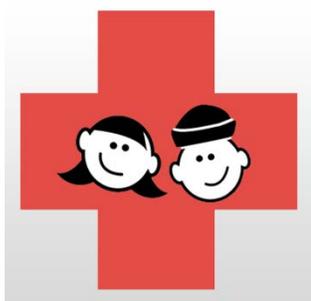




# PediCrisis



## CRITICAL EVENTS CARDS

**Call for help!**

Code Team \_\_\_\_\_  
 PICU \_\_\_\_\_  
 Fire \_\_\_\_\_  
 Overhead STAT \_\_\_\_\_

<b>Air Embolism</b>	<b>2</b>
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# Air Embolism

↓ ETCO<sub>2</sub> ↓ SaO<sub>2</sub> ↓ BP

2

**Objective:** Restore normal SpO<sub>2</sub>, hemodynamic stability, and stop source of air entry.

**Call for help. Notify surgeon.**

Increase **oxygen to 100%**.

**Stop** nitrous oxide and volatile agents.

Find **air entry point, stop source, and limit further entry.**

- Flood wound with irrigation
- Check for open venous lines or air in tubing
- Turn off all pressurized gas sources (laparoscope, endoscope)
- Lower surgical site below level of heart (if possible)
- Perform Valsalva on patient using hand ventilation
- Compress jugular veins intermittently if head or cranial case
- Left-side down once source controlled

Consider

- Vasopressors (epinephrine, norepinephrine)
- **Chest compressions:** 100/min; to force air through lock, even if not in cardiac arrest

Call for **transesophageal echocardiography** (if available and/or diagnosis unclear).



# Anaphylaxis

Rash, bronchospasm, hypotension

3

- Call for help.**
- Increase oxygen to 100%**
- Remove suspected trigger(s).
  - If latex is suspected, thoroughly wash area.
- Ensure adequate ventilation/oxygenation.
- Obtain IV access.
- If hypotensive, turn off anesthetic agents.
- Rapidly infuse NS or LR (10-30 ml/kg IV) to restore intravascular volume
- Epinephrine** (1-10 mcg/kg IV as needed) to restore BP and ↓ mediator release
  - Epinephrine infusion (0.02-0.2 mcg/kg/min) may be required to maintain BP.
- Adjuvants
  - Beta-agonists (**albuterol** 4-10 puffs as needed) for bronchoconstriction
  - Methylprednisolone** (2 mg/kg IV, MAX 100 mg) to ↓ mediator release
  - Diphenhydramine** (1 mg/kg IV, MAX 50 mg) to ↓ histamine-mediated effects
  - Famotidine** (0.25 mg/kg IV) or **ranitidine** (1 mg/kg IV) to ↓ effects of histamine
- If anaphylactic reaction requires laboratory confirmation, send mast cell tryptase level within 2 hours of event.

## Common causative agents:

Neuromuscular blockers, latex, chlorhexidine, IV colloids, antibiotics

# Bradycardia: Unstable

Bradycardia  $\pm$  heart block,  
hypotensive with pulses

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Age < 30 days: HR < 100  
Age > 30 days < 1yr: HR < 80  
Age > 1yr: HR < 60

- Call for help and transcutaneous pacer.**
- Hypoxia is common cause of bradycardia.**
  - Ensure pt is not hypoxic. Give 100% oxygen.
  - Go to 'Hypoxia' card if hypoxia persists.
- Stop surgical stimulation.** If laparoscopy, desufflate.
- Consider
  - Epinephrine** 2-10 mcg/kg IV
  - Chest compression** if  $\downarrow$  pulses
  - Atropine** (0.01 - 0.02 mg/kg IV) if vagal etiology
- Assess for drug-induced causes
  - Beta-blocker overdose: **Glucagon** 0.05 mg/kg IV, then 0.07 mg/kg/h IV infusion
  - Calcium channel blocker overdose: **Calcium chloride** 10-20 mg/kg IV or **calcium gluconate** 50 mg/kg, then glucagon if calcium ineffective.
- If PEA develops, start chest compressions. Go to 'Cardiac Arrest :Asystole, PEA'**

## Instructions for PACING

1. Place pacing ECG electrodes **AND** pacer pads on chest per package instructions.
2. Turn monitor/defibrillator ON, set to PACER mode.
3. Set PACER RATE (ppm) to desired rate/min. (Can be adjusted up or down based on clinical response once pacing is established).
4. Increase the milliamperes (mA) of PACER OUTPUT until electrical capture (pacer spikes aligned with QRS complex; threshold normally 65-100mA).
5. Set final mA to 10mA above this level.
6. Confirm pulse present.\*\*

# Cardiac Arrest: Asystole, PEA

Non-shockable and/or pulseless cardiac arrest

- Call for help.
- Designate team leader, assign roles.
  
