Field Reference Guides

Summary of Changes

General Changes

- References (foot notes) added for all clinical guidance and images gathered from articles, clinical studies, textbooks or other sources references – content not cited as such is based on [redacted] and input from both [redacted] Medical Director and leadership team
- References for drug doses have been deferred to the Formulary and are not repeated in the FRGs
- Changed "Pain, Agitation, & Nausea" to "Analgesia, Sedation & Antiemetics"
- Changed "Pregnancy Induced Hypertension/ (Pre-)Eclampsia/ HELLP Syndrome" to "PIH, (Pre-) Eclampsia & HELLP"
- Added "Procedure: External Fetal Monitoring" & "Procedure: In-Line Nebulizer on the Revel"
- Made lots of the charts/ reference materials larger
- Changed trade names of medications to generic names

Standard of Practice

- Changed "[redacted] Utilization Criteria" to "Flight Intake/ Dispatch Process"
- Added note about performing Field Amputation and Postmortem Cesarean Section against the wishes of bystanders (see those procedures for further detail)

Universal Protocol

- Clarification on use of sterile gloves
- Changed "[redacted] Utilization Criteria" to "Flight Intake/ Dispatch Process"
- Clarified adult maintenance fluids to mean NS or LR, pediatric to mean NS or D5W

Analgesia, Sedation & Antiemetics

- Changed the name, as mentioned above
- Added new Wong-Baker scale ([redacted])
- Added IM doses for Morphine, Fentanyl and (pediatric) Ketamine
- Removed Propofol bolus doses (infusion only)

Airway Management

- Clarified guidance on incomplete vs. complete airway obstruction and added references to Walls textbook
- Created a Quick Reference Chart for Airway Management

Shock

- Removed Ceftriaxone dose and added reference to Infection and Fever FRG
- Dopamine dose adjust to match ACLS and PALS

Respiratory

- Epiglottitis: replaced Dexamethasone with Methylprednisolone
- Pulmonary Embolism: Removed Heparin mixing instructions (now in Formulary)

Neurologic

- Stroke: added "once" to Streptokinase doses for clarification
- Seizure: fixed typos on Midazolam, added route for pediatric dose
- Meningitis: corrected pediatric dose for Ceftriaxone

Cardiovascular

- Acute Coronary Syndrome
  - Changed Aspirin dose to a range
  - Added specific guidance Nitroglycerin use with right-sided MI
  - Clarified time of administration for Streptokinase
  - Removed Heparin mixing instructions (now in Formulary)
- Dysrhythmia
  - Torsades &Adult Tachycardia: corrected typos
  - Hypotension: updated Dopamine dose and added reference to push-dose Epi
  - Hypertension: clarified treatment parameters and added route of administration for Hydralazine
  - Cardiac arrest: updated defib dose for Zoll

Standard of Practice

How to Use Field Reference Guides

- Start with Universal Protocol and proceed to specific patient presentations/ pathology
- Follow guides top to bottom, left to right (except as directed otherwise)
- For more detailed information, consult External Resources

Transport Considerations

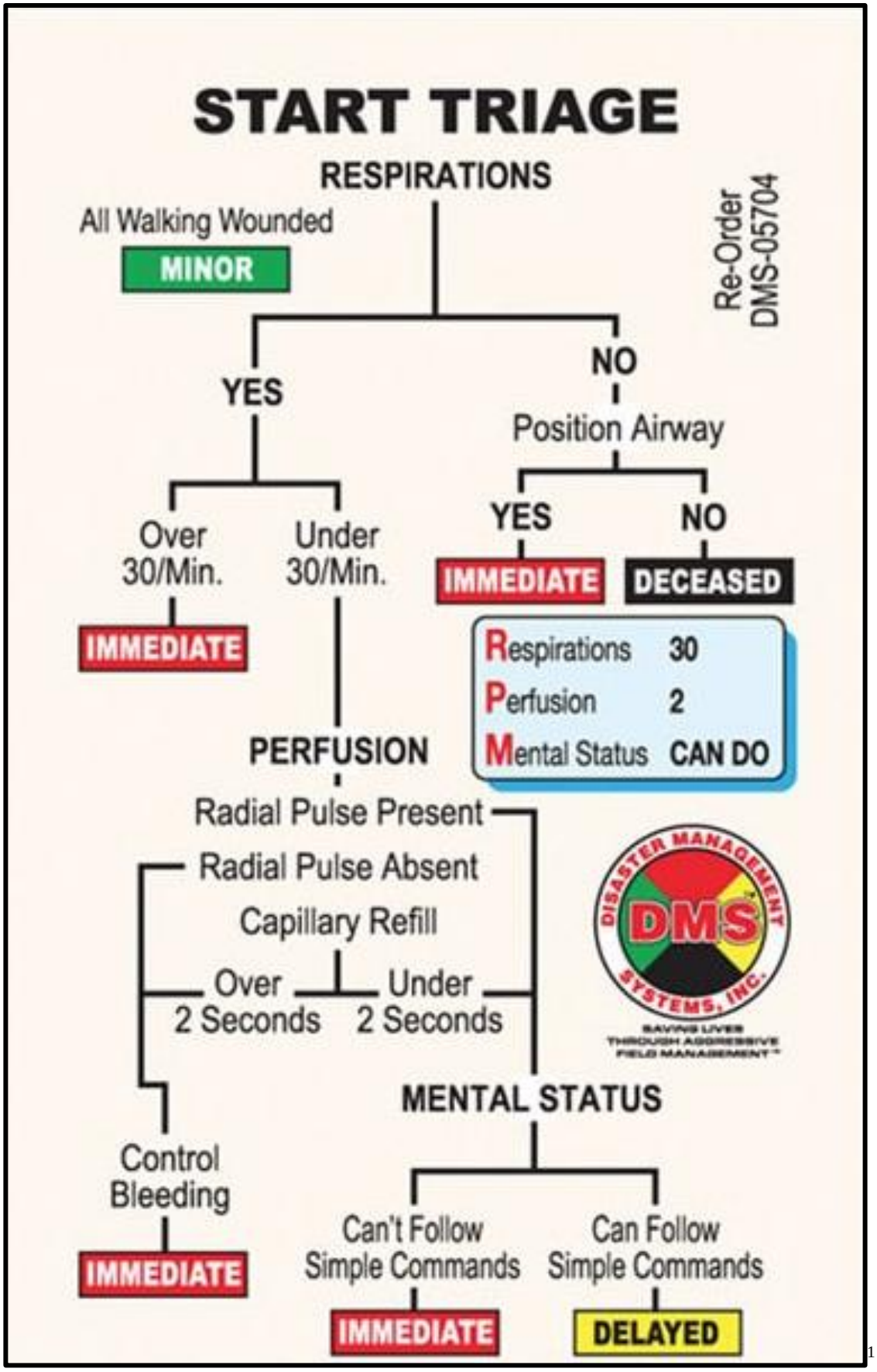
- All patient transfers must be arranged with sending and receiving providers to ensure that patient is admitted upon arrival at destination
- Refer to Flight Intake/ Dispatch Process for specific guidance on the steps involved

Special Considerations

- Pediatric Patients
  - Pediatric Bag to be used for patients <8 years old and <30kg
  - NRP (Management of the Newborn) vs PALS (Dysrhythmia, Pediatric Sections): NRP provides guidance for the treatment of newborns following delivery, there is no clearly defined transition from NRP to PALS; at discretion of crew, NRP guidelines may be used for patients up to 28 days old and PALS guidelines may be used for all patients beyond the initial resuscitation measures following birth
- Refusal
  - [redacted] is not able to transport a patient without consent
    - Consent should be explicit and informed, given by patient (i.e. signed Consent Form)
    - In the event that patient unable to give consent, family may act in his or her interest; consent should still be both explicit and informed, even if given by family
    - If patient unable to participate and no family present/ in contact, use best clinical judgement
  - If in doubt, do not transport (with noted exceptions in Field Amputation and Postmortem Cesarean Section)
- Death Prior to Arrival
  - Confirm death by asystole in multiple leads on cardiac monitor
  - Do not transport the patient
- Death After Assuming Care
  - Resuscitation should be attempted, however may not be feasible in the transport setting
  - If possible, return patient to sending facility
  - If patient cannot be taken back to sending facility (due to weather, safety, etc.), continue to receiving facility
- Mass Casualty Incidents
  - [redacted] is not typically involved in the initial triage related to MCI and typically handles one patient request at a time
  - In the event that [redacted] is called upon to assist with triage, refer to START and JumpSTART system (next page)

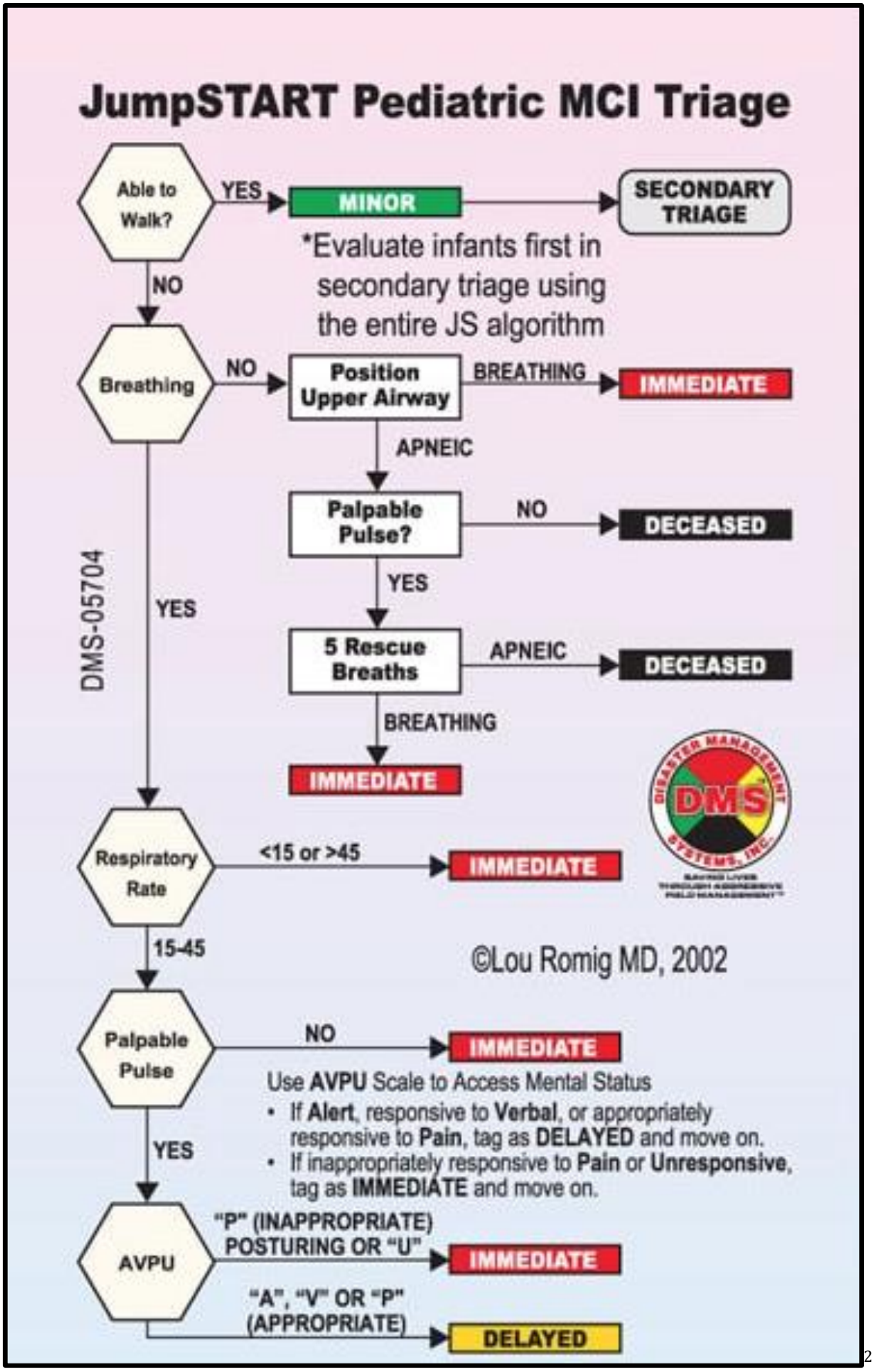
Medical Control

- Field Reference Guides have been approved by [redacted] for use by [redacted] Medical Crew
- There may be situations not covered by these Guides
- Additional guidance may be obtained from External Resources
- [redacted] Medical Crew should also consider their own clinical experience and training
- In the event that further guidance is needed, [redacted] should be contacted by phone



[1]

[1] https://www.allsafeindustries.com/store/p/6188-START/JumpSTART-Pediatric-Prompter-Wallet-Cards.aspx



[2]

[2] https://www.allsafeindustries.com/store/p/6188-START/JumpSTART-Pediatric-Prompter-Wallet-Cards.aspx

Universal Protocol

Scene Size-up

- PPE appropriate to patient condition
  - Gloves (standard): all patients
  - Sterile gloves: invasive procedures with high risk of infection (i.e. foley catheter placement)
  - Facemask: meningitis, measles, flu; any other droplet precautions
  - N95 Mask: tuberculosis
  - Eye protection: with risk of fluid getting in to eyes (i.e. intubation, spitting, arterial bleed, etc.)
  - Gown: with risk of exposure to copious amount of body fluids
- Ensure scene safety
- Determine mechanism of injury/ nature of illness
- Ensure patient on scene correlates to dispatch
- Confirm transport is both appropriate and feasible per <u>Call Intake/ Dispatch Process</u>

Initial Assessment

- Assess response to stimuli/ level of consciousness and GCS

Table 1-1 Mental Status and AVPU

AVPU Level	Assessment Findings	
Alert	Responds spontaneously; further define mental status	
	Alert and oriented × 3	Person, place, and time
	Alert and oriented × 2	Person and place
	Alert and oriented × 1	Person
Verbal	Responds to verbal stimuli	
Pain	Responds to painful stimuli	
Unresponsive	Does not respond to stimuli	

[3]

[3] AMLS (2016), p 11

Table 5-2 Glasgow Coma Scale

Responses	Adult	Pediatric (< 5 years)
Eye opening	4. Spontaneous 3. Voice 2. Pain stimulation 1. None	4. Spontaneous 3. To shout/voice 2. Pain stimulation 1. None
Verbal	5. Oriented 4. Disoriented 3. Inappropriate words 2. Incomprehensible 1. None	5. Smiles, speech/interaction appropriate for age 4. Cries but consolable, inappropriate words/interactions 3. Difficult to console 2. Restless and inconsolable 1. None
Motor	6. Obeys 5. Localizes pain 4. Withdraws from pain 3. Decorticate 2. Decerebrate 1. None	6. Spontaneous 5. Localizes pain 4. Withdraws from pain 3. Decorticate 2. Decerebrate 1. None

[4]

- Assess airway and breathing, Airway Management as appropriate
- Assess circulation (pulse, skin, major bleeding), manage as appropriate
- Consider Shock and treat life threats

Proceed to **History** or **Physical Exam**, then complete the other; **History** first on stable or medical patients, **Physical Exam** first on unstable and trauma patients

History

- SAMPLE history for all patients
- OPQRST with complaints of pain
- Consider associated signs & pertinent negatives
- Collect additional information as outlined in guidelines

The SAMPLER Approach to Past Medical History

The SAMPLER mnemonic represents a sensible approach to inquiring about a patient's medical conditions:

Signs/symptoms

Allergies

Medications

Pertinent past medical history

Last oral intake (what and when)

Events preceding the current illness or injury

Risk factors

[5]

[4] AMLS (2016), p 182

[5] AMLS (2016), p 19

History of the Present Illness: OPQRST

To assess the cause of a patient's injury or illness, providers need to know what brought it on and when, where it hurts, and how badly. The OPQRST mnemonic will help you remember which questions to ask in order to elicit the most pertinent answers from the patient:

- **O**nset—What were you doing when the pain started? Did the pain start all of a sudden or come on over a period of time?
- **P**alliation/provocation—Does anything make the pain go away or feel better or feel worse?
- **Q**uality—Describe the pain (burning, sharp, dull, ache, stabbing).
- **R**egion/radiation/referral—Can you point to the place where it hurts? Does the pain stay there or go somewhere else?
- **S**everity—On a scale of 1 to 10, with 1 being very minor and 10 the worst pain you have ever felt, how would you rate this?
- **T**ime/duration—How long have you felt this way?

Physical Exam

- Head-to-toe for unresponsive, altered mentation, significant mechanism of injury, unstable illness
- Focused assessment if patient able to actively participate in assessment or isolated injury/ illness

Measurements

- All patients: HR, RR, BP, SpO2
- EtCO2 with decreased level of consciousness, respiratory distress and/ or advanced airway in place
- Temperature with pediatric patients, intubated patients, or with suspicion of environmental exposure
- BGL with pediatric patients, any patient with a Glasgow Coma Scale (GCS) <15, any patient with a neurologic deficit
- Fetal heart rate for gravid patients with greater than twenty-five weeks gestation

Interventions

- Initiate/ confirm both IV access and continuous 4-lead monitoring
- Hearing protection for all patients during transport
- If specific patient presentation/ pathology covered in this document, follow appropriate guideline
    - Note that a single patient may fall under more than one guideline
    - Multiple interventions may need to be performed simultaneously
- If not covered in this document, refer to guidance in Standard of Practice
- Infusions initiated at sending facility can be maintained during patient transport at discretion of crew, but should be transferred to IV pump
- Clinicians should be familiar with and consider contraindications to medications/ consult the Formulary prior to administration
- Unless otherwise indicated, "IV Fluids" refers to either NS or LR at 20ml/kg given over 15 minutes and repeated at crew's discretion to maintain treatment goal
- Maintenance fluids should be initiated at the following rates as indicated:
    - Adults: 125ml/hr
    - Pediatrics: calculate maintenance fluids per PALS guidelines (4:2:1 Rule)
      (i.e. 4ml/kg/hr for 1st 10kg, 2ml/kg/hr for 2nd 10kg, 1ml/kg/hr for every kg over 20kg;
      ex. 23kg patient: 4ml/kg/hr x10kg + 2ml/kg/hr x10kg + 1ml/kg/hrx3kg = 63ml/hr)

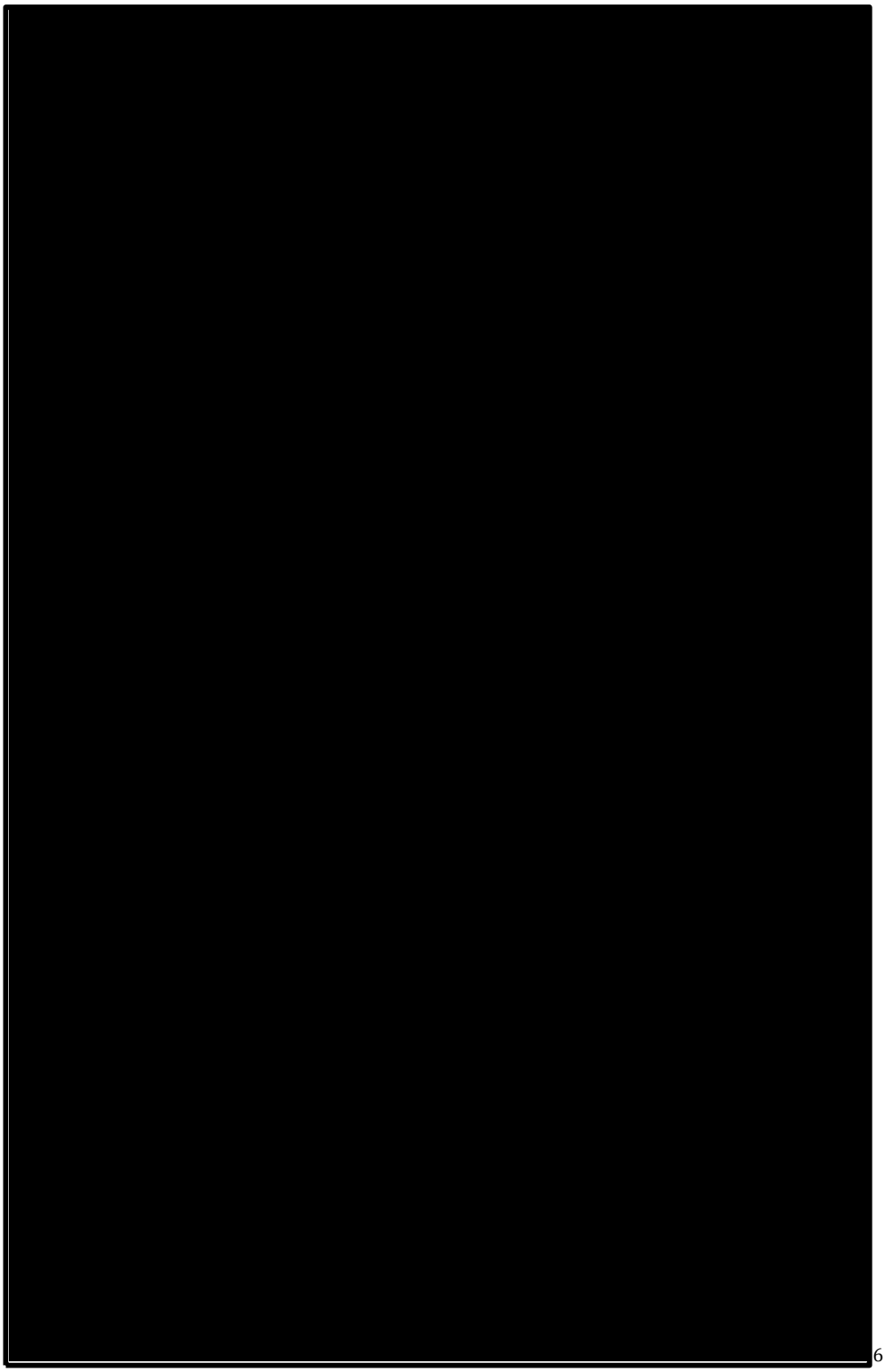
Ongoing Care

- Vitals signs every fifteen with stable patients, every five minutes as indicated/ with an unstable patient
- Patient response to all interventions should be assessed
- Significant change in patient status warrants reevaluation of transport destination/ plan of care

Analgesia, Sedation & Antiemetics

Assessment of Pain, Sedation and/or Agitation

- Verbal Pain Scale (adults)
- Wong-Baker (pediatric)



[redacted]

- FLACC (infant)

Medscape® www.medscape.com

Categories	Scoring		
	0	1	2
Face	No particular expression or smile	Occasional grimace or frown, withdrawn, disinterested	Frequent to constant frown, quivering chin, clenched jaw
Legs	Normal position or relaxed	Uneasy, restless, tense	Kicking or legs drawn up
Activity	Lying quietly, normal position, moves easily	Squirming, shifting back and forth, tense	Arched, rigid, or jerking
Cry	No cry (awake or asleep)	Moans or whimpers; occasional complaint	Crying steadily, screams or sobs, frequent complaints
Consolability	Content, relaxed	Reassured by occasional touching, hugging, or being talked to; distractible	Difficult to console or comfort

Note: Each of the five categories Face (F), Legs (L), Activity (A), Cry (C), and Consolability (C) is scored from 0-2, which results in a total score between 0 and 10.

From Merkel, Voepel-Lewis, Shayevitz, & Malviya (1997). The FLACC: A behavioral scale for scoring postoperative pain in young children. *Pediatric Nursing, 23*(3) 293-297.

Source: Pediatr Nurs © 2003 Jannetti Publications, Inc.

[7]

[7] https://www.medscape.com/content/2003/00/45/26/452694/452694_tab.html

- Adult Nonverbal Pain Scale (ANPS)

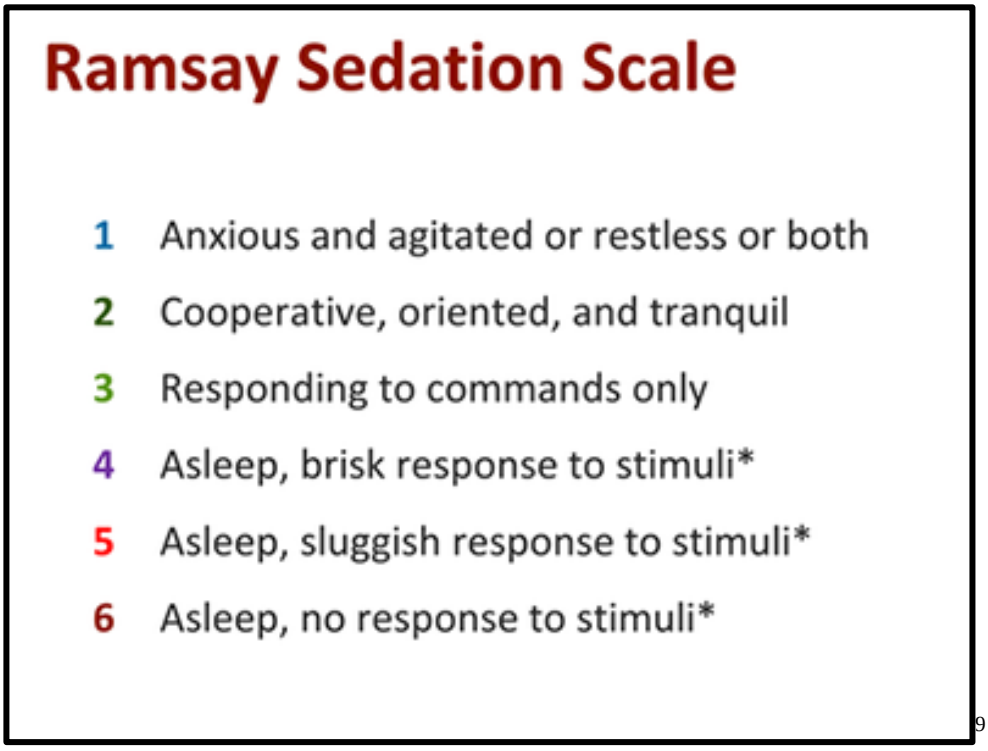
Categories	0	1	2
Face	No particular expression or smile.	Occasional grimace, tearing, frowning, wrinkled forehead.	Frequent grimace, tearing, frowning, wrinkled forehead.
Activity (movement)	Lying quietly, normal position.	Seeking attention through movement or slow, cautious movement.	Restless, excessive activity and/or withdrawal reflexes.
Guarding	Lying quietly, no positioning of hands over areas of body.	Splinting areas of the body, tense.	Rigid, stiff.
Physiology (vital signs)	Stable vital signs	Change in any of the following: * SBP > 20 mm Hg. * HR > 20/minute.	Change in any of the following: * SBP > 30 mm Hg. * HR > 25/minute.
Respiratory	Baseline RR/SpO_2 Compliant with ventilator	RR > 10 above baseline, or 5% ↓SpO_2 mild asynchrony with ventilator	RR > 20 above baseline, or 10% ↓SpO_2 severe asynchrony with ventilator

Abbreviations: HR, heart rate; RR, respiratory rate; SBP, systolic blood pressure; SpO2, pulse oximetry.
Instructions: Each of the 5 categories is scored from 0-2, which results in a total score between 0 and 10. Document total score by adding numbers from each of the 5 categories. Scores of 0-2 indicate no pain, 3-6 moderate pain, and 7-10 severe pain. Document assessment every 4 hours on nursing flow-sheet and complete assessment before and after intervention to maximize patient comfort. Sepsis, hypo-volemia, hypoxia need to be excluded before interventions.

[8]

[8] http://ccn.aacnjournals.org/content/25/1/14.2/T1.expansion

- Ramsay Sedation Score (sedated patients)



[9]

- Physiologic Indicators: tachycardia, tachypnea, inability to hold still, wincing/ grimace, etc.
  *note that the absence of physiologic indicators does not necessarily indicate an absence of pain

Analgesia

- Fentanyl
  - Adult: 0.5 – 1mcg/kg (max 100mcg) IV/IM/IN, repeat as needed
  - Pediatric: 0.5 – 1mcg/kg (max 100mcg) IV/IM/IN, repeat as needed
  - Infusion: 1-2mcg/kg/hr, titrated to effect
- Morphine
  - Adult: 2 – 5mg IV/IM, repeat as needed
  - Pediatric: 0.1mg/kg IV/IM, repeat as needed
- Ketamine
  - Adult: 0.1 – 0.25mg/kg IV/IM, repeat as needed
  - Pediatric: 0.1 – 0.25mg/kg IV/IM, repeat as needed

[9] https://www.medscape.org/viewarticle/857986_transcript

Sedation

- Ketamine
  - Adult: 0.5-1mg/kg IV or 4mg/kg IM, once
  - Pediatric: 0.5-1mg/kg IV/IM once
- Etomidate
  - Adult: 10mg/kg IV once
  - Pediatric: 0.3mg/kg (max 10mg) IV once
- Midazolam
  - Adult: 2.5 – 5mg IV/IM/IN, repeat as needed
  - Pediatric: 0.05 -0.1mg/kg (max 5mg) IV/IM/IN, repeat as needed
- Propofol
  - Infusion: 5 – 80mcg/kg/min
- Vecuronium – only when patient is intubated, to protect patient and staff from physical harm and/ or exposure to rabies
  - Adult: 0.1 mg/kg IV, repeat as needed
  - Pediatric: 0.1mg/kg IV, repeat as needed

Antiemetics

- Ondansetron
  - Adult: 4mg IV/IM/SL, may repeat once
  - Pediatric: 0.1mg/kg (max 4mg) IV/IM or 2mg SL, may repeat once
- Promethazine
  - Adult: 12.5 – 25mg IV diluted in NS and over 10min, once
  - Pediatric: 0.1mg/kg (max 12.5mg) IV diluted in NS and over 10min, once

Airway Management

Initial Interventions

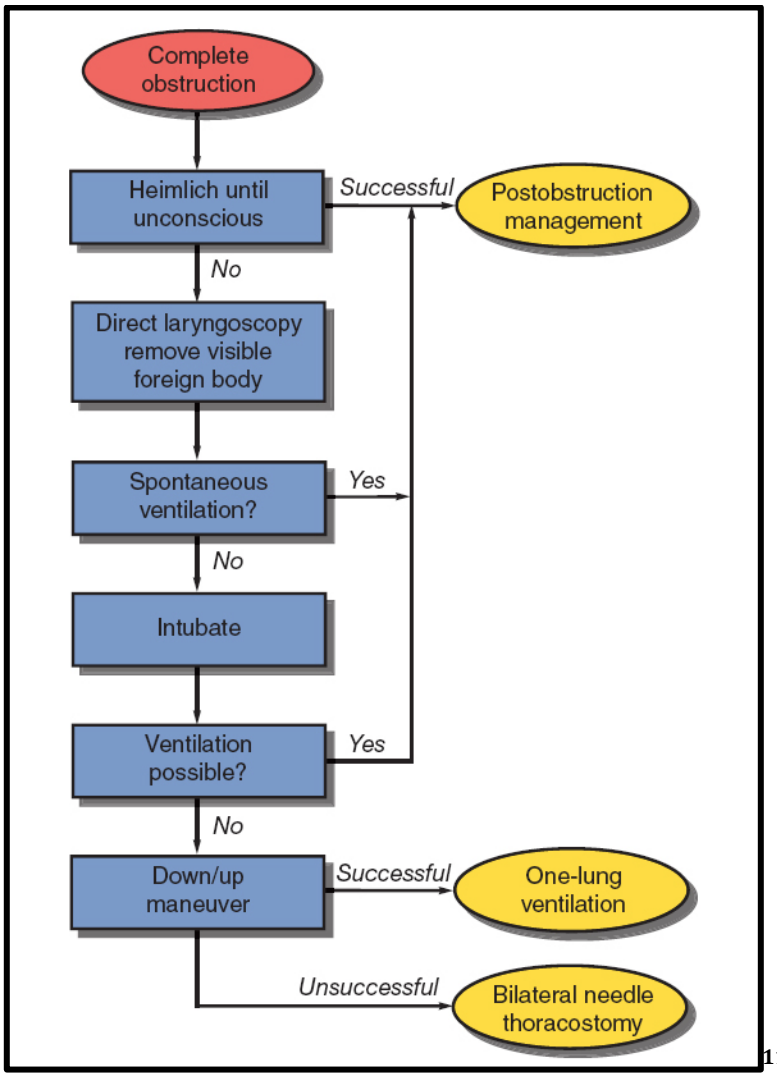
- Ensure patent airway and appropriate patient positioning
- Identify management needs as listed below

Incomplete Airway Obstruction

- Encourage the patient to cough the object out
- Maintain oxygenation as able
- Consider sedation, laryngoscopy and "lift and look" technique[10]

Complete Airway Obstruction/ Choking

- Responsive: abdominal thrusts, chest thrusts (obese or pregnant), back slaps/ chest thrusts (infant <1-year-old); per AHA BLS guidelines
- Unresponsive: laryngoscopy with removal of obstruction using Magill's Forceps, consider forcing object down to right mainstem, CPR with visual airway checks per AHA BLS guidelines



[11]

[10] Walls (2018), p444
[11] Walls (2018), p445

Oxygen Delivery

- Choose delivery device and flow
  - Blow-by: up to 6lpm
  - Nasal cannula: 2-6lpm
  - Nebulizer (mask or T-device): 6-8lpm
  - Simple face mask: 8-10lpm
  - Non-rebreather: 10-15lpm
- Titrate oxygen delivery to patient response (goal is SpO2 94-99%)
- Consider pathology (i.e. Respiratory, Neurologic, Cardiovascular, etc.)

Non-Invasive Management

- EtCO2 monitoring to evaluate ventilation

TABLE 8-2 Abnormal $ETCO_2$ Values

$ETCO_2$	Physiology	Clinical Condition
Increased	Decreased CO_2 clearance	Classic hypoventilation
	Increased circulation	Return of spontaneous circulation in cardiac arrest
	Increased CO_2 production	Increased metabolism (fever and seizure)
Decreased	Increased CO_2 clearance	Hyperventilation
	Lack of CO_2 in gas	Hypopneic hypoventilation
	Sample decreased circulation	Low cardiac output
	Decreased CO_2 production	Pulmonary embolism
		Decreased metabolism (hypothermia)
Zero	No ventilation	Esophageal intubation
		Accidental extubation
		Apnea
	No circulation	Cardiac arrest

[12]

- BVM ventilations (with oxygen at 25lpm)
  - PEEP valve (dial to 10cmH2O, requires maintaining seal at mask)
  - Two-person technique if possible
- NPA/ OPA placement
- Suction
- Non-Invasive Positive Pressure Ventilation

[12] Walls (2018), p80

Invasive Management

- Intubation
  - Unless pulseless, follow Rapid Sequence Intubation guideline
  - Utilize appropriately sized equipment
  - Three attempts max, then proceed to backup airway or Cricothyrotomy
- Backup Airways
  - King for patients ≥35" (90cm) or "yellow" on Broselow/12 – 14kg and larger (sized by patient height)
  - AirQ for patients classified "grey" or "pink" on Broselow/ 4 – 11kg (sized by patient weight)
- Cricothyrotomy (Surgical Cricothyrotomy or Needle Cricothyrotomy)
- Reevaluate transport destination/ plan of care
- Invasive Ventilator Management for any patient with an advanced airway in place

Quick Reference Chart for Airway Management[13]

	<1kg (very preterm)	**1-2kg (preterm)**	**2-3kg (term)**	**3-5kg**	**6-7kg**	**8-9kg**	**10-11kg**
Blade	00 Miller	0 Miller	1 Miller	1 Miller	1 Miller	1 Miller	1 Miller
ETT Size	2.0-2.5	2.5-3.0	3.0-3.5	3.0-3.5	3.5	3.5-4.0	4.0
Backup	none	none	none	AirQ 1.0	AirQ 1.0	AirQ 1.5	AirQ 1.5

	12-14kg	**15-18kg**	**19-22kg**	**24-28kg**	**30-36kg**	**Adult Female**	**Adult Male**
Blade	2 Miller	2 Miller	2 Mac or Miller	2 Mac or Miller	3 Mac or Miller	3 Mac or Video	3 Mac or Video
ETT Size	4.0-4.5	4.5-5.0	5.0	5.5-6.0	6.0-6.5	7.0	7.5
Backup	AirQ 1.5 or King 2	King 2	King 2	King 2 or 2.5	King 2.5	***King Airway by Height***	
						3 48-60"	1.2-1.5m
						4 60-72"	1.5-1.8m
						5 >72"	>1.8m

[13] This chart has lots of references/ footnotes – they are omitted here to avoid clutter, but a copy with references can be found in the References Section at the back of the FRGs

Shock

Types of Shock

- Hypovolemic
  - Hemorrhagic
    - Evidence: acute blood loss (may be internal), either traumatic or non-traumatic (i.e. Gastrointestinal Bleed, Vaginal Bleed, etc.)
    - Interventions: Trauma guideline as appropriate, administer oxygen, Tranexamic Acid if indicated, IV Fluids to maintain SBP ≥80mmHg for adults (or ≥70+2 x years for pediatrics)
  - Non-hemorrhagic
    - Evidence: excessive vomiting, diarrhea, sweating and/ or urination; prolonged state of inadequate fluid intake and/ or environmental exposure; significant burns; overuse of diuretics
    - Interventions: IV Fluids
- Distributive
  - Neurogenic
    - Evidence: hypotension with concurrent bradycardia/ normal heart rate (may be related to Trauma)
    - Interventions: IV Fluids, Dopamine Infusion, monitor temperature
  - Septic
    - Evidence: fever, bounding pulses, source of infection (may not be readily identifiable)
    - Interventions: IV Fluids, Norepinephrine Infusion, Vasopressin Infusion, monitor temperature, consider Ceftriaxone per Infection and Fever
  - Anaphylactic
    - Evidence: concurrent Allergic Reaction
    - Interventions: Epinephrine Infusion
- Cardiogenic
    - Evidence: right or left heart failure, respiratory distress, pulmonary edema; possible ischemia/ AMI or EKG changes
    - Interventions: consider pathophysiology (Acute Coronary Syndrome, Dysrhythmia, Congestive Heart Failure/ Pulmonary Edema, etc.), IV Fluids, Norepinephrine Infusion
- Obstructive
  - Tension Pneumo/Hemothorax
    - Evidence: decreased breath sounds on affected side, asymmetrical chest rise and fall, sucking chest wound, tracheal deviation, etc. with concurrent hemodynamic compromise
    - Interventions: Needle Decompression, Chest Tube Insertion
  - Cardiac Tamponade
    - Evidence: narrowing pulse pressure, muffled heart tones
    - Interventions: IV Fluids, Pericardiocentesis

Medications

Infusions

Guidance for specific agents based on type of shock (as outlined above) may not apply to all patient scenarios, therefore use best clinical judgment when initiating infusions:

- Norepinephrine Infusion
  - Adult: 2-30mcg/min or 0.1-0.5mcg/kg/min
  - Pediatric: 0.05-2mcg/kg/min
- Epinephrine Infusion
  - Adult: 2-20mcg/min or 0.1-0.5mcg/kg/min (max 20mcg/min)
  - Pediatric: 0.1-1mcg/kg/min
- Vasopressin Infusion
  - Adult: 0.01-0.04 units/min
  - Not indicated for pediatric patients
- Dopamine Infusion
  - Adult: 2-20mcg/kg/min
  - Pediatric: 2-20mcg/kg/min

Push-dose Pressors

- Epinephrine
  - Adult: 5-20mcg IV, repeat as needed
  - Pediatric: 5-10mcg IV, repeat as needed

Other

- Tranexamic Acid (TXA)
  - Refer to Formulary for utilization and contraindications
  - Adult: 1g IV over 10min, followed by 1g IV over 8 hours
  - Pediatric: contraindicated in patients <15 years old

