
      - Low minute volume: 10-20% below actual minute volume
  - Increasing T<sub>i</sub>
  - Inserting an esophageal balloon
  - Using inverse-ratio ventilation (IRV)

## PR31: Mechanical CPR Devices

### Applicable To

- ACP and above

### Introduction

Mechanical CPR devices (e.g. LUCAS) are being used by select ACP, CCP, and Paramedic Specialist crews for medical cardiac arrests.

### Indications

Mechanical CPR devices may be used for **medical (e.g. non-traumatic)** cardiac arrests in the following circumstances:

- To ensure the safety of crews when conveying patients with CPR in progress in a moving motor vehicle or aircraft
- As part of an approved clinical trial (e.g. ECPR trial)
- In transfers with appropriately trained medical teams
- Search & rescue or retrieval/conveyance purposes
- If the device is already in place after being applied by an appropriately trained person (e.g., select first responders, Canadian Coast Guard, search and rescue, Canadian Armed Forces, etc.)
- The device may be left in place if the appropriately trained person is able to travel with the patient to hospital; if this is not possible, the device should be removed and manual CPR commenced for conveyance

### Contraindications

- **Mechanical CPR devices are NOT indicated for patients in traumatic cardiac arrest**
  - Patients in traumatic cardiac arrest should receive manual CPR in addition to other interventions as required for the patient's clinical situation; priority in these situations is expedited conveyance if the patient meets criteria for continuation
- Patient is too small: the suction cup is not being completely compressed when it is lowered
- Patient is too large: the support legs of the device cannot be locked into place without compressing the patient

### Procedure

#### Assembly and Application of the LUCAS CPR Device:

1. Start manual compressions while another provider unpacks the LUCAS device. Press and hold 'ON/OFF' button on the user panel for one second. The device will perform a self-test.
2. Cease chest compressions to apply the back plate. As a team, lift the patient's upper body and lay the back plate below the armpits. If the upper portion of the device is not immediately available, resume compressions until the upper portion is ready.
3. Resume manual chest compressions (continue them through steps 4 and 5).
4. Place the upper portion of the LUCAS over the patient's chest so that the claw locks of the support legs can engage the back plate. Ensure that the patient's arms are outside the device.
5. Engage one support leg at a time starting with the closest one. **Confirm that both support legs are locked.**
6. Using two fingers, lower the suction cup until the pressure pad inside the cup touches the patient's chest. The lower end of the suction cup should be just above the xiphoid process.
7. Push 'PAUSE' (position 2) to lock the start position.
8. To start compressions, push 'ACTIVE' (30:2) (Position 3). Confirm that the device is working properly and check for central pulses upon compression.
9. To stop chest compressions, push 'PAUSE' (position 2).

#### Attaching the Stabilization Strap:

1. Lift the patient's head and place the support cushion under the patient's neck as close to the shoulders as possible.
2. Ensure that both device straps have been secured to the LUCAS support legs.

3. Tighten the buckles on the support cushion strap as required.
4. Ensure that the device remains properly positioned.

**Cleaning After Use:**

1. Clean all outer surfaces of the device, backboard, and neck strap with Accel disinfectant wipes. Be sure to clean the claw locks as well. Ensure a wet-contact time of 3 minutes.
2. Suction cup: unless grossly contaminated, continue with standard cleaning procedure above and put back in LUCAS bag for re-use.
3. Allow the device and accessories to dry before packing back into the bag.

**Notes**

Patients with traumatic cardiac arrest often have a cause of their arrest that does not respond to CPR (e.g., blood loss, tension pneumothorax, cardiac tamponade, etc.). Mechanical CPR devices take time to remove and can delay critical time-sensitive interventions on arrival to the emergency department (e.g., chest tube insertion, thoracotomy). This has been recently re-emphasized by trauma surgeons representing Trauma Services BC.

Priority for patients in traumatic out-of-hospital cardiac arrest is prompt conveyance to the nearest trauma centre if the patient meets criteria for continuation of resuscitation. Do not use mechanical CPR devices for these patients.

**Resources**

## PR32: Vascular Compression Band

### Applicable To

■ EMR and above

### Introduction

The Vascular Compression Band (VCB) is a device designed to obtain hemostasis of the radial artery post trans-radial cardiac angiography. The device uses an inflatable cushion that sits over the puncture site compressing the radial artery but allowing the ulna artery to supply blood to the hand. A syringe is used to add and remove air.

**Assessing the patient is key.**

### Procedure

#### Assessment with Band On

1. Check baseline vital signs
2. Conduct site check every 15 minutes ensuring to assess circulation:
  - Capillary refill (< 2 seconds)
  - Pain/tingling/numbness
  - Coolness and/or colour change
  - Bleeding, swelling, hematoma at site
  - O<sub>2</sub> saturation of the affected thumb
3. Document hematoma if present
4. Ensure proper time frame to start removal process

#### Pre-Removal Assessment

- Note band application time
- Look for band release start time on the post procedure form
- Note how many mLs of air was at starting point
- The usual amount is 15 mL and the maximum amount of air is 18 mL

#### Band Removal

Use the syringe provided with the band

1. Insert syringe tip into the band inflator (air port)
2. Ensure the syringe is in the 2 mL deflation position
3. Remove 2 mL of air from the inflation balloon every 15 minutes via air port
4. Re-assess site for bleeding and hematoma after each deflation

Repeat steps 1 to 4 until all the air is removed from the band

If there is no bleeding:

1. Remove the band from the patient's wrist
2. Apply Tegaderm dressing

***If at any time during the deflation process bleeding occurs, stop the process and re-inflate with the same amount that was removed. This will usually achieve hemostasis.***

## After the Band Has Been Removed

1. Assess site for hematoma or bleeding
2. Capillary refill (< 2 seconds)
3. Coolness and/or colour change
4. O<sub>2</sub> saturation of the affected thumb
5. Continue the scheduled site checks
6. Check every 15 minutes or if hand is used in any way

## Conveyance guidelines

- Patient position - of comfort
- Arm position - of comfort; patient is not to use hand
- Wrist movement restrictions - no flexion, extension, or pressure
- IV - in situ and patent (max 500 mL bag attached to patient)
- SpO<sub>2</sub> - on while the band is on the patient

## Notes

## Complications

### Bleeding

If bleeding occurs while the band is on, remove the band and apply direct pressure just proximal to the access site for 10 minutes using a gloved hand. Once hemostasis is achieved, continue with site checks.

- If the site continues to bleed after 10 minutes, continue direct pressure and take the patient to the closest hospital
- **DO NOT RE-APPLY THE BAND**

If bleeding occurs at any time during the deflation process, inject enough air to restore hemostasis (never inflate VCD beyond 18 mL). Wait 30 minutes and then repeat Step 1 of the removal protocol (4.2). Restart scheduled site checks every 15 minutes.

- Document
- Notify receiving hospital

### Hematoma

If a hematoma occurs while the band is on:

1. Remove the VC band and apply direct pressure just proximal to the access site for 10 minutes
2. Outline perimeter
3. Refer back to hematoma chart (use the legend on the RCCL document)
4. Restart site checks
5. Document
6. Notify receiving hospital

### Neurovascular Compromise

If patient presents the following:

- Capillary refill prolonged (> 2 seconds)
  - Cool, pale, or discoloured limb
  - Pain/tingling
1. Remove 1 mL of air via band air port
  2. Monitor for improvement
    - With improvement: continue site checks as per schedule
    - With NO improvement: convey patient to the closest hospital



3. Document
4. Notify receiving hospital

## Resources



## References

1. Kern, M. et al. The Cardiac Catheterization Handbook (6th ed). 2016.
2. Vascular Solutions Inc. VASCTM Band Hemostat [Product Reference Sheet]. [\[Link\]](#)

### Changelog:

- 2023-06-13: enabled VCB for EMR scope of practice

## PR33: PCP LifePak 15 IFT Procedure

### Applicable To

- PCP and above

### Introduction

To provide clear guidelines for the Primary Care Paramedic (PCP) inter-facility transport (IFT) of stable patients requiring electrocardiogram (ECG) monitoring.

### Indications

All of the following criteria must be met prior to the initiation of transport:

- Patients must have been pre-screened by EPOS or Critical Care Paramedic Advisor (CCP-A) for appropriateness of transport
- No current or ongoing chest pain
- SpO<sub>2</sub> > 92%
- Systolic blood pressure > 90 mmHg
- Glasgow Coma Scale 15/15

CliniCall consultation required to confirm transport in the following circumstances:

- Heart rate < 50 or > 100 beats/minute
- Recent cardiac dysrhythmias within six hours of transport
- Recent cardiac chest pain within three hours of transport
- Recent thrombolysis within three hours of transport

### Procedure

1. Assess the patient for indications.
2. Complete a full assessment including:
  - Full patient history
  - Complete physical exam
  - Vital signs
  - Baseline ECG
3. Indications met with EPOS/CCP-A approval:
  1. Continue with monitoring
  2. Confirm transport logistics of transfer
  3. Load and transport patient
4. Change in patient condition during transport:
  - If the patient becomes unstable during transport:
    - Unresponsive or decreased LOC
    - Seizures
    - Hypotension
    - Cardiac chest pain
    - Severe shortness of breath with dyspnea
  - Contact CliniCall/CCP-A for consultation
  - If closer to hospital, transport directly to the hospital and notify dispatch of the change in patient status.
  - If closer to an arriving critical care transport team, notify team and continue meet.

### Notes

See also: [LifePak 15 Primary Care Paramedic Standard Operating Procedure](#)

## Resources

For clinical support please contact Clinical (1-833-829-4099)

For additional information contact your regional Paramedic Practice Educator (PPEd)

## PR34: Transvenous Pacing

Brian Reichert

### Applicable To

■ CCP only

### Introduction

Transvenous pacing is a temporary method of endocardial pacing via central venous access. Although an invasive procedure, it is more comfortable than transcutaneous pacing and the wires are less prone to displacement during conveyance.

### Indications

- Maintain transvenous pacing if initiated at the sending facility
- Life-saving treatment for bradyarrhythmias unresponsive to medications, with symptoms or severe hemodynamic impairment
- Prolonged conveyance given the risks of sedation for patients being transcutaneously paced where the risks outweigh those of transvenous pacing

### Contraindications

- Bradycardia that is well-tolerated
- Myocardial infarction being treated with a thrombolytic agent and is being aggressively treated with anticoagulant or antiplatelet agents
- Inability to maintain cardiac monitoring
- Prosthetic tricuspid valve
- Severe hypothermia

Exercise caution in patients whose bradycardia is associated with correctable causes.

### Procedure

1. The CVC, either internal jugular or subclavian, with a cordis is in situ.
2. The pacing wires have been sheathed, floated, and placed.
3. The sending facility has initiated the transvenous pacing.
4. TVP settings:
  - Most modern generators have a locking mechanism to reduce the risk of accidental changes. This is usually a button that looks like a key or a lock -- unlock this to change pacing settings.
  - Set the rate to maintain an appropriate cardiac output for the patient's needs.
  - There are two methods of setting current (measured in mA) to establish capture:
    - Start at 10-20 mA and decrease the current until capture is lost, then increase by 1 mA increments to maintain capture.
    - Set the output at 2 to 3 times the pacing threshold.
  - Sensing is measured in mV. If the patient has no intrinsic rate, the sensitivity is turned to the least sensitive value. If the patient has intrinsic activity, set the sensitivity to allow for normal beats to be sensed and pacing to be inhibited. The sensitivity setting on the generator is decreased to allow for a greater sensitivity threshold (and vice versa).
5. Ensure fluid is running through the cordis appropriately.
6. Gather the appropriate equipment:
  - Generator
  - Spare batteries

- Pacing wires
  - Return address of the sending hospital
7. Ensure the locking mechanism of closed and mark the depth of the wires.
  8. Ensure the pacemaker has electrical and mechanical capture.