- Give 100% oxygen. Turn off all anesthetic gases and infusions. Place pt on backboard.
- Obtain defibrillator
  
- Start chest compressions (100 chest compressions/min + 8 breaths/min)**
  - Maintain good hand position.
  - Maximize ET $\text{CO}_2$  > 10 mm Hg with force/depth of compressions.
  - Allow full recoil between compressions.
  - Switch with another provider every 2 minutes, if possible.
  - Use sudden increase in ET $\text{CO}_2$  for ROSC – do not stop compressions for pulse check.
- Epinephrine** 10 mcg/kg IV q 3-5 min
- Check pulse & rhythm (q 2 min during compressor switch).

No Pulse and Not Shockable: Resume CPR and checklist.

### Read out H&Ts

Hypovolemia	Tension Pneumothorax
Hypoxemia	Tamponade (Cardiac)
Hydrogen ion (acidosis)	Thrombosis
Hyperkalemia	Toxin (anesthetic, $\beta$ -blocker)
Hypoglycemia	Trauma (bleeding outside surgical area)
Hypothermia	

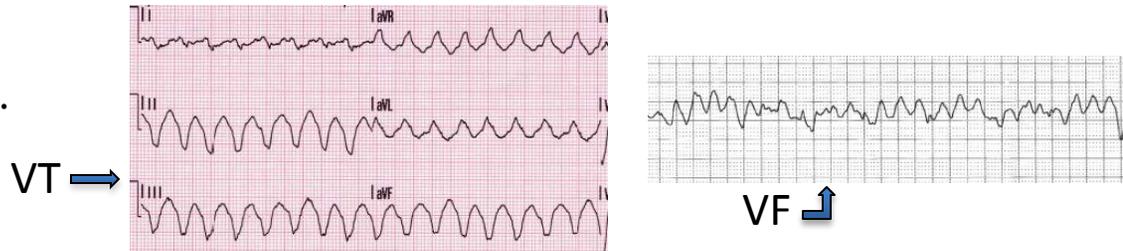
- Call for **ECMO** (if available) if no ROSC after 6 min of CPR.
- Notify parents/guardian that cardiac arrest occurred.

# Cardiac Arrest: VF/VT

Shockable , pulseless cardiac arrest

6

- Call for help and defibrillator.
- Designate team leader / assign roles.



- Give 100% oxygen. Turn off all anesthetic gases. Place pt on backboard.
- Start chest compressions (100 chest compressions/min + 8 breaths/min).**
  - Maintain good hand position
  - Maximize ETCO<sub>2</sub> > 10 mm Hg with force/depth of compressions
  - Allow full recoil between compressions – lift hands off chest
- Shock 2-4 joules/kg**
- Resume chest compressions x 2 min.
- Epinephrine 10 mcg/kg IV**
- Check pulse & rhythm (q2 min during compressor switch)

## If shockable rhythm continues:

- Shock 4 joules/kg.**
- Resume chest compressions x 2 min.
- Epinephrine 10 mcg/kg IV**
- Check pulse & rhythm (q 2 min during compressor switch).
- Shock 4-10 joules/kg**, continue chest compressions, and epinephrine 10 mcg/kg every 3-5 min.
- Amiodarone 5 mg/kg bolus**; may repeat x 2
- Call for **ECMO** (if available) after 6 min of CPR
- Notify parents/guardian that cardiac arrest occurred.

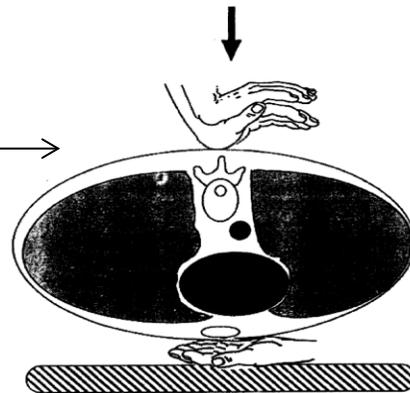
# Cardiac Arrest: Prone CPR

Chest compression for patient in prone position

❑ Call for help.