Additional Considerations

- Consider adverse effects of all medications (i.e. analgesics and sedatives) – refer to Formulary
- Consider acidosis: ensure adequate ventilation, recognize that patient may compensate

Respiratory

Specific Considerations

- Tuberculosis
- Epiglottitis
- Croup
- Bronchospasm
- Allergic Reaction
- Pulmonary Embolism
- Pulmonary Edema
  - Adult: see Congestive Heart Failure/ Pulmonary Edema (under Cardiovascular)
  - Pediatric: see Management of the Sick Baby (under Pediatric)
- Consider additional etiologies:

Table 2-5 Differential Diagnosis of Dyspnea by Body System

Critical	Emergent	Nonemergent
	Pulmonary Diagnoses	
Airway obstruction	Spontaneous pneumothorax	Pleural effusion
Pulmonary embolus	Asthma	Neoplasm
Noncardiogenic edema	Cor pulmonale	Pneumonia
Anaphylaxis	Aspiration pneumonia	COPD
	Cardiac Diagnoses	
Pulmonary edema	Pericarditis	Congenital heart disease
Myocardial infarction		Valvular heart disease
Cardiac tamponade		Cardiomyopathy
	Abdominal Diagnoses	
Abdominal dissection	Ischemic bowel	Ascites
Bowel perforation	Pancreatitis	Ileus
Perforated diverticula	Cholecystitis	Obesity
Gangrenous gallbladder	Bowel obstruction	
Perforated esophagus	Herniated diaphragm	

(continues)

[14]

[14] AMLS (2016), p68

Table 2-5 Differential Diagnosis of Dyspnea by Body System (*continued*)

Critical	Emergent	Nonemergent
	Metabolic Diagnoses	
Diabetic ketoacidosis	Hyperglycemia	
Thyroid storm	Hyperthyroidism	
	Infectious Diagnoses	
Sepsis	Pneumonia, viral	Influenza
Pneumonia	Pneumonia, bacterial	Bronchitis
Epiglottitis	Pneumonia, fungal	Human immunodeficiency virus (HIV) infection
Bacterial tracheitis	Pneumonitis	Tuberculosis
Retropharyngeal abscess	Aspiration pneumonitis	
Foreign object aspiration	Lung abscess	
Meningitis	Empyema	
	Hematologic Diagnoses	
Severe anemia	Anemia	Chronic anemia
Hemorrhage, gastrointestinal	Leukemia	
	Lymphoma	
	Neuromuscular Diagnoses	
Intracerebral hemorrhage	Encephalopathies	Neuromuscular degenerative disease (amyotrophic lateral sclerosis [ALS])
Cerebrovascular accident	Alcohol intoxication	Myasthenia gravis
Transient ischemic attack	Basilar artery syndrome	Multiple sclerosis

[15]

[15] AMLS (2016), p69

Tuberculosis:

- Consider PPE: mask on patient (oxygen-delivery mask or surgical face mask)
- Ensure that receiving facility is aware that patient has tuberculosis
- Additional management based on symptoms

Epiglottitis**:** patients of any age (although most commonly children aged 2-6) with stridor, excessive drooling, vocal changes (i.e. muffled voice) and/ or respiratory distress on assessment; "thumbprint sign" on lateral neck x-ray

- Minimize agitation to patient, consider:
  - Nebulized versus parenteral medications
  - Deferring hands-on assessment until airway has been addressed
  - Sedation prior to invasive intervention
- Humidified oxygen (nebulized NS or sterile water)
- Methylprednisolone
  - Adult: 125mg IV, once
  - Pediatric: 2mg/kg (max 125mg) IV, once
- Ceftriaxone
  - Adult: 1-2g IV over 2-5min, once
  - Pediatric: 50mg/kg (max 2g) IV over 2-5min, once

Croup**:** any patient (though most commonly ≤5 years old and very rarely in adults over 15) presenting with "seal-like" or "barking" cough, stridor and/ or hoarse voice; "steeple sign" on anterior neck xray

- Racemic Epinephrine
  - Adult: 1.25mg NEB, repeat as needed
  - Pediatric: 1.25mg NEB, repeat as needed
- Treat concurrent Bronchospasm if indicated
- Maintenance IV Fluids
- Methylprednisolone
  - Adult: 125mg IV, once
  - Pediatric: 2mg/kg (max 125mg) IV, once

***Bronchospasm*:** respiratory distress related to asthma, COPD (emphysema or chronic bronchitis), allergic reaction; wheezes on auscultation; hypoxia and/ or hypercapnia without identifiable cause

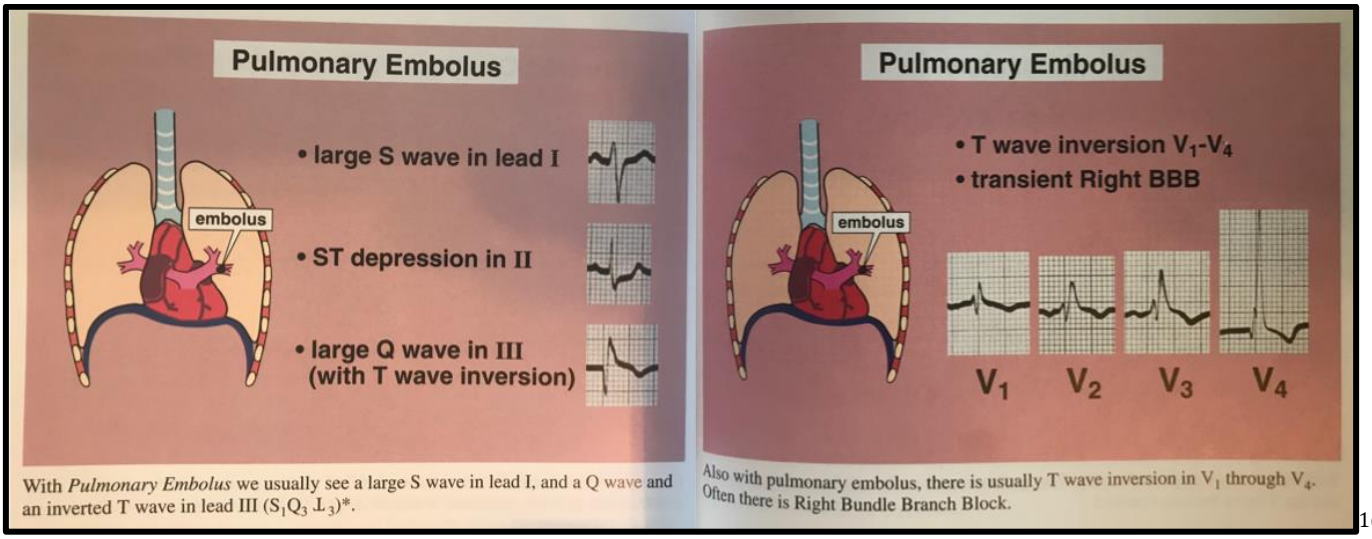
- Albuterol
  - Adult: 2.5mg NEB, repeat as needed
  - Pediatric: 2.5mg NEB, repeat as needed to max 10mg/hr
- Epinephrine 1:1000 [1mg/ml]
  - Adult: 0.3mg IM, repeat as needed [0.3ml]
  - Pediatric: 0.01mg/kg (max 0.3mg) IM, repeat as needed to 3 total doses [0.01ml/kg]
- Non-Invasive Positive Pressure Ventilation or High Flow Nasal Canula
- Magnesium Sulfate
  - Adult: 2g IV over 20min, repeat as needed
  - Pediatric: 50mg/kg (max 2g) IV over 20min, repeat as needed
- Terbutaline
  - Adult: 0.25mg IM, may repeat once
  - Pediatric: 0.005 – 0.01mg/kg IM, may repeat once
- IV Fluid Bolus
- Rapid Sequence Intubation with Ketamine (over Etomidate) if warranted
- Ipratropium (may be given simultaneously with Albuterol)
  - Adult: 0.5mg NEB, may repeat up to 3 total doses
  - Pediatric: 0.5mg NEB, once
- Methylprednisolone
  - Adult: 125mg IV, once
  - Pediatric: 2mg/kg (max 125mg) IV, once

***Allergic Reaction*:** exaggerated immune response to external stimuli that may include: urticaria/ hives, erythema, pruritis, angioedema; respiratory distress (possibly with stridor and/ or wheezing); hypotension, tachycardia

- Distance patient from trigger/ avoid continued exposure
- Treat Bronchospasm if needed
- Epinephrine 1:1000 [1mg/ml]
  - Adult: 0.3mg IM, repeat as needed [0.3ml]
  - Pediatric: 0.01mg/kg (max 0.3mg), repeat as need to 3 total doses [0.01ml/kg]
- Epinephrine 1:10,000 [0.1mg/ml] (with continued/ anaphylactic reaction)
  - Adult: 0.1-0.5mg IV over 2-5min, repeat as needed [1-5ml]
  - Pediatric: 0.01mg/kg IV (max 0.5mg) over 2-5min, repeat as needed [0.1ml/kg]
- Hemodynamic compromise (Shock):
  - IV Fluid Bolus
  - Epinephrine Infusion
    - Adult: 2-10mcg/min
    - Pediatric: 0.1-2mcg/kg/min
- Diphenhydramine (alone for mild/ moderate reaction, as adjunct with severe reaction/ anaphylaxis)
  - Adult: 1mg/kg (max 50mg) IV/ deep IM, once
  - Pediatric: 1mg/kg (max 50mg) IV/ deep IM, once

***Pulmonary Embolism*:** patient suspected of PE (dyspnea, syncope, chest pain, bloody sputum, etc.), as suspected by Well's Score ≥4 or characteristic EKG changes; as confirmed by CT angiogram

- PE suspected by Well's Score ≥4 or characteristic EKG changes
  - Heparin bolus
    - Adult: 5000u IV, once
    - Not indicated for pediatric patients
  - Follow by Heparin infusion
    - Adult: 1000u/hr
    - Not indicated for pediatric patients



[16]

(simplified: "S1Q3T3" – large S in I, large Q in III, T-wave inversion in III)

[16] Dubin, p 312, 313

Medscape® www.medscape.com

Variable	Points
Clinical signs and symptoms of DVT*	3.0
An alternative diagnosis is less likely than PE	3.0
Heart rate >100 beats per minute	1.5
Immobilization or surgery in previous 4 weeks	1.5
Previous DVT/PE	1.5
Hemoptysis	1.0
Malignancy (on treatment, treated in the last 6 mos or palliative)	1.0

**Minimum of leg swelling and pain with palpation of deep veins; DVT, deep-vein thrombosis; PE, pulmonary embolism*

Score	Category	Score	Category
<2 points	low probability	<4 points	unlikely PE
2–6 points	moderate probability	≥4 points	likely PE
>6 points	high probability		

Source: Lab Med © 2008 American Society for Clinical Pathology [17]

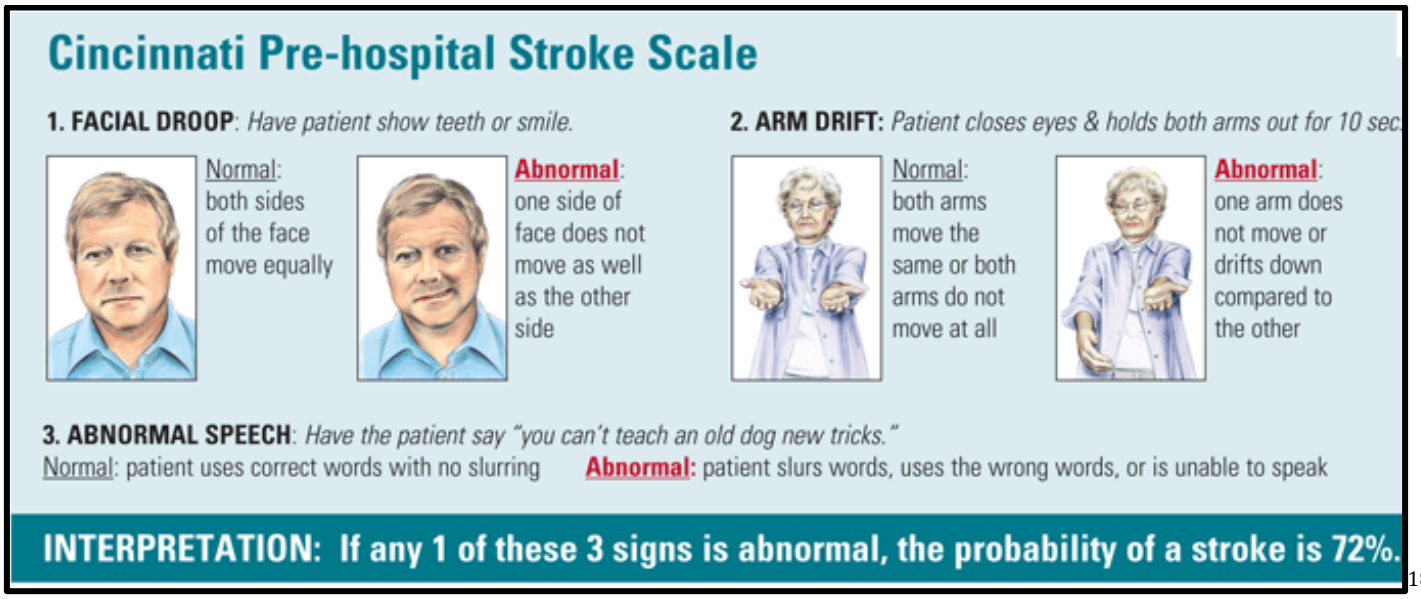
- PE confirmed by CT scan, hemodynamic instability and right heart failure per echocardiogram or CT angiogram (all three must be present)
  - Perform Thrombolytic Checklist
  - If no contraindications noted, administer Streptokinase bolus
    - Adult: 250,000u IV over 30min
    - Not indicated for pediatric patients
  - Followed by Streptokinase infusion
    - Adult: 100,000u/hr for 24 hours
    - Not indicated for pediatric patients
  - Reassess clotting times at 4 hours after initiation of Streptokinase, if no improvement noted (i.e. evidence of lysis), discontinue infusion

[17] http://ecc-education.blogspot.com/2016/02/evaluation-of-patients-with-suspected.html

Neurologic

General Management

- Administer oxygen (per Airway Management)
- Attempt to determine baseline mental status and specific time when last seen at that baseline
- Asses BGL and treat per Diabetic Emergencies guideline, as indicated
- Assess all patients with neurologic symptoms for possible Stroke using the CPSS:



[18]

- Consider additional assessments
  - 12-lead EKG
  - Cranial Nerve Assessment

Table 1-6 Cranial Nerves and Their Functions

Nerve No.	Name	Function	Assessment
I	Olfactory	Sense of smell	Ask the patient to close her eyes. Place spirits of ammonia or an alcohol wipe under her nose. The patient should be able to identify the odor.
II	Optic	Sense of sight	Evaluate visual acuity using a Snellen visual acuity chart or Rosenbaum card. Ask the patient to cover one eye and tell you how many fingers you're holding up. Then evaluate the opposite eye.
III	Oculomotor	Size, symmetry, and shape of pupils Eye movement	Test the pupil response to light for equality, reactivity, and roundness. Pupils should briskly constrict with light and dilate in darkness.
IV	Trochlear	Downward gaze	Hold the patient's chin to prevent movement. Ask the patient to follow a penlight or object in an "H" pattern to track the six visual fields.

(continues)

[19]

[18] http://thenurseszone.com/cincinnati-pre-hospital-stroke-scale/
[19] AMLS (2016), p 32

Table 1-6 Cranial Nerves and Their Functions (*continued*)

Nerve No.	Name	Function	Assessment
V	Trigeminal	Cheek Jaw motion Chewing Facial sensation	Ask the patient to clench his teeth to determine the strength of the jaw and the ability to close the mouth without difficulty. The patient should feel a slight touch bilaterally.
VI	Abducens	Lateral eye movement	Same as for cranial nerve IV.
VII	Facial	Strength of facial muscles Taste Saliva secretion	Assess for weakness or asymmetry by inspecting the face at rest and when speaking. Ask the patient to raise his eyebrows, frown, show his upper and lower teeth, smile, and puff out both cheeks.
VIII	Acoustic	Sense of hearing Balance	Occlude each ear independently to test for hearing and balance.
IX	Glossopharyngeal	Tongue and pharynx sensation Taste Muscles of swallowing	Ask the patient to say "ahhh," and observe the uvula and soft palate response. The soft palate should move up, and the uvula should remain midline.
X	Vagus	Sensation of throat and trachea Taste Muscles for voice production Heart rate	Same as cranial nerve IX
XI	Spinal accessory	Shoulder movement Ability to turn head	Ask the patient to raise and lower her shoulders against the resistance of your hand on her shoulder.
XII	Hypoglossal	Speech articulation Tongue movement	Ask the patient to stick out his tongue and move it in several directions with symmetry.

[20]

[20] AMLS (2016), p 33

- Scoring DTRs

Scoring Deep Tendon Reflexes	
Grade	**Deep Tendon Reflex Response**
0	No response
1+	Sluggish or diminished
2+	Active or expected response
3+	More brisk than expected, slightly hyperactive
4+	Brisk, hyperactive, with intermittent or transient clonus

[21]

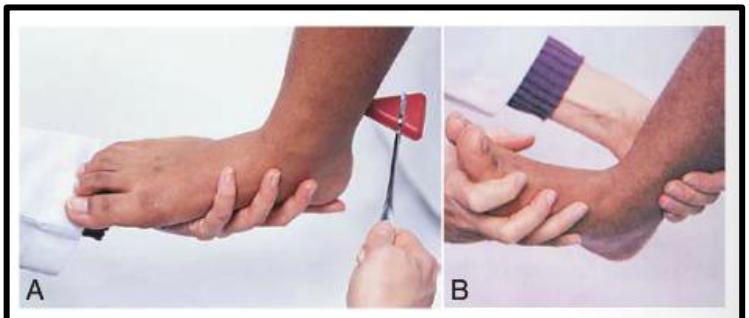


Figure 1-20 Location of tendons for evaluation of deep tendon reflexes. **A.** Patellar. **B.** Achilles.

[22]

[23]

[21] AMLS (2016) p 34
[22] AMLS (2016), p 34
[23] https://meded.ucsd.edu/clinicalmed/neuro3.htm

Specific Considerations

- Altered Mental Status
- Stroke
- Seizure
- Meningitis
- Other Intracranial Hemorrhage discussed in Trauma: Traumatic Brain Injury (TBI)

Altered Mental Status: attempt to narrow differential diagnosis and treat appropriately:

- Hypoxia (Airway Management)
- Hypoperfusion (Shock)
- Infection and Fever
- Trauma
- Seizure
- Diabetic Emergencies
- Environmental
- Electrolyte Abnormalities
- Endocrine Disorders
- Stroke
- Toxic Exposure
- Psychosis (Pain, Agitation, & Nausea)
- Opiate overdose, administer Naloxone
    - Adult: 0.4-2mg IV/IM/IN, repeat as needed
    - Pediatric: 0.1mg/kg (max 2mg) IV/IM/IN, repeat as needed
- Cerebral edema, administer either:
    - Mannitol
        - Adult: 1g/kg IV over 10min (use filter)
        - Pediatric: 1g/kg IV over 10min (use filter)

Initial Assessment of Altered Mental Status: SNOT

Remember this mnemonic when performing initial assessment in the prehospital setting:

S Sugar
Stroke
Seizure
N Narcosis (CO_2, opiates)
O Oxygen
T Trauma
Toxins
Temperature

Be aware that this list is not a comprehensive survey of all possible causes of altered mental status.[24]

[24] AMLS (2016), p183

Causes of Decreased Level of Consciousness: AEIOU-TIPS

A	Alcohol, anaphylaxis, acute myocardial infarction
E	Epilepsy
	Endocrine abnormality
	Electrolyte imbalance
I	Insulin (glucose)
O	Opiates
U	Uremia
T	Trauma
I	Intracranial (tumor, hemorrhage, or hypertension)
	Infection
P	Poisoning
S	Seizure
	Stroke
	Syncope

[25]

Assessment of Acute Mental Status Changes: SMASHED

S	Substrates—Substrates may include hyperglycemia, hypoglycemia, and thiamine
	Sepsis
M	Meningitis and other CNS infections
	Mental illness
A	Alcohol—Intoxicated or in withdrawal
S	Seizure—Ictal (active) or postictal phase
	Stimulants—Anticholinergic agents, hallucinogens, or cocaine
H	Hyper—Hyperthyroidism, hyperthermia, hypercarbia
	Hypo—Hypotension, hypothyroidism, hypoxia
E	Electrolytes—Hypernatremia, hyponatremia, or hypercalcemia
	Encephalopathy—Hepatic, uremic, hypertensive, or others
D	Drugs—Any type

[26]

[25] AMLS (2016), p182
[26] AMLS (2016), p183

Stroke

For pediatric patients suspected of stroke: consider infection, sickle cell disease, clotting or bleeding disorder; contact Medical Control for specific guidance as needed.

For adult patients:

- Transport Considerations
  - Do not transport within country if:
    - >4 hours after onset of symptoms (as defined by time at which patient was last seen at baseline)
    - Hemorrhagic stroke confirmed by CT *and* no evidence of intraventricular hemorrhage
  - Consider transport within country if within 4 hours after onset of symptoms and any one of the following:
    - Ischemic (confirmed by CT) or undifferentiated stroke (in the absence of CT)
    - Hemorrhagic stroke with confirmed intraventricular hemorrhage on CT
  - Consider transport out of the country at discretion of crew and/or Medical Control
- Maintain elevated HOB unless contraindicated
- Concurrent Hypotension
  - IV Fluid Bolus
  - Norepinephrine Infusion: 2-30mcg/min or 0.1-0.5mcg/kg/min
- Concurrent Hypertension
  - Treat with labetalol to goal as defined below:
    - Undifferentiated or ischemic, maintain BP <220/120
    - Hemorrhagic, maintain SBP <160
  - Labetalol: 20mg IV over 2-5min, may repeat q 10min at 40mg, then 80mg; after that, proceed to another antihypertensive
  - If unable to treat with Labetalol, consider Hydralazine: 10mg IV, may repeat as needed to 4 total doses
- Evidence of herniation
  - Hyperventilate to ETCO2 of 30-35mmHg
  - Mannitol: 1g/kg IV over 10min (use filter)
- Streptokinase for ischemic stroke
  - Criteria:
    - Measurable neurologic deficit that will cause serious functional problems
    - Onset of symptoms <4.5 hours (if onset unknown, do not administer)
    - CT performed to rule out hemorrhagic stroke
    - Age ≥18 and <75 years
    - No contraindications per Thrombolytic Checklist
  - Administration:
    - Adult >65kg: 1,500,000u IV over 60min, once
    - Adult <65kg: 1,200,000u IV over 60min, once

Seizure

- If patient actively seizing
  - Protect from further injury
  - Do not place anything in the mouth
  - Administer one of the following:
    - Midazolam
      - Adult: 2.5-5mg IV/IM/IN, repeat as needed
      - Pediatric: 0.05-0.1mg/kg IV/IM/IN (max 5mg), repeat as needed
    - Phenytoin
      - Adult: 15-20mg/kg over 20min (max 50mg/min), once (use filter)
      - Pediatric: 20mg/kg (max 1000mg) over 20min, once (use filter)
    - Magnesium Sulfate (for eclampsia only, per PIH, (Pre-)Eclampsia, and HELLP)
- If patient post-ictal: routine care, monitor for further seizures, treat underlaying cause(s) as appropriate
- If Rapid Sequence Intubation indicated, consider Succinylcholine (over Rocuronium)

Meningitis

- Consider PPE for staff, mask on patient (oxygen-delivery mask or surgical face mask)
- Treatment is similar for both viral and bacterial etiologies
  - Manage symptoms: fever (with Tylenol, below), pain (Pain, Agitation & Nausea), Seizure
    - Acetaminophen/ Paracetamol
      - Adult: 10-15mg/kg PR (max 1000mg), once
      - Pediatric: 10-15mg/kg PR (max 1000mg), once
  - Ceftriaxone (if not already given; even if viral meningitis is suspected, unless confirmed by cerebrospinal fluid PCR testing)
    - Adult: 2g IV/IM over 2-5min, once
    - Pediatric: 100mg/kg (max 2g) IV/IM over 2-5min, once
- Ensure that receiving facility is aware that patient has meningitis

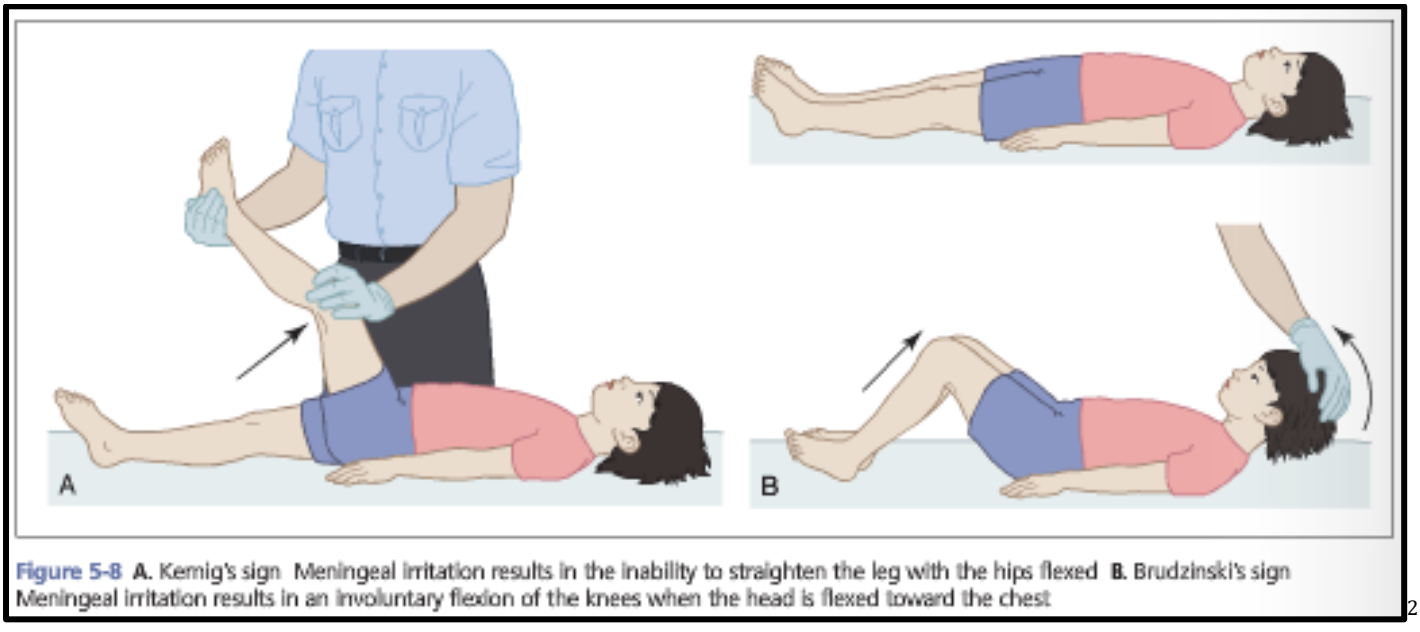


Figure 5-8 **A.** Kernig's sign Meningeal irritation results in the inability to straighten the leg with the hips flexed **B.** Brudzinski's sign Meningeal irritation results in an involuntary flexion of the knees when the head is flexed toward the chest

[27]

[27] AMLS (2016), p196

Cardiovascular

Specific Considerations

- Acute Coronary Syndrome
- Dysrhythmia
    - Torsades
    - Adult Bradycardia
    - Adult Tachycardia
    - Pediatric Bradycardia
    - Pediatric Tachycardia, Adequate Perfusion
    - Pediatric Tachycardia, Poor Perfusion
- Congestive Heart Failure/ Pulmonary Edema
- Hypotension
- Hypertension
- Cardiac Arrest
    - Adult Cardiac Arrest
    - Pediatric Cardiac Arrest
    - Adult Post Arrest
    - Pediatric Post Arrest, with Shock

Associated Procedures

- 12-lead EKG
- Assessing Heart Tones
- Vagal Maneuvers

***Acute Coronary Syndrome*:** any adult patient complaining of chest pain, discomfort, or pressure; suspicion for ischemia based on patient presentation (respiratory distress, history of cardiac dysfunction, etc.); any patient with new onset ST segment elevation on 12-lead; maintain increased suspicion for patients with non-specific complaints, females and diabetics

Does not apply to pediatric patients, consider other causes for symptoms that might be associated with ACS in the pediatric patient.

- Perform 12-lead EKG
  - If ST elevations noted, identify area of heart affected
    - Elevations defined as ≥2mm
    - ST elevation in ≥2 anatomically contiguous leads indicated STEMI
  - If inferior wall MI identified, perform right-sided EKG
  - If right-sided MI confirmed, do not administer Nitroglycerin
- Aspirin (all ACS patients): 162-324mg PO, once
- Nitroglycerin (SBP must be ≥ 90): 0.4mg SL, may repeat as needed to 3 total doses
  - With right-sided MI or presence of murmur related to aortic stenosis (systolic), consider going directly to Nitroglycerin infusion and starting at 5mcg/min (to avoid large, single dose that might cause hemodynamic instability)
- Nitroglycerin Infusion (with persistent discomfort after SL doses): 5-200mcg/min
- IV Fluids (to maintain SBP ≥ 90)
- Streptokinase (with confirmed STEMI within 24 hours of onset)
  - Adult: 1,500,000u IV over 30-60 min
  - Monitor for reperfusion dysrhythmia, do not treat unless sustained for 30s
- Heparin (along with Streptokinase or if NSTEMI diagnosed by sending facility and confirmed with positive troponins): bolus 5000u IV, once; followed by infusion of 1000u/hr
- Metoprolol (only administer if BP will tolerate): 5-10mg IV, once
- Also consider alternative etiology with chest pain/ discomfort

Table 3-5 Causes of Chest Discomfort: Differential Diagnoses

- Acute coronary artery occlusion
- Pulmonary embolism
- Coronary artery dissection (often in association with thoracic aortic dissection)
- Uncontrolled hypertension
- Coronary artery spasm
- Coronary artery embolism (secondary to atrial myxoma, platelet thrombi, valvular vegetation, etc.)
- Gastrointestinal diseases
  - Acute gastritis
  - Acute pancreatitis
  - Acid reflux, esophagitis
  - Peptic ulcer disease
  - Boerhaave's syndrome
- Pneumonia, pleuritic
- Viral myocarditis/pericarditis
- Systemic vasculitis with coronary artery involvement
- Toxic exposure (cyanide or carbon monoxide, for example)
- Anemia or red blood cell dysfunction (sickle cell, for example)
- Shock (hypovolemic or septic)
- Cardiac arrhythmias
- Structural abnormalities of the heart (congenital or acquired)

[28]

[28] AMLS (2016), p127

***Dysrhythmia*:** any patient presenting with an abnormal heart rate or rhythm (by manual interpretation of 4-lead EKG), to include bradycardias and tachycardias for both adult and pediatric patients; if no pulse detected or non-perfusing rhythm noted on assessment, refer to Cardiac Arrest guideline

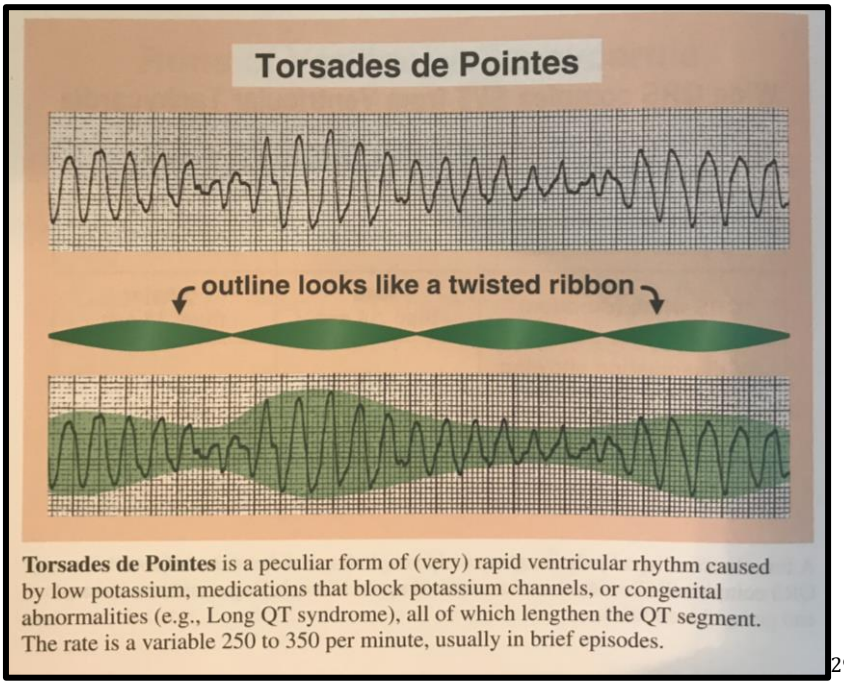
Approach to Management**:** after initial identification of a dysrhythmia, treatment should follow ACLS or PALS algorithms (reproduced below) except as noted and in compliance with [redacted] Policies and Procedures; not all treatments and/ or medications referred to in AHA guidelines are carried by [redacted], in these instances providers should defer to available treatments and/ or medications.

Specific Algorithms

- Torsades
- Adult Bradycardia
- Adult Tachycardia
- Pediatric Bradycardia
- Pediatric Tachycardia, Adequate Perfusion
- Pediatric Tachycardia, Poor Perfusion

Torsades

- Often self-limiting, however may progress to arrest if underlaying cause no addressed
- If non-perfusing (i.e. pulseless), treat per Cardiac Arrest and administer Magnesium Sulfate only if Torsades in confirmed on rhythm assessment and refractory to defibrillation
    - Adult: 1-2g IV diluted in NS and over 5min, once
    - Pediatric: 25-50mg/kg (max 2g) IV diluted in NS and over 5min, once
- If perfusing, administer Magnesium Sulfate
    - Adult: 1-2g IV diluted in NS and given over 30min; followed by infusion at 0.5-1g/hr with conversion
    - Pediatric: 25-50mg/kg (max 2g) IV diluted in NS and given over 30min, once

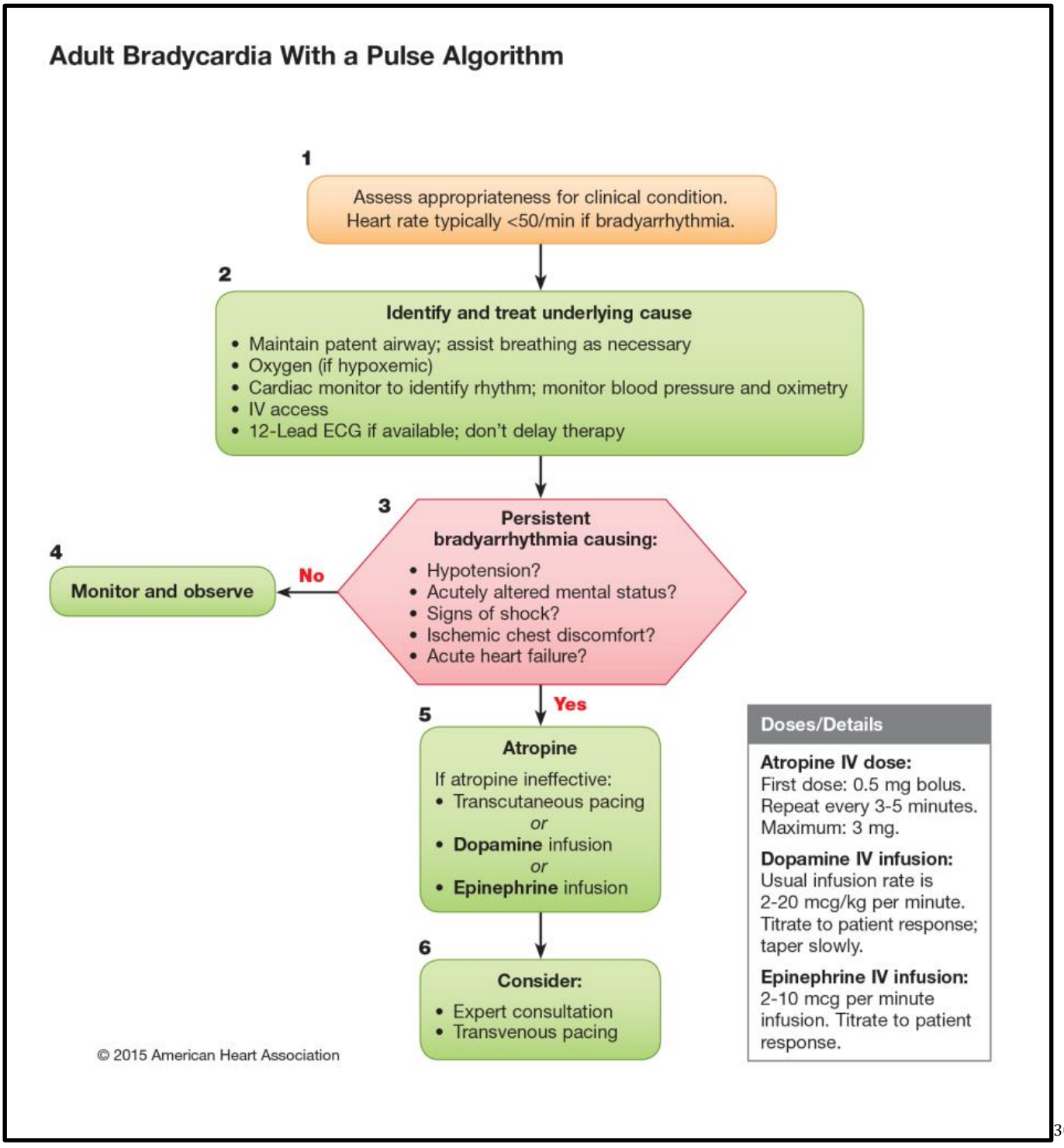


[29]

[29] Dubin (?), p158

Adult Bradycardia

- Transcutaneous/ transthoracic pacing is NOT to be performed unless ALL of the following apply:
  - Patient is being transferred out of [redacted]
  - Receiving facility has ICU and is known to have internal pacing capabilities
  - Receiving facility is aware that patient is to be paced
- Give analgesia and sedation prior to/ concurrently with pacing (Pain, Agitation & Nausea)