Example of pacemaker generator:



## Notes

Troubleshooting:

- Check the rate
- Check for capture:
  - Generator failure
  - Displaced or broken wire
  - Battery failure
  - Underlying clinical condition
- Check pacing:
  - Current (mA)
  - Sensitivity (mV)
  - Battery
  - Displaced wire
- Check sensitivity:
  - Under-sensed
  - Over-sensed
- Bleeding
- Air or pulmonary embolism
- Pneumothorax

## References

1. Costello, L. Pacemaker essentials. 2016. [\[Link\]](#)
2. Ganz, LI. Temporary cardiac pacing. 2021. [\[Link\]](#)
3. Bohanske, M. Transvenous pacemaker placement. 2020. [\[Link\]](#)



## PR35: Bladder Pressure Monitoring

Brian Reichert

### Applicable To

■ CCP only

### Introduction

Bladder pressure monitoring is used to identify an often under-recognized and under-treated cause of obstructive shock related to intra-abdominal hypertension. Intra-abdominal pressure (IAP) is graded by:

- Grade I: 12-15 mmHg
- Grade II: 16-20 mmHg
- Grade III: 21-25 mmHg
- Grade IV: > 25 mmHg

Abdominal compartment syndrome is a sustained IAP of more than 20 mmHg and is associated with new organ dysfunction. Consideration needs to be paid to a primary or secondary cause so that appropriate treatment can be initiated. Reducing the obstructive shock state allows for a safer conveyance.

### Indications

- Suspected obstructive shock resulting from either a primary or secondary source of abdominal hypertension that has led to abdominal compartment syndrome

### Contraindications

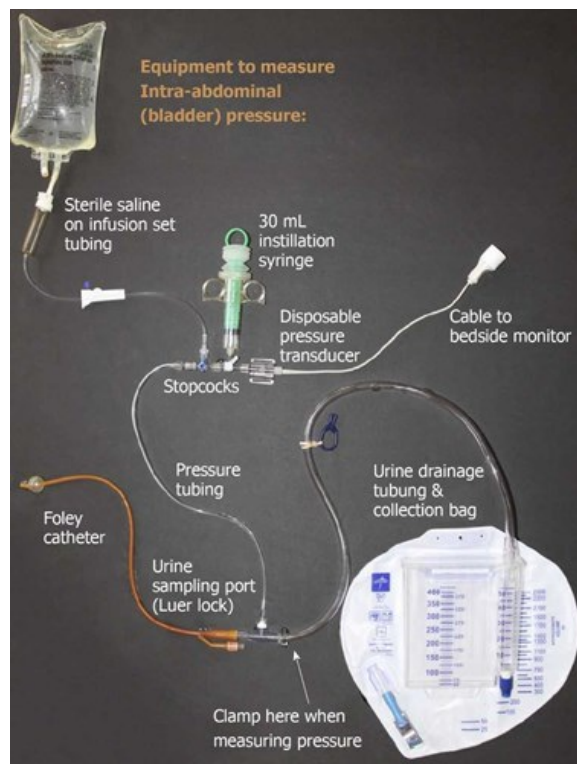
- Any patient unable to tolerate a head-of-bed < 20°

**Caution:** a blocked or kinked Foley will give falsely high pressures

**Caution:** PEEP will cause falsely high pressures

### Procedure

1. Perform hand hygiene.
2. Patient should be placed in the supine position for measurement. The head of the bed needs to be < 20°. If this is not clinically feasible, it is important to recognize that elevation of the head of the bed will result in a higher IAP.
3. Document position and ensure all subsequent readings are taken in the same position.
4. Prime the pressure monitoring tubing.
5. Connect the tubing to the sampling port on the Foley tubing using aseptic technique.
6. Connect the transducer cable to the monitor.
7. Level at the cross section of the mid-axillary line and the iliac crest; zero the transducer.
8. Change the scale on the monitor to 30 mmHg.
9. Clamp the drainage tube to the urine bag below or distal to the sampling port.
10. Using the port on the tubing and the three-way stopcock, fill the bladder with 1mL/kg (minimum of 3 mL and maximum 25 mL) of 0.9% sterile sodium chloride using the syringe. The volume of fluid in the bladder should be constant for each subsequent measurement.
11. Once instilled, close the stopcock of the syringe and wait 60 seconds.
12. Obtain the mean pressure reading upon end expiration.
13. The abdominal pressure should produce fluctuations in the waveform.
14. Once finished with the reading, re-open the clamp.



## Notes

- False positives can occur with patient position, RASS, and detrusor muscle contraction.
- Some commercial products connect directly in line with the Foley tubing.

## References

1. Gestring M. Abdominal compartment syndrome in adults. 2020. [\[Link\]](#)
2. Raccanello J., Morris K. Intra-abdominal pressure monitoring. 2020. [\[Link\]](#)
3. Morgan B. Information and procedure: intra-abdominal pressure monitoring. [\[Link\]](#)
4. Rogers WK, Garcia L. Intraabdominal hypertension, abdominal compartment syndrome, and the open abdomen. 2018. [\[Link\]](#)

## PR36: Turkel Needle Thoracentesis

Brian Reichert

### Applicable To

■ ACP and higher

### Introduction

Needle thoracentesis or thoracostomy is a common procedure in which any tube or small catheter is placed through the chest wall into the pleural cavity and used primarily to drain air or fluid. The Turkel device is used by ACPs and CCPs to relieve a tension pneumothorax or hemothorax.

### Indications

- Tension pneumothorax or hemothorax with deteriorating vital signs, markedly decreased cardiac output, profound shock, or cardiac arrest.
- Altitude and flight physiology suggests that hemodynamic and patient deterioration may occur due to Boyle's law; the issues regarding in-flight assessment and treatment options may be limited and earlier intervention may be necessary.

### Contraindications

- Needle thoracentesis increases morbidity if performed when a tension pneumothorax is suspected but absent.

**Caution:** (CCPs) The lack of lung sliding with ultrasound is not 100% sensitive or specific of a pneumothorax.

### Procedure

1. Identify most appropriate insertion point: the 4th or 5th intercostal space in the mid-axillary line, or alternately, the 2nd intercostal space in the mid-clavicular line (MCL). Consider underlying injury when selecting a site.
2. Clean skin over the selected site.
3. Prepare the insertion site; use surgical scalpel to lacerate the skin at the site of insertion. The nick is not required but will likely aid in the insertion.
4. Hold the device between the thumb and middle finger with the index finger. Hold at the prefabricated finger hold and not at the main body or stopcock.
5. Advance the device through the chest wall until the indicator changes from red to green indicating that the tip is no longer encountering resistance. Stop advancing.
6. Advance the catheter over the needle into the pleural space and withdraw the needle assembly.
7. Additional catheters may be placed as required.
8. To relieve the pressure, open the three-way stopcock.
9. Secure, + or – a Heimlich valve as appropriate. It is not appropriate to put suction directly onto the three-way stopcock. For CCPs, if suction is required, use a Heimlich.

### Notes

Children and neonates may benefit from a much smaller gauge needle to avoid lung injury and surrounding structures.

### References

Huggins JT, Carr SR, Woodward GA. Thoracostomy tubes and catheters: Placement techniques and complications. 2020. [\[Link\]](#)

Blackwell T. Prehospital care of the adult trauma patient. 2020. [\[Link\]](#)

## PR37: Femoral Arterial Line Placement

Brian Reichert

### Applicable To

■ CCP only

### Introduction

Direct continuous measurement with an intra-arterial catheter is the gold standard for determining arterial blood pressure and blood sampling. This allows for aiding and guiding ongoing care in real time. The most common site for insertion is the radial artery as it is easiest to access and landmark. Due to patient habitus or anatomy, a femoral approach may be necessary as an alternative.

### Indications

- Identification and monitoring of acid-base disturbances
- Measurement of the partial pressures of oxygen and carbon dioxide
- Assessment of the response to therapeutic interventions
- Hemoglobin quantification and response to intervention

### Contraindications

Relative:

- Local infection, thrombus, or distorted anatomy at the puncture site
- Severe peripheral vascular disease
- Supratherapeutic coagulopathy and infusion of thrombolytic agents
- INR  $\geq 3$
- PTT  $\geq 100$
- Platelet count  $< 50 \times 10^9/L$

**Caution:** Arterial line placement should be done for ongoing guidance of care and not a singular point of care test.

### Procedure

1. Prime femoral arterial line set (with or without VAMP).
2. Normal saline run through arterial line set.
3. Remove white vented caps and replace with blue non-vented caps.
4. Apply pressure infuser at 300 mmHg.
5. Connect to monitoring cable.
6. Identify femoral artery either by palpation or with ultrasound (preferable).
7. Locate the inguinal ligament. Never allow the needle to cross the inguinal ligament.
8. If applicable, move the pannus.
9. Clean insertion site using aseptic sterile technique.
10. Full barrier precautions including mask, cap, and eye protection should be worn.
11. Position wrist/hand to allow for access to femoral artery.
12. Landmark femoral artery for catheter insertion.
13. A skin nick should be made with a scalpel to avoid a skin plug or damage to the catheter.
14. Using femoral artery line catheter, insert at 45° angle until blood return.
15. Use included slide and guidewire to perform Seldinger technique to assist in catheter insertion. (If using a separate wire, utmost care should always be used for strict wire control.)
16. Slide catheter off hub while retracting needle (this will be an exposed sharp).

17. Secure line with suturing.
18. Apply Opsite.
19. Attach primed femoral artery line tubing.
20. Level the transducer.
21. Zero art line.
22. Turn off to patient.
23. Open line to air.
24. Zero on monitor.
25. Perform square waveform test.

## Notes

- Consider the risk stratification for an invasive procedure including the time associated with insertion and the need for conveyance.
- Consider the use of venous blood samples when appropriate.
- Arterial samples are often not required if oxygenation is known to be appropriate and SpO2 levels are adequate and reliable.
- Venous blood gas samples can be adapted to determine acid-base status with the appropriate conversions (excluding a reliable PaO2).
- Hemodynamic monitoring may be accomplished with a faster, albeit less reliable, procedure (NIBP). A risk assessment should be done to determine the need.
- The femoral site is at a greater risk of infection. Diligent cleaning and sterile technique needs to be done prior to insertion.

## References

1. Theodore AC, Clermont G. (2020). Intra-arterial catheterization for invasive monitoring: Indications, insertion techniques, and interpretation. [\[Link\]](#)
2. Theodore, AC. (2021). Venous blood gases and other alternative to arterial blood gases. [\[Link\]](#)
3. Theodore AC. (2020). Arterial blood gases. [\[Link\]](#)

## PR38: Radial Arterial Line Placement

Brian Reichert

### Applicable To

■ CCP only

### Introduction

The use of arterial lines for hemodynamic monitoring and access for blood sampling in high-risk surgical and critically ill patients has become standard practice. Thus, aiding and guiding ongoing care in real time. The most common site for insertion is the radial artery as it is easiest to access and landmark.