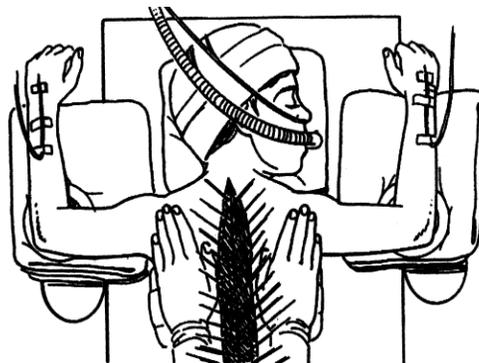
## Children/Adolescents

**No midline incision:**  
Compress with heel of hand on spine and second hand on top



From: Dequin P-F et al. Cardiopulmonary resuscitation in the prone position: kouwenhoven revisited. Intensive Care Med 1996;22:1272

**Midline incision:**  
Compress with heel of each hand under scapula



From: Tobias et al, J Pediatr Surg. 1994;29, 1537-1539

## Infants

Compress with encircling technique:  
■ Thumbs midline if no incision  
■ Thumbs lateral if incision

## Difficult Airway: After Induction

Unable to intubate or ventilate;  
oxygen saturation < 90%

8

- Call for help.**
- Increase oxygen to 100%.**
- Get airway cart.**
- Bag-mask** ventilation
- Notify surgeon – may need to stop or cancel surgery. May awaken if surgery not started.
- If unable to mask ventilate, 2-hand if needed:
  - Add **oral airway**
  - Add nasal airway
  - Add **LMA**
- Regain spontaneous ventilation, if able; reverse neuromuscular blocker
- Alternative approaches for intubation:

▪ Different blade	▪ Video-laryngoscope
▪ Different operator	▪ Intubating LMA
▪ Re-position head	▪ Fiberoptic scope
▪ Blind oral	▪ Light wand
▪ Blind nasal	▪ Elastic bougie
	▪ Intubating stylet
	▪ Retrograde intubation
- If still unable to ventilate:**
  - Consider possibility of invasive airway in early stage.
  - Emergency non-invasive airway (rigid bronchoscopy)
  - **Emergency invasive/surgical airway**

# Fire: Airway

Fire in tracheal tube, circuit, canister

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- Call for help.**
  
- Disconnect** breathing circuit and **Stop** all gas flow ( $O_2$ ,  $N_2O$ )
- Pour saline into ETT, if available.
- Remove** ETT.
- Remove sponges and other flammable materials from airway.
  
- Re-intubate and re-establish ventilation.
- If intubation difficult, don't hesitate to obtain surgical airway.
  
- Consider bronchoscopy to assess for thermal injury, look for tracheal tube fragments, and remove residual material.
- Impound all equipment and supplies for later inspection.



Picture from ECRI: [www.ecri.org](http://www.ecri.org)

# OR Fire (non-airway)

Fire in OR, equipment smoke,  
odor, flash/fire on patient

10

- Call for help.**
- Protect patient, contain fire.**
- If drapes on fire, **remove drapes** from patient.
- Activate fire alarm.**
- Stop medical gases.**
- Declare team leader and define roles.
- Make one attempt to extinguish fire.
  - Use fire extinguisher or saline soaked gauze.
- If fire not extinguished on 1<sup>st</sup> attempt:
  - Remove patient from OR.
  - Confine fire by closing all OR doors.
  - Turn off O<sub>2</sub> gas supply to OR.
- Impound all equipment and supplies for later inspection.



Picture from ECRI: [www.ecri.org](http://www.ecri.org)

# Hyperkalemia

Serum K<sup>+</sup> > 6 meq/L

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## Causes:

- Excessive intake: massive or “old” blood transfusion, cardioplegia, “K<sup>+</sup> runs”
- Shift of K<sup>+</sup> from tissues to plasma: crush injury, burns, succinylcholine, malignant hyperthermia, acidosis
- Inadequate excretion: renal failure