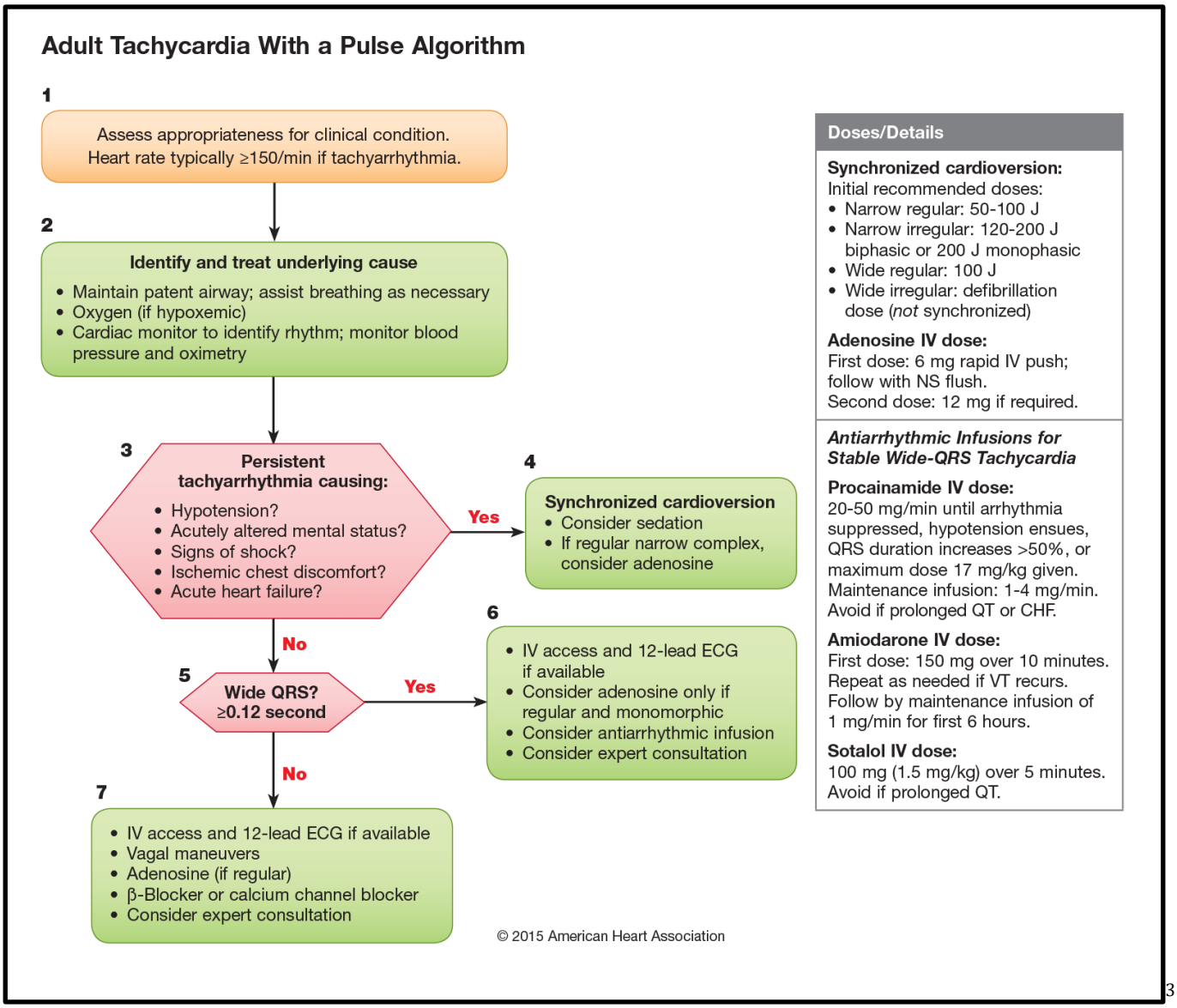


[30]

[30] ACLS (2015)

Adult Tachycardia

- With Stable Wide-QRS Tachycardia (Box #6), for "consider antiarrhythmic infusion," administer Amiodarone as outlined, (Procainamide and Sotalol unavailable)
- With Stable Narrow-QRS Tachycardia (Box #7), for "B-blocker or calcium channel blocker," administer (in sequential order or until conversion):
    - Diltiazem
        - 10mg IV over 2-5min, repeat once at 20mg IV over 2-5min as needed
        - Maintenance infusion with conversion: 5-15mg/hr
    - Metoprolol: 5mg IV, repeat as needed to 3 total doses
    - Amiodarone: 150mg IV over 10min, once
- Give analgesia and sedation prior to cardioversion (Pain, Agitation & Nausea)
- Consider Torsades

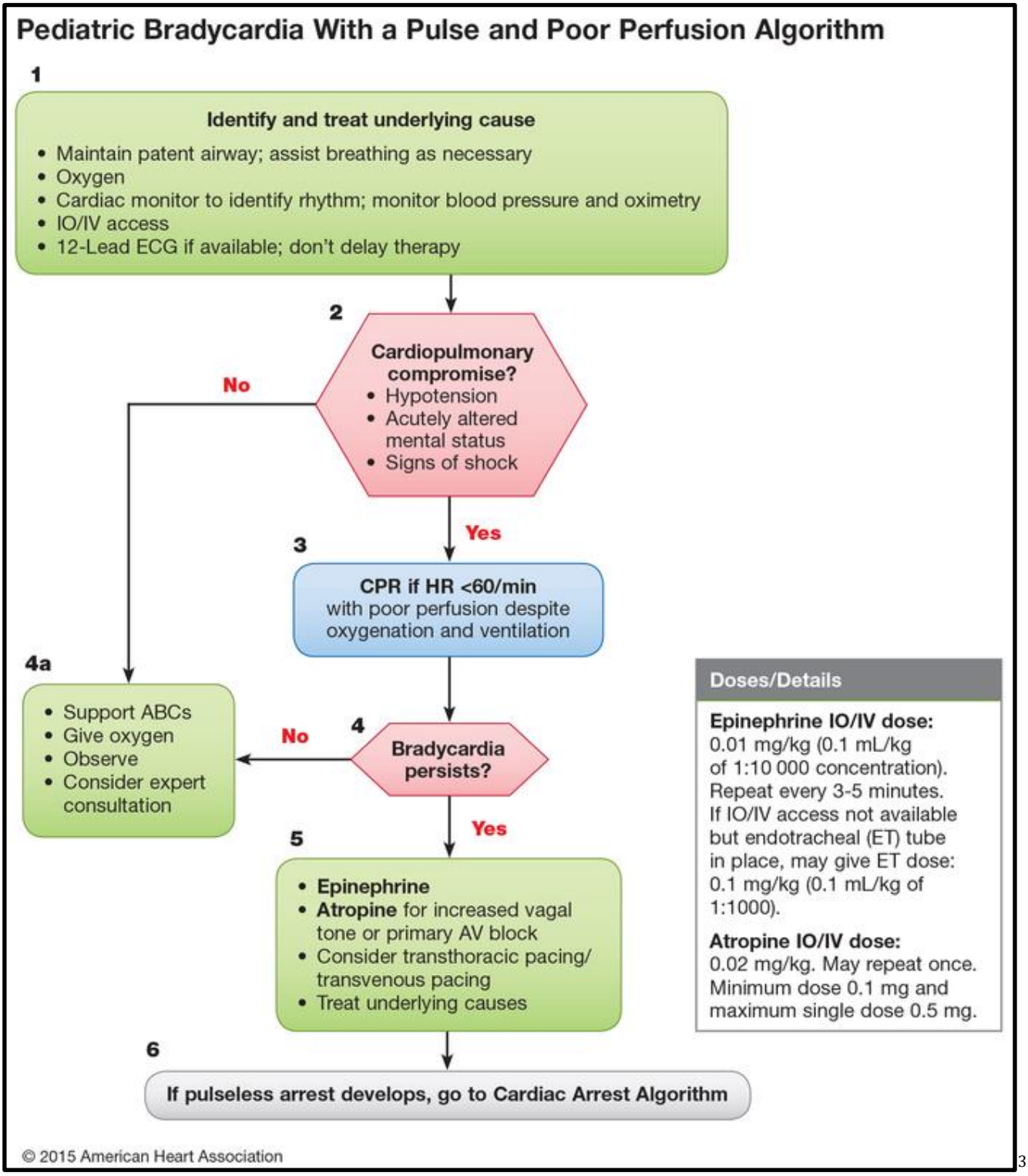


[31]

[31] ACLS (2015)

Pediatric Bradycardia

- Transcutaneous/ transthoracic pacing is NOT to be performed unless ALL of the following apply:
  - Patient is being transferred out of [redacted]
  - Receiving facility is known to have internal pacing capabilities
  - Receiving facility is aware that patient is to be paced
- Give analgesia and sedation prior to/ concurrently with pacing (Pain, Agitation & Nausea)

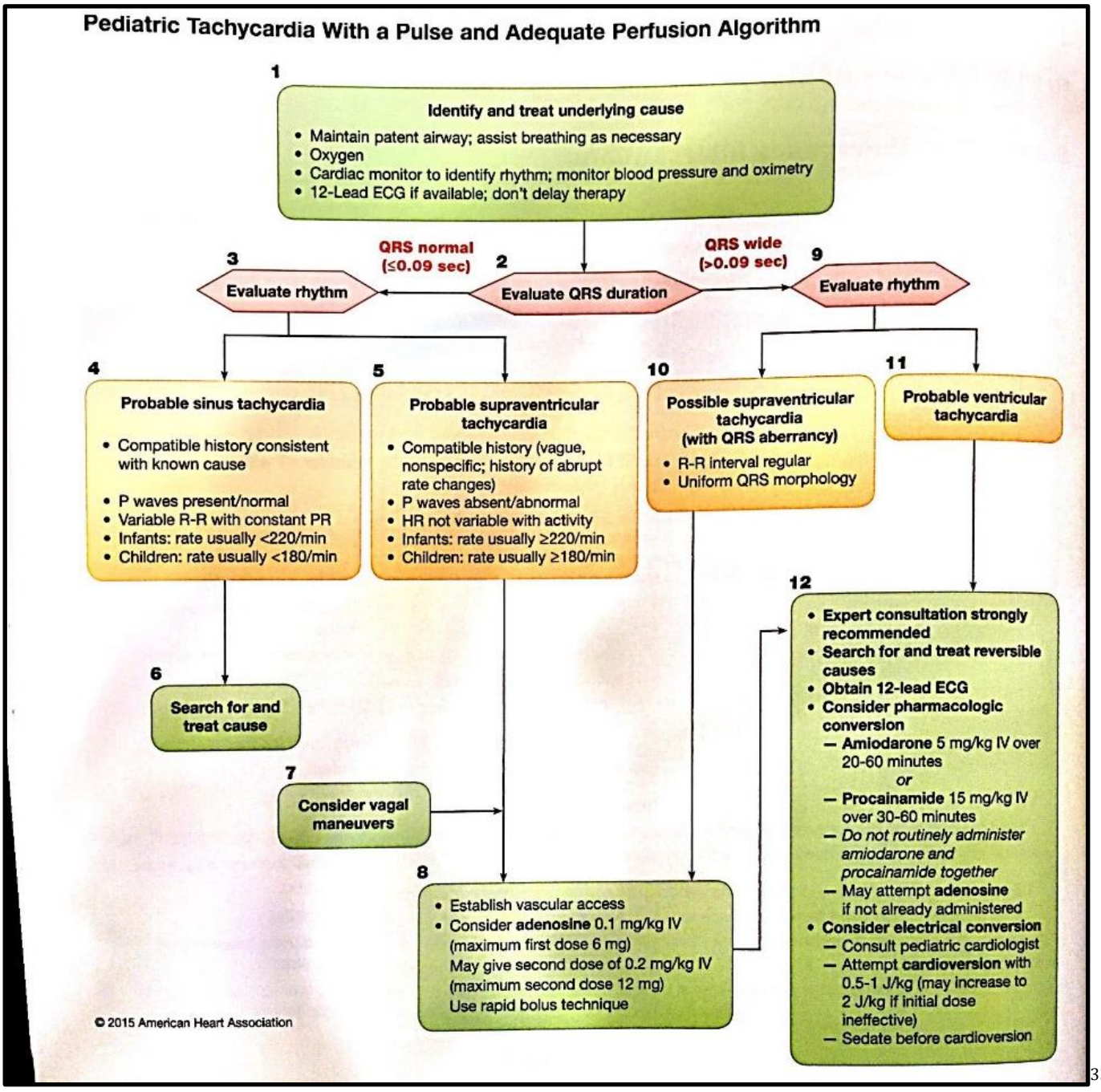


[32]

[32] PALS (2015)

Pediatric Tachycardia, Adequate Perfusion

- For refractory SVT or Probable Ventricular Tachycardia (Box #12), for "consider pharmacologic conversion," administer either Amiodarone or Adenosine as outlined, (Procainamide not available)
- Give analgesia and sedation prior to cardioversion (Pain, Agitation & Nausea)

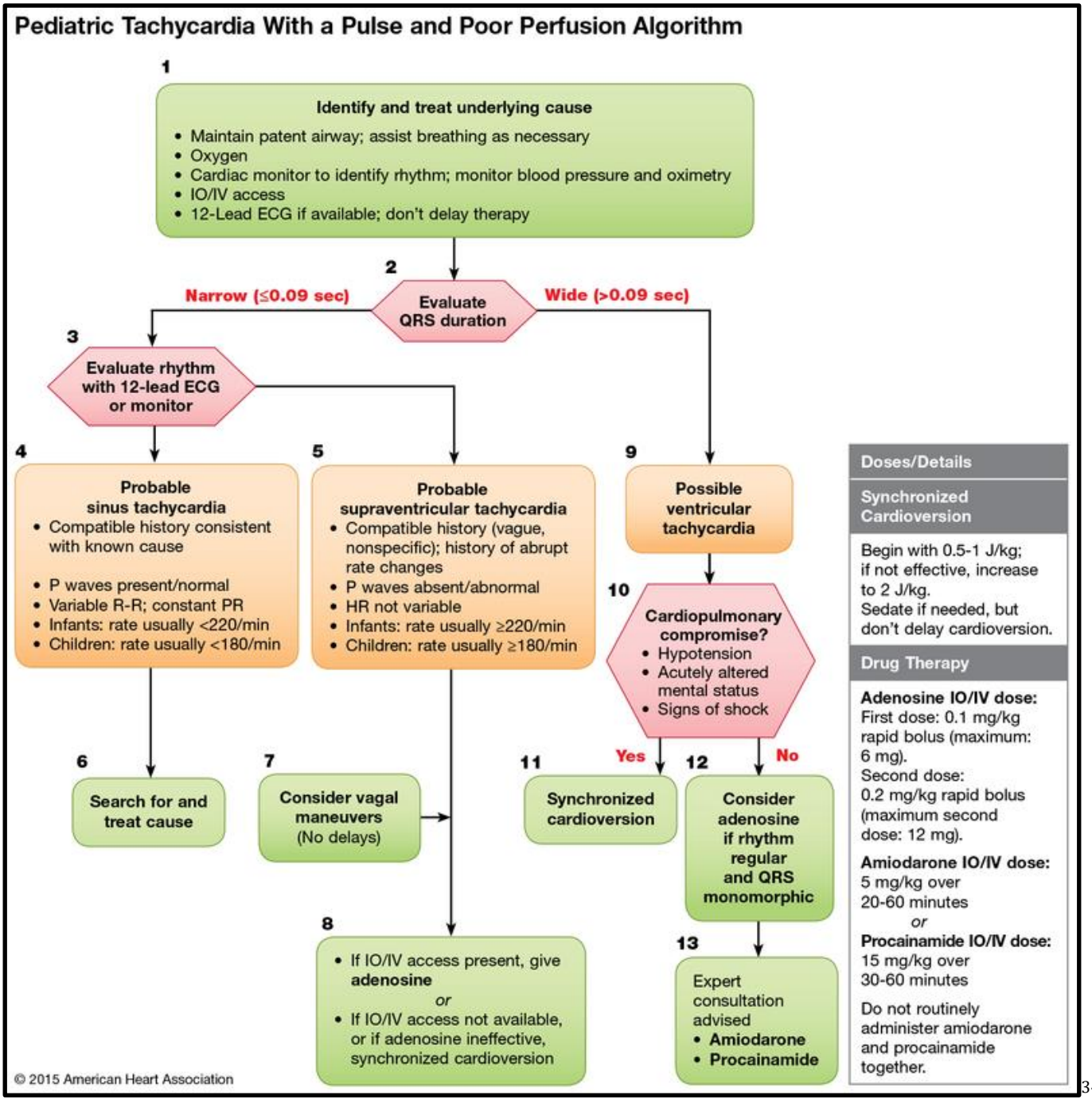


[33]

[33] PALS (2015)

Pediatric Tachycardia, Poor Perfusion

- For possible Ventricular Tachycardia with Cardiopulmonary Compromise after consideration/ attempt of Adenosine (Box #13), administer Amiodarone as outlined (Procainamide not available)
- Give analgesia and sedation prior to cardioversion (Pain, Agitation & Nausea)



[34]

[34] PALS (2015)

Congestive Heart Failure/ Pulmonary Edema: rales, rhonchi, or "wet lungs" on auscultation; new onset or worsening dependent edema; clinical history of CHF with acute symptoms

For pediatric patients with CHF/ Pulmonary Edema, refer to Management of the Sick Baby

- Consider treatable causes (Dysrhythmia, Acute Coronary Syndrome, Pulmonary Embolism, etc.)
- Treat wheezing per Bronchospasm guideline
- Consider Non-Invasive Positive Pressure Ventilation
- Nitroglycerin to relieve symptoms (maintain SBP ≥90): 0.4mg SL, repeat as needed
- Nitroglycerin Infusion if symptoms persist (maintain SBP ≥90): 40 – 200mcg/min
- Furosemide (contraindicated with suspicion of dehydration): 1mg/kg (max 160mg) IV, once; or match patient's PO dose
- With concurrent hypotension, stop/ decrease Nitroglycerin and treat (per Shock guideline):
    - IV Fluids (however monitor for pulmonary edema, consider giving boluses incrementally)
    - Norepinephrine Infusion: 2-30mcg/min or 0.1-0.5mcg/kg/min
- Consider foley catheter

Hypotension**:** any adult patient with SBP < 90 or a pediatric patient with SBP < 70 + 2 x years

- Consider treatable causes (Dysrhythmia, Acute Coronary Syndrome, etc.)
- IV Fluids
- If hypotension likely due to cause other than hypovolemia, administer any of the following to maintain MAP ≥65 and consider Shock:
    - Norepinephrine Infusion
        - Adult: 2-30mcg/min or 0.1-0.5mcg/kg/min
        - Pediatric: 0.05-2mcg/kg/min
    - Epinephrine Infusion
        - Adult: 2-20mcg/min or 0.1-0.5mcg/kg/min (max 20mcg/min)
        - Pediatric: 0.1-1mcg/kg/min
    - Vasopressin Infusion
        - Adult: 0.01-0.04 units/min
        - Not indicated for pediatric patients
    - Dopamine Infusion
        - Adult: 2-20mcg/kg/min
        - Pediatric: 2-20mcg/kg/min
- Consider push-dose Epinephrine if hypotension occurs suddenly or as a temporary measure while other interventions are initiated

Hypertension: blood pressure acutely above patient's known or assumed baseline with associated symptoms

- Consider each of the following (and treat per appropriate guideline):
  - Stroke
  - Congestive Heart Failure/ Pulmonary Edema
  - Aortic Aneurysm with risk of rupture/ dissection, control SBP ≤ 120 and HR ≤60 with Labetalol and Metoprolol
  - Cocaine or amphetamine use, avoid Beta-blockers and control with Midazolam:
    - Adult: 2.5-5mg IV/IM/IN, repeat as needed
    - Pediatric: 0.05-0.1mg/kg (max 5mg) IV/IM/IN, repeat as needed
- If hypertension still present in absence of one of the above causes and is symptomatic or has the potential for organ dysfunction, administer one of the following to relieve symptoms or until MAP reduced as outlined below:
  - Initial SBP >190, reduce MAP by no more than 25%
  - Initial SBP ≤190, reduce SBP to no more than 150 *and* avoid reducing MAP by over 25%
  - Labetalol
    - Adult: 20mg IV over 2-5min, may repeat q 10min at 40mg, then 80mg; after that, proceed to another antihypertensive
    - Pediatric: 0.2-1mg/kg IV (max 20mg), repeat as needed at twice previous dose for total of 3 doses
    - Infusion: 0.25-3mg/kg/hr
  - Hydralazine
    - Adult: 10mg IV/ IM, repeat as needed to 4 total doses
    - Pediatric: 0.2-0.6mg/kg IV/IM, once

***Cardiac Arrest*:** any patient without a readily identifiable pulse after checking for up to ten seconds; ventricular fibrillation

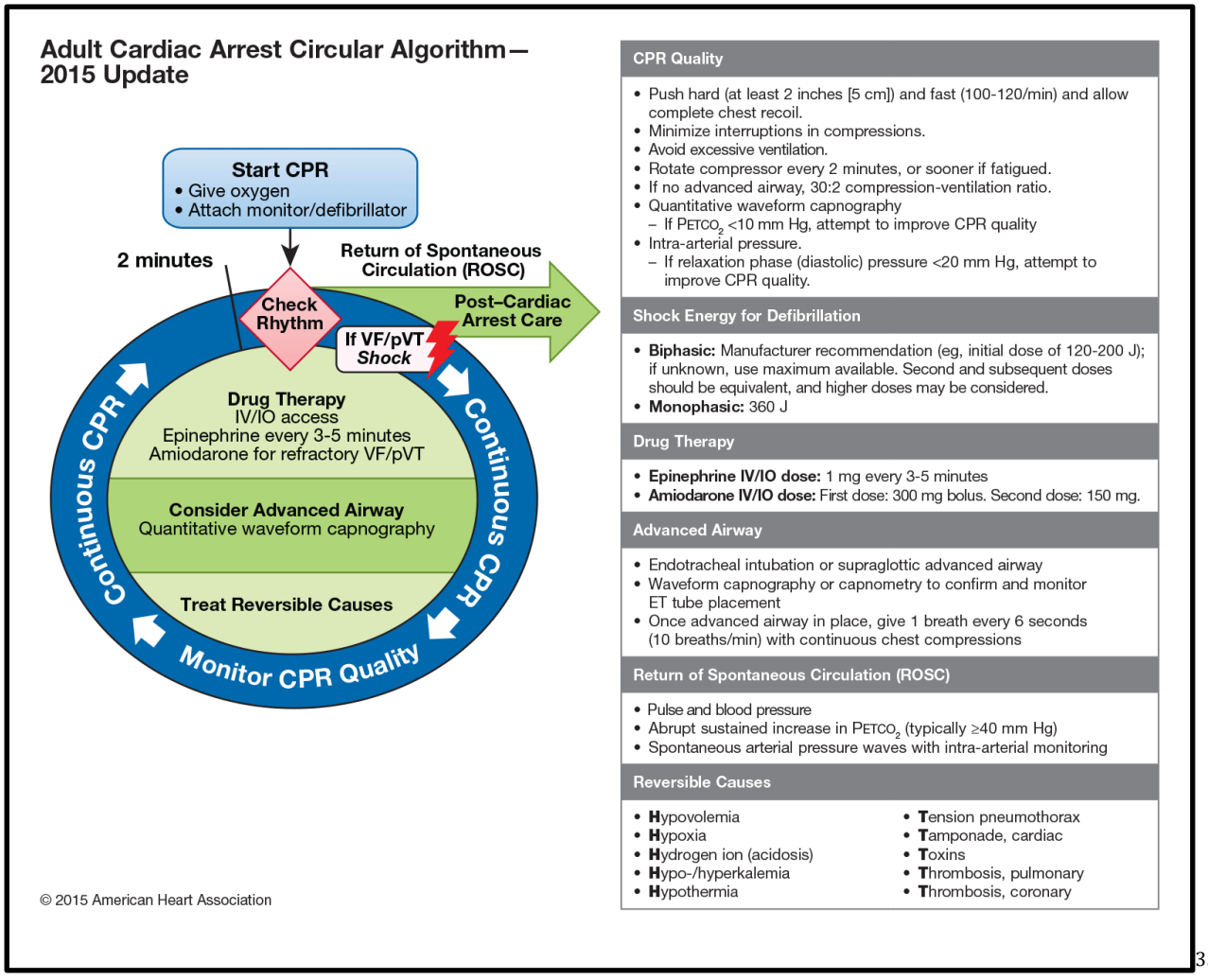
Approach to Management: treatment should follow ACLS or PALS algorithms (reproduced below) except as noted and in compliance with [redacted] Policies and Procedures; with ROSC, proceed to appropriate Post Arrest Algorithm

Specific Algorithms

- Adult Cardiac Arrest
- Pediatric Cardiac Arrest
- Adult Post Arrest
- Pediatric Post Arrest, with Shock
  *for pediatric patient with ROSC and no evidence of Shock, assess patient per Universal Protocol and provide care as indicated

Adult Cardiac Arrest

- Intra-arterial pressure monitoring not available
- Shock at 120-200J on PropaqMD
- Consider Torsades



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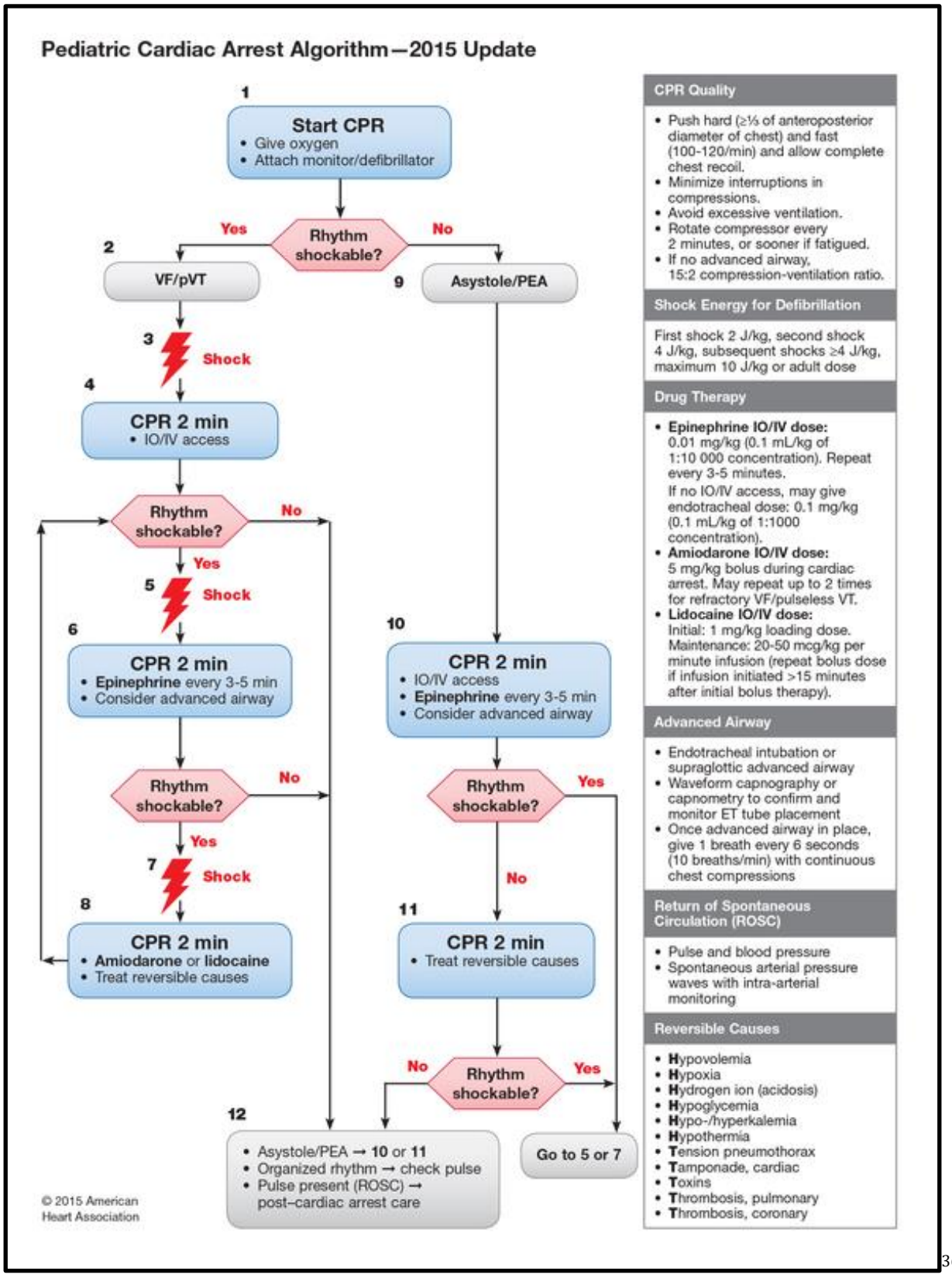
[35] ACLS (2015)

Pediatric Cardiac Arrest

- Intra-arterial pressure monitoring not available
- Consider Torsades



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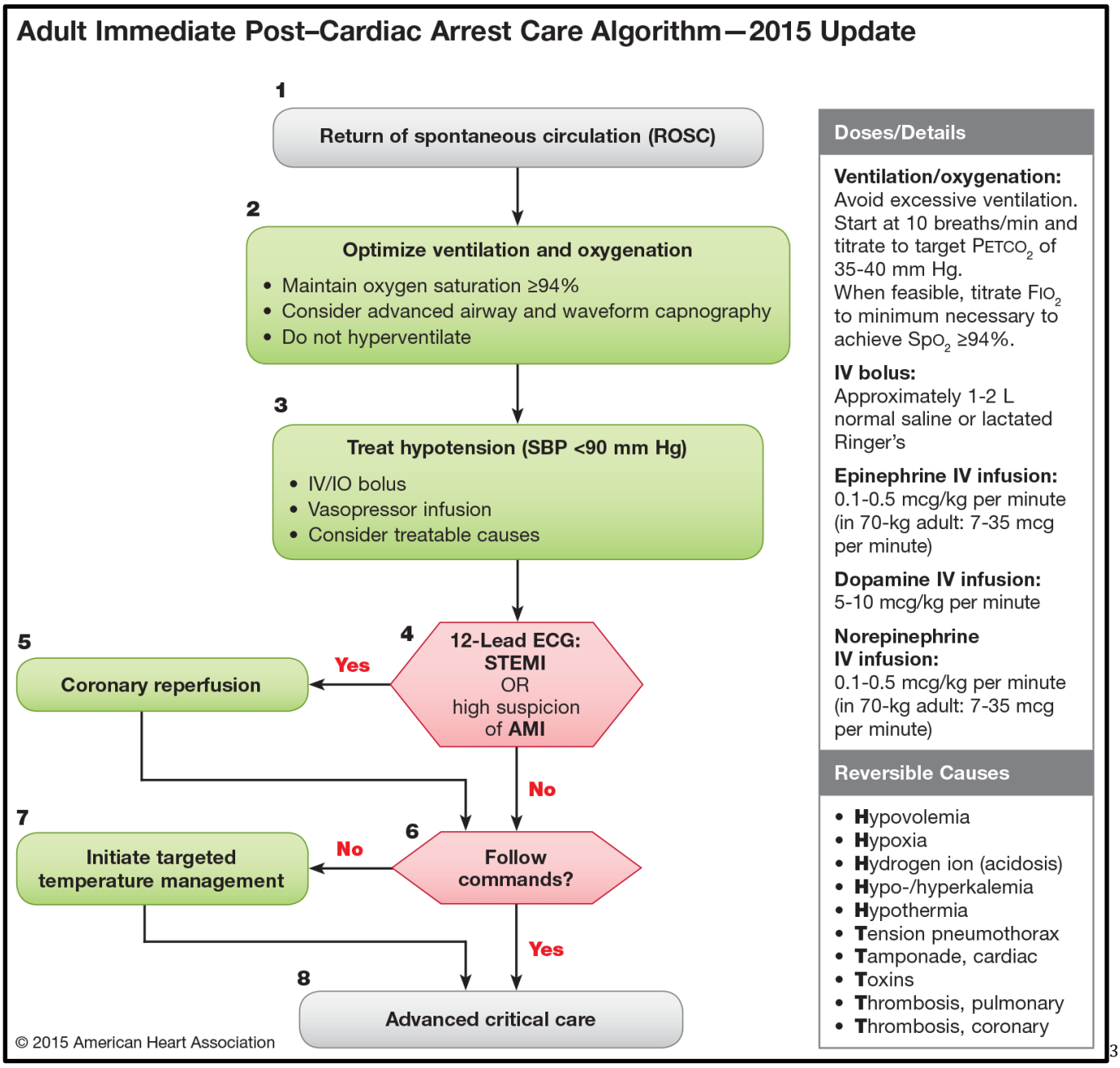
[36] PALS (2015)

Adult Post Arrest

- Targeted temperature management (Box #7) not to be utilized by [redacted]



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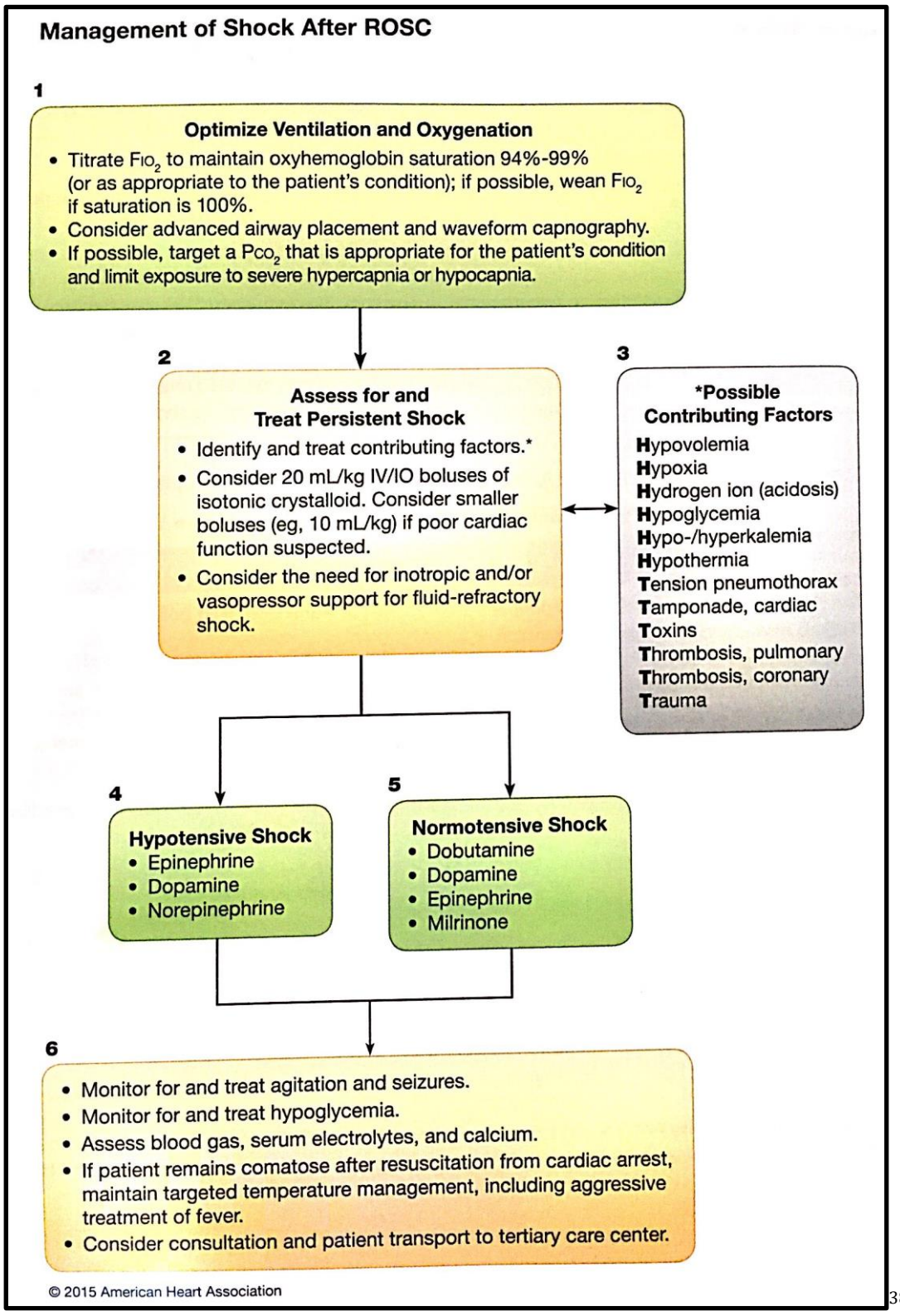
[37] ACLS (2015)

Pediatric Post Arrest, with Shock

- Targeted temperature management (Box #6) not to be utilized by [redacted]
- For medication doses for either Hypotensive Shock (Box #4) or Normotensive Shock (Box #5), proceed to Shock guideline or Formulary



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[38] PALS (2015)

Medical

Specific Considerations

- Diabetic Emergencies
- Gastrointestinal Bleed
- Infection and Fever
- Abdominal Pain
- Electrolyte Abnormalities
- Endocrine Disorders
- Toxic Exposure
- Tetanus

Diabetic Emergencies

Hyperglycemia: consider insulin for BGL >400, definitely administer for BGL >500

- IV Fluids (note that some hyperglycemic patients may need over 5L of fluid resuscitation during the course of treatment)
- Regular Insulin Bolus
    - Adult: 10u SQ and recheck in 1 hour
    - Pediatric: 0.1u/kg (max 10u) SQ and recheck in 1 hour
- Regular Insulin Infusion (as alternative to bolus doses): 0.1u/kg/hr
    - Monitor BGL every 30min during insulin infusion
- When BGL <300, initiate D5W maintenance fluids
- Consider potassium shift with acidosis and treat as needed (Electrolyte Abnormalities)
- Consider foley catheter

Hypoglycemia: BGL <60mg/dl for adults and pediatrics, <40mg/dl for neonates

- Administer Dextrose
    - Adult: 25g IV [50ml D50]
    - Pediatric≥2 years: 0.5g/kg IV [1ml/kg D50 or 2ml/kgD25]
    - Pediatric<2 years: 0.5-1g/kg IV [2-4ml/kg D25, do not use D50]
    - Neonate: 0.5-1g/kg [5-10ml/kg D10 or 10-20ml/kg D5]
- If unable to initiate IV/IO, administer Glucagon
    - Adult: 1mg IM
    - Pediatric: 0.5mg IM
    - Neonate <5kg: 0.25mg IM
- Reassess BGL within 15min of either Dextrose or Glucagon administration, repeat as needed

Gastrointestinal Bleed

- Assess for Shock and treat appropriately
- Consider NGT/ OGT placement
- Vasopressin Infusion
    - Adult: 0.01-0.04u/min
    - Not indicated for pediatric patients
- Consider continuation of Omeprazole (PPI) or Octreotide if initiated by sending facility

Infection and Fever

- Consider specific etiologies: Meningitis, Tuberculosis, Croup, Epiglottitis
- Acetaminophen
  - Adult: 10-15mg/kg PR (max 1000mg), once
  - Pediatric: 10-15mg/kg PR (max 1000mg), once
- Consider Shock and administer IV Fluids to maintain MAP >65
- If MAP remains low after fluids, continue with fluids and initiate vasopressors
  - Begin with Norepinephrine Infusion
    - Adult: 2-30mcg/min or 0.1-0.5mcg/kg/min
    - Pediatric: 0.05-2mcg/kg/min
  - If BP nonresponsive, consider either:
    - Epinephrine Infusion
      - Adult: 2-20mcg/min or 0.1-0.5mcg/kg/min (max 20mcg/min)
      - Pediatric: 0.1-1mcg/kg/min
    - Vasopressin Infusion
      - Adult: 0.01-0.04u/min
      - Not indicated for pediatric patients
    - Dopamine Infusion
      - Adult: 5-20mcg/kg/min
      - Pediatric: 5-20mcg/kg/min
- Rocephin (if broad-spectrum antibiotics not already administered by sending facility)
  - Adult: 1-2g IV over 2-5min, once
  - Pediatric: 50mg/kg (max 2g) IV over 2-5ming, once
- Rapid Sequence Intubation with Ketamine (over Etomidate), if indicated

Abdominal Pain

- Keep patient NPO
- Consider NGT/ OGT if vomiting
- IV Fluids, if needed
- Address and manage pain (Pain, Agitation & Nausea)
- Consider additional causes (i.e. Ectopic Pregnancy for all females of childbearing age, Acute Coronary Syndrome, Electrolyte Abnormalities, Heat/ Exertional Illness, Hyperglycemia, etc.)
- Specific guidance for management of abdominal pain depends largely on diagnosis and specifics, which may be unavailable in the field; consider the following for guidance:

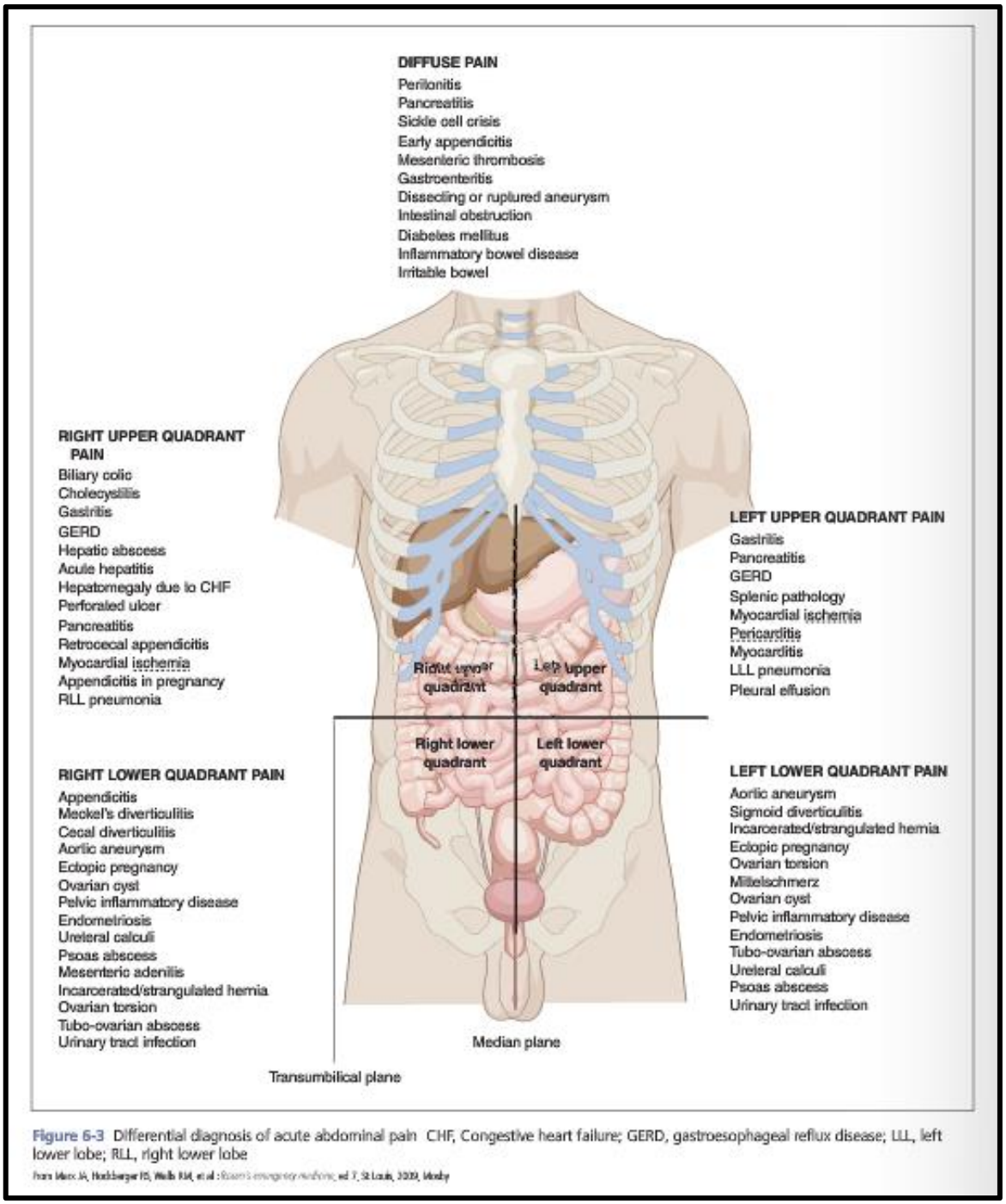


Figure 6-3 Differential diagnosis of acute abdominal pain CHF, Congestive heart failure; GERD, gastroesophageal reflux disease; LLL, left lower lobe; RLL, right lower lobe

Table 6-2 Differential Diagnosis of Abdominal Discomfort with Nausea and Vomiting

Neurologic					
Intracerebral bleeding	Bleeding within the brain tissue	Trauma, stroke, hypertension, smoking, alcohol abuse	Hemiparesis, hemiplegia, nausea, headache, altered level of consciousness, Cushing's triad	CTA, CBC, coagulation studies, electrolytes, glucose	Maintain airway. Administer oxygen. Establish IV access. Place a 12-lead ECG.
Meningitis	Bacterial, viral, or fungal infection of the meninges	—	High fever, headache, stiff neck, seizures Resembles flu Can progress over several days	CBC, electrolytes, blood cultures, lumbar puncture	Maintain airway. Administer oxygen. Place a 12-Lead ECG. Establish IV access. Administer isotonic fluid. Give antibiotics if the infection is bacterial.
Cardiac					
Acute MI	Necrosis of the heart muscle	Coronary artery disease, smoking, high cholesterol, history of MI	Chest, midepigastric, back, and neck pain Nausea Difficulty breathing	Serial 12-lead ECG, x-ray, CBC, coagulation studies, electrolytes	Administer oxygen. Establish IV access. Administer nitroglycerin, ASA, and anticoagulants. Angiography will be performed at the receiving facility. For hypotension, use caution with the administration of nitroglycerin and consider RV, MI, and 15 lead for normal or nondiagnostic findings.
Gastrointestinal					
Boerhaave's syndrome	Spontaneous rupture of the esophagus	Explosive vomiting, coughing, seizures, childbirth, status asthmaticus	Pain in the chest, neck, back, or abdomen Difficulty breathing, tachycardia, hematemesis, fever, subcutaneous emphysema	CBC, coagulation studies, type and cross-match	Treat airway compromise, hypoxia, and shock. Surgery will be performed at the receiving facility.
Mallory-Weiss tear	Longitudinal tears in the esophageal mucosa, causing severe arterial bleeding	Severe, protracted vomiting, bleeding	Severe, protracted vomiting Bleeding	Bronchoscopy, CBC, coagulation studies, type and cross-match	Treat airway compromise and shock, administer oxygen, and establish IV access. Gastric lavage and possibly surgery will be performed at the receiving facility.
Gastrointestinal					
Upper GI bleeding	Bleeding proximal to the junction of the duodenum and jejunum	Hematemesis (vomiting blood that is bright red or resembles coffee grounds), alcohol abuse, use of NSAIDs, liver disease, varices	Abdominal pain Red or coffee-colored vomitus or stool	Chest and abdominal x-rays, angiography CBC, Hct, Hb, PTT, platelets, coagulation studies, type and cross-match, etc.) Nasogastric tube, endoscopy	Administer oxygen. Perform an ECG. Establish IV access. Treat shock. Administer blood products.
Ischemic bowel	Necrosis of the GI tract	Severe abdominal pain, sick appearance, hypercoagulability, recent surgery, shock	Abdominal pain, tachycardia, hypotension, fever, restlessness	CBC, coagulation studies, electrolytes, type and cross-match	Administer oxygen. Perform an ECG. Establish IV access. Treat shock. Radiography and CT imaging and surgery will be performed at the receiving facility.
Endocrine					
Diabetic ketoacidosis	Hyperglycemia, ketosis, and acidosis	Diabetes, especially type 1, but can occur in patients with type 2 diabetes who are ill	Nausea, vomiting, polydipsia, polyuria, abdominal pain, metabolic acidosis	Blood glucose, serum electrolytes, arterial blood gas analysis, CBC	Administer oxygen. Establish IV access. Administer isotonic fluids and insulin as indicated.

ASA, acetylsalicylic acid; CBC, complete blood count; CT, computed tomography; CTA, computed tomography angiography; ECG, electrocardiogram; GI, gastrointestinal; Hb, hemoglobin; Hct, hematocrit; IV, intravenous; MI, myocardial infarction; NSAIDs, nonsteroidal antiinflammatory drugs; PTT, partial thromboplastin time.

Table 6-8 Differential Diagnosis of Abdominal Disorders with Emergent Presentations

Disorder	Causes	History	Findings	Prehospital Treatment	Hospital Testing/ Treatment
Mesenteric ischemia	Myocardial infarction, valvular heart disease, arrhythmia, peripheral vascular disease, hypercoagulability, oral contraceptive use, aortic dissection, trauma	Acute onset of severe midabdominal pain, nausea, vomiting, and diarrhea	Severe midabdominal pain, nausea, vomiting, diarrhea Pain out of proportion to tenderness	Administer oxygen. Place patient in a comfortable position. Establish IV access.	Surgical consult
Intestinal obstruction	Can be due to stool, foreign body, intussusception, adhesions, polyps, volvulus, tumors, ulcerative colitis, or diverticulitis	Abrupt onset: suspect small-bowel obstruction Onset over 1–2 days: suspect distal obstruction History of bowel obstruction, abdominal surgery, cancer, radiation therapy, chemotherapy, hernia, or abdominal illness	Crampy abdominal pain, constipation, diarrhea, inability to pass flatus, distended abdomen Absent or high-pitched bowel sounds	Administer oxygen. Place patient in a comfortable position. Establish IV access. Give nothing by mouth.	Laboratory and x-ray to determine location and extent of obstruction
Perforated viscus	Peptic ulcer disease, diverticula, trauma, use of NSAIDs, advancing age	Acute onset of epigastric pain Vomiting	Epigastric pain, vomiting, fever, shock, sepsis Elevated WBCs and amylase	Administer oxygen. Place patient in a comfortable position. Establish IV access. Give nothing by mouth.	Laboratory, x-ray, and CT to determine location and extent of perforation
Acute pancreatitis	Alcohol, cholelithiasis, trauma, infection, inflammation	Alcohol use, use of certain drugs, recent trauma, cholelithiasis	Midepigastric abdominal pain, low-grade fever, nausea, vomiting	Place patient in a comfortable position. Establish IV access. Give nothing by mouth.	Amylase/lipase levels and CT
Ruptured appendix	Obstruction, infection	Initially patient feels diffuse pain, especially in umbilical area. Later, pain settles in the right lower quadrant or lower back.	Nausea, vomiting, fever, positive Rovsing's sign	Place patient in a comfortable position. Establish IV access. Give nothing by mouth.	Laboratory, CT/ ultrasound, antibiotics, and surgical consult

CT, Computed tomography; IV, intravenous; NSAIDs, nonsteroidal antiinflammatory drugs; WBCs, white blood cells.

Table 6-4 Selected System Considerations for Assessment of Abdominal Complaints

System	History, Differential Diagnosis, and Other Assessment Considerations
Neurologic	Ask about recent accidents or trauma, particularly if the patient has an altered level of consciousness or nausea and vomiting.
Respiratory	Explore any evidence of breathing problems. Pneumonia may be associated with upper abdominal discomfort. Esophageal ruptures may present with respiratory signs and symptoms.
Cardiovascular	Indigestion and upper abdominal discomfort should prompt you to evaluate the patient for acute coronary syndrome.
Gastrointestinal, genitourinary, and reproductive	Explore any history of chronic or acute diagnoses. Question the patient about any changes in eating, bowel, or urinary habits that may suggest a diagnosis. Vaginal discharge, bleeding, and menstrual changes suggest specific disease processes.
Musculoskeletal and skin	Observe the skin for pallor, jaundice, uremia, and other changes that may suggest the cause of abdominal pain. Look for any scars, ostomies, or external devices (such as drains, tubes, and pumps) that may indicate the cause of the patient's abdominal symptoms.
Endocrine, metabolic, and environmental	Collect past medical history. Assess blood glucose level. Assess the scene or thoroughly question the patient, family, and bystanders if you are unable to observe the conditions to which the patient was subjected.
Infectious disease and hematologic	The patient's history, a foul smell, and the presence of a Foley catheter or other invasive drain may point to an infectious process. Take the patient's temperature to evaluate for fever. Assess the patient for damage to the bowel, which is associated with peritonitis and possibly sepsis. Analyze lab values that may be useful in making a hematologic diagnosis, such as white blood cell count, hemoglobin and hematocrit, prothrombin time, and partial thromboplastin time.
Toxicologic (nuclear, biological, and chemical)	Explore exposure problems. Many toxidromes have a GI component. Being familiar with a range of toxidromes and maintaining a high index of suspicion will prevent you from overlooking them in your differential diagnosis.

Table 6-10 Neurologic Causes of Abdominal Discomfort

	Description	Symptoms	Treatment
Migraine	Recurrent headache, sometimes accompanied by an aura Lasts 3–72 hours	Unilateral or bilateral throbbing or sharp headache Photophobia Nausea and vomiting	Provide supportive care. Dim the ambulance lights. Establish IV access. Administer antiemetics. Apply ice or heat packs.
Central nervous system tumor	Primary tumor: begins in the brain Secondary tumor: spreads from another cancerous site More common among people over age 65, in those who have had radiation to the head, and in those who smoke or are HIV positive	Recurrent, severe headaches Nausea and vomiting Dizziness and lack of coordination Vision alterations Seizures	Provide supportive care to reduce nausea and vomiting, ease pain, and prevent or control seizures.
Increased intracranial pressure	Can be caused by obstruction or by increase of cerebrospinal fluid in ventricles	Headache Photophobia Nausea and vomiting Seizures	Provide comfort care. Position the patient lying flat. Administer antiemetics and antiseizure medications.

Table 6-11 Phases of Acute Renal Failure

Phase	Description and Characteristics	Treatment
Oliguric phase	Usually lasts 10–20 days, with urine output decreasing by 50–400 mL/day Protein spill Hyponatremia Hyperkalemia Metabolic acidosis	Monitor ECG for peaked T waves and a widened QRS (hyperkalemia). Order a laboratory potassium study, since a lethal level may exist. Be prepared to administer sodium bicarbonate and calcium until dialysis can be initiated. CHF may also develop, so monitor for signs of left- and right-sided heart failure.
Diuretic phase	Occurs when urine output exceeds 500 mL in 24 hours Causes sodium and potassium loss in the urine May cause hypovolemia, since the patient may lose up to 3,000 mL in 24 hours through diuresis	Monitor for electrolyte disturbances and signs of hypovolemia. Be prepared to administer fluids and electrolytes to replace as much as 75% of the previous day's volume loss. Be prepared to treat GI bleeding and respiratory failure.
Recovery phase	May last weeks to months	Prevent fluid overload. Closely monitor electrolyte and fluid balance.

CHF, Congestive heart failure; ECG, electrocardiogram; GI, gastrointestinal.

Electrolyte Abnormalities

General Considerations

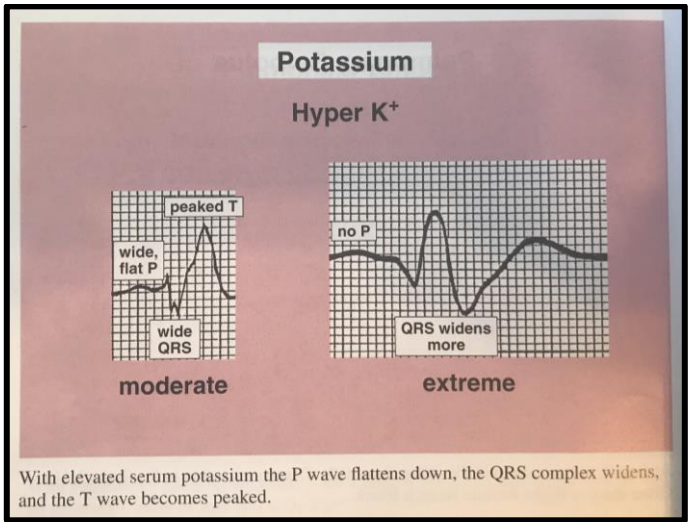
- Not all abnormal values must be treated
- Consider different measurement scales prior to treatment

Sodium Imbalance

- Hypernatremia: treat dehydration
    - Rehydrate with Normal Saline
        - Adult: 150-200ml/hr
        - Pediatric: twice maintenance fluid rate
    - Monitor urine output/ consider foley catheter
- Hyponatremia: treat with concurrent neurologic deficits & no other obvious cause
    - Consider Lasix for hypervolemic hyponatremia
        - Adult: 1mg/kg (max 160mg) IV, once; or match patient's PO dose
        - Not indicated for pediatric patients in this situation
    - Limit free water intake
    - Rehydrate with Normal Saline
        - Adult: 150-200ml/hr
        - Pediatric: twice maintenance fluid rate

Potassium Imbalance

- Hyperkalemia: treat when EKG shows significant changes (i.e. loss of P waves and prolonged QRS) or when serum K exceeds 7.0mEq/L

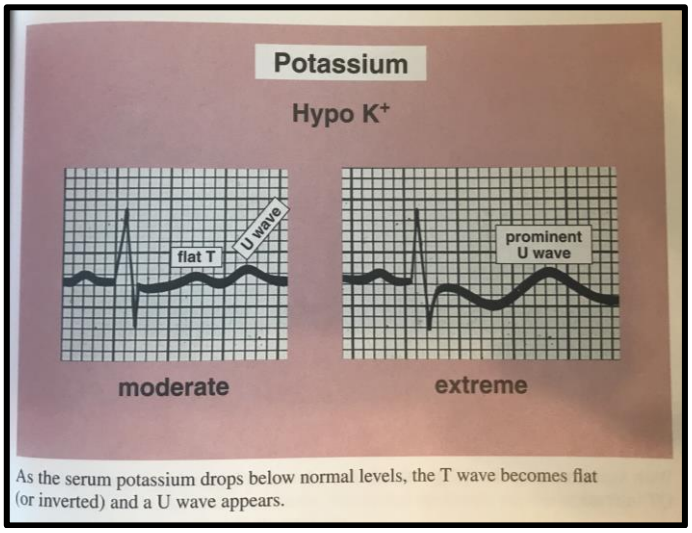


With elevated serum potassium the P wave flattens down, the QRS complex widens, and the T wave becomes peaked.

    - Stabilize cardiac cells with Calcium Chloride or Calcium Gluconate
        - Calcium Chloride
            - Adult: 1g IV over 2-5min, once [10ml or 1 Amp]
            - Pediatric: 100mg/kg (max 1g) over 2-5min, once
        - Calcium Gluconate
            - Adult: 1-2g IV over 2-5min, once [10-20ml or 1-2 vials]
            - Pediatric: 100mg/kg (max 2g) over 2-5min, once

- Shift potassium back in to intracellular space by giving all of the following
  - Sodium Bicarbonate
    - Adult: 50mEq IV, once
    - Pediatric: 1mEq/ kg (max 50mEq) IV, once
  - Dextrose 50% (always give with insulin)
    - Adult: 25g IV [50ml D50]
    - Pediatric≥2 years: 0.5g/kg IV [1ml/kg D50 or 2ml/kgD25]
    - Pediatric <2 years: 0.5-1g/kg IV [2-4ml/kg D25, do not use D50]
    - Neonate: 0.5-1g/kg IV [5-10ml/kg D10 or 10-20ml/kg D5]
  - Insulin (always give with D50)
    - Adult: 10u IV
    - Pediatric: 0.1u/kg IV
  - Albuterol
    - Adult: 5mg NEB, once
    - Pediatric: 2.5mg NEB, once
  - Dextrose/ Insulin may be given again as needed; check BGL and treat with additional Dextrose as indicated

- Hypokalemia: treat with K < 2.5mEq or significant symptoms noted (to include cardiac dysrhythmia); also treat if K <5.5mEq in DKA patient receiving insulin



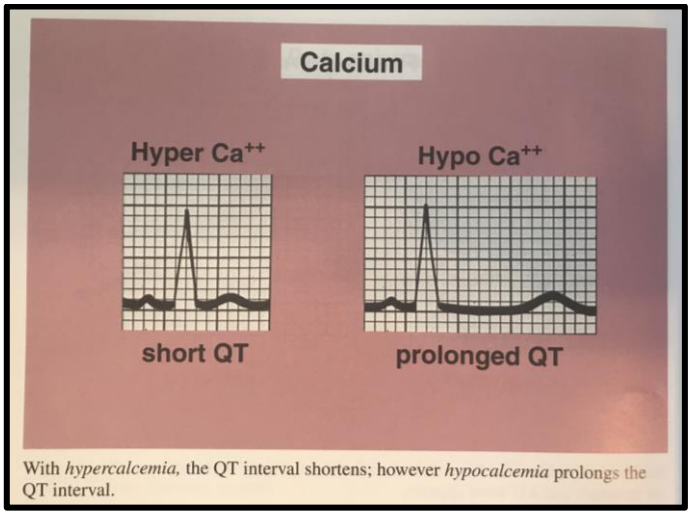
As the serum potassium drops below normal levels, the T wave becomes flat (or inverted) and a U wave appears.

  - Potassium Chloride (if available from sending facility)
    - Adult: 10mEq/hr (up to 20mEq/hr via central line)
    - Pediatric: 1mEq/kg/kr (max 10mEq/hr)
  - Consider concurrent hypomagnesemia

Magnesium Imbalance

- Hypermagnesemia: treat with concurrent change in responsiveness/ level of consciousness or loss of DTRs (see Neurologic: Scoring of DTRs)
    - Calcium Chloride
        - Adult: 1g IV over 2-5min, once [10ml or 1 Amp]
        - Pediatric: 100mg/kg (max 1g) over 2-5min, once
    - Calcium Gluconate
        - Adult: 1-2g IV over 2-5min, once [10-20ml or 1-2 vials]
        - Pediatric: 100mg/kg (max 2g) over 2-5min, once
- Hypomagnesemia: treat with concurrent tachycardia, severe cramping, vertigo, ataxia, altered mental status or seizures
    - Magnesium Sulfate
        - Adult: 2g IV over 20min, repeat as needed
        - Pediatric: 50mg/kg (max 2g) IV over 20min, repeat as needed

Calcium Imbalance



With *hypercalcemia,* the QT interval shortens; however *hypocalcemia* prolongs the QT interval.

- Hypercalcemia: treatment likely not needed in the field, IV Fluids to promote excretion
- Hypocalcemia: treat with positive Trousseau's or Chvostek's Sign, tetany, seizures, or long QT
    - Calcium Chloride
        - Adult: 1g IV over 2-5min, once [10ml or 1 Amp]
        - Pediatric: 100mg/kg (max 1g) over 2-5min, once
    - Calcium Gluconate
        - Adult: 1-2g IV over 2-55min, once [10-20ml or 1-2 vials]
        - Pediatric: 100mg/kg (max 2g) over 2-5min, once

Endocrine Disorders: not commonly treated in the field and often chronic in nature, however acute and life-threatening states described here with guidance for treatment

Parathyroid Disorders

- *Hyperparathyroidism:* acute presentation unlikely, would present as Hypercalcemia and is treated in the field with IV Fluids to promote calcium excretion
- *Hypoparathyroidism*: muscle spasms, paresthesia, tetany and/ or Seizure; symptoms related to Hypocalcemia
    - Versed (benzodiazepine preferred over Phenytoin)
        - Adult: 2.5-5mg IV/IM/IN, repeat as needed
        - Pediatric: 0.05-0.1mg/kg (max 5mg) IV/IM/IN, repeat as needed
    - Calcium Chloride
        - Adult: 1g IV over 2-5min, once [10ml or 1 Amp]
        - Pediatric: 100mg/kg (max 1g) over 2-5min, once
    - Calcium Gluconate
        - Adult: 1-2g IV over 2-5min, once [10-20ml or 1-2 vials]
        - Pediatric: 100mg/kg (max 2g) over 2-5min, once

Thyroid Disorders

- *Hyperthyroidism* (thyrotoxicosis, thyroid storm, Grave's disease): GI upset, fever, tachycardic Dysrhythmia, altered mental status, hemodynamic instability
    - IV Fluids
    - Acetaminophen (for fever)
        - Adult: 10-15mg/kg PR (max 1000mg), once
        - Pediatric: 10-15mg/kg PR (max 1000mg), once
    - Metoprolol for Tachycardia, adults only (Dysrhythmia: Adult Tachycardia)
        - Adult: 5mg IV, repeat as needed to 3 total doses
        - Not indicated for pediatric patients
    - Labetalol for Hypertension
        - Adult: 20mg IV over 2-5min, may repeat q 10min at 40mg, then 80mg; after that proceed to another antihypertensive
        - Pediatric: 0.2-1mg/kg (max 20mg) IV, repeat as needed at twice previous dose for total of 3 doses
        - Infusion: 0.25-3mg/kg/hr
- *Hypothyroidism* (myxedema coma): Hypotension, Bradycardia, Hypoglycemia, Hyponatremia, Altered Mental Status; no specific treatment

Adrenal Gland Disorders

- *Hyperadrenalism* (Cushing's Syndrome): supportive treatment with focus on Dysrhythmia, Hyperglycemia and Hypertension
- *Adrenal Insufficiency* (Addisonian Crisis): supportive treatment with focus on Hypoglycemia and Hypotension (may not respond well to IV fluids)

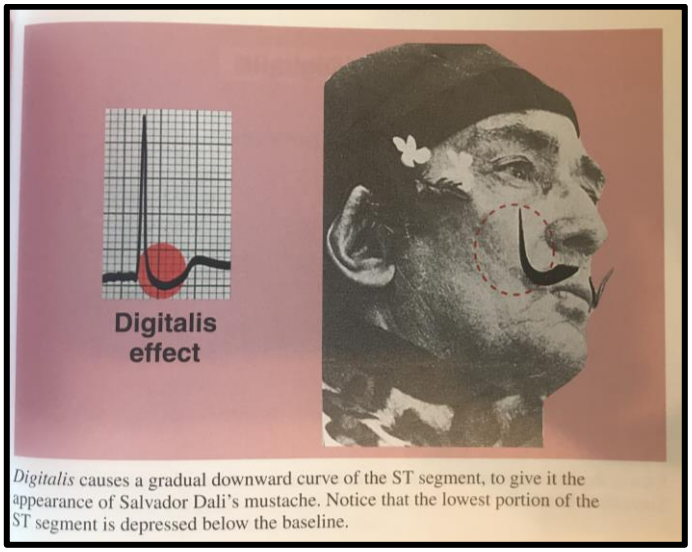
Diabetes Insipidus: increased urine output, excessive thirst, vomiting/ diarrhea

- Consider foley catheter
- IV Fluids for dehydration and consider both Hypokalemia and Hypernatremia

Toxic Exposure: many forms of toxic exposure require only supportive treatment and management of symptoms, refer to this list for specific actions based on agent

Medication/ Drug Overdose

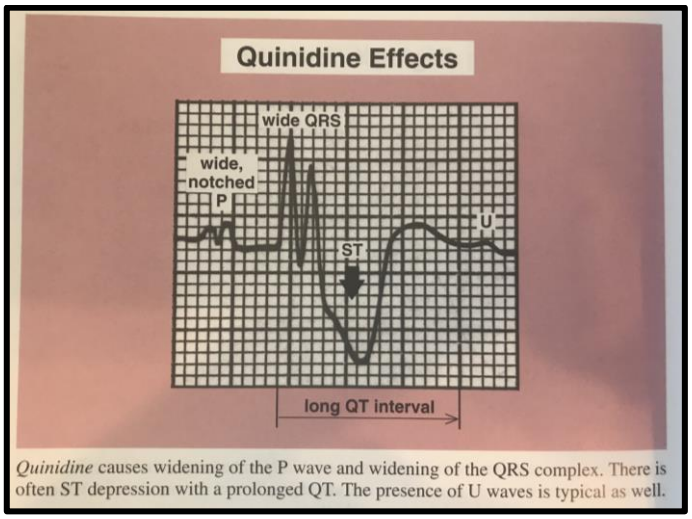
- Opiates
  - Naloxone
    - Adult: 0.4-2mg IV/IM/IN, repeat as needed
    - Pediatric: 0.1mg/kg (max 2mg) IV/IM/IN, repeat as needed
- Cocaine: Benzodiazepines, avoid Beta-Blockers with Hypertension (treat with nitrates instead)
  - Versed
    - Adult: 2.5-5mg IV/IM/IN, repeat as needed
    - Pediatric: 0.05-0.1mg/kg (max 5mg) IV/IM/IN, repeat as needed
- Methamphetamine (same as Cocaine, above)
- Benzodiazepine: supportive care only; Flumazenil is antidote, not typically given in the field and not available in [redacted]
- Digoxin: monitor for Hyperkalemia, avoid Calcium Chloride; Digibind is antidote, but not available in [redacted]



Digitalis causes a gradual downward curve of the ST segment, to give it the appearance of Salvador Dali's mustache. Notice that the lowest portion of the ST segment is depressed below the baseline.

- Calcium Channel Blocker
  - Calcium Chloride
    - Adult: 1g IV over 2-5min, once [10ml or 1 Amp]
    - Pediatric: 100mg/kg (max 1g) over 2-5min, once
  - Calcium Gluconate
    - Adult: 1-2g IV over 2-5min, once [10-20ml or 1-2 vials]
    - Pediatric: 100mg/kg (max 2g) over 2-5min, once
- Magnesium Sulfate (same as Calcium Channel Blocker, above)
- Beta Blocker
  - Glucagon
    - Adult: 3-10mg IV/IM
    - Pediatric: 0.1mg/kg (max 10mg) IV/IM

- Tricyclic Antidepressants
    - Sodium Bicarbonate with long QT, wide QRS, ventricular Dysrhythmia or Hypotension
        - Adult: 50mEq IV, may repeat once
        - Pediatric: 1mEq/kg (max 50mEq) IV, may repeat once
    - Avoid Beta-Blockers
    - Monitor for Seizure
    - Monitor for Torsades and treat with Magnesium Sulfate
        - Adult: 1-2g IV diluted in NS, once
        - Pediatric: 25-50mg/kg (max 2g) IV diluted in NS, once
        - Give over 5min if non-perfusing, over 30min if perfusing
- Cholinergic (see Exposure: Organophosphate, below)
- Acetaminophen: IV Fluids and supportive care, identify receiving facility with N-acetylcysteine
- Salicylates: IV Fluids, consider acidosis and treatment with Sodium Bicarbonate
    - Sodium Bicarbonate
        - Adult: 50mEq IV, once
        - Pediatric: 1mEq/ kg (max 50mEq) IV, once
- Quinidine: monitor for Seizure, Dysrhythmia (especially Torsades), consider both Hypokalemia and Hypocalcemia



Quinidine causes widening of the P wave and widening of the QRS complex. There is often ST depression with a prolonged QT. The presence of U waves is typical as well.

Exposure

- Organophosphate
  - Atropine
    - Adult: 2mg IV, repeat as needed
    - Pediatric: 0.05mg/kg (max 2mg), repeat as needed
  - Pralidoxime (2-PAM) is not available in [redacted]
- Carbon Monoxide: 100% oxygen, consider false SpO2 reading

Table 2-12 Signs and Symptoms of Carbon Monoxide Poisoning

Severity	CO-Hb Level	Signs and Symptoms
Mild	< 15–20%	Headache, nausea, vomiting, dizziness, blurred vision
Moderate	21–40%	Confusion, syncope, chest pain, dyspnea, weakness, tachycardia, tachypnea, rhabdomyolysis
Severe	41–59%	Palpitations, dysrhythmias, hypotension, myocardial ischemia, cardiac arrest, respiratory arrest, pulmonary edema, seizures, coma
Fatal	> 60%	Death

- Inhaled Poisons: 100% oxygen, Airway Management, consider specific agents listed here
- Corrosives: decontaminate exposed skin with water after removing solid material, treat soft-tissue injury like Burns
  - Exposure to eyes: flush with clean water for at least 15min
  - Hydrofluoric acid (used as in oil refining and industrial cleaning)
    - Consider Calcium Chloride or Calcium Gluconate to prevent Dysrhythmia
      - Calcium Chloride
        - Adult: 1g IV over 2-5min, once [10ml or 1 Amp]
        - Pediatric: 100mg/kg (max 1g) over 2-5min, once
      - Calcium Gluconate
        - Adult: 1-2g IV over 2-5min, once [10-20ml or 2 vials]
        - Pediatric: 100mg/kg (max 2g) over 2-5min, once
    - Consider subcutaneous injection of Calcium Gluconate into wound with deep injury
- Ethylene Glycol (antifreeze, deicer and windshield washer fluid): IV Fluids, Versed (benzodiazepines) for Seizure, consider acidosis and treatment with Sodium Bicarbonate
  - Versed
    - Adult: 2.5-5mg IV/IM/IN, repeat as needed
    - Pediatric: 0.05-0.1mg/kg (max 5mg) IV/IM/IN, repeat as needed
  - Sodium Bicarbonate
    - Adult: 50mEq IV, once
    - Pediatric 1mEq/kg (max 50mEq) IV, once
- Petroleum Distillates (gasoline, mineral spirits, paint thinner; toluene, xylene, benzene, hexane): mostly supportive care for CNS symptoms
  - Treat ventricular Dysrhythmia with Metoprolol
    - Adult: 5mg IV once, repeat as needed to 3 total doses and proceed to Dysrhythmia
    - Not indicated for pediatric patients (i.e. treat per Dysrhythmia)
  - Avoid Epinephrine
  - If cause of cardiac arrest not definitely attributable to exposure, perform ACLS as usual
- Cyanide: supportive care only, antidote not available in [redacted]

Tetanus

- Tetanus Immune Globulin (TIG) or Tetanus Anti-Toxin
  - Human Preparation
    - Adult: 500u IM, once
    - Pediatric: 250u IM, once
  - Equine Preparation
    - Perform intradermal skin test prior to administration of full dose
    - Adult: 1500u IM, once
    - Pediatric: 750u IM, once
- Additional Treatments for symptomatic Tetanus
  - Place in sensory deprivation as able (i.e. ear plugs and muff, cover eyes, limit physical contact, etc.)
  - Diazepam
    - Adult: 5mg IV, repeat as needed
    - Pediatric: 0.1mg/kg (max 5mg) IV, repeat as needed
    - Infusion may be maintained if initiated by sending facility
  - Versed
    - Adult: 2.5mg IV/IM/IN, may repeat as needed
    - Pediatric: 0.05mg/kg (max 2.5mg) IV/IM/IN, may repeat as needed
  - Magnesium Sulfate
    - Adult: 5g loading dose IV
    - Pediatric: 75mg/kg (max 5g) loading dose IV
    - Infusion: 1-3g/hr
- Additional Considerations for Tetanus
  - Consider management of pain (Pain, Agitation & Nausea)
  - Avoid Beta-Blockers other than Esmolol
  - Avoid Succinylcholine; consider Rocuronium/ Vecuronium both for intubation and relief of tetany

Environmental

Specific Considerations

- Heat/ Exertional Illness
- Hypothermia
- Altitude Illness
- Drowning
- Diving Emergencies
- Electrocution

Heat/ Exertional Illness

- Remove patient from environment/ situation that precipitated symptoms (due to risk of VFib/ Cardiac Arrest, see Dysrhythmia)
- Administer IV Fluids
- Actively cool patient
    - Remove excessive clothing
    - Evaporative cooling with water to skin
    - Cool packs/ ice to axilla and groin
- Monitor core body temperature and BGL

Hypothermia

- Use caution when moving a patient with severe hypothermia
- Remove patient from cold environment
- Assess rectal temperature
    - ≥34C: rewarm patient by available means
    - <34C: rewarm trunk of body, do not attempt to re-warm extremities
- Hypothermia and cardiac arrest
    - Allow additional time to assess for pulse (up to 30s)
    - With temperature <30C:
        - Withhold IV medications
        - Limit defibrillation attempts to three

Altitude Illness

General Considerations

- Acute Mountain Sickness (AMS) may include headache, nausea, vomiting, etc.
- Descend to a lower altitude
- Address and treat symptoms
- Assess for HAPE & HACE

High Altitude Pulmonary Edema (HAPE)

- Do not administer diuretics
- Consider Non-Invasive Positive Pressure Ventilation

High Altitude Cerebral Edema (HACE)

- If unconscious, manage as Traumatic Brain Injury (TBI)
- Dexamethasone
    - Adult: 10mg IV/IM, once
    - Pediatric: 0.25-0.5mg/kg (max 10mg) IV/IM, once

Drowning

- Consider concurrent Trauma (and need for spinal motion restriction), Bronchospasm, Hypothermia and/ or Diving Emergency
- If invasive airway management indicated
    - Consider PEEP ≥5
    - Place NGT/ OGT to decompress stomach
    - Observe for signs of neurological deterioration (and target ETCO2 30-35 if present)

Diving Emergencies

General treatment

- No hyperbaric chamber available in [redacted]
- Maintain lowest possible altitude in transport
- Administer high-flow oxygen (even if SpO2 within normal limits)

Arterial Gas Embolism (AGE)

- Typically presents with loss of consciousness on surfacing/ shortly thereafter
- Transport patient in supine position (no Trendelenburg)
- Administer high-flow oxygen, consider Non-Invasive Positive Pressure Ventilation

Decompression Sickness

- Characterized by fatigue and aches that may progress to weakness, paralysis and/ or loss of consciousness
- May have delayed onset after resurfacing (up to 48 hours)
- Administer high-flow oxygen, consider Non-Invasive Positive Pressure Ventilation

Electrocution

- Utilize reverse triage in mass casualty incident (MCI)
- Treat soft tissue injuries as Burns
- IV Fluids as needed

Trauma

General Management

- Consider spinal motion restriction for any criteria outlined below, recognize that full spinal immobilization may not be warranted
    - Focal neurologic deficit
    - Midline spinal tenderness
    - Altered level of consciousness
    - Intoxication
    - Any distracting injury
- Consider associated procedures early
- Consider potential for Shock,
    - Permissive hypotension (to SBP >80) may be warranted in adult patients only
    - Monitor for trauma triad: hypothermia, acidosis, coagulopathy
- Treat Pain, Agitation & Nausea as indicated

Specific Considerations

- Impaled Objects
- Traumatic Brain Injury (TBI)
- Spinal Cord Injury
- Scalp, Face and Neck Injuries
- Abdominal and Thoracic Trauma
- Extremity Trauma
- Burns
- Crush Injury
- Trauma in Pregnancy

Associated Procedures

- Cricothyrotomy
- Needle Decompression
- Chest Tube Insertion
- Pericardiocentesis
- Field Amputation
- Escharotomy

Impaled Objects

- Do not remove unless impaled object interferes with airway management or prevents transport
- Impaled objects should be stabilized with bulky dressings to prevent movement and further injury
- Bleeding control interventions (i.e. direct pressure, tourniquets, etc.) should still be considered as with any traumatic injury

Traumatic Brain Injury (TBI)

- TBI includes a range of injuries from concussion to intracranial bleeds, but management to be focused on treatment of Hypertension or Hypotension and associated symptoms (i.e. Pain, Agitation & Nausea or suspected herniation, discussed below)
- Concurrent Hypotension
    - IV Fluid Bolus
    - Norepinephrine Infusion
        - Adult: 2-30mcg/min or 0.1-0.5mcg/kg/min
        - Pediatric: 0.05-2mcg/kg/min
- Concurrent Hypertension
    - Treat to maintain BP <180/110
    - Labetalol
        - Adult: 20mg IV over 2-5min, may repeat q 10min at 40mg, then 80mg; after that, proceed to another antihypertensive
        - Pediatric: 0.2-1mg/kg (max 20mg) IV, repeat as needed at twice previous dose for total of three doses
        - Infusion: 0.25-3mg/kg/hr
    - If unable to treat with Labetalol, administer Hydralazine
        - Adult: 10mg IV, repeat as needed to 4 total doses
        - Pediatric: 0.2-0.6mg/kg IV/IM, once
- Suspected herniation, consider either:
    - Mannitol
        - Adult: 1g/kg IV over 10min, once (use filter)
        - Pediatric: 1g/kg IV over 10min, once (use filter)
- Suspected herniation and need for mechanical ventilation:
    - Maintain EtCO2 between 30 – 35mmHg
    - Use caution with PEEP > 6cm H2O

Spinal Cord Injury

- Do not transport the following (unless patient being transported out of the country):
  - Cervical spine injury with concurrent respiratory distress
  - Any spine injury with complete distal loss of sensation and motor function greater than six hours from onset of injury; if within six hours or if patient still retains some function (sensation or motor function), continue to transport
- Methylprednisolone loading dose
  - Adult: 1g IV over 20min
  - Pediatric: 30mg/kg (max 1g) IV over 20min
- After 45 minutes, Methylprednisolone maintenance infusion (for 23 hours): 5.4mg/kg/hr

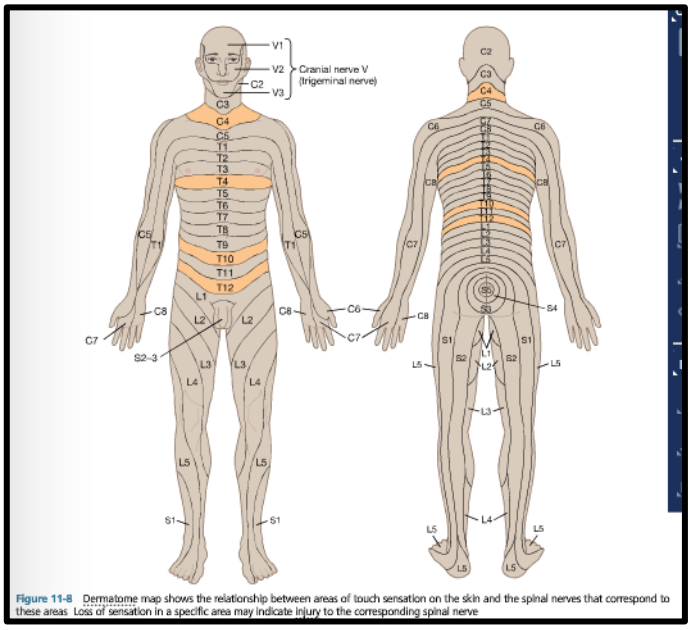
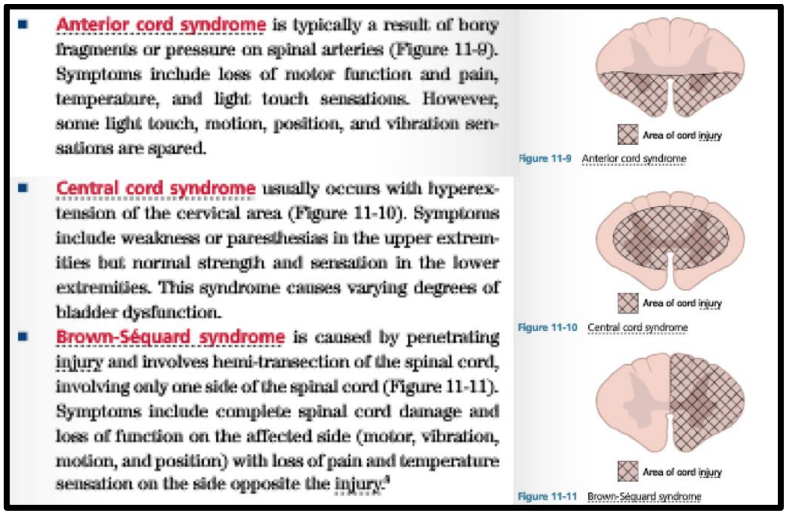


Figure 11-8 Dermatome map shows the relationship between areas of touch sensation on the skin and the spinal nerves that correspond to these areas. Loss of sensation in a specific area may indicate injury to the corresponding spinal nerve.