### Indications

- Identification and monitoring of acid-base disturbances
- Measurement of the partial pressures of oxygen and carbon dioxide
- Assessment of the response to therapeutic interventions
- Hemoglobin quantification and response to intervention

### Contraindications

Relative:

- Abnormal Allen's test
- Local infection, thrombus, or distorted anatomy at the puncture site
- Severe peripheral vascular disease
- Active Raynaud's syndrome

#### Cautions:

- Arterial line placement should be done for ongoing guidance of care and not a singular point of care test
- Supratherapeutic coagulopathy and infusion of thrombolytic agents
- INR  $\geq 3$
- PTT  $\geq 100$
- Platelet count  $< 50 \times 10^9/L$

### Procedure

1. Prime radial arterial line set (with or without VAMP).
2. Normal saline run through arterial line set.
3. Remove white vented caps and replace with blue non-vented caps.
4. Apply pressure infuser 300 mmHg.
5. Connect to monitoring cable.
6. Identify radial artery.
7. Perform modified Allen's test to ensure adequate collateral circulation.
8. Clean insertion site using aseptic technique.
9. Position wrist/hand to allow for access to radial artery.
10. Landmark radial artery for catheter insertion.
11. Using radial artery line catheter, insert at 45° angle until blood return.
12. Use included slide and guidewire to perform Seldinger technique to assist in catheter insertion.
13. Slide catheter off hub while retracting needle (this will be an exposed sharp).
14. Secure line with suturing.

15. Apply Opsite.
16. Attach primed radial artery line.
17. Level the transducer.
18. Zero art line.
19. Turn off to patient.
20. Open line to air.
21. Zero on monitor.
22. Perform square waveform test.
23. Note: In cases where radial artery access is not achievable, alternate sites (i.e., femoral) may be initiated. It is important to note that longer FA catheters must be used as standard RA ones are likely to be too short to be effective.

## Notes

- Consider the risk stratification for an invasive procedure including the time associated with insertion and the need for conveyance.
- Consider the use of venous samples when appropriate.
- Arterial samples are often not required if oxygenation is known to be appropriate and SpO2 levels are adequate and reliable.
- Venous blood gas samples can be adapted to determine acid-base status with the appropriate conversions (excluding a reliable PaO2).
- Hemodynamic monitoring may be accomplished with a faster albeit less reliable procedure (NIBP). A risk assessment should be done to determine the need.

## References

1. Theodore AC, Clermont G. (2020). Intra-arterial catheterization for invasive monitoring: Indications, insertion techniques, and interpretation. [\[Link\]](#)
2. Theodore, AC. (2021). Venous blood gases and other alternative to arterial blood gases. [\[Link\]](#)

## PR39: Escharotomy

Brian Reichert

### Applicable To

RESTRICTED TO PHYSICIAN SUPPORT ONLY

### Introduction

This is limited to chest escharotomies.

Circumferential deep partial-thickness and full thickness burns involving the chest wall can lead to respiratory collapse. This is the case when the dermis becomes stiff and unyielding, leading to the restriction of wall motion during respiration. This burnt, stiff, and unyielding tissue is referred to as an eschar. A decompressive escharotomy is an extremely rare but potentially life-saving procedure to preserve respiration. Clinicians need to be mindful this is not a fasciotomy. The incision is only through the non-viable eschar allowing the cutaneous envelope to become more compliant.

### Indications

- In consultation with physician support (ETP/EPOS)
- Respiratory decompensation secondary to the restrictive lung wall compliance resulting from a deep circumferential or near circumferential burn involving the chest
- Inability to ventilate due to high pressures related to a restrictive chest wall

### Contraindications

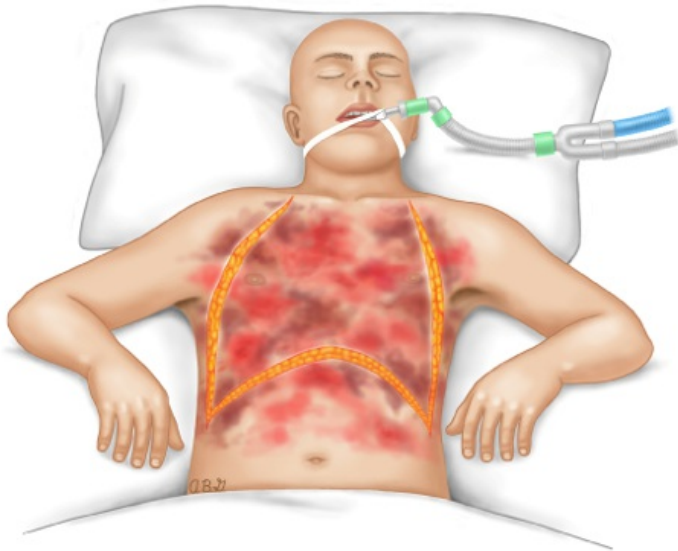
- No contraindications with circumferential or near-circumferential deep partial-thickness or greater burns to the torso with impending or established respiratory collapse

**Caution:** This is a rare but potentially life-saving event; consult with ETP/EPOS.

### Procedure

1. The patient is placed in a supine position while maintaining ventilatory support efforts.
2. Time permitting – cleanse the area of any excess debris or loose clothing.
3. Utilizing a scalpel cut down through the eschar to the level of the subcutaneous fat. This depth is approximately 1 cm. An immediate release in tissue pressure is experienced often as a discernible popping sensation.
4. Using sterile technique, incise the chest wall from the clavicle to the costal margin in the anterior axillary line bilaterally; avoid breast tissue in women.
5. Once the escharotomy is performed, monitor for improvement in ventilation as evidenced by improved compliance of ventilations using a mechanical ventilator or bag/valve device, visible chest rise, and improvements in oxygen saturation.
6. If improved compliance is not seen after the initial incision, revise the escharotomy in an attempt to improve ventilatory support. Consider joining these vertical incisions with two transverse incisions. These transverse incisions connect the previous vertical incisions made above. The first is at the clavicles inferiorly and the second is superior to the abdomen at the level of the costal margin. (Sometimes referred as a Roman breastplate approach.)
7. Once completed, cover the torso/chest wall area with a sterile burn sheet.
8. Maintain continuous monitoring of the patient's respiratory compliance and oxygenation.





## Notes

- Complications include hemorrhage, increased fluid loss, subcutaneous infection, and neuromuscular injury.

## References

1. Streitz MJ. How to do burn escharotomy. 2020. [\[Link\]](#)
2. Rice PL. Orgill DP. Emergency care of moderate and severe thermal burns in adults. 2019. [\[Link\]](#)
3. Phelan HA. Bernal E. Treatment of deep burns. 2019. [\[Link\]](#)

# PR40: Foley Catheterization

Brian Reichert

## Applicable To

- ACP with Schedule 2 endorsement
- CCP independently

## Introduction

Bladder catheters are used for urinary drainage, or to collect urine for measurement.

## Indications

- Management of urinary retention with or without bladder outlet obstruction
- Hourly urine output measurement in critically ill patients
- Daily urine output measurement for fluid management or diagnostic test
- Management of hematuria associated with clots
- Management of immobilized patients (e.g., stroke, pelvic fracture)
- Management of patients with neurogenic bladder
- Management of open wounds located in the sacral or perineal regions in patients who are incontinent
- Intravesical pharmacologic therapy
- Improved patient comfort for end-of-life care
- Management of patients with urinary incontinence following failure of conservative, behavioral, pharmacologic, and surgical therapy

## Contraindications

- Urethral injury
- Pelvic trauma
- Blood at the meatus or gross hematuria associated with trauma

### Caution:

- Urethral stricture
- Recent urinary tract surgery
- Artificial sphincter

## Procedure

1. Position the patient supine.
2. In women, the lower extremities are frog-legged to maximize exposure of the periurethral region.
3. Sterile gloves are donned and the catheterization kit is inspected to ensure its contents are complete and free of defects.
4. **For silicone catheters**, checking the balloon should not be performed because the region of the balloon can become wrinkled making placement more difficult. The end of the catheter, if not preattached, can be connected to the drainage system before or after catheter placement.
5. Drapes are placed and the periurethral region cleansed. In men, the penis is grasped firmly with the nondominant hand and tension directed toward the ceiling, straightening the urethra. In women, the nondominant hand is used to spread the labia to facilitate cleansing the periurethral region and viewing the urethral meatus.
6. The gloved dominant hand is used to place the catheter into the urethral meatus and provide steady, gentle pressure to advance the catheter. When a coude catheter is used, the curved tip of the catheter should be oriented toward the dorsal surface of the penis. When the catheter tip approaches the external sphincter in men, resistance will be felt. It is often helpful to pause momentarily to let the sphincter relax before continuing insertion.
7. The catheter should be inserted to the flared portion of the catheter (i.e., hub). The balloon is inflated with sterile

water only after the flow of urine is seen. Saline should not be used to inflate the balloon because crystal formation may obstruct the balloon channel and prevent balloon deflation.

8. Once the balloon is inflated, the catheter is withdrawn until slight resistance is felt. The urine collection system is connected, if not already done in step 4.
9. The drainage tubing is then anchored to the leg with tape to prevent traction of the catheter on the urethral meatus.

## Notes

### Troubleshooting

- If no urine is obtained, gentle pressure may be applied to the suprapubic region.
- If placement of the catheter is uncertain, consider the use of agitated saline and ultrasound to confirm placement.
- If a vaginal catheterization has occurred, leave the tubing in place, gather another set, and insert. This will allow better landmarking for the second attempt.
- Gentle irrigation through the end of the catheter using 10 to 20 mL sterile saline can be performed and should return the saline mixed with urine. If the saline is not returned or any resistance to catheterization was encountered, underlying pathology may be present and urologic consultation should be obtained.
- If the patient complains of pain during insertion, the catheter should be removed.
- If blood appears at the meatus or on the tip of the catheter, a urethral injury may have occurred. Abandon the procedure and get a urological consultation.

## References

1. Schaeffer AJ. Placement and management of urinary bladder catheters in adults. 2021. [\[Link\]](#)
2. Bajaj L, Bothner J. Urine collection techniques in infants and children with suspected urinary tract infection. 2020. [\[Link\]](#)

# PR41: Recruitment Maneuver

Brian Reichert

## Applicable To

■ CCP only

## Introduction

A recruitment maneuver is the brief application of a high level of airway pressure, with the goal of recruiting non-gas exchanging parts of the lung. This pressure is input and then held for a period trying to open previously collapsed alveoli. This is part of an open lung strategy for hypoxic ARDS patients due to the heterogeneity of the disease process.

## Indications

- ARDS criteria of moderate to severe hypoxemia as identified by the [Berlin criteria](#). This is despite conventional low T<sub>v</sub> ventilation and escalation of the PEEP ladder
- The presence of recruitable lung as identified by CXR, Ct, or ultrasound

## Contraindications

- Hemodynamic instability
- COPD and lung emphysema
- Bronchopleural fistula
- Acute cor pulmonale

### Caution:

- Severe TBI or raised ICP (All options must have failed before a recruitment maneuver in this patient demographic; a risk stratification must be completed)
- Optimal timing and frequency are unknown
- Alveolar overdistension and profound acidosis may occur with multiple maneuvers
- May not be as effective in the fibroproliferate phase

## Procedure

Using the Hamilton ventilator:

1. Select Mode.
2. Choose APRV.
3. Confirm.
4. Set the T High for 40 and set the P High for 40. Other pressures may be considered based on clinical circumstances.
5. The T low and P low do not need to be set from the standard preset but to ensure they are not problematic, or if starting from APRV set them to:
  - T low for 0.60
  - P low for 10
7. The Flow Trigger can be set at 3.
8. The FIO<sub>2</sub> should be left at 1.
9. Confirm.
10. If no breath is started immediately, select the manual breath button as the machine may be in the expiratory phase.
11. If hemodynamic instability occurs during the maneuver, abort the breath hold by pressing the manual breath button.
12. While the ventilator is in an inspiratory hold, SCMV can be selected as the ventilation strategy post recruitment. As the pressure will start low, volume may potentially be lost. The pressure will increase +/- 2 cmH<sub>2</sub>O per breath and the volume will slowly increase. However, this lag time may lead to de-recruitment of lung tissue. Choose PCV instead, and allow for an increase in PEEP to maintain the newly recruited alveoli. The rest of the settings in PCV are as per patient needs.

13. Confirm.
14. If you want to go back to SCMV after this initial stabilization on PCV you may. This will now maintain your pressure and thus your volume without losing recruitment.