## Manifestations:

Tall peaked T wave, heart block, sine wave, v fib or asystole

## Management:

**CALL FOR HELP!**

**Stop K<sup>+</sup> containing fluids (LR/RBCs) → Switch to NS/washed RBCs**

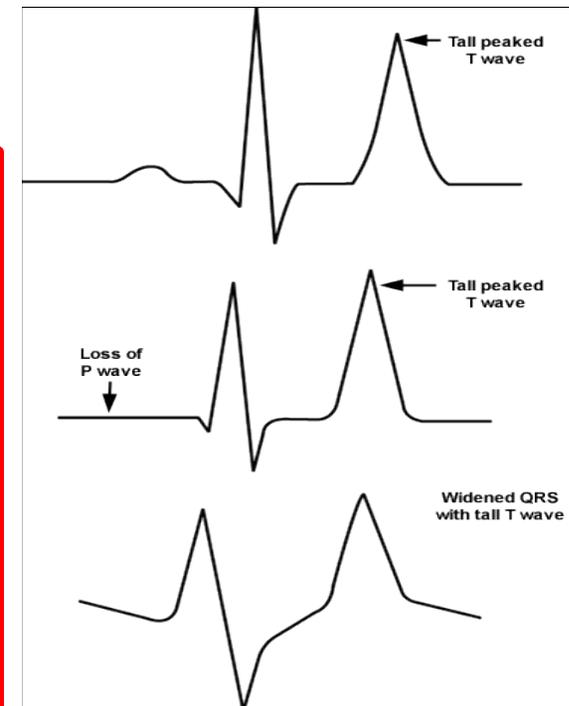
**If hemodynamically unstable: initiate CPR/PALS**

**Hyperventilate with 100% Oxygen and give**

- Calcium chloride 20 mg/kg or calcium gluconate 60 mg/kg IV
- Albuterol by nebulizer
- Insulin IV/SC 0.1 Unit/kg
- Dextrose IV 0.25 -1 gram/kg
- Sodium Bicarbonate IV 1-2 mEq/kg
- Furosemide IV 0.1 mg/kg
- Terbutaline 10 mcg/kg load then 0.1-10 mcg/kg/min

**Dialysis** if refractory to treatment

**Activate ECMO** (if available) if cardiac arrest > 6 min



From: Slovis C, Jenkins R. ABC of clinical electrocardiography: conditions not primarily affecting the heart. BMJ 2002;324:1320.

# Acute Hypertension

BP > 99<sup>th</sup> %tile for age + 5 mmHg

- ❑ Consider likely cause. Rule out medication error, light anesthesia, measurement error (e.g. transducer level) and other patient-specific factors.
- ❑ Ensure that correct BP cuff size is used with a cuff bladder width approximately 40% of limb circumference.
- ❑ 99<sup>th</sup> %tile for BP is based on patient age and height.

Action	Drug (IV Dosing)
Direct smooth muscle relaxation	<ul style="list-style-type: none"> <li>▪ <b>Sodium nitroprusside</b> 0.5-10 mcg/kg/min</li> <li>▪ <b>Hydralazine</b> 0.1-0.2 mg/kg (adult dose 5-10 mg)</li> </ul>
β-Adrenergic blockade	<ul style="list-style-type: none"> <li>▪ <b>Esmolol</b> 100-500 mcg/kg over 5 min then 50-200 mcg/kg/min</li> <li>▪ <b>Labetalol</b> (also α effect) 0.2-1 mg/kg q10 min or 0.4-3 mg/kg/h (adult dose</li> <li>▪ <b>Propranolol</b> 10-100 mcg/kg slow push (adult dose 1-5 mg)</li> </ul>
α <sub>2</sub> -Agonist	<b>Clonidine</b> 0.5-2 µg/kg
Calcium channel blockade	<ul style="list-style-type: none"> <li>▪ <b>Nicardipine</b> 0.5-5 mcg/kg/min</li> <li>▪ <b>Clevidipine</b> 0.5-3.5 mcg/kg/min</li> </ul>
D-1 agonist	▪ <b>Fenoldopam</b> 0.3-0.5 mcg/kg/min (max. 2.5 mcg/kg/min)

Age (yr)	99 <sup>th</sup> %tile systolic range (5 <sup>th</sup> – 95 <sup>th</sup> %tile height)	99 <sup>th</sup> %tile diastolic range (5 <sup>th</sup> – 95 <sup>th</sup> %tile height)
1	105-114	61-66
2	109-117	66-71
3	111-120	71-75
4	113-122	74-79
5	115-123	77-82
6	116-125	80-84
7	117-126	82-86
8	119-127	83-88
9	120-129	84-89
10	122-130	85-90
11	124-132	86-90
12	126-135	86-91

# Hypotension

**Systolic BP < 5%tile for age.**  
**For pt > 1yr, 5<sup>th</sup> %tile = 70mmHg +(2 x age in yrs)**

## Causes of Hypotension

↓ <b>Preload</b>	↓ <b>Contractility</b>	↓ <b>Afterload</b>
<ul style="list-style-type: none"> <li>•Hypovolemia</li> <li>•Vasodilation</li> <li>•Impaired venous return</li> <li>•Tamponade</li> <li>•Pulmonary embolism</li> </ul>	<ul style="list-style-type: none"> <li>•Negative inotropic drugs (anesthetic agents)</li> <li>•Arrhythmias</li> <li>•Hypoxemia</li> <li>•Heart failure (ischemia)</li> </ul>	<ul style="list-style-type: none"> <li>•Drug-induced vasodilation</li> <li>•Sepsis</li> <li>•Anaphylaxis</li> <li>•Endocrine crisis</li> </ul>