Scalp, Face, and Neck Injuries

- Consider Traumatic Brain Injury (TBI)
- Scalp injuries: hemostasis may be difficult, consider QuickClot
- Maxillofacial injury and/ or possible basilar skull fracture: use caution with insertion of NPA or NG tube and with nasotracheal intubation
- Eye injury:
    - Consider irrigation to remove debris (with NS over 15-30min)
    - Consider covering both eyes (to prevent movement and further injury)
    - With hyphema (blood in anterior chamber), head of bed to 45 degrees
    - Minimum safe cruising altitude during transport
- Open neck injury: cover with dry gauze and occlusive dressing

Abdominal and Thoracic Trauma

- Maintain high index of suspicion for internal bleeding, tension pneumothorax/ hemothorax requiring Needle Chest Decompression and/ or Chest Tube Insertion, and Shock
- Flail chest: stabilize with bulky dressing
- Sucking chest wound: apply chest seal
- Evisceration: moistened dressing to exposed bowel
- Pelvic injury: apply pelvic binder
  (consider with any instability or pain on assessment, significant mechanism of injury, or AMS)
- Injury to great vessels (or potential for): minimize increase in intrathoracic pressure
    - Avoid PPV if possible
    - Avoid excessive PEEP if PPV required
    - Consider increasing TV and decreasing RR to maintain MV if on vent (Invasive Mechanical Ventilation)

Extremity Trauma

Amputation

- Attempt to control bleeding with direct pressure/ QuickClot
- Transport amputated part with patient and place on ice (if possible)
- Apply moist dressing to stump

Uncontrolled bleeding

- Apply tourniquet
- With continued hemorrhage, place another tourniquet proximal to first (and leave first one in place)
- Document time of placement (and convey that time to receiving facility on arrival)
- Reassess for bleeding throughout transport
- Do not remove or loosen a tourniquet after initial application

In extreme circumstances of limb entrapment: consider Field Amputation

Other extremity injuries

- Assess for distal pulse, motor function and sensation; readjust limb if needed (once)
- Splint, sling, swath
- Reassess extremity (and re-do splint if pulse, motor function or sensation compromised due to intervention)
- Pain out of proportion to injury, consider compartment syndrome and discuss case with receiving facility

Burns

- Do not transport if:
  - Burn occurred ≥24 hours prior
  - Burn classified as minor or moderate (see below)
- Assess TBSA affected by burn

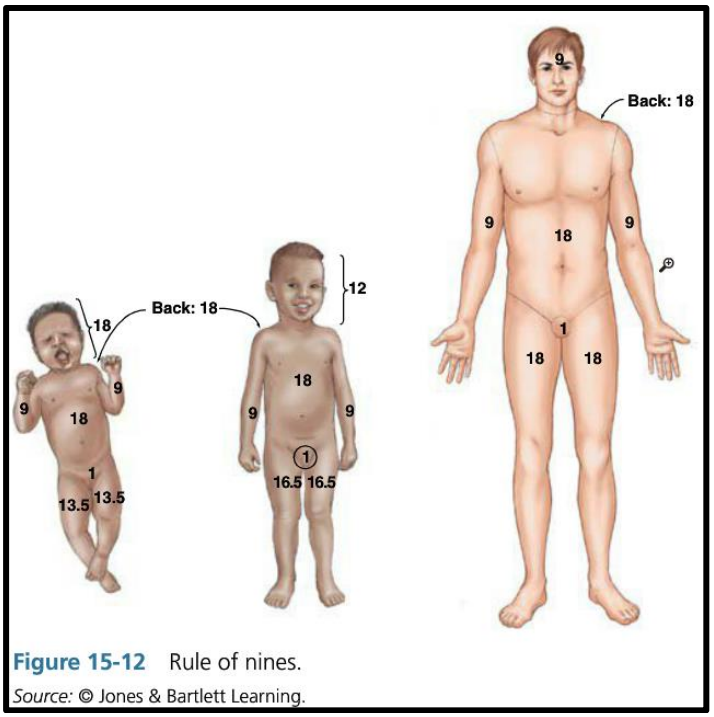


Figure 15-12 Rule of nines.
Source: © Jones & Bartlett Learning.

American Burn Association severity classification[36]		
Minor	Moderate	Major
Adult <10% TBSA	Adult 10–20% TBSA	Adult >20% TBSA
Young or old < 5% TBSA	Young or old 5–10% TBSA	Young or old >10% TBSA
<2% full thickness burn	2–5% full thickness burn	>5% full thickness burn
	High voltage injury	High voltage burn
	Possible inhalation injury	Known inhalation injury
	Circumferential burn	Significant burn to face, joints, hands or feet
	Other health problems	Associated injuries

- Maintain high index of suspicion for airway/ breathing compromise and address early
    - Treat Bronchospasm per guideline
    - Rapid Sequence Intubation with Ketamine (over Etomidate) if indicated
- Stop burning process and cover burns with dry, sterile dressings
- Remove jewelry in anticipation of swelling
- IV Fluids per Parkland Formula: 4ml/kg/% TBSA burned; ½ given within 8 hours

Calculation of Fluid Resuscitation Measures

For example, consider an 80-kg (176-pound) man who has sustained third-degree burns to 30% of his TBSA and who is managed on scene shortly after the injury. The fluid resuscitation volume would be calculated as follows:

24-hour fluid total = 4 ml/kg × weight in kg × % TBSA burned
= 4 ml/kg × 80 kg × 30% TBSA burned
= 9,600 ml

Note that in this formula, the units of kilograms and percent cancel out so that only ml is left, thus making the calculation 4 ml × 80 × 30 = 9,600 ml.

Once the 24-hour total is calculated, divide that number by 2:

Amount of fluid to be given from time of injury to hour 8 = 9,600 ml/2 = 4,800 ml

To determine the hourly rate for the first 8 hours, divide this total by 8:

Fluid rate for the first 8 hours = 4,800 ml/8 hours = 600 ml/hour

The fluid requirement for the next period (hours 8 to 24) is calculated as follows:

Amount of fluid to be given from hours 8 to 24 = 9,600 ml/2 = 4,800 ml

To determine the hourly rate for the final 16 hours, divide this total by 16:

Fluid rate for final 16 hours = 4,800 ml/16 hours = 300 ml/hour

- Monitor urine output and consider insertion of foley
- Consider increased need for analgesia (Pain, Agitation, & Nausea)
- Consider Carbon Monoxide and Cyanide Toxicity (Toxic Exposure)
- Circumferential burns to extremity or chest that breathing or circulation, consider Escharotomy
- Chemical burns: physically remove agent from patient's skin and treat injury as outlined above

Crush Injury

- With release any of crush >1 hour, anticipate the following:
  - Hyperkalemia with possible Dysrhythmia
  - Myoglobinemia with possible acute renal failure
- Prior to release of crush
  - Consider tourniquet placement
  - IV Fluids (use NS and avoid LR)
  - Sodium Bicarbonate
    - Adult: 50mEq IV, once; or 150mEq (3 Amps) in D5W over 1 hour, once
    - Pediatric: 01mEq/kg (max 50mEq) IV, once
  - Mannitol
    - Adult: 1g/kg IV over 10 min, once (use filter)
    - Pediatric: 1g/kg IV over 10 min, once (use filter)
- Monitor for Hyperkalemia
  - Stabilize cardiac cells with Calcium Chloride or Calcium Gluconate
    - Calcium Chloride
      - Adult: 1g IV over 2-5min, once [10ml or 1 Amp]
      - Pediatric: 100mg/kg (max 1g) over 2-5min, once
    - Calcium Gluconate
      - Adult: 1-2g IV over 2-5min, once [10-20ml or 1-2 vials]
      - Pediatric: 100mg/kg (max 2g) over 2-5min, once
  - Shift potassium back in to intracellular space by giving all of the following
    - Sodium Bicarbonate
      - Adult: 50mEq IV, once
      - Pediatric: 1mEq/kg (max 50mEq) IV, once
    - Dextrose 50% (always give with insulin)
      - Adult: 25g IV [50ml D50]
      - Pediatric≥2 years: 0.5g/kg IV [1ml/kg D50 or 2ml/kg D25]
      - Pediatric<2 years: 0.5-1g/kg [2-4ml/kg D25, do not use D50]
      - Neonate: 0.5-1g/kg [5-10ml/kg D10 or 10-20ml/kg D5]
    - Insulin (always give with D50)
      - Adult: 10u IV
      - Pediatric: 0.1u/kg IV
    - Albuterol
      - Adult: 5mg NEB once
      - Pediatric: 2.5mg NEB once
    - Dextrose/ Insulin may be given again as needed; check BGL and treat with additional Dextrose as indicated

Obstetrics and Gynecology

General Management

- Additional history to gather for patients
  - Of childbearing age
    - Possibility of pregnancy?
    - Currently pregnant?
    - Date(s) of last menstrual period
    - Gravida and Parity (Parity: term births, premature births, abortions, living children)
  - Who are known to be pregnant
    - Due date
    - Number of fetuses/ expected babies
    - Complications with current pregnancy
    - Complication with previous pregnancies
    - Details of prenatal care
    - Recent infection
    - Blood type and Rh
      (Rhogam for Rh- moms at 27 weeks)
    - Fetal activity
  - Who are in labor
    - Onset, frequency, intensity and duration of contractions
    - Rupture of membranes? (and color/ presence of meconium staining)
    - Presentation or showing? (actually look!)
    - Dilation, effacement and station (if available from sending; do not perform!)
- Additional considerations
  - Left lateral recumbent position
  - Delivery in aircraft may not be possible (therefore consider alternative options with imminent delivery)
  - Fetal heart tones should be monitored with gestational age >25 weeks

Specific Considerations

- Vaginal Bleed
- Ectopic Pregnancy
- Pregnancy Induced Hypertension, (Pre-)Eclampsia and HELLP Syndrome
- Preterm Labor & Tocolytics
- Standard Delivery
- Abnormal Delivery
- Management of the Newborn
- Trauma in Pregnancy: simultaneously address Trauma and Obstetrics and Gynecology

Associated Procedures

- Fetal Monitoring
- Postmortem Cesarean Section

Vaginal Bleed

- General Management
  - Do not pack the vagina
  - Treat for Shock as indicated
  - Consider TXA
- Differential:
  - Traumatic: simultaneously address Trauma and Obstetrics and Gynecology
  - Non-traumatic
    - Not Pregnant (not known to be pregnant prior to bleed)
      - Consider early/ unidentified pregnancy (and potential miscarriage)
        - Supportive care
        - Transport fetal parts/ blood clots to receiving if possible
      - Consider Ectopic Pregnancy and ensure patient to be transported to facility with OR capabilities
    - Pregnant
      - Placental Abruption: no specific treatment
      - Placenta Previa:
        - Magnesium Sulfate preferred for tocolytic therapy: 4g IV over 30min loading dose, 2-4g/hr maintenance infusion
          (Terbutaline should be avoided)
  - Related to Delivery
    - Hemorrhage During Delivery
      - Do not administer Oxytocin until placenta delivers
    - Post-Partum Hemorrhage
      - Fundal massage
      - Encourage breast feeding
      - Oxytocin: 20-40mu/min or 10u IM once
        [mix 10u in 1000ml NS or LR, 120-240ml/hr]

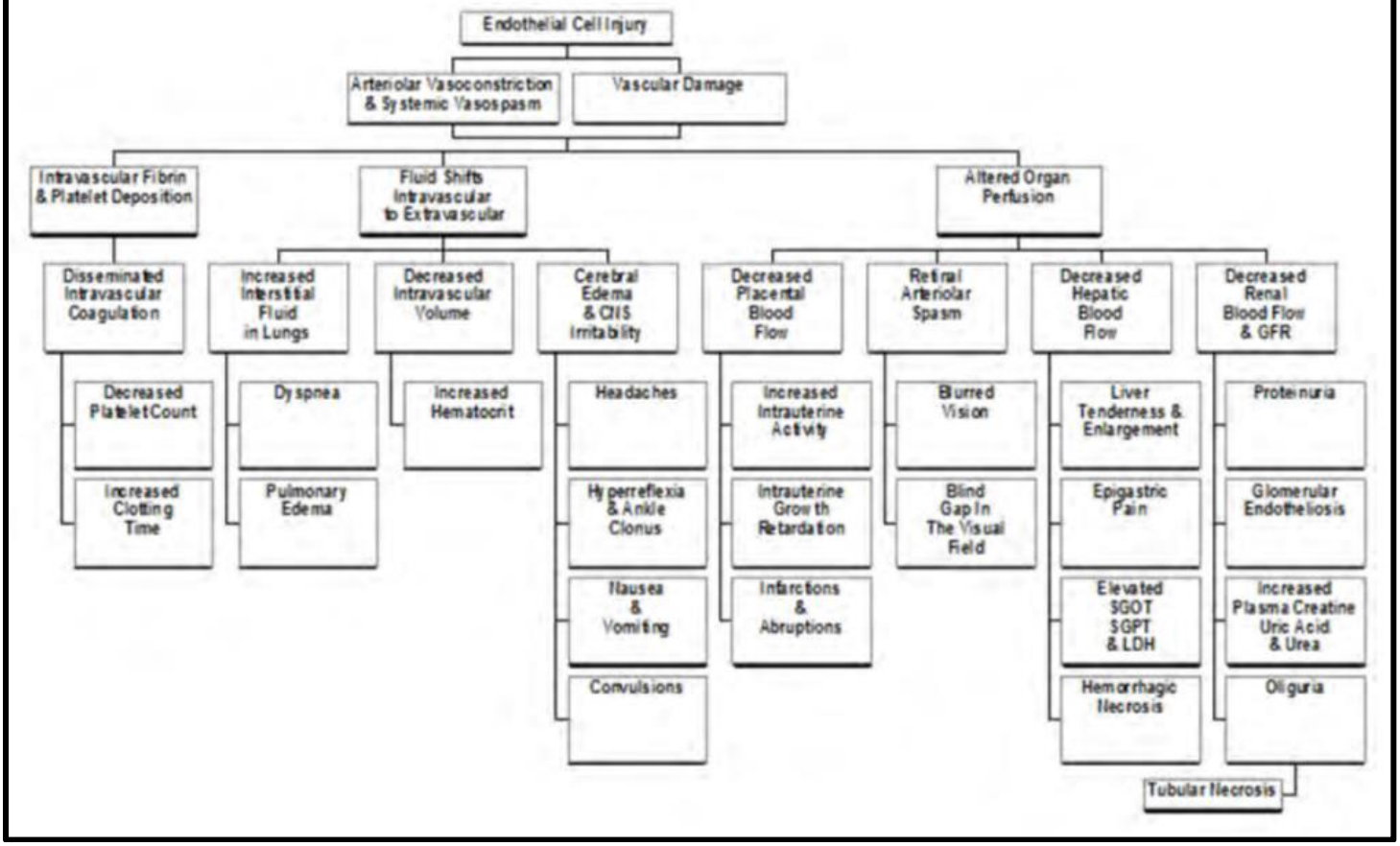
Ectopic Pregnancy

- Patient to be transported to facility with OR capabilities
- TXA only to be considered with clinically significant bleed

Pregnancy Induced Hypertension, (Pre-)Eclampsia and HELLP Syndrome

- Seizure Prevention
  - Magnesium Sulfate loading dose: 4g IV over 20min
  - Followed by maintenance infusion: 2-4g/hr IV
- Magnesium Toxicity (decreased DTRs, decreased LoC), treat Hypermagnesemia (also see Neurologic: Scoring DTRs)
  - Stop Magnesium Sulfate and do not restart for at least 1 hour
  - Calcium Chloride: 1g IV over 2-5min, once
  - Calcium Gluconate: 1-2g IV over 2-5min, once
- Hypertension (treat SBP >160 or DBP >110, do not drop SBP to <100)
  - Labetalol: 20mg IV over 2-5min, may repeat q 10min at 40mg, then 80mg; after that, proceed to another antihypertensive
  - Hydralazine: 10mg IV, repeat as needed to 4 total doses
- Pulmonary edema
  - Avoid diuretics
  - Maintain elevated head of bed
  - Consider PPV/ Non-Invasive Positive Pressure Ventilation
- Active seizures
  - Magnesium Sulfate 4g IV over 20min, followed by infusion at 2-4g/hr
  - Midazolam if seizures continue after 20min: 2.5 - 5mg IV/IM/IN, repeat as needed
- With concern for HELLP, consider transport to facility that carries blood and/ or has an ICU

Figure 13. Pathophysiologic Changes in Severe PIH



Preterm Labor & Tocolytics

- Not all cases of preterm labor require tocolytics, but they should be utilized in cases where the delay of delivery may result in an improved outcome for baby and/ or mother
- Consider relative contraindications to tocolysis and determine treatment strategy:
    - Fetal demise or anomalies incompatible with life
    - Fetal distress
    - Premature Rupture of Membranes
    - Pre-eclampsia/ Hypertension
    - Severe bleeding or placental abruption
    - Severe intrauterine growth retardation (IUGR)
    - Chorioamnionitis
    - Cervical dilation >5cm
    - Heart disease/ tachycardia
    - Hypersensitivity to medication(s) used
    - Trauma
- IV Fluids (preterm labor often due to dehydration)
- Magnesium Sulfate
    - Loading dose: 4g IV over 20min
    - Maintenance infusion: 2-4g/hr
- Terbutaline: 0.25mg IM, may repeat to 3 total doses or until Magnesium Sulfate is ready
- Continue Terbutaline or Ritodrine Infusions if initiated by sending facility
- Magnesium Toxicity (decreased DTRs, decreased LoC), treat Hypermagnesemia (also see Neurologic: Scoring DTRs)
    - Stop Magnesium Sulfate and do not restart for at least 1 hour
    - Calcium Chloride: 1g IV over 2-5min, once
    - Calcium Gluconate: 1-2g IV over 2-5min, once

Standard Delivery

- Prepare for simultaneous care of both mother and newborn
- Attempt to maintain sterility of procedure as possible
- As baby is delivered, perform the following simultaneously
    - Support head
    - Suction mouth first, then nose
    - Assess for nuchal card (and remove, if needed)
    - Continue treatment of newborn per Management of the Newborn
- As newborn is assessed and treated
    - Clamp and cut umbilical cord
    - Facilitate delivery of placenta (normally within 15min of delivery of the newborn)
        - Do not pull on the umbilical cord
        - Assess placenta and/ or transport to receiving facility (in paper bag)
        - With evidence of uterine prolapse
            - Manually replace uterus with gloved hand
            - Maintain that position and transport patient to facility with OR capabilities
- Continue to assess mother and monitor for Post-Partum Hemorrhage, treat per Vaginal Bleeding
    - Fundal massage
    - Encourage breast feeding
    - Oxytocin: 20-40mu/min or 10u IM once
      [mix 10u in 1000ml NS or LR, 120-240ml/hr]

Abnormal Delivery

- Prolapsed Umbilical Cord
- Shoulder Dystocia
- Breech Delivery

Prolapsed Umbilical Cord

- Position patient in knee-chest position or lateral Sim's position
- Lift presenting part off of umbilical cord and maintain this position during flight
- Administer tocolytics (Preterm Labor and Tocolytics)
- Do not manually replace the cord

Shoulder Dystocia

- Do not pull, push or pivot the baby during delivery (other than as outlined in specific maneuvers)
- Consider techniques of ALARMER mnemonic
    - **A**sk for help
    - **L**ift/ hyperflex legs (McRobert's Maneuver)

Figure 1- McRobert's manoeuvre

    - **A**nterior shoulder disimpaction
        - Abdominal approach (Mazzanti Maneuver)

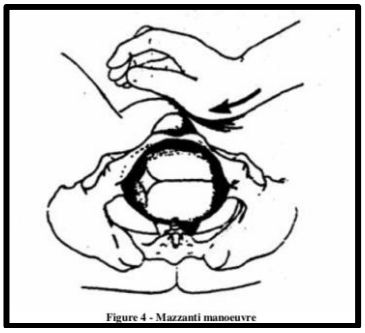


Figure 4 - Mazzanti manoeuvre

- Vaginal approach (Rubin Manuever)

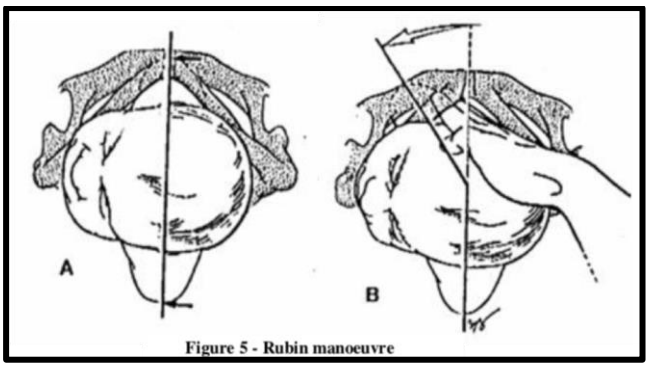


Figure 5 - Rubin manoeuvre

- **R**otation of the posterior shoulder (Wood's Maneuver)

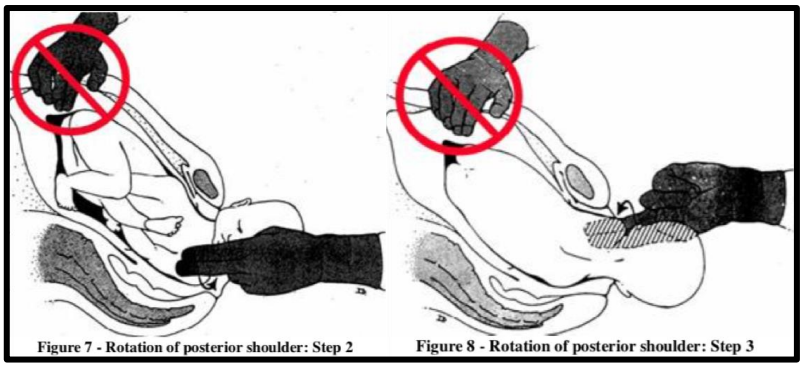


Figure 7 - Rotation of posterior shoulder: Step 2

Figure 8 - Rotation of posterior shoulder: Step 3

- **M**anual removal posterior arm

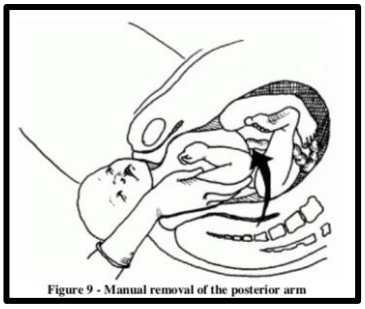


Figure 9 - Manual removal of the posterior arm

- **E**pisiotomy (only if all maneuvers, to include deliberate fracture of the clavicle, fail to result in delivery of the baby)
- **R**oll over onto "all fours" (Gaskin Maneuver)

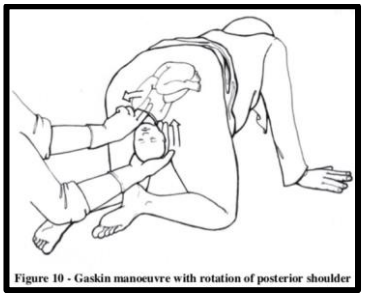


Figure 10 - Gaskin manoeuvre with rotation of posterior shoulder

- Consider deliberate fracture of the clavicle

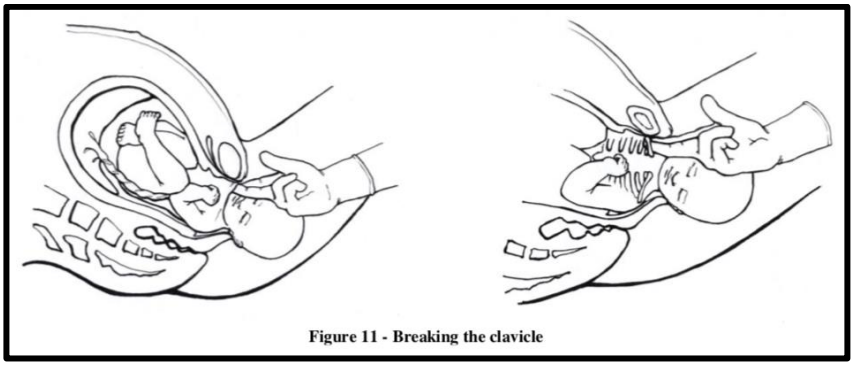


Figure 11 - Breaking the clavicle

Breech Delivery

- Ensure adequate analgesia (Pain, Agitation & Nausea)
- Encourage pushing (by mother)
- Do not pull on the baby
- If legs do not deliver spontaneously, consider Pinard Manuever

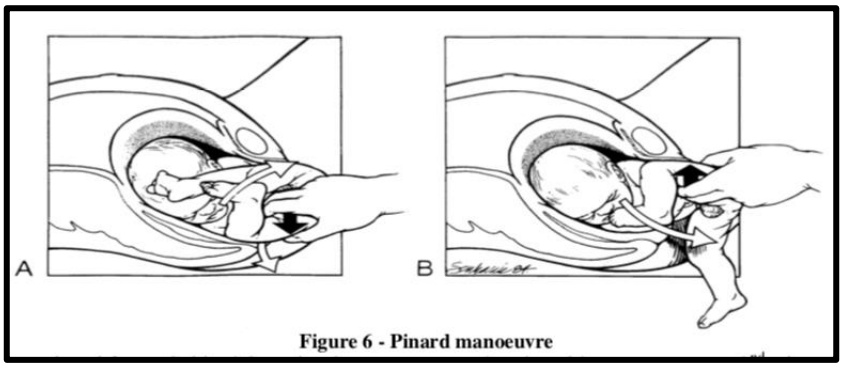


Figure 6 - Pinard manoeuvre

- Episiotomy may be considered once anterior buttock and anus are "crowning"
- Support baby at hips, have mother push until scapula are visible

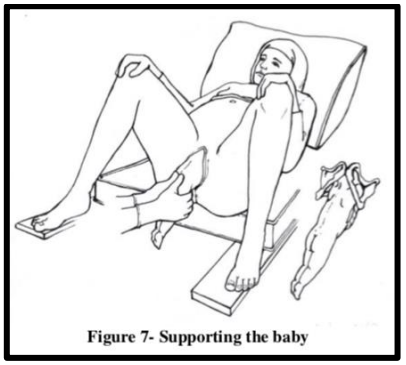
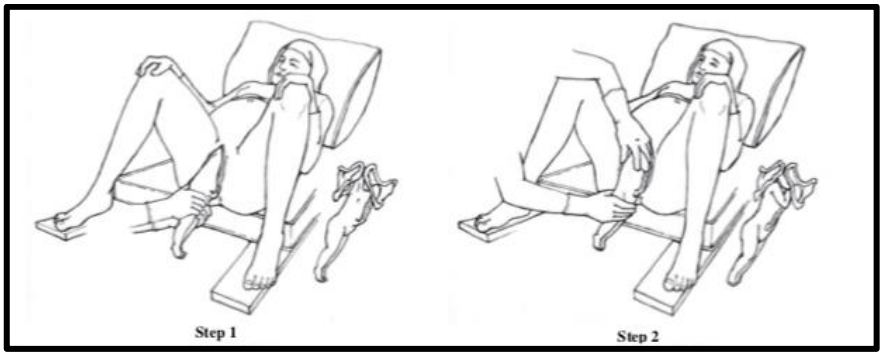
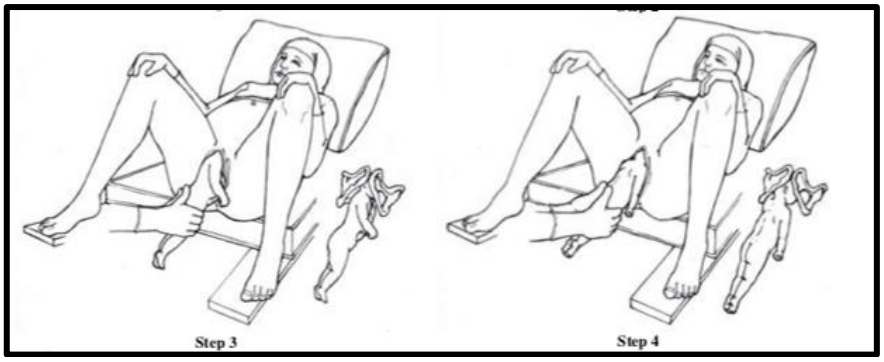
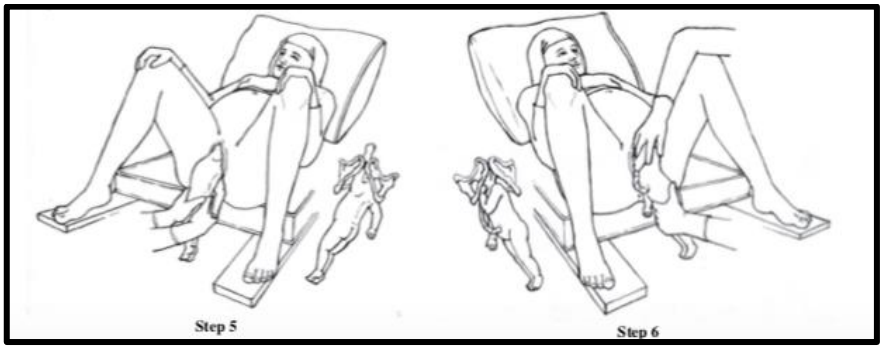


Figure 7- Supporting the baby

- Rotate body to facilitate delivery of arms over the chest (Loveset Manuever)







- Support baby with head in flexed position, encourage mother to push until nape of baby's neck appears

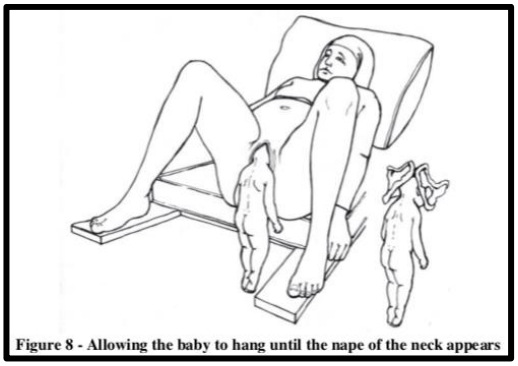


Figure 8 - Allowing the baby to hang until the nape of the neck appears

- Deliver the head via Mariceau-Smellie-Veit Maneuver
    - Maintain head in a flexed position with fingers over baby's chin/ face
    - Simultaneously apply suprapubic pressure (to mother)

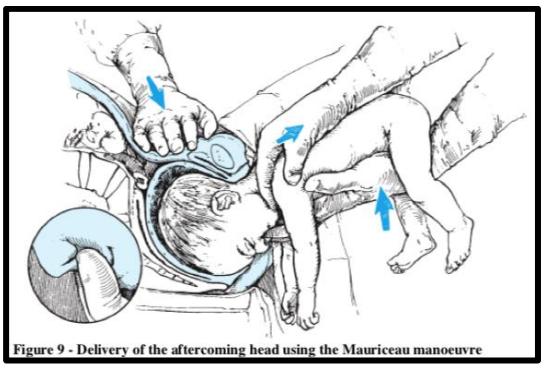


Figure 9 - Delivery of the aftercoming head using the Mauriceau manoeuvre

- With head entrapment, maintain baby's airway and transport to OR for symphysiotomy or cesarean section

Pediatric

General Management

- Utilize Broselow as primary reference for pediatric sizing
- Refer to NRP, PALS and Walls as secondary references

Table 10. Normal Blood Pressures

Age	Systolic Pressure (mm Hg)*	Diastolic Pressure (mm Hg)*	Mean Arterial Pressure (mm Hg)†
Birth (12 hours, <1000 g)	39-59	16-36	28-42‡
Birth (12 hours, 3 kg)	60-76	31-45	48-57
Neonate (96 hours)	67-84	35-53	45-60
Infant (1-12 months)	72-104	37-56	50-62
Toddler (1-2 years)	86-106	42-63	49-62
Preschooler (3-5 years)	89-112	46-72	58-69
School-age child (6-9 years)	97-115	57-76	66-72
Preadolescent (10-12 years)	102-120	61-80	71-79
Adolescent (12-15 years)	110-131	64-83	73-84

*Systolic and diastolic blood pressure ranges assume 50th percentile for height for children 1 year and older.
†Mean arterial pressures (diastolic pressure + [difference between systolic and diastolic pressure/3]) for 1 year and older, assuming 50th percentile for height.
‡Approximately equal to postconception age in weeks (may add 5 mm Hg).

Table 11. Definition of Hypotension by Systolic Blood Pressure and Age

Age	Systolic Blood Pressure (mm Hg)
Term neonates (0-28 days)	<60
Infants (1-12 months)	<70
Children 1-10 years	<70 + (age in years × 2) (this estimates systolic blood pressure that is less than the fifth blood pressure percentile for age)*
Children >10 years	<90

*This fifth percentile is a systolic blood pressure that is lower than all but 5% of normal children (ie, it will be hypotensive for 95% of normal children).

Table 8. Normal Heart Rates*

Age	Awake Rate (/min)	Sleeping Rate (/min)
Neonate	100-205	90-160
Infant	100-180	90-160
Toddler	98-140	80-120
Preschooler	80-120	65-100
School-age child	75-118	58-90
Adolescent	60-100	50-90

*Always consider the patient's normal range and clinical condition. Heart rate will normally increase with fever or stress.

Normal spontaneous breathing is accomplished with minimal work, resulting in quiet breathing with unlabored inspiration and passive expiration. The normal respiratory rate is inversely related to age (Table 6); it is rapid in the neonate and decreases as the child gets older.

Table 6. Normal Respiratory Rates by Age

Age	Breaths per Minute
Infant	30-53
Toddler	22-37
Preschooler	20-28
School-age child	18-25
Adolescent	12-20

Table 5-4. Initial endotracheal tube insertion depth ("tip to lip") for orotracheal intubation

Gestation (weeks)	Endotracheal tube insertion depth at lips (cm)	Baby's Weight (grams)
23-24	5.5	500-600
25-26	6.0	700-800
27-29	6.5	900-1000
30-32	7.0	1,100-1,400
33-34	7.5	1,500-1,800
35-37	8.0	1,900-2,400
38-40	8.5	2,500-3,100
41-43	9.0	3,200-4,200

Adapted from Kempley ST, Moreira JW, Petrone FL. Endotracheal tube length for neonatal intubation. *Resuscitation*. 2008;77(3):369-373.

Table 5-1. Endotracheal tube size for babies of various weights and gestational ages

Weight (g)	Gestational Age (wks)	Endotracheal Tube Size (mm ID)
Below 1,000	Below 28	2.5
1,000-2,000	28-34	3.0
Greater than 2,000	Greater than 34	3.5

Table 5-2. Suction catheter size for endotracheal tubes of various inner diameters

Endotracheal Tube Size (mm ID)	Catheter Size
2.5	5F or 6F
3.0	6F or 8F
3.5	8F

TABLE 24-1 Equipment Selection

	Pink[a]	Red	Purple	Yellow	White	Blue	Orange	Green
Length (cm)-based pediatric equipment chart								
Weight (kg)	6–7	8–9	10–11	12–14	15–18	19–23	23–31	31–41
Length (cm)	60.75–67.75	67.75–75.25	75.25–85	85–98.25	98.25–110.75	110.75–122.5	122.5–137.5	137.5–155
ETT size (mm)	3.5 uncuff, 3.0 cuff	3.5 uncuff, 3.0 cuff	4.0 uncuff, 3.5 cuff	4.5 uncuff, 4.0 cuff	5.0 uncuff, 4.5 cuff	5.5 uncuff, 5.0 cuff	6.0 cuff	6.5 cuff
Lip-to-tip length (mm)	10–10.5	10.5–11	11–12	12.5–13.5	14–15	15.5–16.5	17–18	18.5–19.5
Laryngoscope size+blade	1 straight	1 straight	1 straight	2 straight	2 straight	2 straight or curved	2 straight or curved	3 straight or curved
Suction catheter	8F	8F	8F	8F–10F	10F	10F	10F	12F
Stylet	6F	6F	10F	10F	10F	10F	14F	14F
Oral airway (mm)	50	50	60	60	60	70	80	80
Nasopharyngeal airway	14F	14F	18F	20F	22F	24F	26F	30F
Bag/valve device	Infant	Infant	Child	Child	Child	Child	Child/adult	Adult
Oxygen mask	Newborn	Newborn	Pediatric	Pediatric	Pediatric	Pediatric	Adult	Adult
Vascular access	22–24/23–25	22–24/23–25	20–22/23–25	18–22/21–23	18–22/21–23	18–20/21–23	18–20/21–22	16–20/18–21
Catheter/butterfly	Intraosseous	Intraosseous	Intraosseous	Intraosseous	Intraosseous	Intraosseous		
NG tube	5–8F	5–8F	8–10F	10F	10–12F	12–14F	14–18F	18F
Urinary catheter	5–8F	5–8F	8–10F	10F	10–12F	10–12F	12F	12F
Chest tube	10–12F	10–12F	16–20F	20–24F	20–24F	24–32F	24–32F	32–40F
BP cuff	Newborn/infant	Newborn/infant	Infant/child	Child	Child	Child	Child/adult	Adult
LMA[b]	1.5	1.5	2	2	2	2–2.5	2.5	3

Directions for use: (1) measure patient length with centimeter tape or with a Broselow tape; (2) using measured length in centimeters or Broselow tape measurement, access appropriate equipment column; (3) column for ETTs, oral and nasopharyngeal airways, and LMAs; always select one size smaller and one size larger than the recommended size.