## Notes

- There are other recruitment maneuvers that can be performed (20-20, 30-30).
- Multiple breath holds can be done but caution is advised as respiratory acidosis associated with the breath hold may exacerbate an already acidotic patient.
- Alveolar overdistension does not appear to occur with one breath hold but multiple holds may be associated with alveolar overdistension.

## References

1. Siegle MD, Hyzy RC. Ventilator management strategies for adults with acute respiratory distress syndrome. 2021. [\[Link\]](#)
2. Gertler R. Mechanical ventilation during anesthesia in adults. 2021. [\[Link\]](#)
3. Hamilton T1 Quick Manual. 2021. [\[Link\]](#)

## PR42: EVD Monitoring and Drainage

Brian Reichert

### Applicable To

■ CCP only

### Introduction

An external ventricular drain (EVD) is a small catheter inserted through the skull, usually into the lateral ventricle, which is typically connected to a collecting device to allow for drainage of cerebrospinal fluid. The EVD can also be connected to a transducer that monitors and records ICP. This allows ICP monitoring and guidance of ICP management using the equation  $CPP = MAP - ICP$ . Cerebral perfusion can thus be guided with osmotherapy, hypertonic solutions, and vasopressors to avoid herniation and cerebral ischemia. CSF can also be drained to avoid further herniation. The overall management allows for parenchymal fluid shift, CSF drainage, and hemodynamic optimization to improve cerebral blood flow.

### Indications

- Currently limited locations can insert or monitor such devices; as such it must be in situ prior to the transfer
- Hydrocephalus and neurologic decline
- TBI with a GCS  $\leq 8$  and an abnormal CT scan showing evidence of mass effect
- Following surgery, particularly tumor surgery, until the CSF circulation is re-established
- To enable drainage of infected CSF
- In patients with a severe head injury to provide both a means of measuring ICP and allowing CSF drainage to treat raised ICP
- ICP monitoring in severe TBI patients with a normal CT scan may be indicated if two of the following features are present: age  $> 40$  years; motor posturing; systolic blood pressure  $< 90$  mmHg

### Contraindications

- A patient receiving anticoagulation therapy
- A scalp infection
- **Caution:** Caution must be used with continuous drainage since excessive drainage can lead to ventricular collapse and malfunctioning, or occlusion, of the catheter in the setting of cerebral edema in small ventricles. In the conveyance environment, the patient will not be level at all times. Therefore, continuous drainage should be avoided.

### Procedure

Consult with appropriate neurological service for specific instructions and care planning during conveyance.

#### 1. Errors in positioning the transducer:

- Too far above the foramen of Monro (FOM) will lead to a falsely low ICP measurement and insufficient drainage of CSF. In this case, intracranial hypertension would go undetected and untreated.
- Too far below the FOM will lead to a falsely high ICP measurement and excessive drainage of CSF. This may collapse the ventricles and possibly induce blockage of the system resulting in unnecessary treatments.

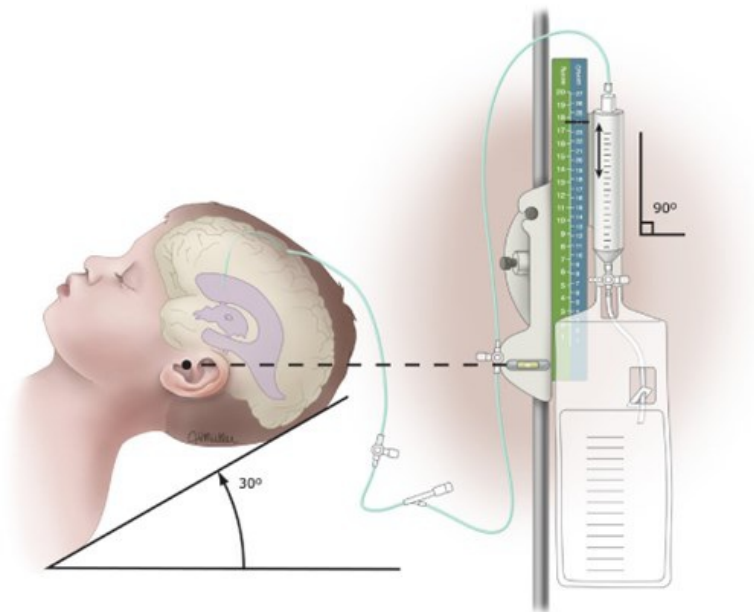
#### 2. Leveling procedure:

- Explain to the patient/family what is about to occur.
- Perform hand hygiene.
- Turn on the laser (protect the patient's eyes from the laser).
- Ensure the level is horizontal and the bubble is centred between the lines.
- Turn the 3-way stopcock between the patient and the burette on the EVD system to the off position, preventing the flow of CSF.

- Alter the height of the entire EVD system to bring the transducer laser horizontal with the patient's FOM. (Supine = tragus of the ear; lateral = midsagittal line, between the eyebrows.)
- Once levelled, turn the 3-way stopcock between the patient and the burette on the EVD system to the on position, allowing the flow of CSF.
- This procedure needs to be followed at the beginning of the transfer and every time the patient moves or is moved.

### 3. Monitoring:

- Set the burette level appropriate for the individual needs. Often 15-20, but this will be patient dependent. Note the monitoring units of the burette, either cmH<sub>2</sub>O or mmHg. The difference is 1.36. The monitor will measure in mmHg and if the burette is in cmH<sub>2</sub>O, an ongoing calculation will have to be made to ensure accidental drainage does not occur.
- Once leveled, zero the transducer.
- Ensure connections are secure.
- Turn monitor on and ensure appropriate ICP cords are connected.
- Set appropriate alarm limits (including ICP limits).
- Perform hand hygiene.
- Zero on the monitor:
  - Turn stopcock off.
  - Lower the drip chamber until the pressure indicator window is centred over the 0 position on the pressure scale.
  - Press zero on the monitor.
  - Once the pressure transducer is zeroed, the drip chamber needs to be raised back to the desired setting.
- Turn the EVD stopcock to the off position. This will allow a pressure to be read on the monitor.
- The off position should be utilized for conveyance as bumps in the road, takeoffs, and landings will alter patient positioning and thus leveling. The off position will ensure that inadvertent drainage will not occur.
- If the ICP is increasing and drainage is required, first ensure the patient and transducer are leveled.
- If opening the stopcock for CSF drainage due to increasing ICP, turn the EVD on and ensure the drain is oscillating/draining. Keep in mind CSF is produced at a rate of 20 mL/hour.
- Key point: ICP cannot be measured if the EVD is open or on continuous drainage.
- Once opened and the goal of care is met, reset the stopcock to the closed position.



## Notes

- The major complications associated with EVD use are catheter occlusion, due to clotted blood at the intraventricular orifice, and infection.
- Be aware of excessive CSF drainage if the drain is left open or inappropriately leveled.
- Patients with more severely impaired autoregulation and suboptimal CPP are best managed with efforts to lower ICP, rather than by elevating MAP with vasopressors; hypertension is more likely to worsen cerebral edema when protective

autoregulation is impaired.

- An ICP goal  $\leq 22$  mmHg is recommended as the threshold that predicts survival and a favourable outcome following TBI. Individual goals need to be discussed with ETP.

## References

1. Cucchiara BL. Intraventricular hemorrhage. (2021). [\[Link\]](#)
2. Venkatakrishna R. Management of acute moderate and severe traumatic brain injury. (2019). [\[Link\]](#)
3. Tunstall T, Wray A. External ventricular drains and intracranial pressure monitoring. (2020). [\[Link\]](#)



## PR43: Point of Care Testing

Brian Reichart

### Applicable To

■ CCP only

### Introduction

The epoc® point of care analyzer is currently used for evaluation of patient blood chemistries by BCEHS critical care paramedics. This includes blood gases, hematology, electrolytes, and lactate. The assay analyzed is at the discretion of the clinician to guide patient care.

### Indications

- Any patient that requires lab data to guide ongoing treatments

### Contraindications

- No specific contraindications for point of care testing
- A negative Allen's test is a contraindication for a radial arterial sample

#### Cautions:

- Once the sample has been withdrawn and before injecting it, the sample should be rolled to ensure it has not coagulated and that your hemoglobin values will be accurate
- Ensure the reader always remains horizontal during the analyzing phase
- Ensure the cap on the vented syringe is used to avoid blood gas errors if a prolonged wait interval is experienced

### Procedure

1. Prepare the patient and draw the blood sample.
2. Turn 'ON' epoc® Reader and epoc® Host.
3. Log in to Host software application.
4. Use epoc® Host to establish wireless connection with the epoc® Reader.
5. Begin test sequence.
6. Obtain a new test card and remove from pouch.
7. Insert test card into Reader.
8. The internal motor of the Reader is actuated to start the calibration process. This process releases a calibration fluid in the card that flows across sensors within the card.
9. Enter patient information, select tests, and sample type. This brings up the appropriate values in the menu.
10. If using a non-heparinized syringe, cancel the calcium value.
11. In the syringe, a meniscus is formed at the tip. The sample size is exceedingly small and, if injected, a partial air/blood sample is injected which will then develop a sample size error. Instead, eject 1 drop of blood to get rid of the meniscus and then introduce the blood to the cartridge.
12. Introduce the sample into the test card upon completion of calibration.
13. Introduce the blood sample into test card until an audible beep is heard.
14. If the syringe is withdrawn vertically, a suction will be produced at the card/syringe interface and a partial sample will accidentally be removed. To avoid this, once the sample is injected, roll the syringe off to the side.
15. The Reader sends test results to the Host. Results are calculated and displayed on the Host in approximately 30 seconds.
16. Observe, record, and analyze the results.
17. Remove the test card and discard.
18. Analyze the data and adjust patient care as needed.

## Notes

- If the epoc® is outside of the temperature range, warm or cool both the epoc® and the cartridge until the temperature range is met.

## References

1. Epoc® system manual. (2016). [[Link](#)]
2. Siemens Healthcare. Epoc® system manual. (2021). [[Link](#)]

## PR44: Pericardiocentesis

Brian Reichert

### Applicable To

RESTRICTED TO PHYSICIAN SUPPORT ONLY

### Introduction

Emergency pericardiocentesis is needed only for those individuals with hemodynamic collapse secondary to a pericardial tamponade. The lethality of a pericardial effusion has been recognized since the 1600s but the evolution of pericardiocentesis correlates to the advancement of ultrasound techniques. The blind subcostal procedure remains standard when ultrasonography is unavailable, but with a high complication rate. Ultrasound can find a pericardial effusion, but the diagnosis is not radiological; it remains a clinical determination. The hemodynamic consequences of a pericardial effusion are related to the speed and volume of accumulation. Cardiac tamponade represents obstructive shock physiology when the intrapericardial pressure is greater than the intracardiac pressure.

### Indications

- Acute cardiac tamponade causing overt hemodynamic compromise; this means peri-arrest or cardiac arrest that requires urgent removal of pericardial fluid.
- Obstructive shock physiology with a radiological identification of an acute pericardial effusion unresponsive to other treatment modalities.