## Treatment of Hypotension

<ul style="list-style-type: none"> <li><input type="checkbox"/> Inform surgeon and OR nurse</li> <li><input type="checkbox"/> Ensure oxygenation/ventilation</li> <li><input type="checkbox"/> Turn off anesthetic agents</li> <li><input type="checkbox"/> Verify patient is truly hypotensive, check cuff size and position</li> </ul>		
<ul style="list-style-type: none"> <li><input type="checkbox"/> Expand circulating blood volume (administer fluids rapidly)</li> <li><input type="checkbox"/> Trendelenberg position</li> <li><input type="checkbox"/> Place or replace IV; consider interosseous needle</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Start inotrope infusion (dopamine, epinephrine, milrinone) as needed</li> <li><input type="checkbox"/> Review ECG for rhythm disturbances or ischemia</li> <li><input type="checkbox"/> Send ABG, Hb, electrolytes</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Start vasopressor infusion: phenylephrine, norepinephrine</li> <li><input type="checkbox"/> Follow “Anaphylaxis” Card if appropriate.</li> <li><input type="checkbox"/> Administer steroids for endocrine crisis</li> </ul>

## Hypoxia: All Patients

### Give 100% oxygen

Check:

- Oxygen flow
- Airway patency
- Breathing circuit connected and patent
- Ventilation rate and depth adequate
- Listen to breath sounds:
  - Wheezing
  - Crackles
  - Diminished or absent
- Is pulse oximeter working correctly?
- Presence of cardiac shunt
- Possibility of embolus

## Hypoxia: Intubated Patients

**D**islodged: Check ETT position

- Mainstem
- Not in trachea

**O**bststructed: Suction ETT

- Kinked
- Mucus plug

**P**neumothorax: Listen to breath sounds

- Decompress with needle

**E**quipment

Check from patient to wall:

- Oxygen flow
- Valves
- CO<sub>2</sub> canister
- Inspect for disconnections and obstructions

# Hypoxia: Loss of ETCO<sub>2</sub>

↓ ETCO<sub>2</sub> ↓ SpO<sub>2</sub> ↓ BP

Respiratory	Cardiac Output
<p><b>Give 100% oxygen</b></p> <p><b>Check:</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Airway patency</li> <li><input type="checkbox"/> Breathing circuit connections           <ul style="list-style-type: none"> <li>▪ Kinked endotracheal tube</li> </ul> </li> <li><input type="checkbox"/> Breath sounds and chest excursion           <ul style="list-style-type: none"> <li>▪ Bilateral sounds and chest movement</li> <li>▪ Quality of breath sounds</li> <li>▪ Presence of <b>wheezing</b> or crackles</li> </ul> </li> <li><input type="checkbox"/> Gas analyzer connections; power on?</li> <li><input type="checkbox"/> Ventilation rate (excessive?)</li> </ul>	<p><b><u>Embolus: air, blood, fat</u></b></p> <p><b>Actions: See Air Embolism card</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Inform surgeon</li> <li><input type="checkbox"/> Flood surgical field with saline</li> <li><input type="checkbox"/> Lower surgical site below heart</li> </ul> <p><b><u>Low cardiac output or cardiac arrest</u></b></p> <p><b>Actions:</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Follow PALS algorithm if cardiac arrest</li> <li><input type="checkbox"/> Give 100% oxygen</li> <li><input type="checkbox"/> Support ventilation</li> <li><input type="checkbox"/> Support blood pressure with IV saline (10-20 mL/kg bolus)</li> <li><input type="checkbox"/> Turn off anesthetic agents</li> </ul>

# Local Anesthetic Toxicity

Hypotension, rhythm disturbance,  
altered consciousness, seizures

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- Call for help.**
- Stop local anesthetic.**
- Request **Intralipid** kit .
  
- Secure airway and ventilation
- Give 100% oxygen.
- Confirm or establish adequate IV access.
- Confirm and monitor continuous ECG, BP, and SaO<sub>2</sub>.
  