[a]For infants smaller than the pink zone, but not preterm, use the same equipment as the pink zone.

[b]Based on manufacturer's weight-based guidelines:

Mask size	Patient size (kg)
1	≤5
1.5	5–10
2	10–20
2.5	20–30
3	>30

Permission to reproduce with modification from Luten RC, Wears RL, Broselow J, et al. Managing the unique size related issues of pediatric resuscitation: reducing cognitive load with resuscitation aids. *Acad Emerg Med.* 1992;21:900–904.

Specific Considerations

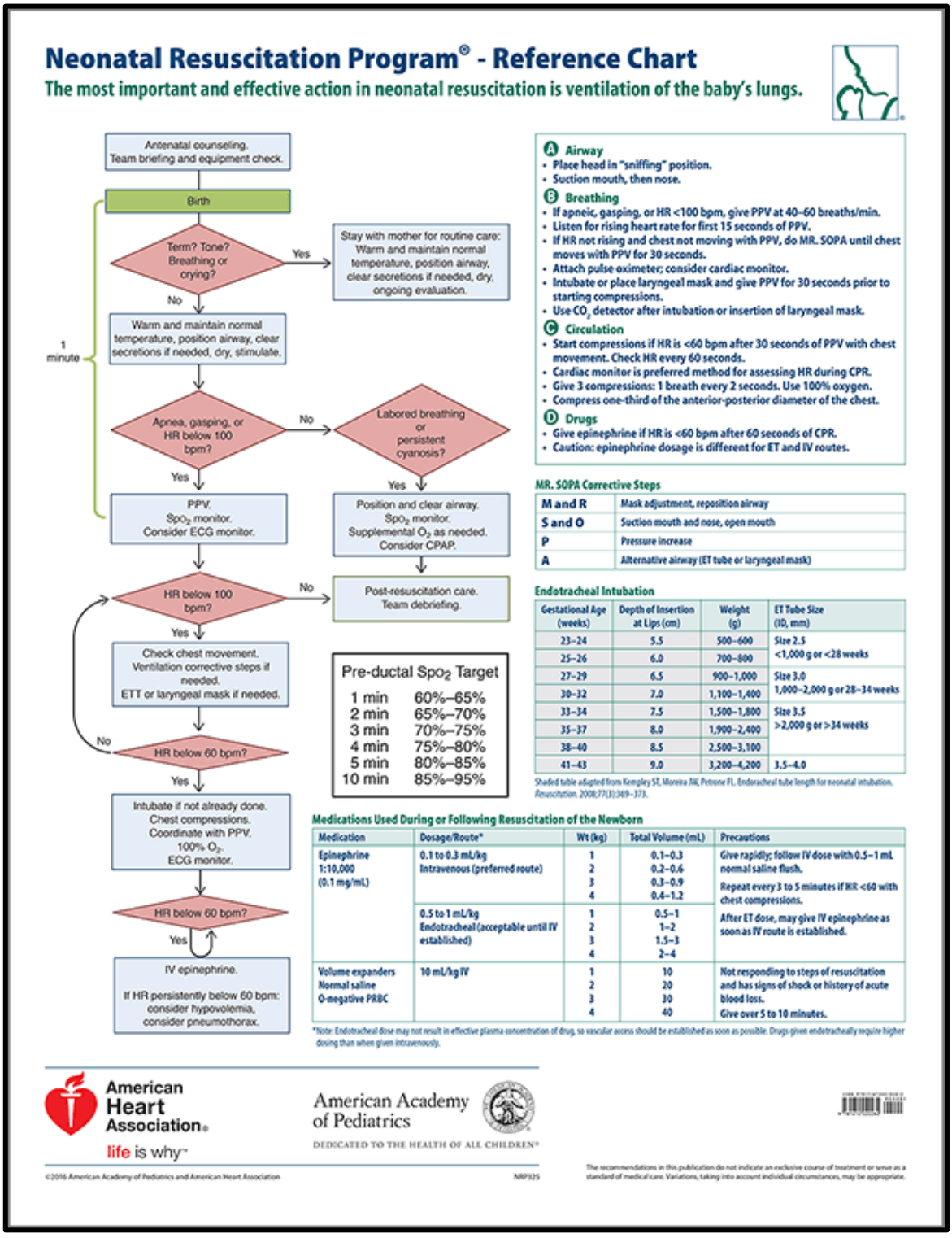
- Management of the Newborn
- Management of the Sick Baby

Associated Procedures

- Umbilical Vein Catheterization

Management of the Newborn.

- Assess APGAR at 1 and 5 minutes after birth (see next page)
- Monitor BGL and treat for Hypoglycemia if <40mg/dl
- Consider Umbilical Vein Catheterization for IV access



Neonatal Resuscitation Program® - Reference Chart

The most important and effective action in neonatal resuscitation is ventilation of the baby's lungs.

Antenatal counseling.
Team briefing and equipment check.

Birth

Term? Tone? Breathing or crying?
- Yes → Stay with mother for routine care: Warm and maintain normal temperature, position airway, clear secretions if needed, dry, ongoing evaluation.
- No → Warm and maintain normal temperature, position airway, clear secretions if needed, dry, stimulate.

1 minute

Apnea, gasping, or HR below 100 bpm?
- No → Labored breathing or persistent cyanosis?
  - Yes → Position and clear airway. SpO_2 monitor. Supplemental O_2 as needed. Consider CPAP.
  - No → Post-resuscitation care. Team debriefing.
- Yes → PPV. SpO_2 monitor. Consider ECG monitor.

HR below 100 bpm?
- Yes → Check chest movement. Ventilation corrective steps if needed. ETT or laryngeal mask if needed.
- No → HR below 60 bpm?
  - Yes → Intubate if not already done. Chest compressions. Coordinate with PPV. 100% O_2. ECG monitor.

HR below 60 bpm?
- Yes → IV epinephrine.
  If HR persistently below 60 bpm: consider hypovolemia, consider pneumothorax.

Pre-ductal SpO_2 Target

1 min	60%–65%
2 min	65%–70%
3 min	70%–75%
4 min	75%–80%
5 min	80%–85%
10 min	85%–95%

A Airway
- Place head in "sniffing" position.
- Suction mouth, then nose.

B Breathing
- If apneic, gasping, or HR <100 bpm, give PPV at 40–60 breaths/min.
- Listen for rising heart rate for first 15 seconds of PPV.
- If HR not rising and chest not moving with PPV, do MR. SOPA until chest moves with PPV for 30 seconds.
- Attach pulse oximeter; consider cardiac monitor.
- Intubate or place laryngeal mask and give PPV for 30 seconds prior to starting compressions.
- Use CO_2 detector after intubation or insertion of laryngeal mask.

C Circulation
- Start compressions if HR is <60 bpm after 30 seconds of PPV with chest movement. Check HR every 60 seconds.
- Cardiac monitor is preferred method for assessing HR during CPR.
- Give 3 compressions: 1 breath every 2 seconds. Use 100% oxygen.
- Compress one-third of the anterior-posterior diameter of the chest.

D Drugs
- Give epinephrine if HR is <60 bpm after 60 seconds of CPR.
- Caution: epinephrine dosage is different for ET and IV routes.

MR. SOPA Corrective Steps

M and R	Mask adjustment, reposition airway
S and O	Suction mouth and nose, open mouth
P	Pressure increase
A	Alternative airway (ET tube or laryngeal mask)

Endotracheal Intubation

Gestational Age (weeks)	Depth of Insertion at Lips (cm)	Weight (g)	ET Tube Size (ID, mm)
23–24	5.5	500–600	Size 2.5 <1,000 g or <28 weeks
25–26	6.0	700–800	
27–29	6.5	900–1,000	Size 3.0 1,000–2,000 g or 28–34 weeks
30–32	7.0	1,100–1,400	
33–34	7.5	1,500–1,800	Size 3.5 >2,000 g or >34 weeks
35–37	8.0	1,900–2,400	
38–40	8.5	2,500–3,100	
41–43	9.0	3,200–4,200	3.5–4.0

Shaded table adapted from Kempley ST, Moreira JW, Petrone FL. Endotracheal tube length for neonatal intubation. *Resuscitation*. 2008;77(3):369–373.

Medications Used During or Following Resuscitation of the Newborn

Medication	Dosage/Route*	Wt (kg)	Total Volume (mL)	Precautions
Epinephrine 1:10,000 (0.1 mg/mL)	0.1 to 0.3 mL/kg Intravenous (preferred route)	1 2 3 4	0.1–0.3 0.2–0.6 0.3–0.9 0.4–1.2	Give rapidly; follow IV dose with 0.5–1 mL normal saline flush. Repeat every 3 to 5 minutes if HR <60 with chest compressions.
	0.5 to 1 mL/kg Endotracheal (acceptable until IV established)	1 2 3 4	0.5–1 1–2 1.5–3 2–4	After ET dose, may give IV epinephrine as soon as IV route is established.
Volume expanders Normal saline O-negative PRBC	10 mL/kg IV	1 2 3 4	10 20 30 40	Not responding to steps of resuscitation and has signs of shock or history of acute blood loss. Give over 5 to 10 minutes.

*Note: Endotracheal dose may not result in effective plasma concentration of drug, so vascular access should be established as soon as possible. Drugs given endotracheally require higher dosing than when given intravenously.

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The recommendations in this publication do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

Table 25 APGAR Scoring

	Sign	0 Points	1 Point	2 points
A	**Activity (Muscle Tone)**	Absent	Arms and legs flexed	Active movement
P	**Pulse**	Absent	Below 100 bpm	Above 100 bpm
G	**Grimace (Reflex Irritability)**	No response	Grimace	Sneeze, cough, pulls away
A	**Appearance (Skin Color)**	Blue-gray, pale all over	Normal, except for extremities	Normal over entire body
R	**Respiration**	Absent	Slow, irregular	Good, crying

Management of the Sick Baby

Specific Considerations

- STABLE Mnemonic to Guide Treatment
- Consider Congenital Heart Defect
- Other Congenital Conditions
- Congestive Heart Failure

STABLE Mnemonic to Guide Treatment

- **S**ugar
  - Consider Hypoglycemia: BGL <60mg/dl for pediatrics, <40mg/dl for neonates
    - Administer Dextrose
      - Pediatric<2 years: 0.5-1g/kg [2-4ml/kg D25, do not use D50]
      - Neonate: 0.5-1g/kg [5-10ml/kg D10 or 10-20ml/kg D5]
  - D5 Maintenance Fluids with risk of Hypoglycemia

Table 92. Estimation of Maintenance Fluid Requirements

Weight (kg)	Estimated Hourly Fluid Requirements	Sample Collection
<10	4 mL/kg per hour	8-kg infant: 4 mL/kg per hour × 8 kg = 32 mL/h
10-20	40 mL/h + 2 mL/kg per hour for each kilogram between 10 and 20 kg	15-kg child: 40 mL/h + 2 mL/kg per hour × 5 kg = 50 mL/h
>20	60 mL/h + 1 mL/kg per hour for each kilogram above 20 kg	30-kg child: 60 mL/h + 1 mL/kg per hour × 10 kg = 70 mL/h

An alternate calculation of maintenance hourly fluid rate for patients weighing greater than 20 kg is weight in kilograms + 40 mL/h.

- **T**emperature
  - Consider core body temperature/ rectal probe placement
  - If too high/ Fever, administer Acetaminophen: 10-15mg/kg PR (max 1000mg), once
  - If too low, implement measures to warm the baby
- **A**irway
  - Airway Management
  - Recognize that high concentrations of oxygen may not be appropriate for all babies
  - Consider padding baby's shoulders to maintain a patent airway

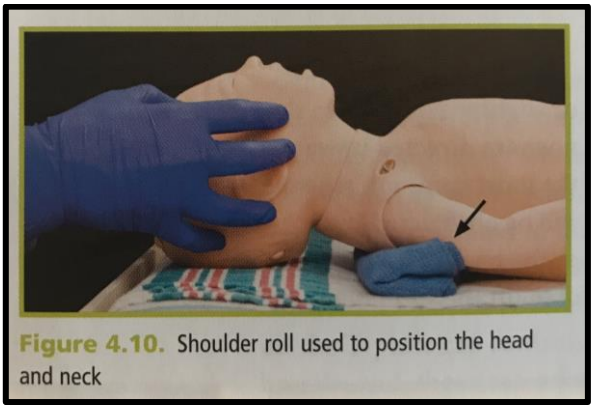

Figure 4.10. Shoulder roll used to position the head and neck

- **B**lood Pressure (treat per Hypotension to goals outlined below)

Table 10. Normal Blood Pressures

Age	Systolic Pressure (mm Hg)*	Diastolic Pressure (mm Hg)*	Mean Arterial Pressure (mm Hg)†
Birth (12 hours, <1000 g)	39-59	16-36	28-42‡
Birth (12 hours, 3 kg)	60-76	31-45	48-57
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Toddler (1-2 years)	86-106	42-63	49-62
Preschooler (3-5 years)	89-112	46-72	58-69

Table 11. Definition of Hypotension by Systolic Blood Pressure and Age

Age	Systolic Blood Pressure (mm Hg)
Term neonates (0-28 days)	<60
Infants (1-12 months)	<70
Children 1-10 years	<70 + (age in years × 2) (this estimates systolic blood pressure that is less than the fifth blood pressure percentile for age)*

- **L**ab Work
  - Glucose (see above)
  - Electrolyte Abnormalities
  - Septic work-up (Infection and Fever)
  - BNP
- **E**motional Support

Consider Congenital Heart Disease

- Assessment
  - Baby's age?
    - Any infant **<1 month of age** with cyanosis or shock should be considered to have duct-dependent critical congenital disease until proven otherwise; this is almost always a left heart lesion/ ductal dependent lesion such as Tetralogy of Fallot
    - Shunting or mixing lesions such as VSD or PDA and heart failure typically present later during infancy, usually **after 1-6 months of age**
  - Color?
    - **Pink:** think *heart failure* (adequate pulmonary blood flow, relatively well-perfused and oxygenated; usually due to a shunting lesion)
    - **Grey:** think *shock/ circulatory collapse* (not enough systemic flow, not oxygenating well; usually left-sided obstructive, ductal-dependent lesion); these patients are very sick with hypotension, tachypnea and poor capillary refill
    - **Blue:** think *right obstructive* duct-dependent in the first moth of life or *mixing lesion* (inadequate pulmonary blood flow: usually right-sided obstructive ductal-dependent lesion or a mixing lesion) after one month
  - Exams and Tests
    - Assess for Obstructive Process (i.e. aortic coarctation or stenosis)
      - Absence or weakness of femoral (compared to brachial)
      - Difference >10mmHG between pre-ductal and post-ductal SBPs
    - SpO2 Differential
      - Findings: pre-ductal vs. post-ductal difference >3%, post-ductal value <94% or any value <90%
      - Indications: CHD or significant pathology that warrants specialty care
    - Heart Tones: should be assessed and discussed with receiving, however findings are not always reliable indicators of specific conditions for infants

- Treatment Considerations for Duct-Dependent Lesion
    - Prostaglandin therapy indicated with blue or grey babies less than one month of age (i.e. consider capabilities of receiving facility)
    - IV Fluids (consider incrementally at 5-10ml/kg per bolus)
        - Will improve preload
        - Will encourage further opening of PDA (and blood flow through duct)
    - Consider Inotropes/ Vasopressors early (Shock)
    - Positive Pressure ventilation cab increase PVR and decrease SVR (which adversely affects shunt flow), therefore consider minimal PEEP with PPV or Mechanical Ventilation
    - Rapid Sequence Intubation with Etomidate (over Ketamine), if indicated (Ketamine can worsen left-to-right shunt)

Other Congenital Conditions

- Robin Sequence
    - Combination of facial anomalies related to abnormal development of the mandible
    - With labored breathing, consider the following:
        - Place patient prone
        - Pass small (2.5) ETT to posterior oropharynx
        - LMA preferred to intubation

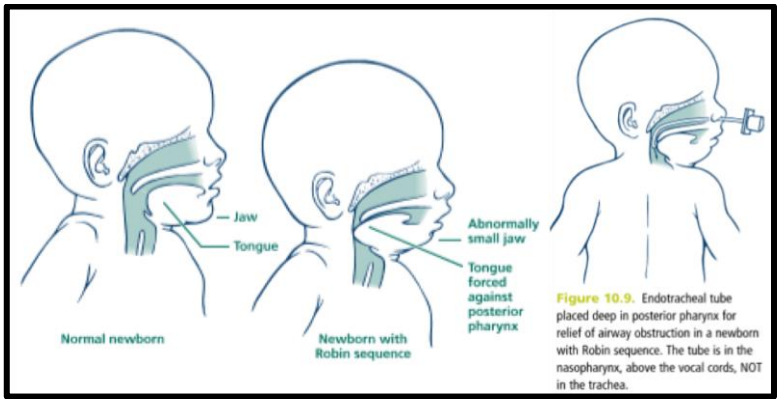


Figure 10.9. Endotracheal tube placed deep in posterior pharynx for relief of airway obstruction in a newborn with Robin sequence. The tube is in the nasopharynx, above the vocal cords, NOT in the trachea.

- Choanal Atresia
    - Condition in which nasal airway is obstructed by bone or tissue (usually unilateral)
    - Does respond well to PPV if indicated
    - Consider placement of short OPA to maintain airway patency

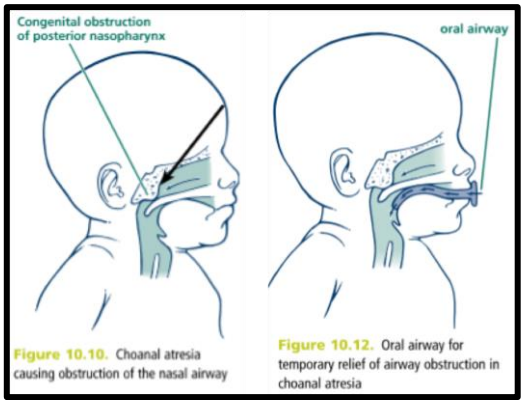


Figure 10.10. Choanal atresia causing obstruction of the nasal airway

Figure 10.12. Oral airway for temporary relief of airway obstruction in choanal atresia

- Diaphragmatic Hernia
    - Abnormal formation of the diaphragm, results in abdominal content within the chest cavity
    - Signs and symptoms: scaphoid abdomen, respiratory distress, hypoxemia
    - PPV via BVM can be detrimental, therefore intubate and place gastric tube

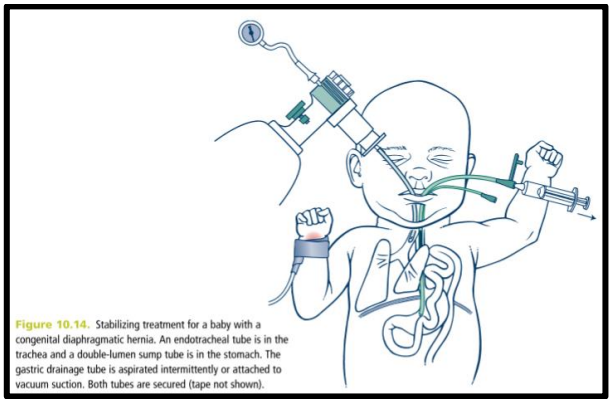
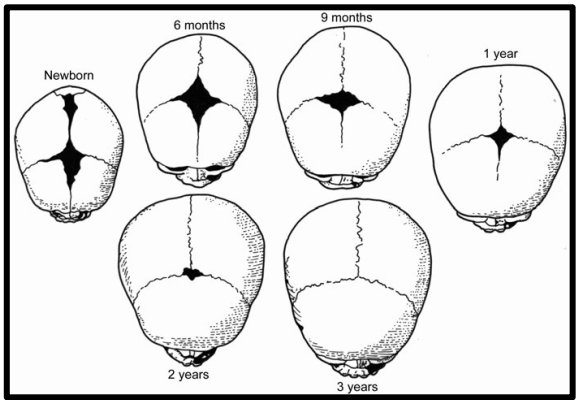


Figure 10.14. Stabilizing treatment for a baby with a congenital diaphragmatic hernia. An endotracheal tube is in the trachea and a double-lumen sump tube is in the stomach. The gastric drainage tube is aspirated intermittently or attached to vacuum suction. Both tubes are secured (tape not shown).

Congestive Heart Failure/ Pulmonary Edema

- Assessment
    - Often "pink" and well oxygenated; however, may be tachypneic or present with abnormal respirations
    - Assume wheezes in the infant result from CHF
    - Hepatomegaly (≥2cm below costal margin)
- Underlaying Pathology
    - Structural (i.e. CHD): VSD, ASD, Aortic Stenosis, PDA, etc.
    - Other: Dysrhythmia, cardiomyopathy, myocarditis
- Treatment
    - Use caution with supplemental oxygen
        - Oxygen promotes closure of a PDA
        - Infants may be able to tolerate a lower SpO2 than adults
    - Consider hydration status
        - CHF may be the result of tachycardia due to severe dehydration
        - Assess fontanelles & question staff/ caretaker about urine output



        - If IV Fluids indicated, consider smaller boluses of 5-10ml/kg
        - If not dehydrated (i.e. adequately hydrated/ overhydrated), Lasix: 1mg/kg IV, once

Rapid Sequence Intubation

1. Preparation
   - Continuous monitoring with PropaqMD
     - Baseline vitals (and q2min during RSI)
     - Set up EtCO2
     - Set alarms (especially SpO2)
   - Consider fluids (Shock) and/ or tension pneumothorax (Needle Chest Decompression)
   - Equipment
     (for pediatric sizes, use Broselow or reference chart next page)
     - Suction (hook it up)
     - Handle, blade, and alternative
     - Tube and extras (1/2 size up and down)
     - Bougie
     - Backup airway
   - Consider laryngoscopy technique (HEAVEN Criteria, see opposite page)
   - Draw up medications (see below)

2. Preoxygenation
   - HOB elevated
   - Passive oxygenation with regular NC at 15lpm
   - NRB or BVM
     - Two-person BVM technique
     - PEEP valve with BVM
   - NPA x2 (and OPA, if possible)

3. Pretreatment (choose one)
   - Ketamine 1 – 2mg/kg IV
     - Preferred with Bronchospasm
     - Caution with hypertension or concern for increased ICP
   - Etomidate 0.3mg/kg (max 40mg) IV
     - Caution with sepsis

4. Paralysis (choose one)
   - Rocuronium 1mg/kg IV
     - Caution with seizures
   - Succinylcholine 1.5-2mg/kg (2mg/kg pediatric) IV
     - Multiple contraindications (see opposite page)

5. Positioning
   - Remove collar and manually hold c-spine if indicated
   - Sniffing position if not contraindicated
   - Consider position of crew/ space

6. Placement
   - Suction prior to attempt (consider SALAD Technique)
   - Direct/ video visualization
   - Confirm with EtCO2 waveform
   - Confirm absence of epigastric sounds, presence of breath sounds

7. Post-Intubation
   - Secure tube
   - Ventilator Management
   - Analgesia & Sedation (Pain, Agitation & Nausea)
   - OG tube & temperature probe

Heaven Criteria
- Hypoxemia
  - DL faster if straightforward
  - VL may be faster with anatomic difficulty
- Extremes of size
  - Large: VL (out-to-in), then DL (in-to-out) if not recognized
  - Small: DL with straight blade
- Anatomic Disruption/ Obstruction
  - VL (out-to-in), then DL (in-to-out) if not recognized
  - DL if bloody
- Vomit/ Blood/ Fluid
  - DL with strong lift
  - VL with SALAD Technique
- Exsanguination
  - DL faster, VL with anatomic difficulty
- Neck Mobility/ Neurologic Injury
  - Gentler VL

Contraindications to Succinylcholine
- Hyperkalemia
- Crush/ severe trauma >2 days
- Spinal cord injury >2 days
- Burn >24 hours
- Renal failure
- Pseudocholinesterase deficiency
- Known history of malignant hyperthermia
- Neuromuscular disorders (i.e. muscular dystrophy)
- Penetrating eye injury

Pediatric Airway Stuff

Table 5-4. Initial endotracheal tube insertion depth ("tip to lip") for orotracheal intubation

Gestation (weeks)	Endotracheal tube insertion depth at lips (cm)	Baby's Weight (grams)
23-24	5.5	500-600
25-26	6.0	700-800
27-29	6.5	900-1000
30-32	7.0	1,100-1,400
33-34	7.5	1,500-1,800
35-37	8.0	1,900-2,400
38-40	8.5	2,500-3,100
41-43	9.0	3,200-4,200

Adapted from Kempley ST, Moreira JW, Petrone FL. Endotracheal tube length for neonatal intubation. *Resuscitation*. 2008;77(3):369-373.

Table 5-1. Endotracheal tube size for babies of various weights and gestational ages

Weight (g)	Gestational Age (wks)	Endotracheal Tube Size (mm ID)
Below 1,000	Below 28	2.5
1,000-2,000	28-34	3.0
Greater than 2,000	Greater than 34	3.5

Table 5-2. Suction catheter size for endotracheal tubes of various inner diameters

Endotracheal Tube Size (mm ID)	Catheter Size
2.5	5F or 6F
3.0	6F or 8F
3.5	8F

TABLE 24-1 Equipment Selection

	Pink[a]	Red	Purple	Yellow	White	Blue	Orange	Green
Length (cm)-based pediatric equipment chart								
Weight (kg)	6–7	8–9	10–11	12–14	15–18	19–23	23–31	31–41
Length (cm)	60.75–67.75	67.75–75.25	75.25–85	85–98.25	98.25–110.75	110.75–122.5	122.5–137.5	137.5–155
ETT size (mm)	3.5 uncuff, 3.0 cuff	3.5 uncuff, 3.0 cuff	4.0 uncuff, 3.5 cuff	4.5 uncuff, 4.0 cuff	5.0 uncuff, 4.5 cuff	5.5 uncuff, 5.0 cuff	6.0 cuff	6.5 cuff
Lip-to-tip length (mm)	10–10.5	10.5–11	11–12	12.5–13.5	14–15	15.5–16.5	17–18	18.5–19.5
Laryngoscope size+blade	1 straight	1 straight	1 straight	2 straight	2 straight	2 straight or curved	2 straight or curved	3 straight or curved
Suction catheter	8F	8F	8F	8F–10F	10F	10F	10F	12F
Stylet	6F	6F	10F	10F	10F	10F	14F	14F
Oral airway (mm)	50	50	60	60	60	70	80	80
Nasopharyngeal airway	14F	14F	18F	20F	22F	24F	26F	30F
Bag/valve device	Infant	Infant	Child	Child	Child	Child	Child/adult	Adult
Oxygen mask	Newborn	Newborn	Pediatric	Pediatric	Pediatric	Pediatric	Adult	Adult
Vascular access	22–24/23–25	22–24/23–25	20–22/23–25	18–22/21–23	18–22/21–23	18–20/21–23	18–20/21–22	16–20/18–21
Catheter/butterfly	Intraosseous	Intraosseous	Intraosseous	Intraosseous	Intraosseous	Intraosseous		
NG tube	5–8F	5–8F	8–10F	10F	10–12F	12–14F	14–18F	18F
Urinary catheter	5–8F	5–8F	8–10F	10F	10–12F	10–12F	12F	12F
Chest tube	10–12F	10–12F	16–20F	20–24F	20–24F	24–32F	24–32F	32–40F
BP cuff	Newborn/infant	Newborn/infant	Infant/child	Child	Child	Child	Child/adult	Adult
LMA[b]	1.5	1.5	2	2	2	2–2.5	2.5	3

Directions for use: (1) measure patient length with centimeter tape or with a Broselow tape; (2) using measured length in centimeters or Broselow tape measurement, access appropriate equipment column; (3) column for ETTs, oral and nasopharyngeal airways, and LMAs; always select one size smaller and one size larger than the recommended size.

[a]For infants smaller than the pink zone, but not preterm, use the same equipment as the pink zone.

[b]Based on manufacturer's weight-based guidelines:

Mask size	Patient size (kg)
1	≤5
1.5	5–10
2	10–20
2.5	20–30
3	>30

Permission to reproduce with modification from Luten RC, Wears RL, Broselow J, et al. Managing the unique size related issues of pediatric resuscitation: reducing cognitive load with resuscitation aids. *Acad Emerg Med.* 1992;21:900–904.

Invasive Mechanical Ventilation

1. Set up and check vent circuit, attach HME (at patient's face) and HEPA filter (at vent)

2. Determine Settings

Patient Already on Ventilator (i.e. from sending facility)

1. Assess patient, with focus on the following:
    a. SpO2
    b. EtCO2
    c. Comfort

and also check out our free vent book on the website (click here)

2a. If acceptable, mirror settings

2b. If unacceptable, either:
    a. Adjust settings to address specific parameters and reevaluate
    b. Determine new setting as if patient not on ventilator (below)

Patient Not on Ventilator (i.e. field intubation)

1. Calculate IBW
    Male formula:
        2.3(inches over 5') + 50
    Female formula:
        2.3(inches over 5') + 45.5
    For pediatric patients, use Broselow tape
2. Calculate desired TV and MV:
    TV = 6ml/kg IBW
    MV = 100ml/kg/min
3. Choose patient size (adult, pediatric, infant)
4. Dial in desired TV (adult size only, others default to PC)
3. Adjust rate to 17 (adult size only, go with defaults for pediatric/ infant)
4. Leave all other values at ventilator defaults, unless:

Consideration	**Evidence** (in addition to clinical impression/ diagnosis)	**Intervention**
Bronchospasm	Wheezes on auscultation "Shark fin" EtCO2 waveform	Increase I:E (≥1:4) by decreasing RR
Hypotension	Adult: SBP <90 Pedi: SBP < 70 + 2 x years	Increase TV to 10ml/kg IBW (or max Pplat) and decrease RR to maintain MV
Acidosis	Low pH Kussmaul's Respirations EtCO2 >45	Increase RR by up to 100% (i.e. double it; goal MV is 200ml/kg/min)
*with concurrent Hypotension and Acidosis, defer to Acidosis initial settings		
Acute Lung Injury/ ARDS	Bilateral infiltrates on CXR PaO2/FiO2 < 300	Decrease TV to 4ml/kg IBW and increase RR to maintain MV Consider higher PEEP (also clamp ETT on transfer)

3. Initiate Ventilation

*consider clamping ETT on transfer to vent if concerned with recruitment

4. Initial Parameters to Consider

Parameter	Normal	Intervention
SpO2	93-99%	*Low*: consider position & suction, increase FiO2, then increase PEEP (1-2cm incrementally); consider pathophysiology/ medications; increase I-time/ invert I:E *High*: decrease FiO2 (unless contraindicated, i.e. pregnancy, anemia, severe hemorrhage, etc.)
EtCO2	35-45mmHg (30-35 with TBI)	*Any abnormal value*: consider etiology/ patient compensation for acid-base imbalance *High*: increase TV (max 10ml/kg IBW, monitor Pplat), then consider increase in RR *Low*: consider perfusion status, decrease RR (monitor MV), then consider decrease in TV
Comfort	Ramsay ≤5 or ANPS at provider discretion	Analgesia and sedation (Pain, Agitation & Nausea) Consider settings: MV, I-time Also consider tachypnea/ overbreathing
PIP	<35mmH2O	Consider secretions and/ or Bronchospasm Check circuit for kinks, consider patient position Decrease TV
Pplat	<30mmH2O	Consider pneumothorax and/ or pulmonary edema Decrease TV
AutoPEEP	none	Increase I:E Consider disconnecting circuit to allow exhalation Consider triggers: accidental? if not, increase/ change
MV	100ml/kg/min (200 with acidosis)	*Low*: increase TV and/ or RR *High*: consider patient comfort, monitor EtCO2, decrease TV and/ or RR, consider SIMV

5. Ongoing Management of Specific Considerations

Consideration	Strategy
Bronchospasm	Set up in-line neb treatment (away from wye on inhalation side, remove HME) Consider Ketamine for analgesia/ sedation EtCO2 may be elevated at baseline
Hypotension	Use caution with PEEP Consider fluids and/ or pressors early (Shock)
Acidosis	Consider and adjust to increased MV goal of 200ml/kg/min Realize that EtCO2 may be out of reference range
Acute Lung Injury/ ARDS	Consider recruitment maneuvers Higher PEEP may be needed Inverted I:E may help, but will likely lead to discomfort

6. Additional Considerations

Interventions

- Elevate height of bed
- Place OG tube
- Monitor core body temperature

Pediatrics

- Pediatric and Infant profiles default to PC mode
- Revel vent not recommended for patients <5kg
- Pediatric circuit to be used for patients <20kg

Pressure Control

- Adjust PC to target TV (measured by Vte)
- Vte will vary with each breathe, therefore monitor continuously
- Plateau pressure not measured
- Can be considered for any patient population

SIMV

- Consider as alternative to AC with airtrapping/ AutoPEEP, patient discomfort, and/or overbreathing
- SIMV does not guarantee MV, therefore monitor Vte (with both machine-delivered and patient-triggered breaths) and resultant MV
- Additional parameters may be adjusted to maintain patient comfort: Rise Profile, Time/ Flow Termination

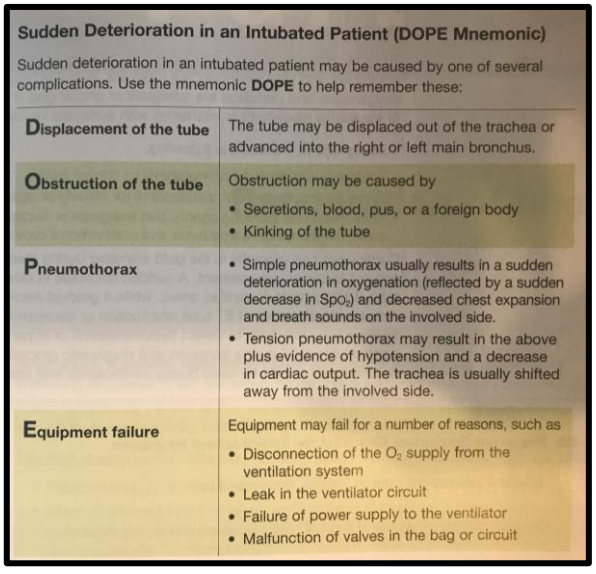
PRVC

- To be used by providers with adequate understanding and competence, given all crewmembers agree to strategy

Alarms

- Alarm limits should be set appropriately for all patients
- Providers should be familiar with troubleshooting all alarms (versus simply silencing them) and can refer to Revel Operating Guide for further information

Consider DOPE mnemonic



Sudden Deterioration in an Intubated Patient (DOPE Mnemonic)

Sudden deterioration in an intubated patient may be caused by one of several complications. Use the mnemonic **DOPE** to help remember these:

Displacement of the tube	The tube may be displaced out of the trachea or advanced into the right or left main bronchus.
Obstruction of the tube	Obstruction may be caused by • Secretions, blood, pus, or a foreign body • Kinking of the tube
Pneumothorax	• Simple pneumothorax usually results in a sudden deterioration in oxygenation (reflected by a sudden decrease in Spo_2) and decreased chest expansion and breath sounds on the involved side. • Tension pneumothorax may result in the above plus evidence of hypotension and a decrease in cardiac output. The trachea is usually shifted away from the involved side.
Equipment failure	Equipment may fail for a number of reasons, such as • Disconnection of the O_2 supply from the ventilation system • Leak in the ventilator circuit • Failure of power supply to the ventilator • Malfunction of valves in the bag or circuit

Non-Invasive Positive Pressure Ventilation

1. **Assess mental status and airway patency**
    1. Patient must be able to follow commands
    2. Patient must be able to protect his or her own airway
2. **Set up vent for NPPV**
    1. Check vent circuit
    2. Attach HME and HEPA filters
    3. Ensure that mask to be used is a non-vented mask
    4. Utilize low-pressure oxygen source
3. **Determine Settings**

    Patient Already on Ventilator (i.e. from sending facility)

    1. Assess patient comfort

    2a. If acceptable, set Revel as follows:
        a. Match EPAP/ PEEP
        b. If transitioning from open system to closed system, set IPAP at 4cm below current IPAP (note the difference between additive and summative reporting of values)
        c. Set rate to 0

    2b. If unacceptable, either:
        a. Adjust settings to address specific parameters and reevaluate (step 4)
        b. Determine new settings as if patient not on ventilator (below)

    Patient Not on Ventilator (i.e. initiating in the field)

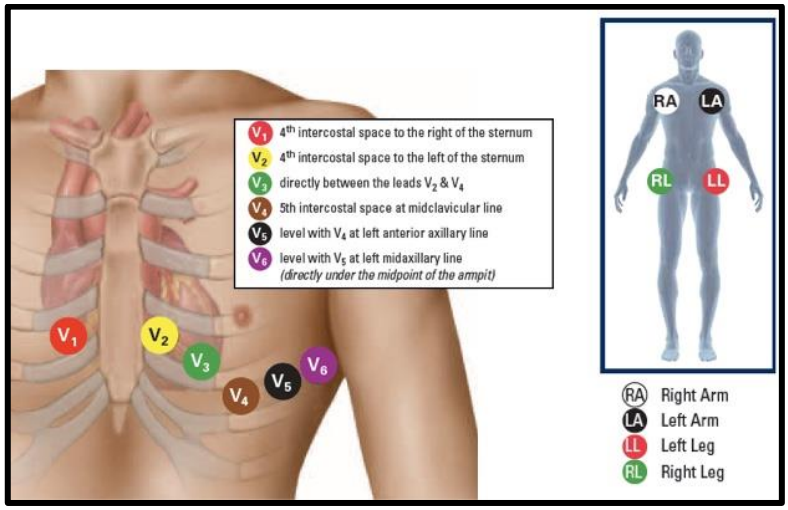
    1. Set EPAP/ PEEP to 5
    2. Set IPAP to 10 (PS to 5)
    3. Set rate to 0
4. **Consider additional adjustments to address patient comfort**
    1. Rise profile: default is 4 (ranges 1-9); consider lower value to start
    2. Flow termination: default is 25% (ranges 10 to 40%); consider higher value to start
    3. Time termination: default is 2.0s (ranges .3 – 3s); 2.0s is adequate
    4. Cancelling alarms
        a. low MV, low peak pressure (main console)
        b. low PEEP, high frequency (extended menu)
5. **Initiate NPPV with mask held against patient's face (preferably with patient doing so)**
6. **Reconsider parameters**
    1. EPAP/ PEEP: increase to improve oxygenation
    2. IPAP/ PS: increase to improve ventilation/ titrate to work of breathing
    3. Rise profile: ask patient if breath is too fast or slow (too fast, titrate up; too slow, titrate down)
    4. Flow termination
        - ask if it is difficult to exhale (if yes, titrate up)
        - ask if the breath is too short or too long (too short, titrate down; too long, titrate up)
    5. Time termination: will not routinely require adjustment, however if "PS" on the vent face flashes as patient inhales, consider titrating this parameter down
7. **Once patient is comfortable with vent setting, apply headstraps and proceed with transport**

NPPV should be immediately discontinued if any of the following occur:

- Patient becomes unable to follow commands
- Patient becomes unable to protect his or her airway
- Consequences of patient discomfort/ anxiety outweigh benefit of therapy

12-lead EKG

1. Place leads and capture image



2. Assess for MI

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Personal Quick Reference Sheets

Infarction (pages 259 to 308)

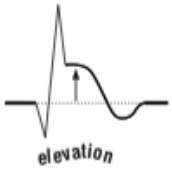
from: ***Rapid Interpretation of EKG's***

by Dale Dubin, MD
COVER Publishing Co., P.O. Box 07037, Fort Myers, FL 33919, USA

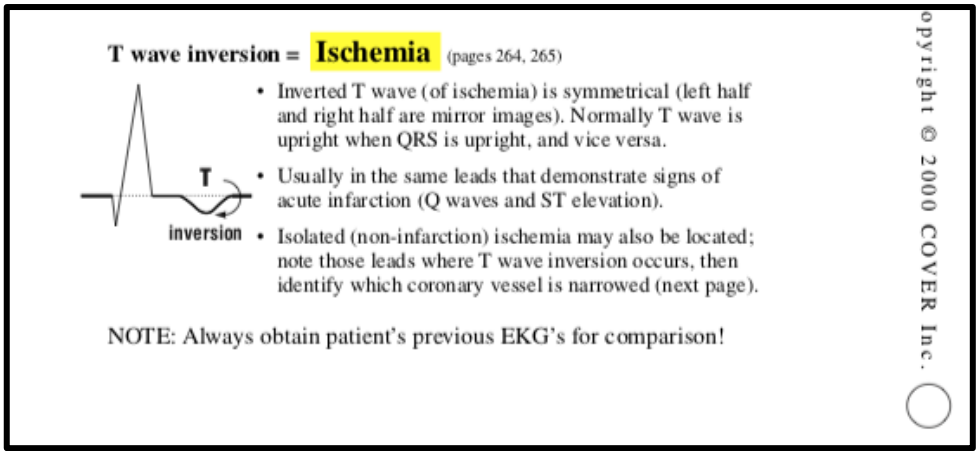
Q wave = Necrosis (significant Q's only) (pages 272-284)

- Significant Q wave is one millimeter (one small square) wide, which is .04 sec. in duration…
  … or is a Q wave 1/3 the amplitude (or more) of the QRS complex.
- Note those leads (omit AVR) where significant Q's are present … see next page to determine infarct location, and to identify the coronary vessel involved.
- Old infarcts: significant Q waves (like infarct damage) remain for a lifetime. To determine if an infarct is acute, see below.