### Contraindications

- "Early" cardiac tamponade with minimal or no evidence of hemodynamic compromise may be treated conservatively, with careful hemodynamic monitoring, serial echocardiographic studies (every 2-3 days, or sooner if clinically indicated), avoidance of volume depletion, and therapy aimed at the underlying cause of the pericardial effusion
- Any delay to a centre capable of an emergency thoracotomy

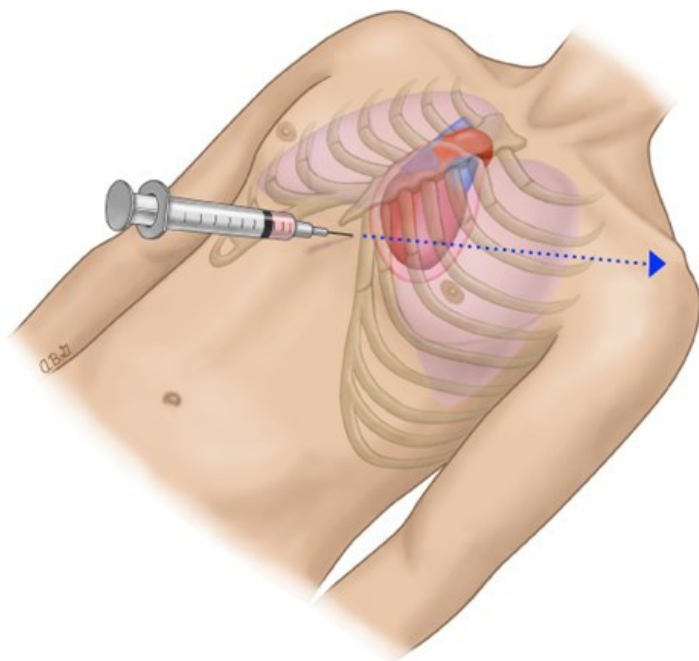
#### Cautions:

- Severe pulmonary hypertension
- Bleeding diathesis/coagulopathy
- Aortic dissection
- Myocardial rupture

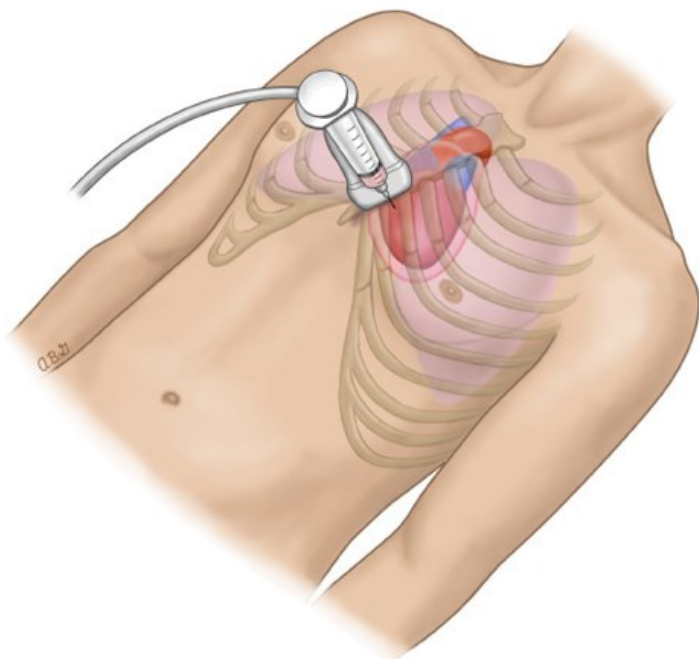
### Procedure

Consultation with OnCall required prior to procedure.

1. Ensure aseptic technique.
2. Select the approach. This is determined by the largest area of pericardial fluid, as noted with ultrasound.
3. Anesthetize the puncture site with lidocaine if applicable and if time permits.
4. Subcostal approach:

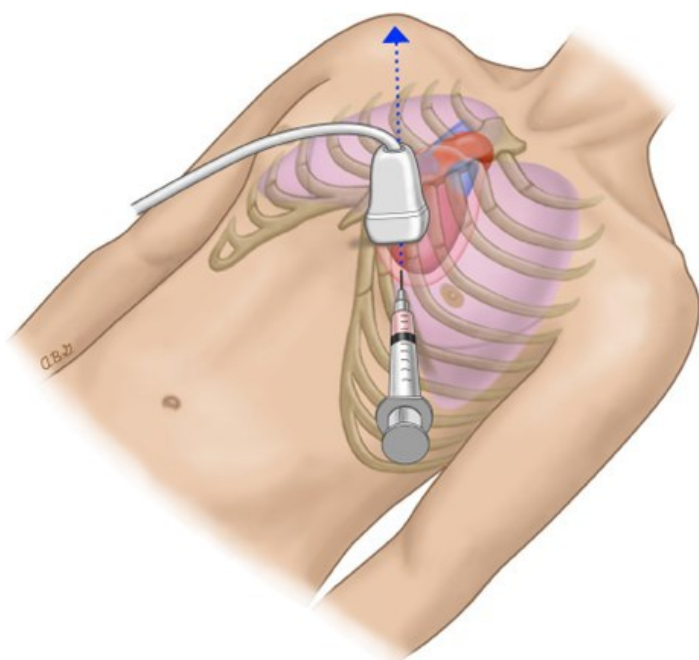


- Carefully consider the location of the mammary artery.
  - Introduce the needle substernally 1 cm inferior to the left xiphocostal angle. Once beneath the cartilage cage, lower the needle so it approximates a 30° inclination with the chest wall.
  - Aim the needle toward the left mid-clavicle and advance it slowly while continuously aspirating. If no fluid is aspirated, the needle should be withdrawn promptly and redirected. In the absence of ultrasound guidance, withdraw the needle to the skin and redirect it along a deeper, slightly posterior trajectory. The required depth of insertion is affected by the patient's anatomy. In most cases, a 7-9 cm needle is adequate, but longer needles (up to 12 cm) may be needed for obese patients.
  - If no fluid is aspirated on the second attempt, withdraw the needle to the skin and redirect it 10° to the patient's right of the last dry needle path. Perform systematic redirected aspirations by working from the patient's left to right until the needle is aimed toward the right neck.
  - Once fluid is aspirated stop advancing.
  - If ventricular irritability coincides with the advancement of the needle, stop advancing and withdraw slowly.
5. Parasternal approach:



- Insert the needle perpendicular to the skin and over the cephalad border of the fifth or sixth rib immediately adjacent to the sternal margin. The cardiac notch of the left lung exposes the pericardium at this site.
- Avoid puncturing more laterally ( $> 1$  cm) to prevent injury to the internal thoracic (mammary) vessels.
- Once fluid is aspirated, stop advancing.
- If ventricular irritability coincides with the advancement of the needle, stop advancing and withdraw slowly.
- Post procedure, assess for a pneumothorax.

6. Apical approach:



- The apical pericardiocentesis approach reduces the risk of cardiac complications by taking advantage of the proximity to the thick-walled left ventricle and the small apical coronary vessels. However, proximity to the left pleural space increases the risk for pneumothorax.
- The apical insertion site is at least 5 cm lateral to the parasternal approach within the fifth, sixth, or seventh intercostal space. Advance the needle over the cephalad border of the rib and towards the patient's right shoulder.

- Once fluid is aspirated, stop advancing.
- If ventricular irritability coincides with the advancement of the needle, stop advancing and withdraw slowly.
- Post procedure, assess for a pneumothorax.

## Notes

- In contrast to the high rates of procedure related complications associated with blind aspiration, multiple observational studies of ultrasound-guided pericardiocentesis report improved safety and success.
- This is a temporizing measure and is not curative. Timely conveyance to a site able to perform a thoracostomy is paramount.

## References

1. Heffner AC. Emergency pericardiocentesis. (2019). [[Link](#)]
2. Hoit BD. Cardiac tamponade. (2019). [[Link](#)]
3. Hoit BD. Diagnosis and treatment of pericardial effusion. [[Link](#)]

## PR45: Prone Ventilation

Brian Reichart

### Applicable To

■ CCP only

### Introduction

Prone ventilation is an oxygenation strategy for patients whose hypoxemia is refractory to treatment. Movement from a supine to a prone position attempts to optimize ventral-dorsal transpulmonary pressure, reduce dorsal compression, and improve lung perfusion.

### Indications

- Refractory hypoxemia in the ARDS patient unresponsive to multiple attempts at optimization of ventilator settings including recruitment maneuvers
- PF ratio of  $< 150$ , prone ventilation should be considered after normal oxygenation strategies have failed
- PF ratio of  $< 100$ , prone ventilation should be attempted based on clinical presentation, time, and resource availability

### Contraindications

- Spinal instability or risk of spinal instability
- Unstable pelvic or facial fractures
- Anterior burns
- Open wounds
- Shock unresponsive to vasopressors
- Pregnancy
- Recent tracheal surgery
- Raised intracranial pressure

#### Cautions:

- Chest tube
- Hemodynamic instability
- Cardiac abnormalities
- Thoracic and abdominal surgeries
- Difficult airway and/or massive hemoptysis

### Procedure

#### Preparation:

1. Check for contraindications.
2. Consider possible adverse effects of prone positioning on chest tube drainage.
3. Explain the maneuver to the patient, associated health care personnel, and/or their family.
4. Confirm the endotracheal tube is located 2-4 cm above the carina.
5. Inspect and confirm that the endotracheal tube, and all central and large bore peripheral catheters, are firmly secured.
6. Consider how the patient's head, neck, and shoulder girdle will be supported after they are turned prone.
7. Stop tube feeding, check for residual, fully evacuate the stomach, and cap or clamp feeding and gastric tubes.
8. Prepare endotracheal suctioning equipment and review the process for managing copious airway secretions that may abruptly interfere with ventilation.

9. Decide whether the roll will be rightward or leftward, considering line placement, positioning within the aircraft, and ambulance stretcher orientation.
10. Support and/or pad IO site.
11. Prepare all intravenous catheters and other tubing for when the patient is prone:
  - Ensure sufficient tubing length.
  - Ensure all tubing connections are tight and secure.
  - Relocate all drainage bags to the foot of the bed.
  - Roll away from chest tubes if possible.
  - Reposition intravenous and arterial line tubing toward the patient's head.

**Rolling procedure:**

1. Place one (or more) people on both sides of the bed (to be responsible for the rolling processes) and another at the head of the bed (to ensure the central lines and the endotracheal tube do not become dislodged or kinked).
2. Increase the FiO<sub>2</sub> to 1 and note the mode of ventilation, the tidal volume, the minute ventilation, and airway pressures.
3. Pull the patient to the edge of the bed furthest from whichever lateral decubitus position will be used while rolling.
4. Move ET, OG, CVC, arterial line, and IV lines towards the head of the bed.
5. Move foley, or subdiaphragmatic lines, to the foot end.
6. Remove ECG leads and patches. Suction the airway, mouth, and nasal passages if necessary.
7. Ensure no other lines, tubes, securing devices, clips, clamps, or patches are on the patient's anterior side as these will become pressure points when the patient is lying on their anterior aspect.
8. Place the patient's arms down along their sides. Ensure that when rolling, their hands will not become pinched or contorted.
9. Place a new draw sheet over the patient.
10. Place a pillow on the ankles, waist, and chest (total 3 or more if obese).
11. Place another sturdy draw sheet over the pillows.
12. Roll the new sheets with the sheets under the patient together. One side rolls up and the other side rolls down so that the upper sheets and the lower sheets become taught.
13. Slide the patient up the bed so that the patient's head is beyond the top of the bed. In such a manner as to allow the ET tube to freely rotate when rolling the patient.
14. Turn the patient to the prone position when all parties are aware of their role.
15. Reposition the patient to the centre of the bed using the draw sheet and slide the patient down the bed to a comfortable position.
16. Ensure that the airway is not kinked and has not migrated during the rolling process. Suction the airway if necessary.
17. Support the face and shoulders appropriately, avoiding any contact of the supporting pads with the orbits or the eyes.
18. Position the arms for patient comfort. If the patient cannot communicate, avoid any type of arm extension that might result in a brachial plexus injury.
19. Auscultate the chest to check for right mainstem intubation. Reassess the endotracheal tube depth, the tidal volume, and minute ventilation.
20. Adjust all tubing and reassess connections and function.
21. Reattach ECG patches and leads to the back.
22. Slight, intermittent lateral repositioning (20 to 30°) should also be used, changing sides at least every 2 hours.
23. Document a thorough skin assessment every shift, specifically inspecting weight bearing, ventral surfaces.
24. Turn the patient's head every 2 hours to avoid pressure sores, ideally once every hour where possible.