- Seizure treatment: **midazolam** 0.05-0.1 mg/kg IV or **propofol** 1-2 mg/kg IV. Treat resultant hypoventilation.
- Treat hypotension with small doses of **epinephrine** 1 mcg/kg.
- Monitor and correct acidosis, hypercarbia and hyperkalemia.
- Avoid** vasopressin, calcium channel blockers and beta blockers.
- If cardiac instability occurs:
  - Start **CPR**
  - Start **Intralipid** therapy (see inset box)
    - Continue **chest compressions** (lipid must circulate)
- Consider alerting nearest cardiopulmonary bypass center and ICU if no ROSC.

## Intralipid Dosing

- Bolus **Intralipid 20%** 1.5 mL/kg over 1 min
- Start infusion 0.25 mL/kg/min
- Repeat bolus every 3-5 min up to 3 mL/kg total dose until circulation is restored
- Increase the rate to 0.5 mL/kg/min if BP remains low or declines
- Continue infusion until hemodynamic stability is restored.
- Maximum total **Intralipid 20%** dose: 10 mL/kg over first 30 min

- Notify surgeon.
- Turn off inhalation agent/N<sub>2</sub>O and switch to propofol/ketamine infusion.
- Turn off or reverse neuromuscular blockers
- Increase perfusion pressure (MAP > 70 mmHg) using ephedrine (0.2 – 0.3 mg/kg IV) and/or phenylephrine (1-10 mcg/kg IV).
- Check Hb; transfuse RBC (10-15 mL/kg IV) if anemic.
- Ensure normocarbia: ↑ I/E ratio, ↓ PEEP
- Ensure normothermia.
- Consider wake-up test.
- Consider high-dose steroid for spinal cord injury:
  - Methylprednisolone 30 mg/kg IV over 15 min, then 5.4 mg/kg/h IV infusion.

# Malignant Hyperthermia

↑ Temp, ↑HR, ↑CO<sub>2</sub>, Acidosis

MH hotline 1-800-644-9737

- Call for help.
- Get Malignant Hyperthermia (MH) Kit.
- Stop procedure if possible
- Stop volatile anesthetic. Transition to non-triggering anesthetic
- Request chilled IV saline.
- Hyperventilate** pt to reduce CO<sub>2</sub>: 2-4 times patient's minute ventilation
- Dantrolene 2.5 mg/kg IV every 5 min** until symptoms resolve.
- Assign dedicated person to mix dantrolene (20 mg/vial) with 60 mL sterile water.
- Bicarbonate 1-2 meq/kg IV** for suspected metabolic acidosis; maintain pH > 7.2.
- Cool patient** if temperature > 38.5° C.
  - NG lavage with cold water.
  - Apply ice externally.
  - Infuse cold saline intravenously.\*\* Stop cooling if temperature < 38° C.
- Hyperkalemia treatment:** (See 'Hyperkalemia' card)
  - Ca gluconate 30 mg/kg IV or Ca chloride 10 mg/kg IV;
  - Sodium bicarbonate 1-2 mEq/kg IV;
  - Regular insulin 10 Units IV with 1-2 amps D50 (0.1 units insulin/kg and 1 mL/kg D50)
- Dysrhythmia treatment:** Standard anti-arrhythmics; do **NOT** use calcium channel blocker
- Send labs: ABG or VBG, electrolytes, serum CK, serum/urine myoglobin, coagulation
- Place Foley catheter to monitor urine output.
- Call ICU to arrange disposition.

### Recognition

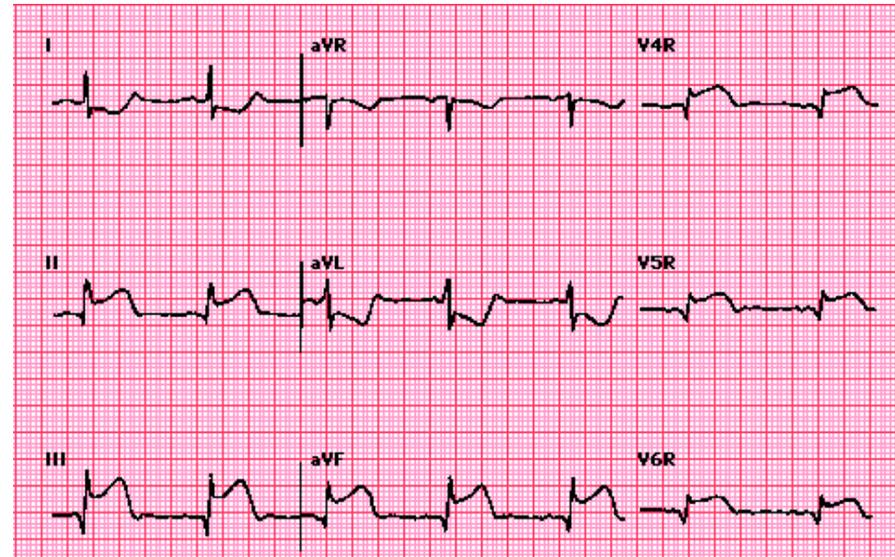
- ST depression  $>0.5$  mm in any lead
- ST elevation  $>1$  mm (2mm in precordial leads)
- Flattened or inverted T waves
- Arrhythmia: VF, VT, ventricular ectopy, heart block