ST (segment) elevation = (acute) Injury (pages 266-271) **(also Depression)**

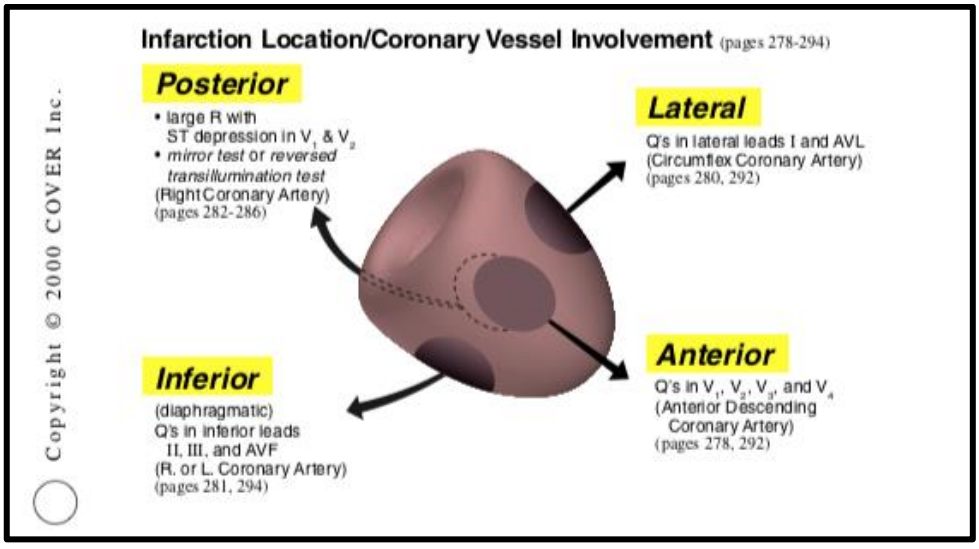


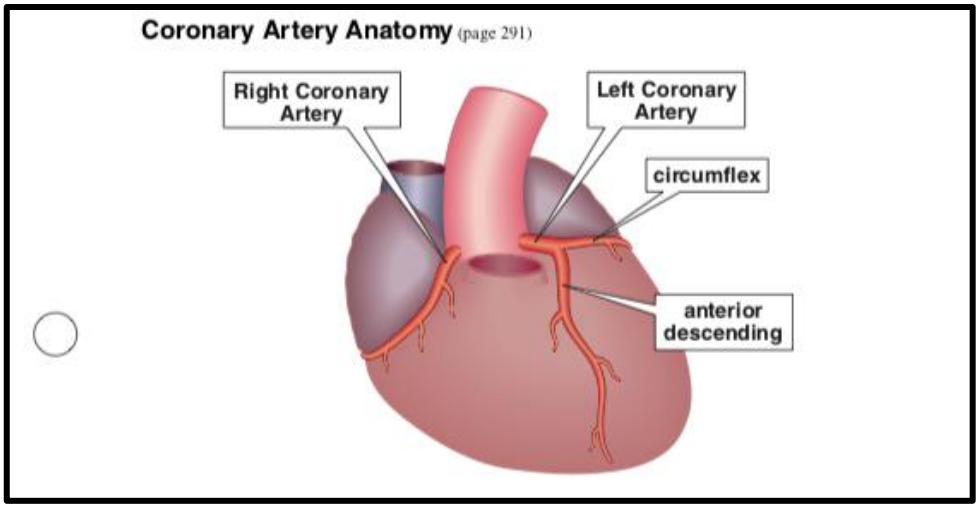
- Signifies an acute process, ST segment returns to baseline with time.
- ST elevation associated with significant Q waves indicates an acute (or recent) infarct.
- A tiny "non-Q wave infarction" appears as significant ST segment elevation without associated Q's. Locate by identifying leads in which ST elevation occurs (next page).
- ST depression (persistent) may represent "subendocardial infarction," which involves a small, shallow area just beneath the endocardium lining the left ventricle. This is also a variety of "non-Q wave infarction." Locate in the same manner as for infarction location (next page).



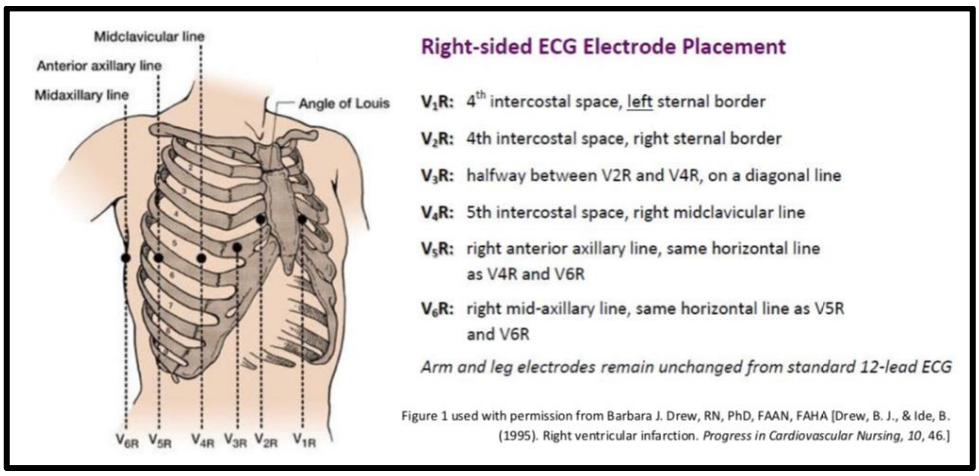
3. Identify area of heart affected by changes

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

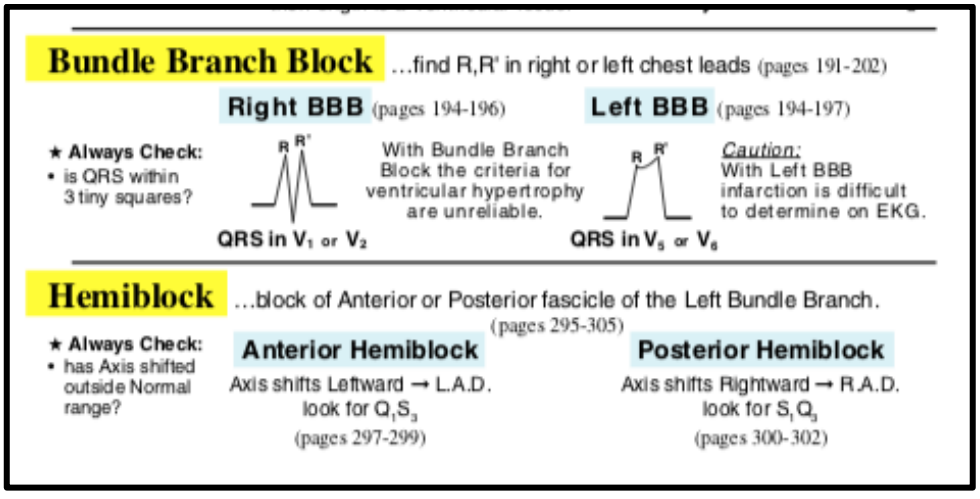




4. Perform additional actions as indicated
   - Right-sided EKG



   - Assess for Blocks



- Sgarbossa Criteria

Sgarbossa Criteria Overview

- In patients with left bundle branch block (LBBB) or ventricular paced rhythm, infarct diagnosis based on the ECG is difficult.
- The baseline ST segments and T waves tend to be shifted in a discordant direction ("appropriate discordance"), which can mask or mimic acute myocardial infarction.
- However, serial ECGs may show dynamic ST segment changes during ischemia.
- A new LBBB is *always* pathological and can be a sign of myocardial infarction.
- First described by Elena B Sgarbossa in 1996

Original Sgarbossa Criteria

The original *three criteria* used to diagnose infarction in patients with LBBB are:

- **Concordant ST elevation > 1mm** in leads with a positive QRS complex (score 5)
- **Concordant ST depression > 1 mm** in V1-V3 (score 3)
- **Excessively discordant ST elevation > 5 mm** in leads with a -ve QRS complex (score 2).

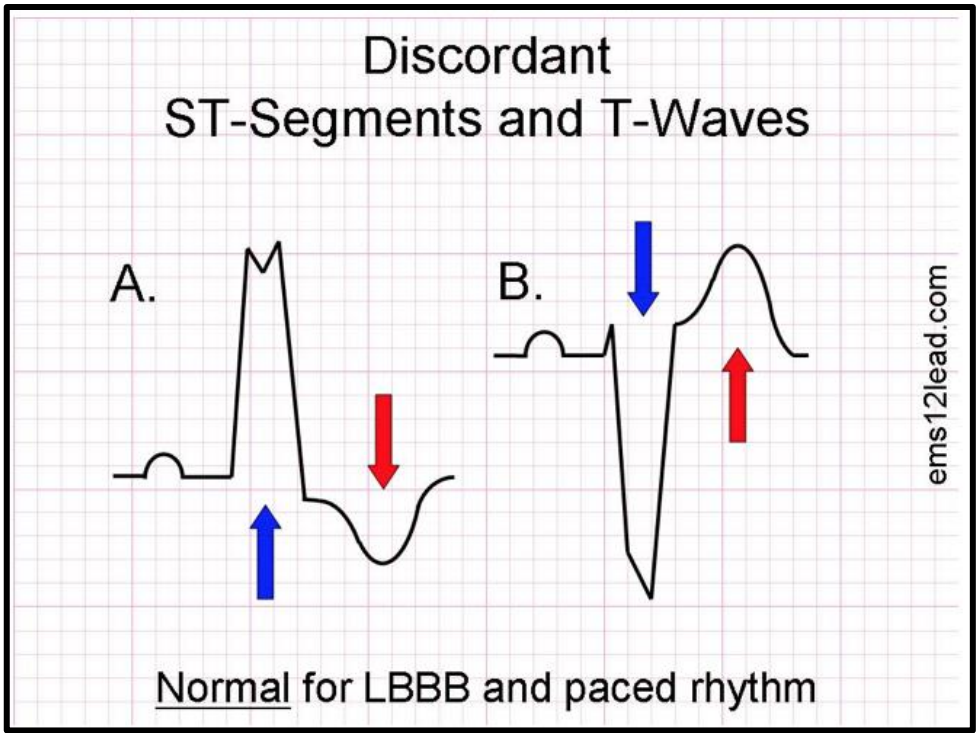
These criteria are specific, but not sensitive for myocardial infarction. A total score of ≥ 3 is reported to have a specificity of 90% for diagnosing myocardial infarction.

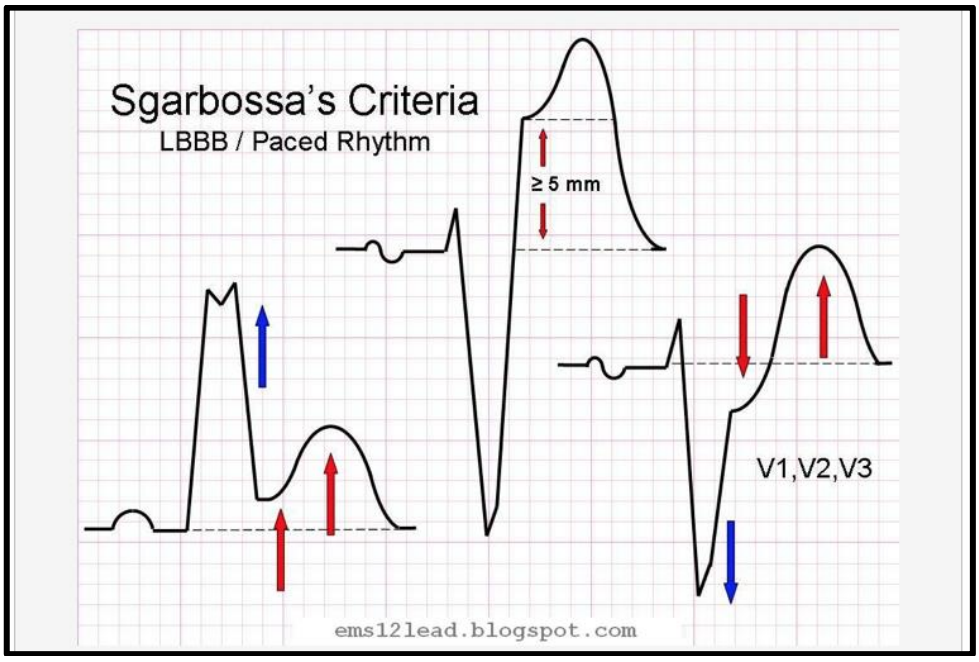
Modified Sgarbossa Criteria

As discussed in this article by Stephen Smith, modified Sgarbossa criteria have been created to improve diagnostic accuracy. The most important change is the modification of the rule for **excessive discordance**. The use of a 5 mm cutoff for excessive discordance was arbitrary and non-specific — for example, patients with LBBB and large voltages will commonly have ST deviations > 5 mm in the absence of ischaemia.The modified rule is positive for STEMI if there is discordant ST elevation with amplitude > 25% of the depth of the preceding S-wave.

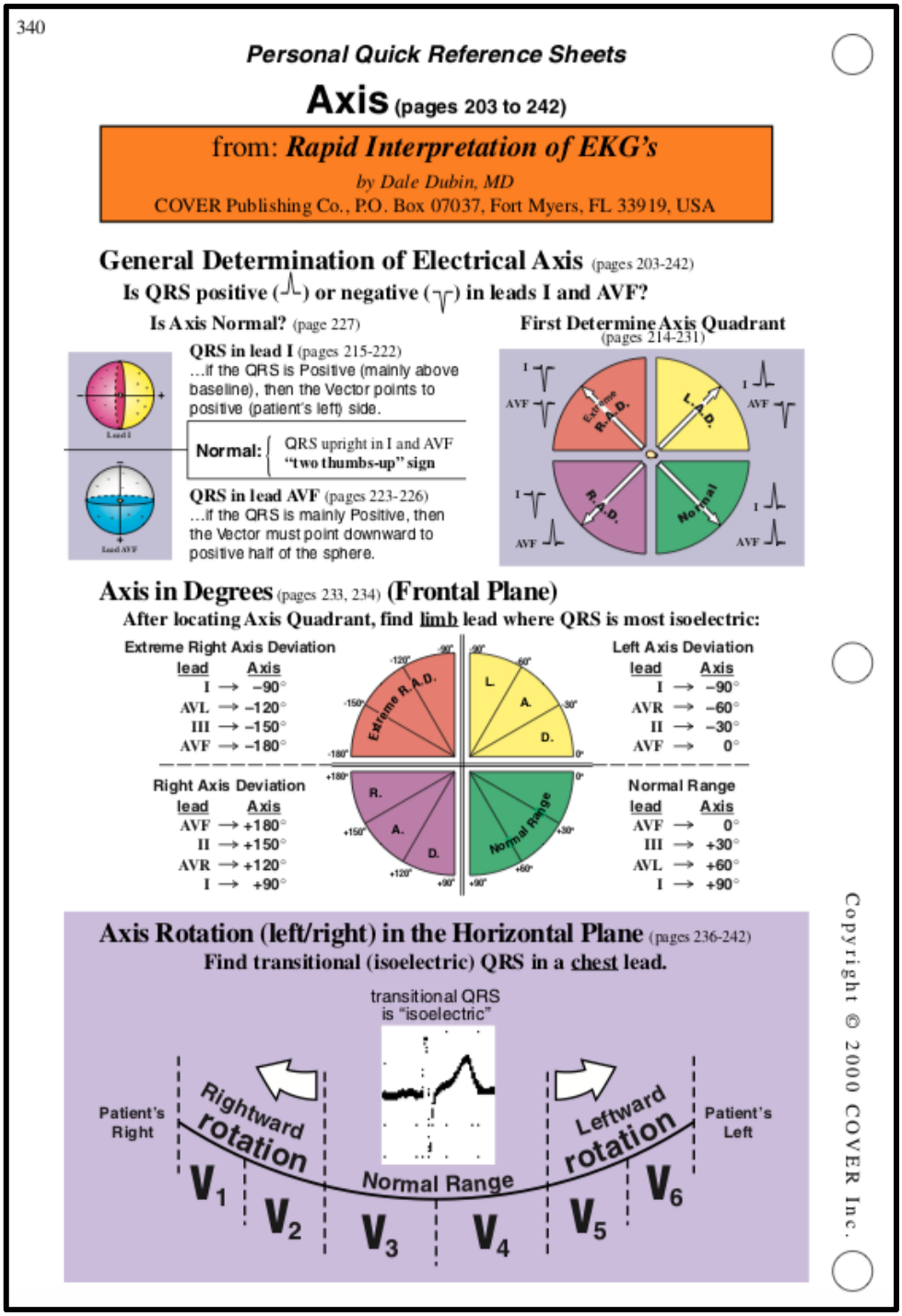
Modified Sgarbossa Criteria:

- ≥ 1 lead with ≥1 mm of concordant ST elevation
- ≥ 1 lead of V1-V3 with ≥ 1 mm of concordant ST depression
- ≥ 1 lead anywhere with ≥ 1 mm STE and proportionally excessive discordant STE, as defined by ≥ 25% of the depth of the preceding S-wave.


Discordant
ST-Segments and T-Waves
A.
B.
ems12lead.com
Normal for LBBB and paced rhythm


Sgarbossa's Criteria
LBBB / Paced Rhythm
≥ 5 mm
V1,V2,V3
ems12lead.blogspot.com

- Axis Deviation/ R wave progression



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Personal Quick Reference Sheets

Axis (pages 203 to 242)

from: ***Rapid Interpretation of EKG's***

by Dale Dubin, MD

COVER Publishing Co., P.O. Box 07037, Fort Myers, FL 33919, USA

General Determination of Electrical Axis (pages 203-242)

Is QRS positive (┘┴└) or negative (┐┬┌) in leads I and AVF?

Is Axis Normal? (page 227)

QRS in lead I (pages 215-222)
...if the QRS is Positive (mainly above baseline), then the Vector points to positive (patient's left) side.

Normal: QRS upright in I and AVF "two thumbs-up" sign

QRS in lead AVF (pages 223-226)
...if the QRS is mainly Positive, then the Vector must point downward to positive half of the sphere.

First Determine Axis Quadrant (pages 214-231)

Axis in Degrees (pages 233, 234) **(Frontal Plane)**

After locating Axis Quadrant, find limb lead where QRS is most isoelectric:

Extreme Right Axis Deviation

lead	Axis
I	−90°
AVL	−120°
III	−150°
AVF	−180°

Left Axis Deviation

lead	Axis
I	−90°
AVR	−60°
II	−30°
AVF	0°

Right Axis Deviation

lead	Axis
AVF	+180°
II	+150°
AVR	+120°
I	+90°

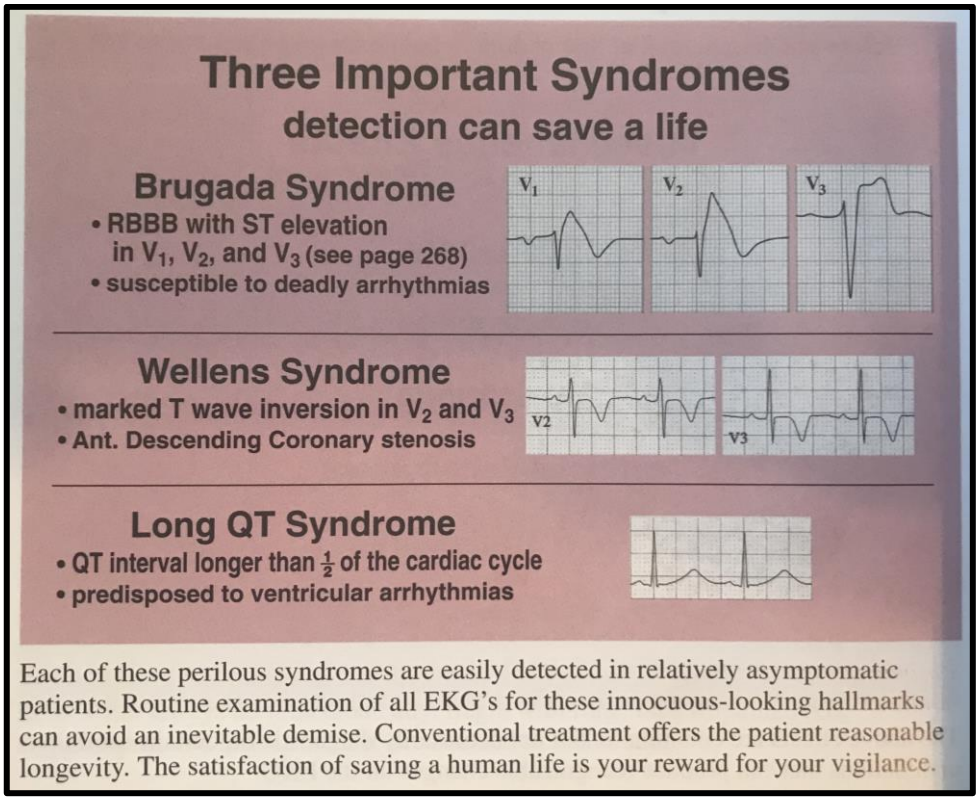
Normal Range

lead	Axis
AVF	0°
III	+30°
AVL	+60°
I	+90°

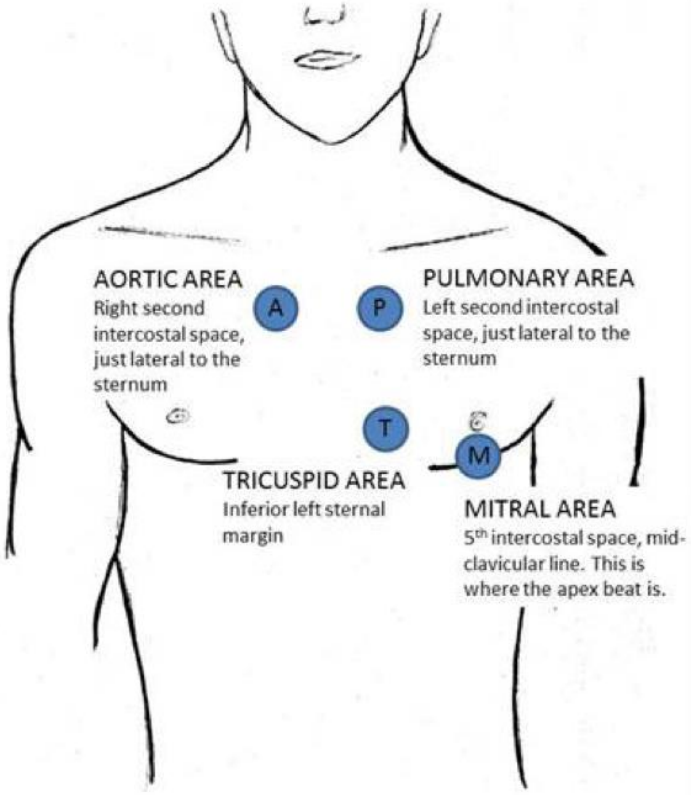
Axis Rotation (left/right) in the Horizontal Plane (pages 236-242)

Find transitional (isoelectric) QRS in a chest lead.

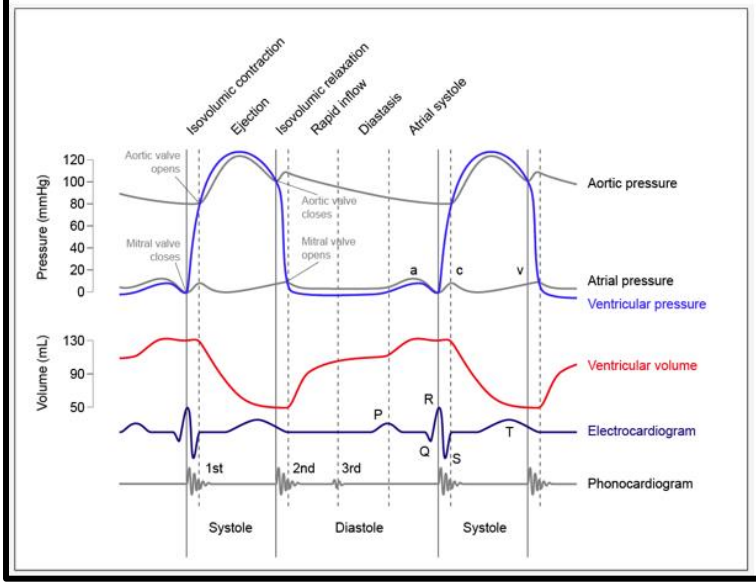
- Additional Findings

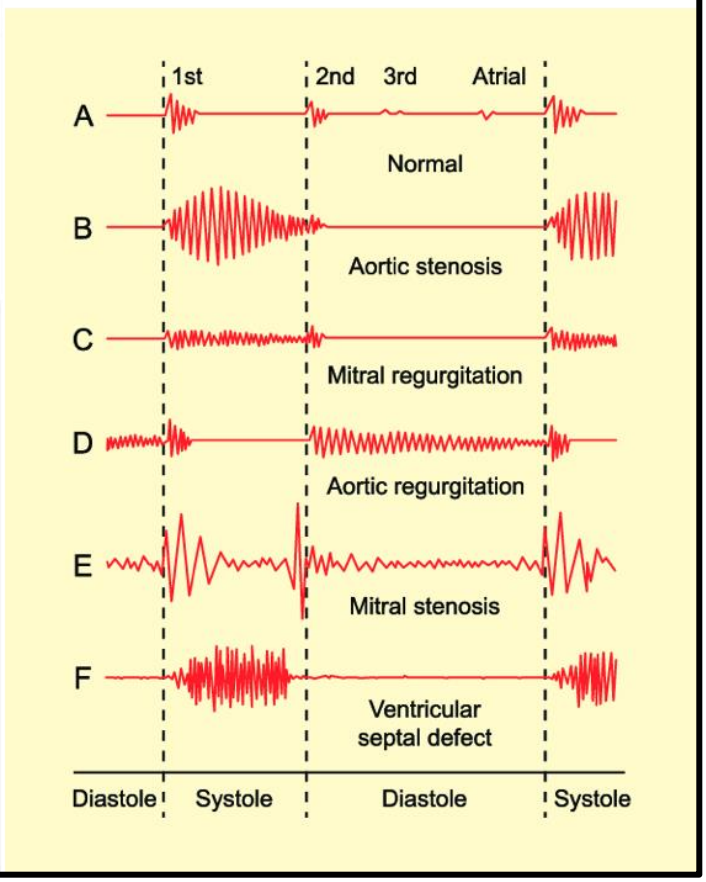


Assessing Heart Tones



Systolic murmurs	Diastolic murmurs
Midsystolic Aortic stenosis Pulmonic stenosis Atrial septal defect HOCM **Holosystolic** Mitral regurgitation Tricuspid regurgitation VSD **Late systolic murmur** Mitral valve prolapse	**Early diastolic** Aortic regurgitation Pulmonic regurgitation Austin-Flint **Mid/late diastolic** Mitral stenosis Tricuspid stenosis **Other rare murmurs** Patent ductus arteriosus

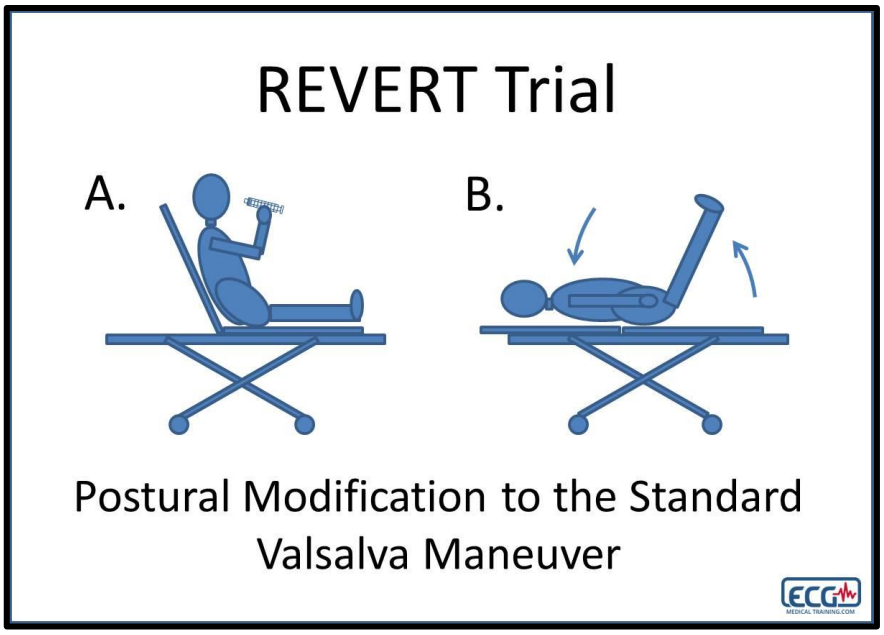




Vagal Maneuvers

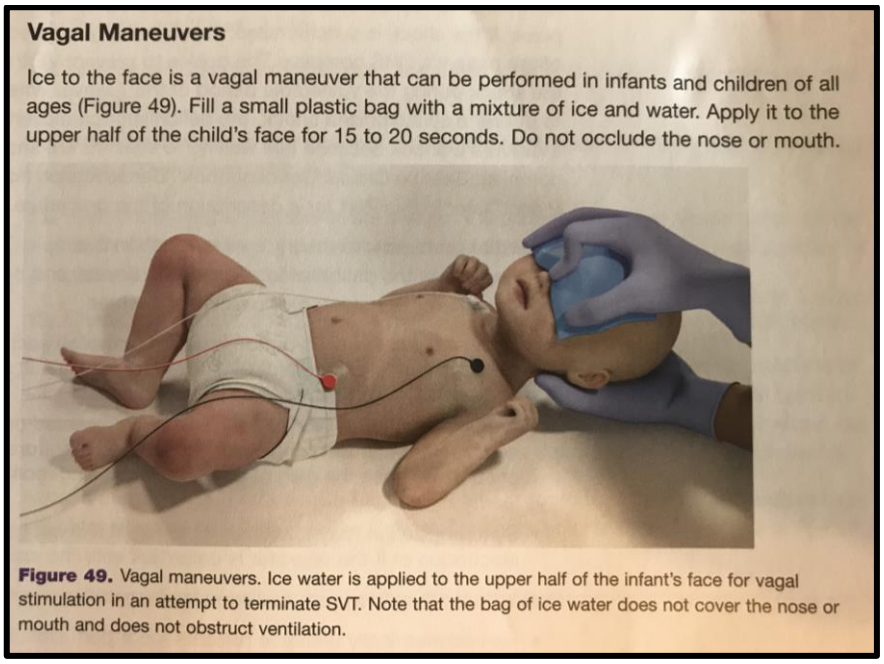
Modified Valsalva Maneuver

- Position patient upright/ sitting
- Have patient blow in to a 10ml syringe, hard enough to move the plunger and for as long as possible (15 seconds is goal)
- Afterwards, lay patient supine and raise the feet as depicted below



Ice to the Face

- Fill small plastic bag with ice water (or use an activated cold pack)
- Apply to upper half of patient's face for 15-20 seconds



Thrombolytic Checklist

If any of the following are noted, DO NOT administer thrombolytics:

- Stroke or head trauma within the past three months
- Previous intracranial hemorrhage
- Previous intracranial or intraspinal surgery
- SBP ≥185 or DBP ≥110 that does not respond to treatment
- BGL <50mg/dL that does not respond to treatment
- Bleeding, clotting problem or blood thinners
    - Active internal bleeding
    - Platelet count <100,000mm3
    - Current Warfarin use with INR >1.7 or current Heparin use
- Right arm vs left arm SBP difference >15
- Pregnant female
- Serious systemic disease (i.e. advanced cancer, severe liver or kidney disease)

Prior to administration, attempt to contact Medical Director to discuss plan of care.

Acid-Base Analysis

Table 2-3 Key Blood Gas Results

Parameter	Normal Range	Abnormal Findings	
		Acid	Alkali
pH	7.35–7.45	↓	↑
Pco_2, mm Hg	35–45	↑	↓
Base excess	–2 to +2	↓	↑
Bicarbonate, mEq/L	22–26	↓	↑

Table 7-4 Precipitants of Respiratory Acidosis

Acute	Chronic
Pharmacologic CNS Depression	***Lung Disease***
▪ Narcotics ▪ Benzodiazepines ▪ Alcohol abuse ▪ Gamma-hydroxybutyrate (GHB) toxicity	▪ Chronic bronchitis ▪ COPD ▪ Pulmonary fibrosis
Lung Disease	***Neuromuscular Diseases***
▪ Interstitial edema ▪ Pneumonia	▪ Muscular dystrophy ▪ Myasthenia gravis
Airway Problems	***Obesity***
▪ Foreign body ▪ Aspiration ▪ Bronchospasm ▪ Apnea	▪ Sleep apnea
Hypoventilation	
▪ Pneumothorax ▪ Flail chest ▪ Myasthenia gravis ▪ Guillain-Barré syndrome ▪ Primary CNS disorders ▪ Brain injury	

CNS, central nervous system; *COPD*, chronic obstructive pulmonary disease.

Table 7-5 Precipitants of Respiratory Alkalosis

Pulmonary
▪ Pulmonary embolism ▪ Pneumonia (bacterial or viral) ▪ Acute pulmonary edema ▪ Atelectasis ▪ Assisted hyperventilation
Infections
▪ Septicemia
Drug Induced
▪ Vasopressors ▪ Thyroxine ▪ Aspirin or caffeine toxicity
Hypoxia
▪ Ventilation-perfusion mismatch ▪ Altitude changes ▪ Severe anemia
Hyperventilation
▪ Hysteria/anxiety ▪ Psychogenic disorders ▪ Central nervous system tumor ▪ Stroke
Metabolic and Electrolyte Disturbances
▪ Hepatic insufficiency ▪ Encephalopathy ▪ Hyponatremia

Table 7-6 Precipitants of Metabolic Alkalosis

Normal Saline-Responsive Metabolic Alkalosis	Normal Saline-Unresponsive Metabolic Alkalosis
Volume depletion ▪ Vomiting ▪ Nasogastric suction ▪ Diuretic use ▪ Low chloride ingestion	Mineralocorticoid excess
	Exogenous ingestions ▪ Chewing tobacco ▪ Licorice
	Primary aldosteronism
	Cushing's syndrome
	Bartter syndrome

RAPID RECALL

CAT MUDPILES

Mnemonic for Precipitants of High-Anion-Gap Metabolic Acidosis

- **C** Carbon monoxide or cyanide intoxication
- **A** Alcohol intoxication or alcoholic ketoacidosis
- **T** Toluene exposure
- **M** Methanol exposure
- **U** Uremia
- **D** Diabetic ketoacidosis
- **P** Paraldehyde ingestion
- **I** Isoniazid or iron intoxication
- **L** Lactic acidosis
- **E** Ethylene glycol intoxication
- **S** Salicylate (ASA) intoxication

ASA, Acetylsalicylic acid.

RAPID RECALL

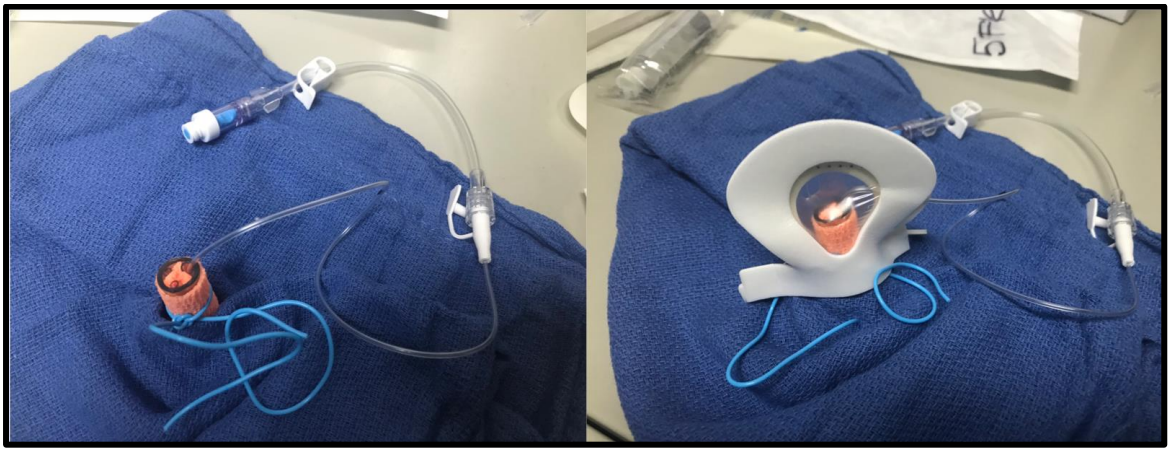
F-USED CARS

Mnemonic for Precipitants of Normal-Anion-Gap Metabolic Acidosis

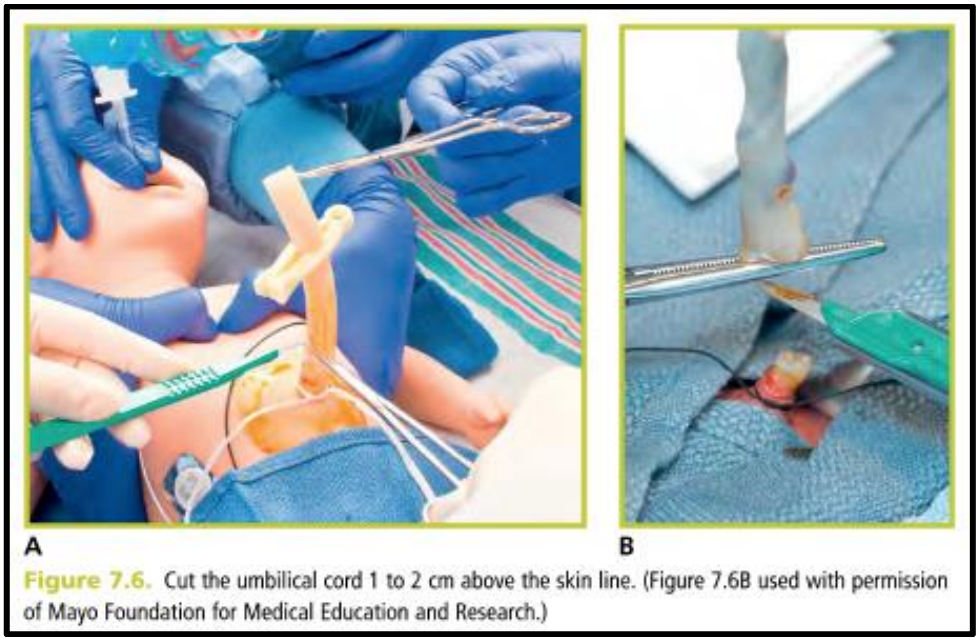
- **F** Fistulae, pancreatic
- **U** Ureteroenteric conduits
- **S** Saline administration (0.9% normal saline)
- **E** Endocrine dysfunction
- **D** Diarrhea
- **C** Carbonic anhydrase inhibitor ingestion
- **A** Arginine, lysine (parenteral nutrition)
- **R** Renal tubular acidosis
- **S** Spironolactone (diuretic) ingestion

Umbilical Vein Catheterization

5F feeding tube + saline lock, secure with tegaderms



Tie place at base of umbilical cord, new cut made in cord



A B

Figure 7.6. Cut the umbilical cord 1 to 2 cm above the skin line. (Figure 7.6B used with permission of Mayo Foundation for Medical Education and Research.)