**Notes****Assessing for a response:**

1. Sustained improvement in gas exchange > PaO<sub>2</sub> 10mmHg.
2. Evidence of alveolar recruitment not increasing the risk of VILI.
3. Be prepared for significant endotracheal drainage following proning.
4. Improvement may take time.



If gas exchange, lung mechanics, or cardiovascular status deteriorates, consider moving the patient back to supine ventilation.

**Complications:**

1. Increased need for sedation and/or paralytics.
2. Hemodynamic instability.
3. Inadvertent endotracheal tube extubation or main stem migration.
4. Obstructed or kinked endotracheal tube.
5. Obstructed chest tube.
6. Dislodged central venous catheter.
7. Dislodged femoral hemodialysis catheter.
8. Compressed tubing infusing vasoactive medications.
9. Transient episodes of supraventricular tachycardia.

**References**

1. Malhotra A, Kacmarek RM. Prone ventilation for adult patients with acute respiratory distress syndrome. (2020). [\[Link\]](#)
2. Morgan B. Procedure for turning a ventilated patient prone. (2021). [\[Link\]](#)

## PR46: Esophageal/Gastric Tamponade

Brian Reichert

### Applicable To

■ CCP only

### Introduction

Portal hypertension and vascular congestion result in esophageal and gastric varices which are prone to rupture. Emergency therapy to control bleeding includes endoscopic ligation and/or sclerotherapy. If these specialized therapies are not available, balloon tamponade, in addition to other therapies, is indicated to temporarily control bleeding. This guideline is specific to the Blakemore tube as it is the most common. There is a variety of tubing available and as such the volume of air and pressures changes with each tube.

### Indications

- Ongoing severe variceal or upper gastrointestinal bleeding not managed by medical therapy

### Contraindications

- Esophageal stricture
- Recent esophageal or gastric surgery
- Inability to intubate (The airway must be protected in all patients receiving such treatment due to impaired ability to clear oral secretions and high risk for aspiration.)

#### Cautions:

- The tubes should be used cautiously in patients with respiratory failure, cardiac arrhythmias, or a hiatal hernia

### Procedure

The procedure below is specific to the Blakemore tube. Other tubes may have different volumes of air. The procedure is the same, but it is recommended to double check the type of tube used and the required volumes.

1. Before placing a balloon tamponade device, the patient should be intubated.
2. The patient should be supine at 45°.
3. Before tube placement, all equipment should be readily at hand.
  - Blakemore
  - Salem Sump
  - A manometer (not needed for Linton tubes)
  - A tamponade tube kit (with the tube and 2 padded clamps)
  - 60 ml Luer-lock Syringe
  - 60 ml Slip-tip Syringe
  - 2 x-mas tree to male Luer-lock converters
  - 3 three-way stopcocks
  - 3 medlock caps
  - Surgilube
  - Optional: 2 Hollister ETAD ET tube securing devices
  - Possibly: Laryngoscope, Magill Forceps
4. The balloon(s) should be inflated with air and held underwater to assess for leakage and then deflated.
5. Measure the tube depth.
6. With the patient in the supine or left-lateral position, the tube is lubricated and carefully inserted through the mouth (preferred) or nostril until at least 50 cm of the tube has been introduced.
7. Once the tube is placed, insufflate the epigastrium with air while auscultating to confirm, then the ports are suctioned to remove all air.

8. The gastric balloon is then inflated with 50 mL of air and clamped with a Kelly clamp.
9. An x-ray should then be obtained to confirm placement.
  - The gastric balloon needs to be below the diaphragm. (Accidental inflation of the balloon in the esophagus or a hiatal hernia could lead to rupture.)
10. Once confirmed, the balloon is filled with an additional 200 mL of air. (A total of 250 mL of air.)
11. Once inflated, the air inlet for the gastric balloon should be clamped.
12. After the gastric balloon is inflated, the tube is pulled until resistance is felt, at which point the balloon is tamponading the gastroesophageal junction.
13. When applying traction, the tube is expected to migrate a couple centimetres due to heating and stretching. More than this may indicate a hiatal hernia and a chest x-ray needs to be performed.
14. The tube is then securely fastened or taped to a football helmet, or stable object such as the tray to maintain tension on the tube. If using the tray, do not forget to secure the patient's head as well. (Thus, continued tamponade at the gastroesophageal junction.)
15. The Salem sump is now placed in the esophagus.
16. If bleeding continues despite inflation of the gastric balloon, the esophageal balloon (if present) should be inflated to 30 to 45 mmHg. (Note this is inflated to a pressure.)
17. While the esophageal balloon is inflated, the pressure should be checked periodically.
18. Do not to overinflate the esophageal balloon as it puts the patient at risk for esophageal necrosis or rupture.
19. Once the bleeding is controlled, the pressure in the esophageal balloon should be reduced in increments of 5 mmHg to a goal pressure of 25 mmHg.
20. If bleeding resumes, increase the pressure by 5 mmHg.

Please review [this video](#) prior to placing a Blakemore tube.

## Notes

- Since this is a temporizing measure, arrangements for definitive treatment (endoscopic therapy, transjugular intrahepatic portosystemic shunt [TIPS] placement, or surgery) should be made.
- Do not secure the Blakemore to the ET securing device. Use a second securing device if necessary, as accidental extubation could be catastrophic.

## References

1. Bajaj JS, Sanval AJ. Methods to achieve hemostasis in patients with acute variceal hemorrhage. UpToDate. (2020). [\[Link\]](#)
2. Powell M, Journey JD. Sengstaken-Blakemore Tube. (2020). [\[Link\]](#)
3. Taddei TH. How to Insert a Blakemore Tube to Control Variceal Bleeding. (2019). [\[Link\]](#)

## PR47: Critical Care Anesthesia Planning

Brian Reichart

### Applicable To

■ CCP only

For ACP-level anesthesia planning for intubation, see [PR18: Anesthesia Induction](#).

### Introduction

Provision of anesthesia is one of the cornerstones of critical care practice. The ideal induction agent has a rapid onset of action, minimal side effects, and is cleared quickly so that recovery is rapid. No induction agent is ideal for all patients and all medications have side effects. This anesthesia guideline is design around the three phases for intubation: induction, maintenance, and emergence. These phases can be further divided into the four A's of anesthesia planning: anesthesia, analgesia, autonomic stability, and areflexia. The sequencing of medications and the procedure performed is based on the individual patient's needs and risk factors.

### Indications

- Any patient requiring anesthesia for the purpose of intubation, maintenance, or emergence
  - Rapid sequence intubation is indicated for any patient who is at risk of aspiration with induction
- Sedation facilitated intubation
- Clinical scenarios where a difficult airway is suspected
- Delayed sequence intubation
- Patients who will not tolerate an RSI procedure due to an inability to preoxygenate, or tolerate peri-intubation procedures including hemodynamic consequences
- Awake intubation
- Predicted difficult airway
- Unstable cervical spine

### Contraindications

- Allergy or sensitivity to the medication
- Lack of equipment necessary to intervene, monitor, and maintain the airway, respirations, hemodynamics, and for any potential interventions
- Lack of trained personnel to perform the procedure safely

#### Cautions:

Cautions should be based around a risk stratification. The complexity of risk stratification revolves around whether airway control is emergent, urgent, or elective. Elements to consider when evaluating an individual patient's risks include:

- Older age
- Significant comorbidities
- Signs of a difficult airway and whether the patient recently ate should be considered before sedation (these are not contraindications but considerations)
- Any patient that is difficult or likely difficult to ventilate
- Any patient that is hemodynamically unstable or likely to become unstable
- Obesity
- Pregnancy

### Procedure

#### Amnesia

Induction and maintenance of amnesia is incredibly important to the long-term psychological outcomes of patients who

undergo ETI. It can be achieved with the use of:

- Etomidate
- KetAMINE
- ProPOFol
- MIDAZOlam
- Dexmedetomidine

#### Analgesia

Effective analgesia not only makes the patient more comfortable, but also decreases the amount of post-intubation sedation required to maintain the desired clinical state through pharmacological synergy. Agents used in maintaining analgesia include:

- KetAMINE
- FentaNYL
- MORPHine
- HYDROMORphone

#### Autonomic Stability

Most patients will require some form of hemodynamic resuscitation in the peri-intubation phase. Hypotension is associated with an increased morbidity and mortality, which is especially true in patients with traumatic brain injuries or right heart syndromes. Use of tools such as the shock index, in conjunction with clinical judgement, can identify patients at risk of hypotension in the context of endotracheal intubation. Autonomic stability can be achieved through the use of:

- Fluid bolus
- PhenyLEPHrine
- EPINEPHrine
- NORepinephrine

#### Areflexia

Areflexia produces the best laryngoscopic views possible, however it is also fraught with complications and potentially dire consequences. It also lowers the required dose of sedation. Deep sedation does *not* result in areflexia, but rather suppresses any response to stimulus. Consider the use of:

- Succinylcholine (Depolarizing)
- Rocuronium (Non-Depolarizing)

Adult doses are shown in the table below. See individual drug monographs for pediatric and expanded dosing strategies.

Goal	Options	Induction (Phase I)	Maintenance (Phase II)	Emergence (Phase III)
Analgesia	<a href="#">MORPHine</a> <a href="#">FentaNYL</a> <a href="#">KetAMINE</a> <a href="#">Hydromorphone</a>	Morphine (2-10mg)	Morphine (1-10mg/hr)	See procedural analgesia if required
		Fentanyl (25-100mcg)	Fentanyl (25-200mcg/hr)	
		Ketamine (0.25-0.5 mg/kg)	Ketamine (0.05-1 mg/kg/hr)	
		Hydromorphone (0.2-1mg)	Hydromorphone (0.5-3mg/hr)	
	<a href="#">MIDAZOlam</a>	Midazolam (0.1-0.3 mg/kg)	Midazolam (0.01-0.1mg/kg/hr)	

<u>Amnesia</u>	<a href="#">KetAMINE</a> <a href="#">Propofol</a> <a href="#">Etomidate</a> <a href="#">Dexmedetomidine</a>	Ketamine (0.5-2 mg/kg) Propofol (1-3 mg/kg) Etomidate (0.3 mg/kg)	Ketamine (0.2-0.5 mg/kg/hr) Propofol (50-200mcg/kg/min) Dexmedetomidine (0.1-0.8 mcg/kg/hour)	See procedural sedation if required
<u>Autonomic Stability</u>	IV Fluids <a href="#">PhenyLEPHRine</a> <a href="#">EPINEPHrine</a> <a href="#">NORepinephrine</a> <a href="#">DOPamine</a>	IV Fluids (10-20ml/kg) Phenylephrine (50-100 mcg) Epinephrine (50-100 mcg) NORepinephrine (5-10 mcg)	IV Fluids (2-4ml/kg/hr) Phenylephrine (0.5-6mcg/kg/min) Epinephrine (0.01-0.5 mcg/kg/min) NORepinephrine (5-60 mcg/min) Dopamine (2-20mcg/min)	IV Fluids (2-4ml/kg/hr)
<u>Areflexia</u>	<a href="#">Rocuronium</a> <a href="#">Succinylcholine</a> Cisatracurium	Rocuronium (0.6-1.2 mg/kg) Succinylcholine (0.6-1.1 mg/kg) Cisatracurium (0.15-0.2 mg/kg)	Rocuronium (0.6-1 mg/kg) Cisatracurium (1-2 mcg/kg/min)	-----

## References

1. King A. Induction of general anesthesia: Overview. (2020). [\[Link\]](#)
2. **King A. General anesthesia: Intravenous induction agents. (2020).** [\[Link\]](#)
3. Berkow L. Rapid sequence induction and intubation (RSII) for anesthesia. (2020). [\[Link\]](#)
4. Brown CA. Approach to the anatomically difficult airway in adults outside the operating room. (2021). [\[Link\]](#)
5. Stems RH. Maintenance and replacement fluid therapy in adults. (2019). [\[Link\]](#)

## PR48: Arterial Blood Gas Sampling

### Arterial Blood Gas Sampling

## Applicable To

■ CCP only

## Introduction

Arterial blood gas analysis provides insight into many aspects of critical care. Samples can be obtained from either an arterial puncture or from an existing arterial line.