### Treat potential causes

- Severe hypoxemia
- Systemic arterial hypo- or hypertension
- Marked tachycardia
- Severe anemia
- Coronary air embolus
- Cardiogenic shock
- Local anesthetic toxicity

### Diagnostic studies

- 12-lead ECG:
  - II, III, aVF for inferior (RCA)
  - V5 for lateral ischemia (LCx)
  - V2, V3 anterior ischemia (LAD)
- Compare to previous ECGs
- Ped Cardiology consult; echocardiography



### Treatment

- Improve O<sub>2</sub> Supply
  - 100% oxygen
  - Correct anemia
  - Correct hypotension
- Decrease O<sub>2</sub> Demand
  - Reduce heart rate
  - Correct hypertension
  - Restore sinus rhythm
- Drug therapy
  - Nitroglycerin 0.5-5 mcg/kg/min
  - Consider heparin infusion
    - 10 units/kg bolus, then 10 units/kg/hr

# Tachycardia

Tachycardia with pulses, associated with hypotension

## Diagnosis:

- ST: narrow complex, p waves present before every QRS
- SVT: narrow complex, no p waves or p waves not associated with QRS
- VT: wide complex, polymorphic or monomorphic

## Treatment:

**If no pulse present, start CPR, go to 'Cardiac Arrest, VF/VT' Card**

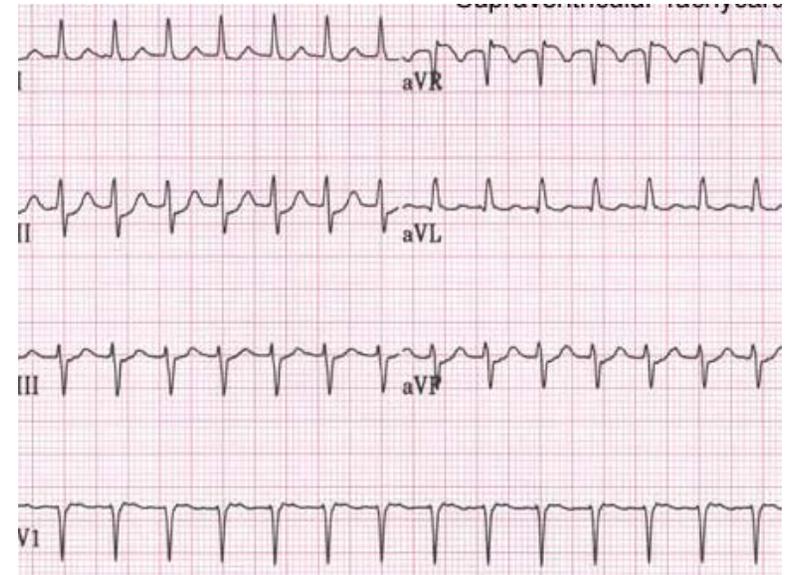
If pulse present:

### Narrow Complex

- Vagal maneuvers: Ice to face; Valsalva; carotid massage
- **Adenosine** 0.1-0.3 mg/kg iv push  
(Max 1<sup>st</sup> dose 6mg/max 2<sup>nd</sup> dose 12mg)

### Wide Complex

- Synchronized cardioversion at 0.5 -1.0 joules/kg (see table)
- **Amiodarone** 5 mg/kg IV bolus over 20-60 minutes, *or*
- **Procainamide** 15 mg/kg IV bolus over 30-60 minutes, *or*
- **Lidocaine** 1 mg/kg IV bolus



Read out H&Ts	
Hypovolemia	Tension pneumothax
Hypoxemia	Tamponade
Hydrogen ion (acidosis)	Thrombosis
Hyperkalemia	Toxin
Hypoglycemia	Trauma
Hypothermia	

VT, Wide-complex irregular rhythm	SVT, tachyarrhythmias with pulse
Biphasic 2 J/kg, then 4 J/kg for additional shocks	Synchronized cardioversion 0.5-1 J/kg, then 2 J/kg for additional shocks