Place catheter

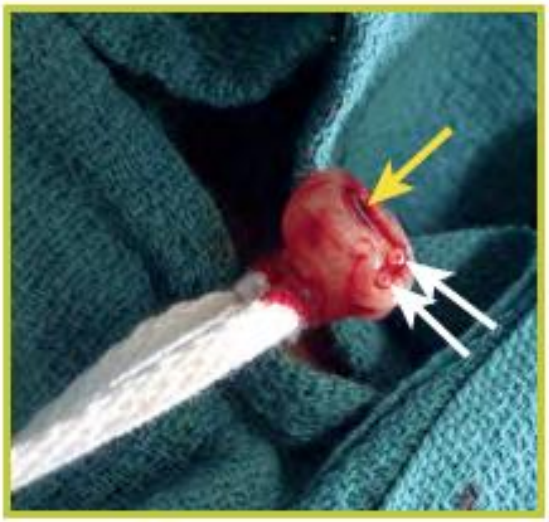


Figure 7.7. The umbilical cord ready for catheter insertion. The umbilical vein is shown by the yellow arrow. The 2 umbilical arteries are shown by the white arrows.

Advance 2-4cm (less in preterm)

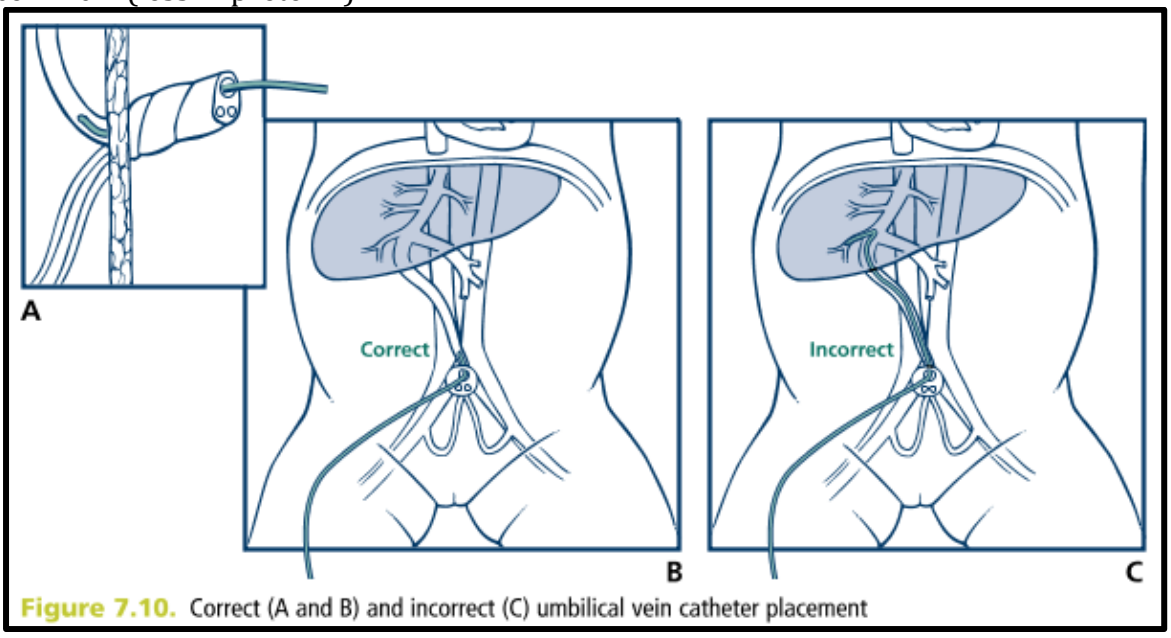
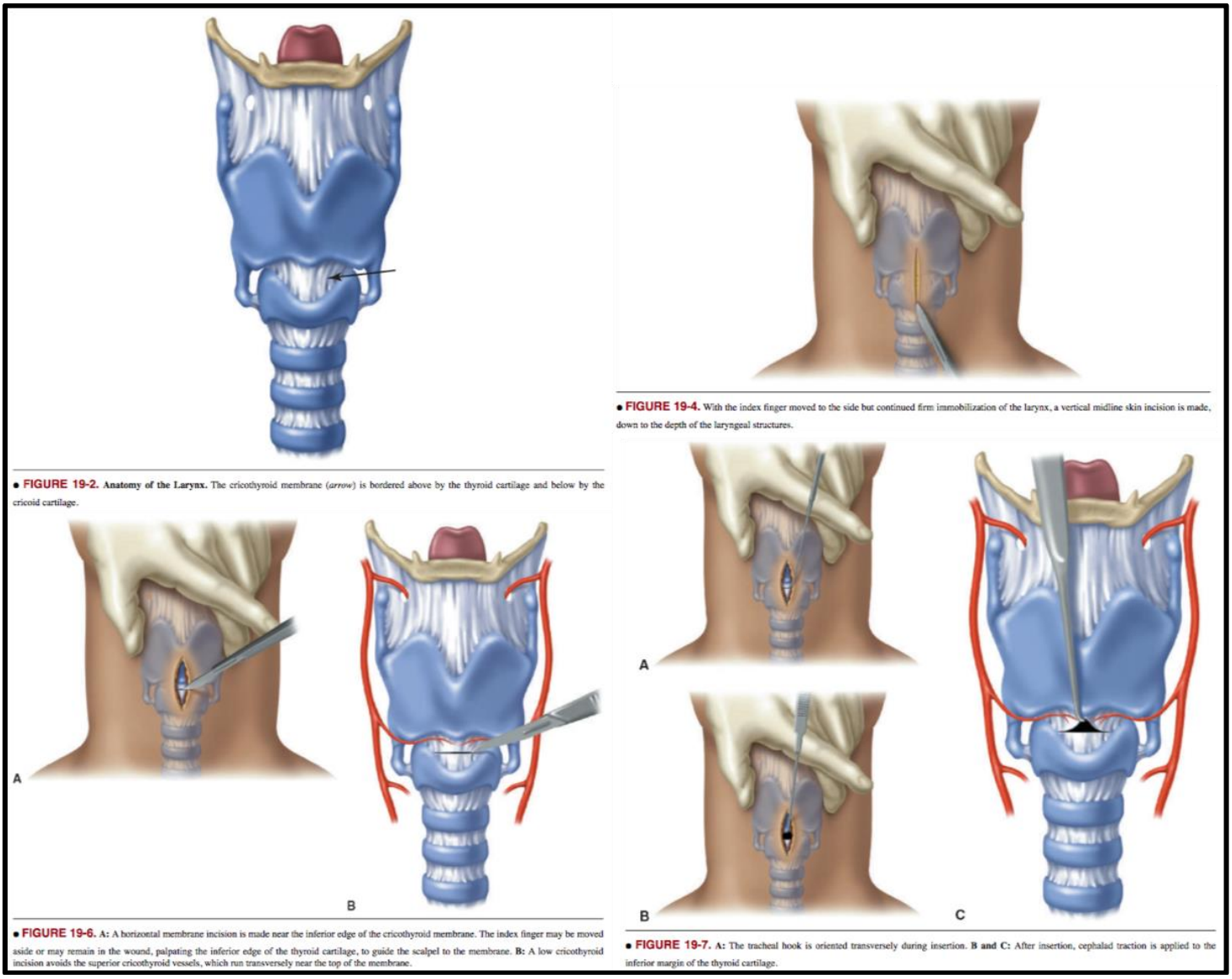


Figure 7.10. Correct (A and B) and incorrect (C) umbilical vein catheter placement

Tighten tie to prevent bleeding around catheter, secure catheter and saline lock

Cricothyrotomy

Surgical



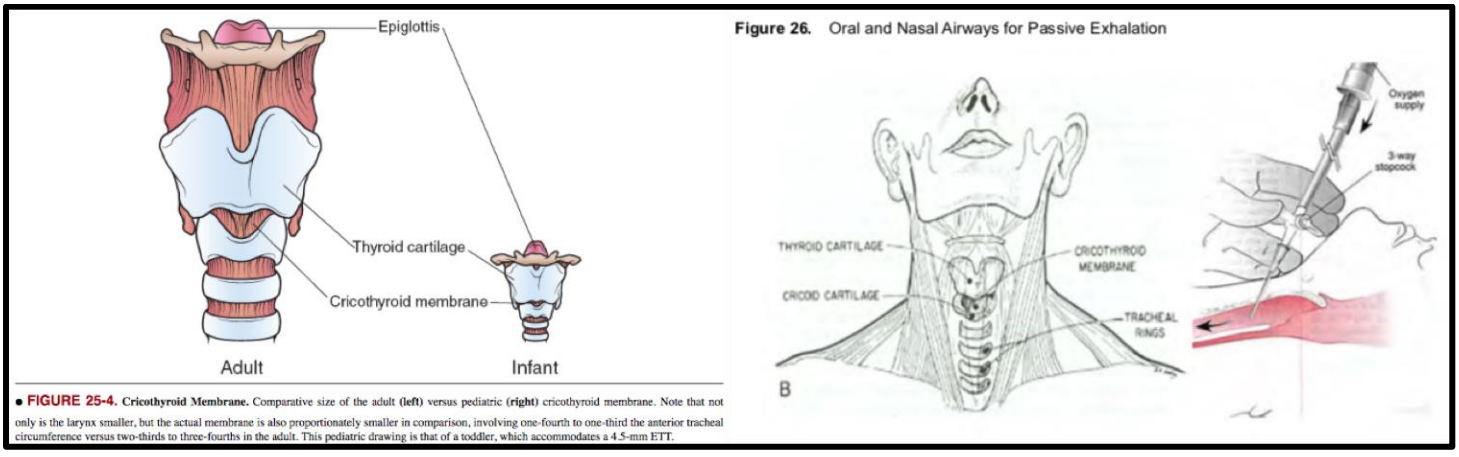
• **FIGURE 19-2. Anatomy of the Larynx.** The cricothyroid membrane (*arrow*) is bordered above by the thyroid cartilage and below by the cricoid cartilage.

• **FIGURE 19-4.** With the index finger moved to the side but continued firm immobilization of the larynx, a vertical midline skin incision is made, down to the depth of the laryngeal structures.

• **FIGURE 19-6. A:** A horizontal membrane incision is made near the inferior edge of the cricothyroid membrane. The index finger may be moved aside or may remain in the wound, palpating the inferior edge of the thyroid cartilage, to guide the scalpel to the membrane. **B:** A low cricothyroid incision avoids the superior cricothyroid vessels, which run transversely near the top of the membrane.

• **FIGURE 19-7. A:** The tracheal hook is oriented transversely during insertion. **B and C:** After insertion, cephalad traction is applied to the inferior margin of the thyroid cartilage.

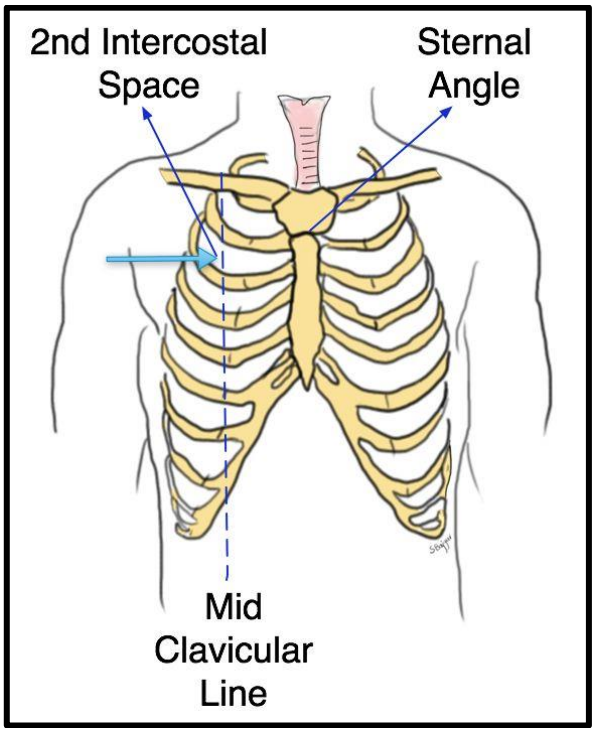
Needle

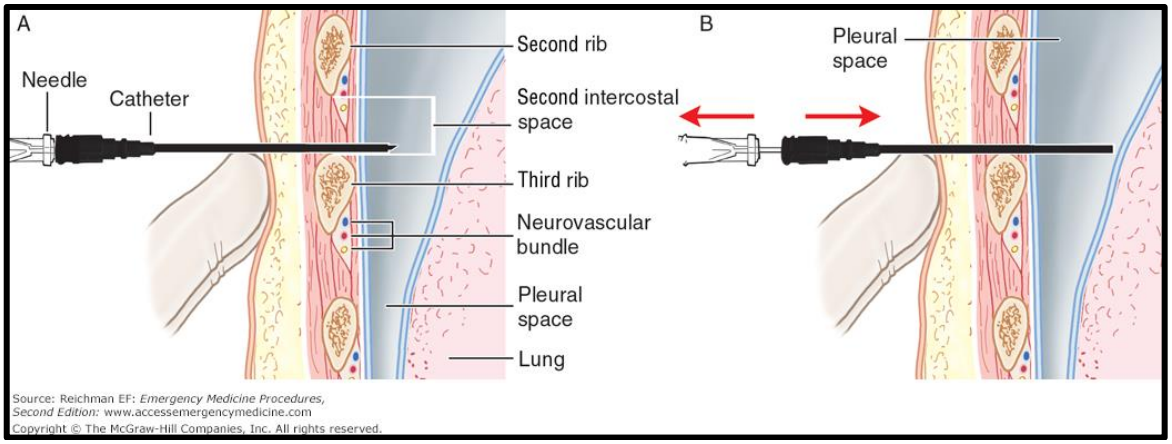


• **FIGURE 25-4. Cricothyroid Membrane.** Comparative size of the adult **(left)** versus pediatric **(right)** cricothyroid membrane. Note that not only is the larynx smaller, but the actual membrane is also proportionately smaller in comparison, involving one-fourth to one-third the anterior tracheal circumference versus two-thirds to three-fourths in the adult. This pediatric drawing is that of a toddler, which accommodates a 4.5-mm ETT.

Needle Decompression

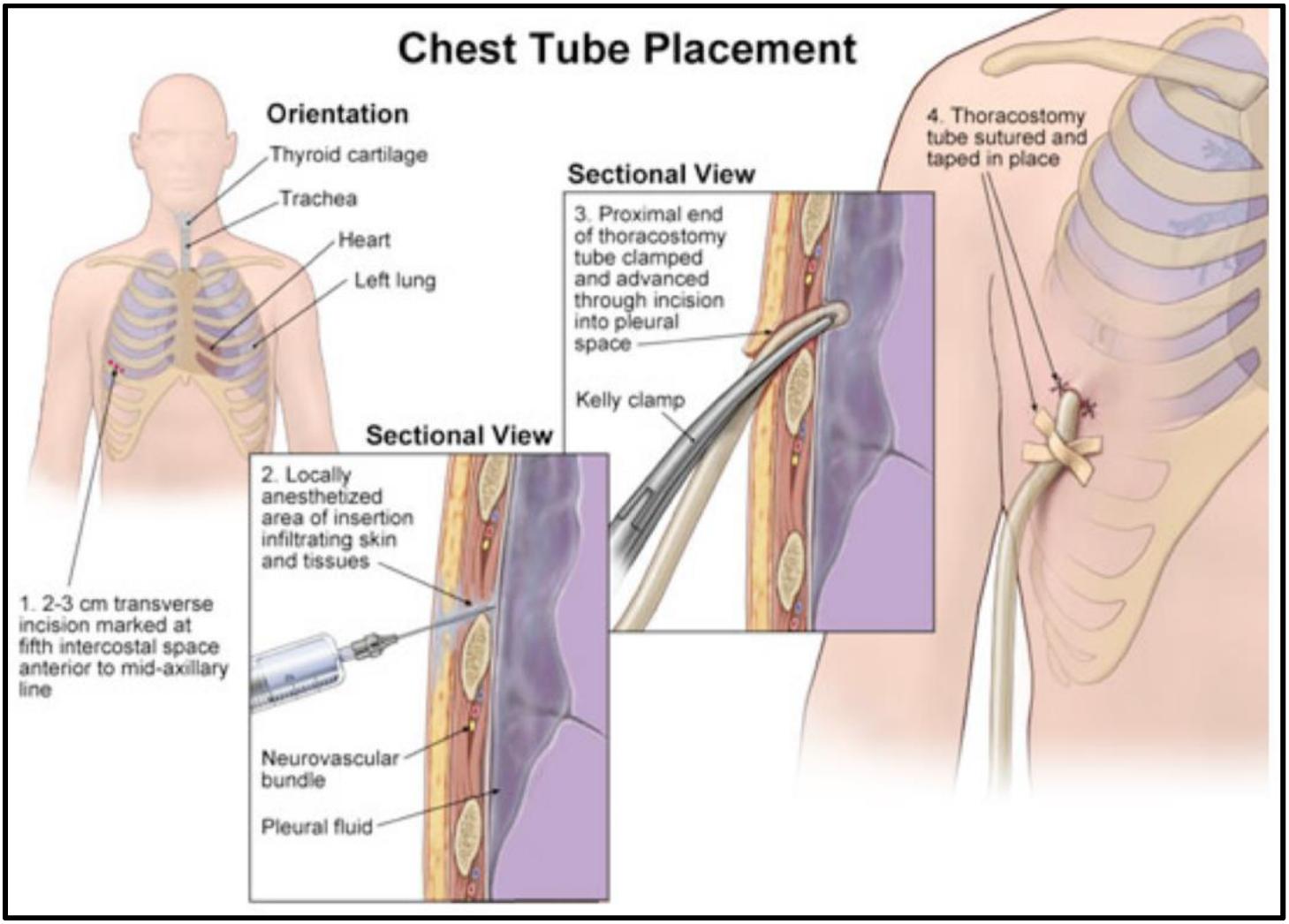
- 2nd intercostal mid-clavicular or 4th intercostal anterior-axillary (all patients, adults to neonates)
- Place needle over superior aspect of rib



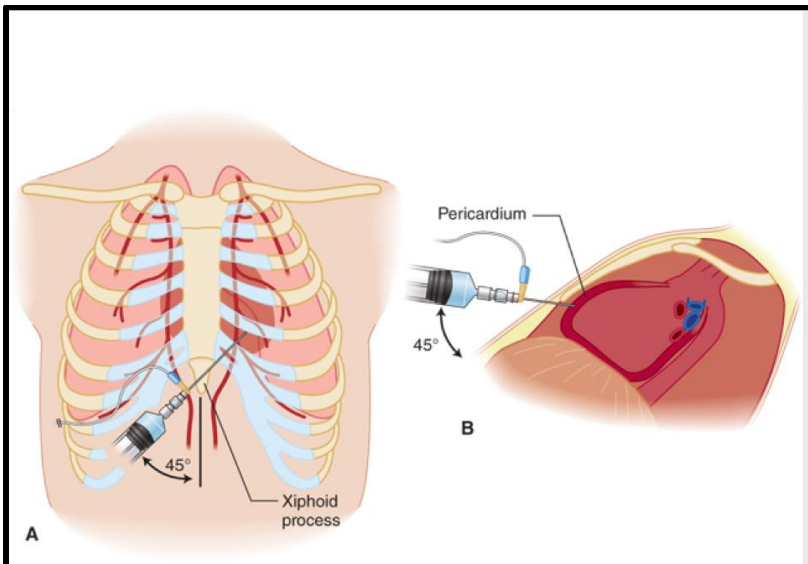


Chest Tube Insertion

- 4th intercostal space is preferred site (better to be high than low)
- Anesthetize with Lidocaine if time permits
- Lateral incision should be 2-3cm along superior border of rib
- For pneumothorax, aim anteriorly and up; for hemothorax, aim posteriorly and down
- Secure tube with clamps and occlusive dressings



Pericardiocentesis



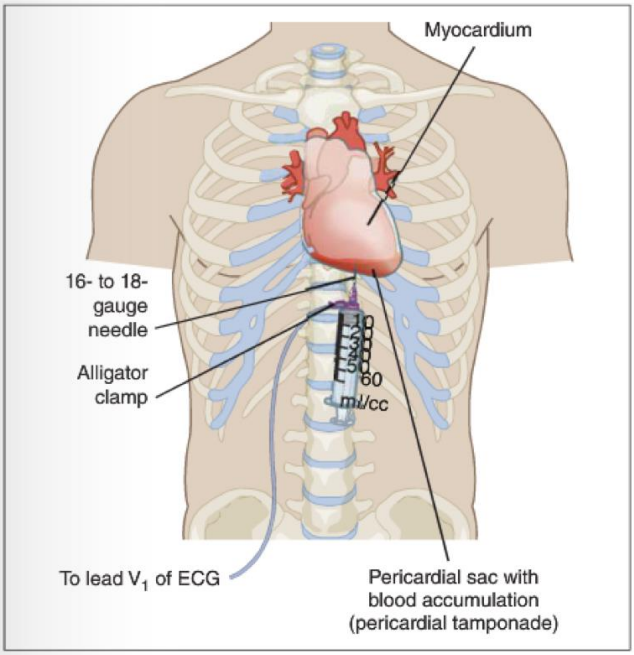


Figure 3-9 Pericardiocentesis to remove blood from the pericardial sac during tamponade.

Field Amputation

This should only be performed under extreme circumstances in order to save the life of the patient.

Team members are in no way obligated to perform this procedure.

The requirements to perform the procedure:

- The patient has a limb that is pinned by a vehicle or other heavy object and there is no possibility of lifting or removing the object.
- The vital signs are unstable, and the patient requires immediate transfer
- It is not possible to take the helicopter to bring a qualified surgeon to the field in a timely fashion
- Consent obtained:
    - If the patient is conscious, obtain the consent of the patient prior to the procedure.
    - If the patient is unconscious, proceed with the procedure even over the objections of people who claim to be family members that are present (i.e. implied consent). We have no way of verifying that this person is a family member and that they have the right to make healthcare decisions for the patient. Since we are acting in the best interest of the patient, the action is defensible in court or in public opinion.

Procedure:

- Ensure that the patient has two working IV's with saline running wide open
- Apply a tourniquet to the limb above the level of the injury
- Administer Ketamine at dissociative dose for analgesia (Pain, Agitation & Nausea)
    - Adult: 1-2 mg/kg IV, repeat as needed
    - Pediatric: 1-2mg/kg IV, repeat as needed
- Consider Shock and consider prepping/ initiating vasopressors to maintain BP with adequate pain management
- Inject 20mL of lidocaine 2% (with epinephrine if available) at the site of the amputation, including deep to the periosteum of the bone, and attempt to ring the limb circumferentially with local anesthetic
- Bathe the amputation site with betadine or alcohol
- Using a scalpel, transect soft tissue circumferentially around the limb below the level of the intended site of bone amputation; in this way, a flap of soft tissue and muscle exists to fold over the bone after the amputation
- Gauze packing should be immediately placed around the bleeding soft tissue with a pressure dressing
- The bone should be cut using the Gigli saw above the level of the soft tissue incision with extra soft tissue hanging off below
- Fold the soft tissue over the bone and pack the entire limb with gauze in a pressure dressing
- Stabilize the patient and transfer to a facility with both a surgeon and blood bank.

Postmortem Cesarean Section

This should only be performed under extreme circumstances and only on an immediately deceased mother.

Team members are in no way obligated to perform this procedure.

The requirements to perform the procedure:

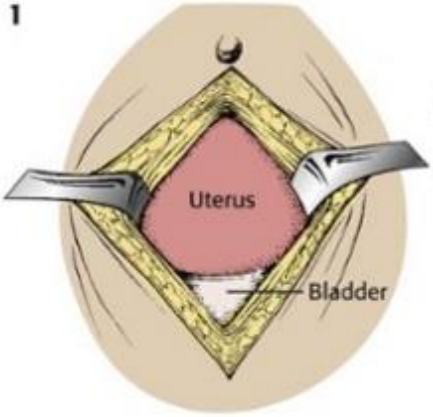
- The [redacted] team must be present at the time of death and/or loss of pulse; there is never any indication for a non-physician [redacted] crew member to perform a Caesarian section on a living mother
- If this occurs during a mass casualty event or if there are any other patients in need of care, the unborn fetus is considered to be "Black Triage Tag" and therefore should be given the lowest priority
- The fetal heart sounds must be able to be detected by Doppler
- [redacted] crew will not perform an emergency Caesarian section if the uterus does not extend past the umbilicus, as the fetus will not be viable
    - Given that the last menstrual period may be impossible to determine at the moment of death, we will not use gestational age cutoffs for the procedure.
    - It is required that the uterus be palpable beyond the level of the umbilicus, which would signify a 20-22 week pregnancy
- Proceed with the procedure even over the objections of people who claim to be family members that are present. We have no way of verifying that this person is a family member and that they have the right to make healthcare decisions for the baby. Since we are acting in the best interest of the baby, the action is defensible in court or in public opinion.

Procedure:

- Immediately after cessation of CPR efforts for the mother, which must be confirmed by all team members present, a team member may proceed with an emergency Caesarian section
- A vertical incision should be made from the level of the umbilicus to the pubic symphysis, cutting through the skin, fascia, and fat with the first incision
- Once the uterus is visualized, a second vertical incision should be made in the uterus wall, being careful not to cut so deeply as to injure the fetus
- The baby should be removed as quickly as possible and the team should immediately use bag valve mask for resuscitation and clamp off the umbilical cord (since the mother has no circulation, keeping the umbilical cord open will be detrimental to the baby)
- At this point, all protocols pertaining to neonatal care should be initiated and followed (Management of the Newborn)
- The baby should be transferred to [redacted] or [redacted] if a bed is available in the ICU
- Once the umbilical cord is severed completely, the deceased mother's abdomen should be sewn up with sutures, or a binder or dressing should be placed around the abdomen
    - All efforts should be made to make the body clean and presentable to family
    - At that point, the mother's body will be the responsibility of the local authorities who contacted [redacted]

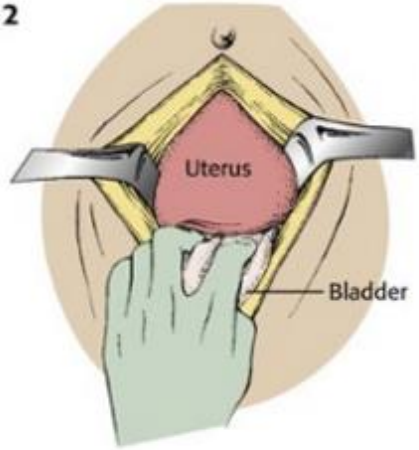
PERIMORTEM CESAREAN DELIVERY

1



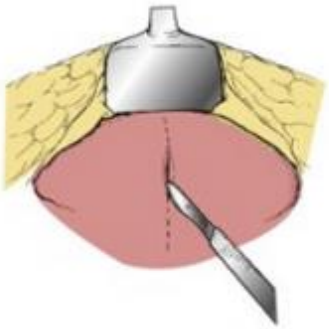
Make a vertical incision through the abdominal wall from the level of the uterine fundus to the symphysis pubis.

2



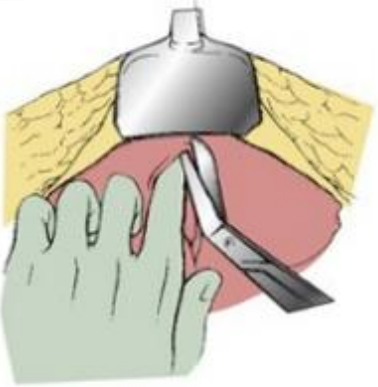
If available, use retractors to expose the anterior surface of the uterus and retract the bladder inferiorly.

3



Use a scalpel to make a small vertical incision through the lower uterine segment.

4



Use bandage scissors to extend the incision vertically to the fundus.

5

Deliver the infant, suction the nose and mouth, and clamp and cut the cord.

Escharotomy

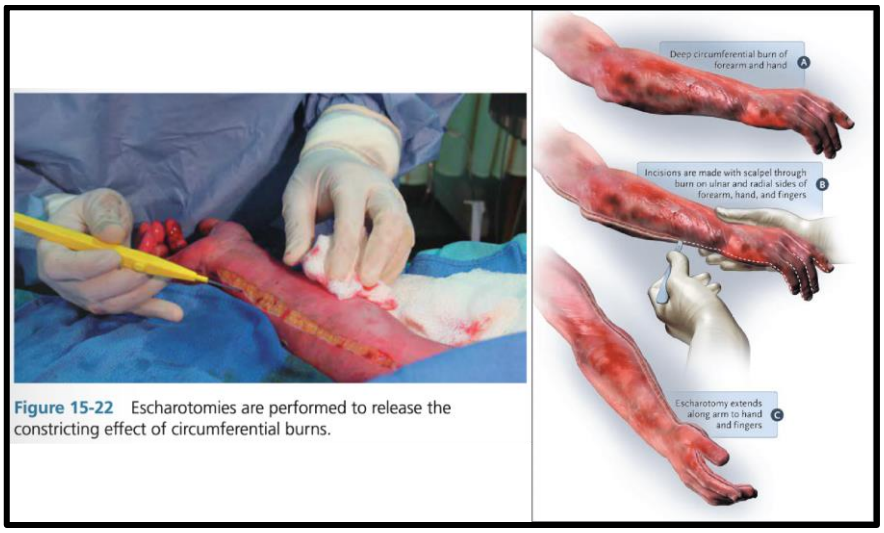
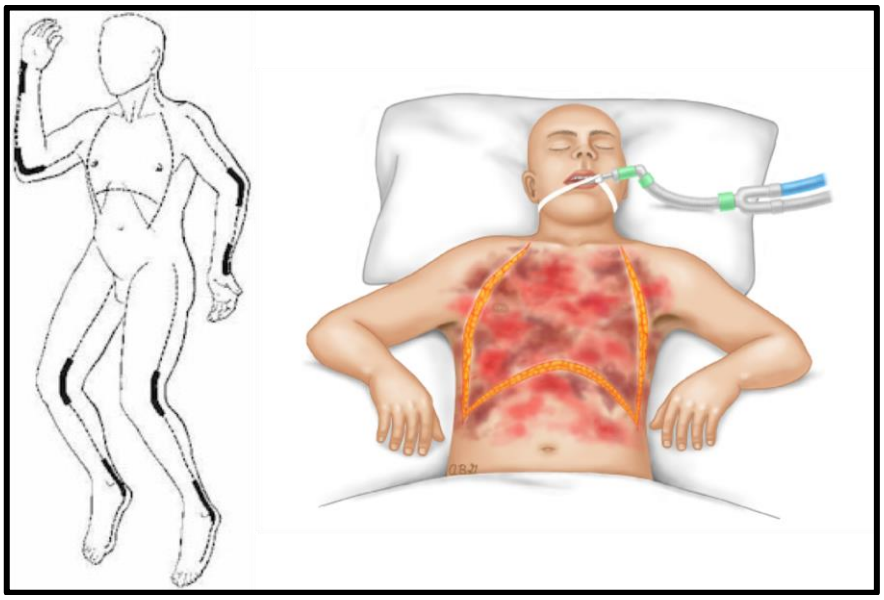
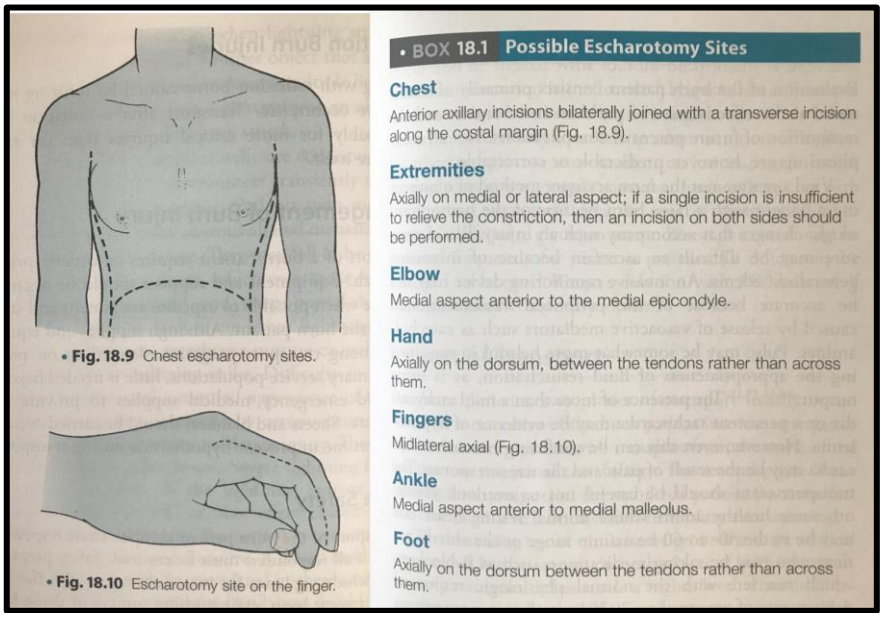


Figure 15-22 Escharotomies are performed to release the constricting effect of circumferential burns.





• **Fig. 18.9** Chest escharotomy sites.

• **Fig. 18.10** Escharotomy site on the finger.

• BOX 18.1 Possible Escharotomy Sites

Chest
Anterior axillary incisions bilaterally joined with a transverse incision along the costal margin (Fig. 18.9).

Extremities
Axially on medial or lateral aspect; if a single incision is insufficient to relieve the constriction, then an incision on both sides should be performed.

Elbow
Medial aspect anterior to the medial epicondyle.

Hand
Axially on the dorsum, between the tendons rather than across them.

Fingers
Midlateral axial (Fig. 18.10).

Ankle
Medial aspect anterior to medial malleolus.

Foot
Axially on the dorsum between the tendons rather than across them.

IO Insertion

Proximal Tibia Insertion Site Identification – Adult
Extend the leg. Insertion site is approximately 2 cm medial to the tibial tuberosity, or approximately 3 cm below the patella and approximately 2 cm medial, along the flat aspect of the tibia.

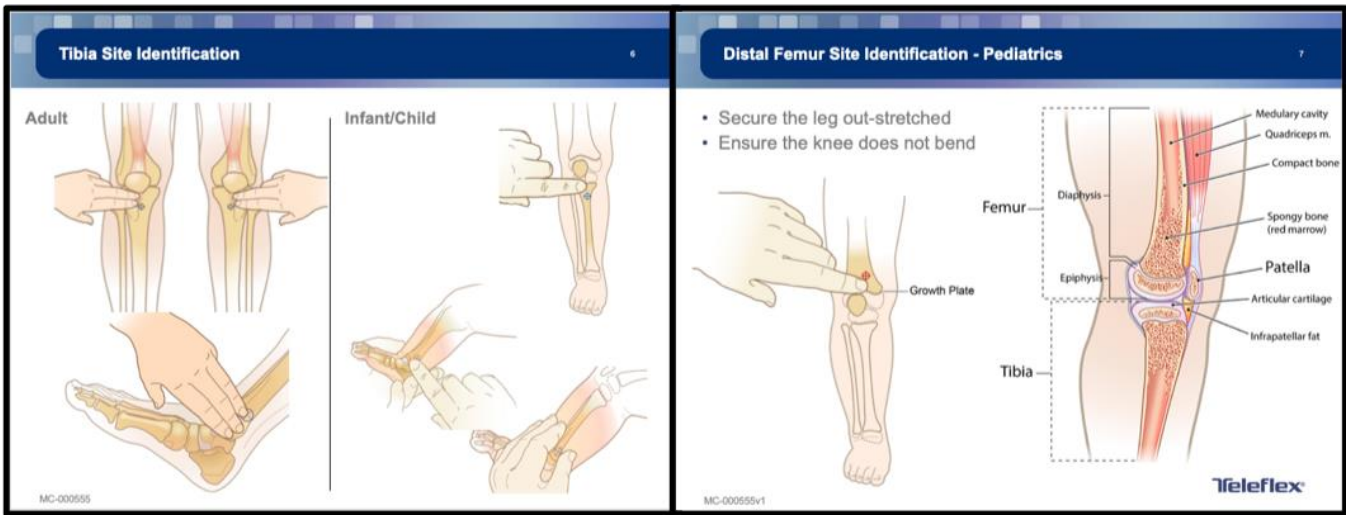
Proximal Tibia Insertion Site Identification – Infant/Child
Extend the leg. Pinch the tibia between your fingers to identify the medial and lateral borders of the tibia. Insertion site is approximately 1 cm medial to the tibial tuberosity, or just below the patella (approximately 1 cm) and slightly medial (approximately 1 cm), along the flat aspect of the tibia.

Distal Tibia Insertion Site Identification - Adult
Insertion site is located approximately 3 cm proximal to the most prominent aspect of the medial malleolus. Palpate the anterior and posterior borders of the tibia to assure that your insertion site is on the flat center aspect of the bone.

Distal Tibia Insertion Site Identification – Infant/Child
Insertion site is located approximately 1-2 cm proximal to the most prominent aspect of the medial malleolus. Palpate the anterior and posterior borders of the tibia to assure that your insertion site is on the flat center aspect of the bone.

Distal Femur Insertion Site Identification - Infant/Child
Secure the leg out-stretched to ensure the knee does not bend. Identify the patella by palpation. The insertion site is just proximal to the patella (maximum 1 cm) and approximately 1-2 cm medial to midline.

*For tibia and femur access, aim the needle set tip at a 90-degree angle to the bone.



Proximal Humerus Insertion Site Identification

- Place the patient's hand over the abdomen (elbow adducted and humerus internally rotated)
- 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 your hand vertically over the axilla and the ulnar aspect of your other 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 up the humerus to the surgical neck
- This may feel like a golf ball on a tee – the spot where the "ball" meets the "tee" is the surgical neck
- The insertion site is 1 to 2 cm above the surgical neck, on the most prominent aspect of the greater tubercle
- Insertion angle is important to ensure placement that will provide optimal vascular access.
- For the proximal humerus insertion, aim the needle set tip at a 45-degree angle to the anterior plane and posteromedial.