## Indications

- The need for acquisition of an arterial blood sample to assess:
  - Arterial oxygenation
  - Arterial acid-base status
  - Electrolyte levels

## Contraindications

- Infection, thrombus, or distorted anatomy at the site of puncture.
- Abnormal modified-Allen's test suggesting inadequate distal collateral flow.
- Severe peripheral vascular disease or Raynaud's syndrome affecting the puncture site.

### Cautions

- Arterial punctures for blood gas analysis should preferentially be taken from the radial artery.
- Monitoring for bleeding or adverse effects (i.e., impaired distal blood flow) should be undertaken following any arterial sampling.
- Arterial sampling should be minimized where possible to reduce the risks of infectious exposure and bleeding.
- Vasospasm, nerve damage, and vasovagal syncope can all result from arterial puncture and should be anticipated.

## Procedure

### Arterial Puncture Sampling

1. Gather necessary equipment:
  1. Heparinized, vented 23g sampling syringe/needle
  2. Bandage or gauze
  3. Alcohol wipes and/or appropriate site cleanser
  4. Local anesthetic (lidocaine 1% or 2% without epinephrine) plus single-use syringe if required.
2. Select the site for puncture considering:
  1. Ease of access
  2. Strength of pulse
  3. Ability to compress the site
  4. Collateral blood flow (modified-Allen's test may be used)
3. Utilize aseptic technique including hand hygiene, gloves, and cleaning of the selected site.
4. Palpate artery and insert needle at approximately a 45-degree angle to obtain flash.
5. Ultrasound may be used to aid in the acquisition.
6. Obtain flash and allow syringe to fill without manipulating the plunger.
7. Withdraw needle when a sufficient sample is obtained and secure the needle.
8. Expel excess air using the plunger and the cap in place.
9. Apply gauze and pressure to the site for a length of time sufficient to stop any bleeding.
10. Dress the site with a bandage if not already done.

11. Perform hand hygiene.
12. Utilize the blood sample for analysis. (Point of Care Testing)
13. Monitor the site of puncture for ongoing bleeding or complications.

**Arterial Line Sampling (VAMP™ line)**

1. Gather necessary equipment:
  1. Heparinized, vented 23g sampling syringe/needle
  2. VAMP™ blunt access tip
  3. Alcohol wipes and/or appropriate site cleanser
2. Remove arterial sampling needle and attach VAMP™ blunt access tip to the sampling syringe
3. Turn stopcock at sample access port to allow for line flow and sampling
4. Squeeze the VAMP reservoir module tabs and pull back over 3-5 seconds to fill the reservoir with blood.
5. Close valve next to reservoir to prevent clearance blood from being sampled.
6. Clean the access port.
7. Insert the syringe with blunt access tip into sampling port and obtain sample.
8. Open the valve next to the reservoir.
9. Push the reservoir down slowly to replace the withdrawn blood.
10. Open the proximal valve and flush the arterial line.
11. Ensure adequate waveform on arterial tracing.

**Arterial Line Sampling (non-VAMP™ line)**

1. Gather necessary equipment:
  1. Heparinized, vented 23g sampling syringe/needle
  2. VAMP™ blunt access tip
  3. 10cc syringe with blunt tip
  4. Alcohol wipes and/or appropriate site cleanser
2. Remove arterial sampling needle and attach VAMP™ blunt access tip to the sampling syringe.
3. Attach 10cc syringe to open port of the stopcock distal to the transducer.
4. Turn the stopcock such that it is closed proximally and open to the patient and 10cc syringe.
5. Withdraw a minimum of 5cc's of blood into the 10cc syringe.
6. Close the stopcock to the syringe.
7. Remove and discard the 10cc syringe and blood.
8. Turn the stopcock such that it is closed distally (to patient) and open to the distal/fluid side and the open port.
9. Briefly flush the port into a disposable container to clear any blood from the port by pulling on the flush valve tab, mindful of the potential for splash, and then cap the open port with a sterile non-vented cap.
10. Insert the syringe with blunt access tip into sampling port distal to the stopcock and obtain sample.
11. Turn the stopcock such that it is closed to the free port and open to the patient and fluid side and flush the arterial line until it is free from blood.
12. Ensure adequate waveform on arterial tracing.

**Notes**

- Consider the use of venous samples when appropriate.
- Arterial samples are often not required if oxygenation is known to be appropriate and SpO<sub>2</sub> levels are adequate and reliable.
- Venous blood gas samples can be adapted to determine acid-base status with the appropriate conversions. (Excluding a reliable PaO<sub>2</sub>)

**References**



- Theodore, AC. (2021). Venous blood gases and other alternative to arterial blood gases. In S. Manaker & G. Finlay (Eds.), *UpToDate*. Retrieved February 2, 2021, from <https://www.uptodate.com/contents/venous-blood-gases-and-other-alternatives-to-arterial-blood-gases>
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- WHO Guidelines on Drawing Blood: Best Practices in Phlebotomy. Geneva: World Health Organization; 2010. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK138661/>

## PR50: Traction (Sager) Splinting

### Applicable To

■ EMR and above

### Introduction

The Sager traction splint is a unipolar split that can be used to align femur fractures. Proper splinting increases arterial blood flow, decreases pain and spasm, and lowers the risk of further injury from bone fragments.

### Indications

■ EMR: Open or closed mid-shaft fractures of the femur in patients who are otherwise clinically stable

### Contraindications

- Clinical instability
  - **Caution:** The energy required to fracture a femur is significant, and may produce other occult or distracting injuries. If there is any doubt as to the clinical stability of the patient, do not attempt to place the traction splint -- splint the injured leg against the uninjured leg and expedite conveyance to hospital.
- Hip or pelvic fracture
- Supracondylar fracture of the distal femur, or knee involvement
- Fractures of the ankle or the foot
- Partial amputation or avulsion with bone separation and only marginal distal tissue connection

### Procedure

Appropriate analgesia should be provided throughout the splinting procedure. See [E08: Pain Management](#) for additional information.

1. Manage any visible external bleeding and provide appropriate wound care where required.
2. Assess the injured leg for distal neurovascular function. If appropriate resources are available, provide manual inline traction prior to splinting.
3. Place the splint along the medial aspect of the injured leg. Adjust its length so that it extends approximately four inches (10 cm) beyond the heel.
4. Secure the top strap to the thigh.
5. Apply the ankle hitch, and attach it to the splint.
6. Apply traction by extending the splint:
  - For closed femur fractures: Adjust the splint to 10% of the patient's body weight in Imperial units, to a maximum of 15 pounds (7 kg).
  - For open femur fractures: Apply 5 pounds (2.5 kg) of traction regardless of the patient's body weight.
7. Reassess the distal neurovascular function.
8. Apply the straps to secure the leg to the splint. Reassess distal neurovascular function following the application of the straps. Ongoing reassessment during conveyance is required.
9. Secure the patient on a clamshell lifting device for transport. Be aware of the positioning of the distal portion of the splint during lifting and loading operations. Ensure the patient is positioned on the stretcher with sufficient space to allow the rear doors of the ambulance to close completely.

## Notes

There is no specific age limit on the use of the Sager splint, however the splint must be able to fit the patient safely. Use the smallest extension possible to achieve appropriate traction.

When adjusting the extension, be aware of the pinch point that exists with the locking mechanism.

## Resources

- [Sager user handbook](#) (BCEHS uses the S301 model)

## References

1. Syme K. Are you pulling my leg? Does the use of traction splints in the prehospital management of patients with femur fractures reduce the complications compared to traditional splinting? 2020. [\[Link\]](#)
2. Davis D et al. EMS traction splint. 2021. [\[Link\]](#)
3. Sunmedica, Inc. Sager user handbook. (n.d.) [\[Link\]](#)

# PR51: Prehospital Fibrinolysis

Jon Deakin

## Applicable To

- ACP with specific reperfusion training

## Introduction

This procedure has been developed to support out-of-hospital reperfusion in patients experiencing ST elevation myocardial infarctions (STEMI) in areas without immediate access to cardiac catheterization laboratories. It requires specific training in out-of-hospital reperfusion. This procedure is not a substitute for sound clinical judgment and collaborative decision-making.

## Indications

ST elevation myocardial infarction in an area ≥ 60 minutes drive time to primary percutaneous coronary intervention facilities.

## Contraindications

Extensive contraindications: see procedure for complete details.

**< 60 minute drive time to PPCI**

## Procedure

### All patients:

- Apply defibrillator pads
- Provide supplemental oxygen if SpO<sub>2</sub> is less than 90%
- [Acquire and interpret 12 lead ECG](#) -- transmit to ClinCall/EPOS immediately if STEMI markers present
  - Continue to obtain serial 12 lead ECGs every 15-30 minutes during care and conveyance
- [Establish IV access](#) (two large-bore lines recommended), including saline lock
  - Avoid right hand/wrist where possible; attempt to keep IVs on same limb where practicable
- Obtain baseline history and examination (details below)
- [Acetylsalicylic acid](#) 160 mg PO chew and swallow
- [Nitroglycerin](#) 0.4 mg spray every 5 minutes x 3 doses for ongoing chest pain if systolic blood pressure is greater than 90 mmHg
- [Fentanyl](#) 25-50 mcg IV every 5 minutes as required (maximum 300 mcg) **or** [MORPHINE](#) 2.5 mg IV every 5 minutes as required (maximum 15 mg) if systolic blood pressure is greater than 90 mmHg for severe, refractory chest pain
- [Dimenhydrinate](#) 25-50 mg IV every 4 hours as required for nausea
- [Atropine](#) 0.6 mg IV/IM every 5 minutes as required (maximum 3 mg) for symptomatic bradycardia
- **[Contact ClinCall / EPOS after appropriate history, physical, inclusion / exclusion criteria reviewed with patient and ECG sent](#)**

### History (check all that apply, and review with EPOS):

- Chest pain
  - Crushing, burning or dull retrosternal
  - Radiating to \_\_\_\_\_
  - Worse with activity or exertion
  - Worse while supine, improves while sitting forward
  - Sharp (knife- or needle-like) and worse with respiration
  - Sharp stabbing or tearing

- Focal neurological symptoms (limb weakness, visual change, speech difficulties)
- Loss of consciousness associated with presentation
- Associated symptoms (nausea, diaphoresis, SOB)
- Comorbidities (HTN, diabetes, smoking, familial hx)

**Physical examination (check all that apply, and review with EPOS):**

- Pupils are equal in size, round, and reactive to light
- GCS \_\_/15, HR \_\_, RR \_\_, SpO2 \_\_%
- Blood pressure
  - Right arm
  - Left arm
  - Systolic difference is > 20 mmHg?
- Pulses present and equal in left and right arms
- Pulses present and equal in both carotid arteries (caution: check one at a time)
- Air entry is equal to both lung bases
- Crepitations heard in lung fields?
- Murmur heard on cardiac auscultation
- Moves all four limbs against resistance.