# Transfusion: Massive Hemorrhage

Replacement of > half of total blood volume (TBV) per hour or TBV < 24h

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- Call for help.
- Notify **Blood Bank** immediately of massive transfusion need.
  - RBC : FFP : Platelets = 1:1:1**
  - Use un-cross matched O negative blood until cross-matched blood available
  - Give cryoprecipitate to maintain fibrinogen > 100
- Obtain additional vascular access if needed.
- Send labs q 30 min
  - Type & Cross
  - CBC, platelets, PT/PTT/INR, fibrinogen
  - ABG, Na, K, Ca, lactate.
- Warm the room
- Blood product administration
  - Use 140 micron filter for all products
  - Use a blood warmer for RBC and FFP transfusion (not for platelets).
  - Rapid transfuser pumps may be used when increased flow is needed.
- Monitoring for hypothermia, hypocalcemia, electrolyte, blood gas, and acid-base disturbances.
- Consider rFactor VIIa for refractory hemorrhage if above measures are corrected.
- Terminate the massive transfusion protocol once bleeding is under control.

## Maintain:

- HCT > 21% or HB > 7
- Platelet Count > 50,000 (>100k brain injury)
- INR < 1.5 ( < 1.3 brain injury)
- Fibrinogen > 100

## For All Reactions

- Call for help.
- Stop transfusion.
- Disconnect donor product and IV tubing.
- Infuse normal saline through clean tubing.
- Examine blood product ID; determine correct pt.
- Send product to Blood Bank.
- Document per Institutional Policy

**Hemolytic** - Hgbemia, Hgburia, DIC, ↓BP,  
↑HR, bronchospasm

- Furosemide 0.1 mg/kg
- Mannitol 0.5 grams/kg (2 mL/kg of 25% mannitol)
- Dopamine (2-4 mcg/kg/min)
- Maintain urine output at least 1-2 mL/kg/h.
- Prepare for cardiovascular instability.
- Send blood and urine sample to laboratory.

**Non-Hemolytic** - ↓BP,  
bronchospasm, pulmonary edema,  
fever, rash

- Stop Transfusion
- Send blood to blood bank
- Treat fever
- Observe for signs of hemolysis

**Anaphylactic** - Erythema, urticaria,  
angioedema, bronchospasm  
tachycardia, shock

- Stop transfusion
- Support airway and circulation as necessary.
- Epinephrine 10 mcg/kg IV
- Diphenhydramine 1 mg/kg IV
- Hydrocortisone 2-5 mg/kg
- Maintain intravascular volume.

### **Prior to pt arrival to OR:**

- Assemble team and assign roles.
- Estimate weight and prepare emergency drugs.
- Gather equipment:
  - airway supplies
  - invasive monitors
  - fluid warmer
  - rapid infusion device
  - code cart with programmed defibrillator
- Type and cross blood products.

### **On pt arrival to OR:**

- Maintain c-spine precautions for transport.
- Secure/confirm airway (aspiration risk, unstable c-spine).
- Ensure adequate ventilation (maintain PIP <20 cmH<sub>2</sub>O).
- Obtain/confirm large-bore IV access (central or interosseus if peripheral unsuccessful).
- Assess circulation
  - Persistent tachycardia, delayed cap refill, decreased pulse pressure = hypovolemia.
    - Bolus 20 mL/kg LR or NS (repeat x2) and/or 10 mL/kg RBCs or 20 mL/kg whole blood
- Place invasive monitors.
- Maintain normothermia.
- Rapidly treat associated conditions (acidosis, electrolyte disturbances).
- Continuously assess for secondary injury (ongoing blood loss)

- Secure airway if GCS < 9, respiratory distress, hemodynamic instability, or elevated ICP.**
  
- Maintain PaCO<sub>2</sub> 30-35 mmHg and PaO<sub>2</sub> >60mmHg.**
  
- Maintain cerebral perfusion pressure.**
  - (MAP – ICP ) > 40 mmHg and systolic BP >5<sup>th</sup> percentile for age (see 'Hypotension' card)
  - Use CVP in place of ICP if no ICP monitor available.
  
- Treat elevated ICP with:**
  - Hyperventilation
  - Propofol or etomidate
  - Mannitol (1g/kg)
  - Hypertonic saline (3% via central venous catheter; 4mL/kg)
  
- Maintain normoglycemia.**
  - Avoid glucose-containing solutions if hyperglycemic.