**Indications for primary percutaneous coronary intervention (check all that apply, and review with EPOS):**

- Contraindication to tenecteplase, **OR**
- Cardiogenic shock, **OR**
- Severe acute heart failure, **OR**
- Recurrent VF/VT, **OR**
- First medical contact to balloon time < 120 minutes (<60 minute drive time) **OR**
- Diagnosis of STEMI in doubt

**Indications for tenecteplase (TNK) administration (check all that apply, and review with EPOS):**

- Time from onset of chest pain is less than 12 hours
- Chest pain is consistent with myocardial ischemia
- ECG changes are consistent with STEMI:
  - In men, new STE at J point  $\geq 2.0$  mm (0.2 mV) in V2 and V3
  - In women, new STE at J point  $\geq 1.5$  mm (0.15 mV) in V2 and V3
  - New STE at J point  $\geq 1.0$  mm (0.1 mV) in other contiguous leads
  - New ST depression at the J point  $\geq 1.0$  mm (0.1 mV) in leads V1/V2 and STE  $\geq 1$  mm (0.1 mV) in posterior leads V7-V9

**ABSOLUTE CONTRAINDICATIONS FOR TENECTEPLASE (CHECK ALL THAT APPLY, AND REVIEW WITH EPOS):**

- Any prior bleeding in the brain
- Structural abnormality of arteries or veins in brain
- Known tumour in brain
- Ischemic stroke within the last 3 months
- Significant closed head or facial trauma in the last 3 months
- Brain or spinal injury within the last 2 months
- Active bleeding or bleeding susceptibility (excluding menses)
- Severe uncontrolled hypertension (unresponsive to emergency therapy)
- Suspected aortic dissection

**Relative contraindications for tenecteplase (check all that apply, and review with EPOS):**

- Known intracranial pathology not covered by absolute contraindications
- Dementia
- Prior stroke greater than 3 months ago
- Major surgery in the past 3 weeks

- Internal bleeding in the past 4 weeks
- Blood pressure greater than 180 systolic, or 110 diastolic on presentation
- History of chronic, severe, poorly controlled hypertension
- Traumatic or prolonged (> 10 minutes) chest compression/CPR
- Pregnancy
- Active stomach ulcers
- Currently taking blood thinners (i.e., warfarin or direct oral anticoagulants)
- Non-compressible vascular punctures

**Tenecteplase criteria -- must satisfy all -- check when complete:**

- NO indications for primary PCI
- Case discussed and ECG reviewed with EPOS
- NO absolute contraindications
- Relative contraindications, if any, reviewed with EPOS
- Risks, benefits, and alternatives to tenecteplase have been reviewed with patient, and CONSENT (verbal) to treatment with TNK is obtained

**Tenecteplase action (choose one):**

- DOES NOT MEET TNK criteria
  - Action: provide usual care and transport
- DOES MEET TNK criteria
  - Action: administer TNK as per protocol

**Tenecteplase informed consent script (read to patient):**

"You are having a heart attack and would benefit from potentially life-saving clot dissolving medications. When given early, these drugs can prevent the heart attack from progressing and causing further heart muscle damage. They can even prevent death from a heart attack and related complications. There are some serious risks associated with the use of these medications, though, that you need to be aware of. Those risks include, but are not limited to, bleeding, strokes, and heart rhythm problems. The risk of bleeding in the brain is less than 1%. We are able to deliver these therapies to you immediately, and the sooner you get these medications the sooner blood supply may be restored to your heart. You have the option of declining these medications and waiting to be assessed when you go to the hospital, although it is important to know that if treatment is given more than 12 hours after onset of symptoms, treatment may cause more harm than benefit. Do you give consent to receive this treatment?"

**Tenecteplase Protocol (check when complete)**

75 years of age or less	over 75 years of age
<ul style="list-style-type: none"> <li>• <a href="#">Enoxaparin</a> 30 mg IV bolus immediately before tenecteplase</li> </ul>	<ul style="list-style-type: none"> <li>• <b>DO NOT GIVE IV ENOXAPARIN</b></li> </ul>
<ul style="list-style-type: none"> <li>• <a href="#">Tenecteplase</a> according to weight IV, over 5 seconds (maximum dose is 50 mg)</li> </ul>	<ul style="list-style-type: none"> <li>• <a href="#">Tenecteplase</a> (1/2 dose) according to weight IV, over 5 seconds (maximum dose is 25 mg)</li> </ul>
<ul style="list-style-type: none"> <li>• <a href="#">Enoxaparin</a> 1 mg/kg SC every 12 hours (maximum dose 100 mg q12h)</li> </ul>	<ul style="list-style-type: none"> <li>• <a href="#">Enoxaparin</a> 0.75 mg/kg SC every 12 hours (maximum dose 75 mg q12h x first 2 doses)</li> </ul>
<ul style="list-style-type: none"> <li>• <a href="#">Clopidogrel</a> 300 mg PO</li> </ul>	<ul style="list-style-type: none"> <li>• <a href="#">Clopidogrel</a> 75 mg PO</li> </ul>

NB: In certain situations, the consulting physician may recommend the administration of enoxaparin and clopidogrel without tenecteplase.

**Tenecteplase dosing based on age and weight**

Weight (kg)	TNK dose (mg) in patients < 75 years	TNK dose (mg) in patients > 75 years
< 60	30 mg (6 mL)	15 mg (3 mL)

60 to < 70	35 mg (7 mL)	17.5 mg (3.5 mL)
70 to < 80	40 mg (8 mL)	20 mg (4 mL)
80 to < 90	45 mg (9 mL)	22.5 mg (4.5 mL)
≥ 90	50 mg (10 mL)	25 mg (5 mL)

Enoxaparin SC Dosing - based on Age and Weight			
Age equal of less than 75		Age greater than 75	
Weight (kg)	Dose 1 mg / kg (volume)	Weight (kg)	Dose 0.75 mg / kg (volume)
40 to 44	40 mg (0.4 mL)	40 to 46	30 mg (0.3 mL)
45 to 54	50 mg (0.5 mL)	47 to 59	40 mg (0.4 mL)
55 to 64	60 mg (0.6 mL)	60 to 73	50 mg (0.5 mL)
65 to 74	70 mg (0.7 mL)	74 to 86	60 mg (0.6 mL)
75 to 84	80 mg (0.8 mL)	87 or greater	70 mg (0.7 mL)
85 to 94	90 mg (0.9 mL)		
95 or greater	100 mg (1 mL)		

**Post tenecteplase administration:**

- Notify receiving ER physician of patient arrival, and report:
  - Patient started on TNK as per physician orders
  - TNK administered at \_\_\_\_\_, with patient weight and dosage
  - Any protocol medications not administered and rationale
  - Current patient status (GCS, appearance, vital signs, chest pain, etc.)
  - Estimated time of arrival in emergency department
  - Where possible: PHN, name, date of birth for pre-arrival registration
- After TNK administration, monitor neurological vitals every 15 minutes for the first hour, and then every 30 minutes thereafter
- After TNK administration, repeat ECG every 15-30 minutes and at 60 minutes. Notify EPOS if:
  - Ongoing chest pain
  - Ongoing ST elevation (less than 50% resolution)
  - Hemodynamic instability develops
- **Transport to closest emergency department:**
  - Complete all relevant sections of ePCR, including ACP prehospital fibrinolysis form (Other Assessments), Hospital Consultation (Procedures), patient weight, vital signs
  - Attach 12 lead ECG to ePCR
  - Handover report is critical to avoid repeat medication administration. Ensure that receiving staff are informed.
  - Send e-mail including the event number to [clinicalpractice@bcehs.ca](mailto:clinicalpractice@bcehs.ca)

**Notes****Tenecteplase kit Build Instructions for ACP's (appendix 2)**

1. Juice box or water bottle
2. Clopidogrel 75mg tablet (in strip packaging) ☐ in labelled zip lock bag
3. Clopidogrel 300mg tablet (in blister) ☐ in labelled zip lock bag
4. Enoxaparin 30mg syringe + IV adapter + IV flush syringe + alcohol swab ☐ in zip lock bag
5. Enoxaparin 100mg syringe + alcohol swab ☐ in zip lock bag
6. TNK 50mg kit + alcohol swab + IV flush syringe ☐ add flush and swab into TNK box
7. Put expiry sticker (provided by pharmacy) on outside of kit
8. Paramedic partner to double check
9. Seal kit with plastic security zip-tie

**Tenecteplase kit removal from Omnicell-Interior ACP's ONLY**

1. Paramedic to sign into main ER Omnicell using credentials
2. Remove Tenecteplase kit under name of current STEMI patient a. Item Name: ***BCEHS use only Tenecteplase***
3. Prepare kit according to "Tenecteplase kit build instructions for paramedics" (see appendix 2)
4. Label outside of kit with expiry label
5. Second paramedic to perform double check of kit, and seal with security zip-tie
6. One prepared kit to be stored on each ACP car at all times
7. **If kit expires before use, return all medications to the pharmacy return bin in ED med room and remove a new kit under the generic patient \*BCEHS Use Only TNK Kit\* found on the Local Patient List**
8. Medications must be stored between 2-30°C. If car temperature goes above 30°C please transfer kits to the station and contact hospital pharmacy department for further instructions

**Resources**

Drug monographs:

- [Acetylsalicylic acid](#)
- [Nitroglycerin](#)
- [FentaNYL](#)
- [MORPHine](#)
- [DimenhyDRINATE](#)
- [Atropine](#)
- [Enoxaparin](#)
- [Tenecteplase](#)
- [Clopidogrel](#)

**References**

- 2023-09-10: updated consent script



## PR52: Dialysis Emergency Disconnect Procedure

PR52: Dialysis Emergency Disconnect Procedure


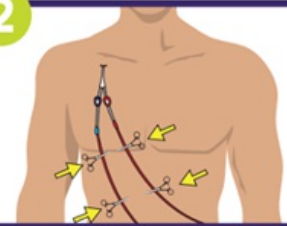
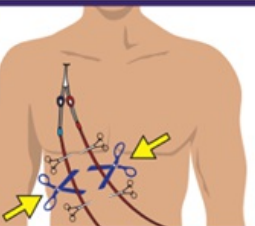

### Classification

All License Levels:


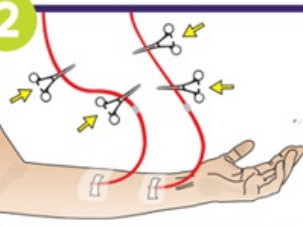
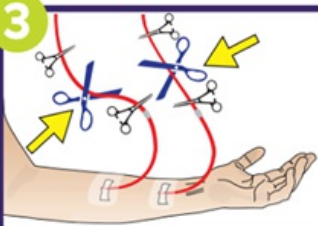

[On-Call consultation recommended](#) to discuss care planning options for all patients, where possible.

#### Emergency Disconnect Instructions

For dialysis patients with a central catheter:

<p><b>1</b></p>  <p><b>USING THE PRODUCTS FOUND IN THE PATIENT'S CLAMP &amp; CUT KIT...</b></p>	<p><b>2</b></p>  <p><b>CLOSE TWO CLAMPS ON EACH OF THE TWO BLOODLINES</b></p>
<p><b>3</b></p>  <p><b>CUT BETWEEN THE CLAMPS</b></p>	<p><b>4</b></p>  <p><b>TRANSPORT THE PATIENT AS-IS TO HOSPITAL</b></p>

For patients with a fistula or graft:

<p><b>1</b></p>  <p><b>USING THE PRODUCTS FOUND IN THE PATIENT'S CLAMP &amp; CUT KIT...</b></p>	<p><b>2</b></p>  <p><b>CLOSE TWO CLAMPS ON EACH OF THE TWO BLOODLINES</b></p>
<p><b>3</b></p>  <p><b>CUT BETWEEN THE CLAMPS</b></p>	<p><b>4</b></p>  <p><b>TRANSPORT THE PATIENT AS-IS TO HOSPITAL</b></p>

