University of California San Francisco

EMERGENCY MANUAL

COGNITIVE AIDS FOR ML ADULT PERIOPERATIVE CRITICAL EVENTS

ACLS

CRITICAL EVENTS: NON-ACLS

Adapted from: 2015 AHA Guidelines for CPR and ECC, Gawande et al. OR Crisis Checklists NEJM 2013; 368: 246-53, & Stanford Anesthesia Cognitive Aid Group's Emergency Manual 2014, V2.0. Edited by Monica Harbell, MD 6/2016, updated 10/2020

1: Cardiac Arrest: Asystole/PEA

Condition: Non-shockable pulseless cardiac arrest.
Objective: Restore pulse, hemodynamic stability

- **Call for help. Code Cart. Inform team.**
- **CPR** (100-120 chest compressions/min + 10 breaths/min, 5-6cm deep). *
  - Ensure full chest recoil with minimal interruptions. Rotate compressors q2min.
- **Turn off anesthetic.**
- Increase **FiO_2 to 100%**, high flow.
- **Epinephrine** (1mg IV q3-5min)
- **Check pulse & rhythm** (after every 2 min of CPR; limit check to 10 secs):
  - **If no pulse and shockable** (VF/VT): **GO TO: Cardiac Arrest – VF/VT Checklist**
  - **If no pulse and NOT shockable** (asystole/PEA):
    - Resume CPR.
    - Read out potential causes (H&Ts).**
    - Consider **common perioperative DDx:** hemorrhage, anesthetic overdose, sepsis or other shock states, auto-PEEP, anaphylaxis, medication error, high spinal, pneumothorax, local anesthetic toxicity, vagal stimulus, pulmonary embolus.
    - Restart checklist.
  - **If pulse:**
    - **Begin post-resuscitation care.**
    - **Read out potential causes** (H&Ts)
- Check **ABG**

During CPR:

- **Circulation** (confirm adequate IV/IO access).
  - If $ETCO_2$<10, improve CPR quality
- **Airway** (bag mask ok if ventilation adequate)
- **Breathing** (100% FiO_2)
- **Assign roles for:** Chest compressions, defibrillation, airway, vascular access, documentation, code cart, time keeping. Orders should be explicitly acknowledged and repeated.

Drug Doses and Treatments:

Epinephrine: 1mg IV, repeat every 3-5 min

Hyperkalemia Treatment:

- Calcium gluconate (10mg/kg) or calcium chloride (10mg/kg) IV
- Sodium Bicarbonate 1-2mEq/kg, slow IV push
- Insulin 10 Units regular IV with 1-2 amps D50W

Toxin Treatments:

Opioid overdose: Naloxone 0.04-0.4mg IV, can repeat dosing if response inadequate.
Local Anesthetic overdose: Intralipid 1.5mL/kg IV bolus, repeat 1-2x for persistent asystole. Start infusion 0.25-0.5mL/kg/min for 30-60min for refractory hypotension.
Magnesium overdose: Calcium chloride 1g IV or calcium gluconate 10% soln 30mL IV
Beta-blocker overdose: Glucagon 2-4mg IV push
Calcium channel blocker overdose: Calcium chloride 1g IV

Potential Causes (H&Ts):

- **Hypovolemia**
- **Hypoxia**
- **Hydrogen ion** (acidosis)
- **Hypo-/hyperkalemia**
- **Hypo-/hyperthermia**
- **Hypoglycemia**
- **Hypocalcemia**
- **Tension Pneumothorax**
- **Tamponade** (Cardiac)
- **Toxins** (narcotic, local anesthetic, beta blocker, channel blocker, infusions)
- **Thrombosis** (Pulmonary, coronary)

**See back for differential diagnosis (H&Ts) →

*In patient without an advanced airway: Cycle of CPR =30 compressions at rate of 100-120/min, followed by 2 breaths. Give 5 cycles of CPR where "CPR x 2 min" is noted. If able to assess, keep $ETCO_2$ >10 and diastolic BP > 20.

Possible Causes of Cardiac Arrest: H&Ts

- **Hypovolemia:** Give rapid IV fluid bolus. Check Hgb/HCT. Give blood for anemia or massive hemorrhage. Consider relative hypovolemia: Auto-PEEP – disconnect circuit; High spinal; or shock states (e.g. anaphylaxis).
- **Hypoxemia:** Increase FiO2 to 100%, high flow. Confirm connections. Check for b/l breath sounds. Suction ETT and reconfirm placement. Consider CXR. GO TO: Hypoxemia event.
- **Hypothermia:** Active warming by forced air blanket, warm IV fluid, raise room temp. Consider CPB.
- **Hyperthermia:** Consider Malignant Hyperthermia. Call for MH cart. Treat with Dantrolene immediately (2.5mg/kg). GO TO: Malignant Hyperthermia event. MH Hotline (800-644-9737).
- Obtain **ABG** to rule-out:
  - **Hyperkalemia:** Give $CaCl_2$ 1g IV, D50 1 amp IV (25g Dextrose) + Regular Insulin 10 units IV. Monitor glucose. Sodium Bicarbonate 1 Amp IV (50mEq).
  - **Hypokalemia:** controlled infusion of potassium & magnesium.
  - **Hypoglycemia:** If ABG delay, check fingerstick. Give D50 1 Amp IV (25g Dextrose). Monitor glucose.
  - **H+ acidosis:** If profound, consider $NaHCO_3$ 1 Amp IV (50mEq). Consider increasing ventilation rate (but can decrease CPR effectiveness).
  - **Hypocalcemia:** Give $CaCl_2$ 1g IV
- **Tension Pneumothorax:** Unilateral breath sounds, possibly distended neck veins and deviated trachea (late signs). Perform emergent needle decompression (2nd intercostal space at mid-clavicular line) followed by chest tube placement. Call for CXR or ultrasound, but do not delay treatment.
- **Thrombosis – Coronary:** Consider TTE/TEE to evaluate wall motion abnormalities. Consider emergent coronary revascularization. GO TO: Myocardial Ischemia event.
- **Thrombosis – Pulmonary:** Consider TTE/TEE to evaluate right ventricle. Consider fibrinolytic agents or pulmonary thrombectomy.
- **Toxins (e.g. infusions):** Consider medication error. Confirm no infusions running and volatile anesthetic off. Consider local anesthetic toxicity event.
- **Tamponade – Cardiac:** Consider TTE/TEE to rule out. Treat with pericardiocentesis.

2: Bradycardia - Unstable

Condition: Hemodynamic instability, persistent bradycardia **with pulses**.
Objective: Restore hemodynamic stability, adequate perfusion.

- **Call for help. Inform team. Call for Code Cart. Get transcutaneous pacer.**
- **Check for pulse. If NO pulse**, GO TO: Asystole/PEA event.**
- Stop **surgical stimulation** (if laparoscopy, desufflate).
- Give **Atropine** (0.5mg IV q3-5min; may repeat to 3mg total).
- **If myocardial infarction suspected** (i.e. ECG changes), treat accordingly
  - (oxygen, nitrates, consider terminating procedure).
- **Assess for drug induced causes** (e.g. beta-blockers, calcium channel blockers, digoxin).
- **If persistent bradycardia, call for pacer and consider** repeat dose of **atropine, or:**
  - **Epinephrine** (2-10 mcg/min) **or Dopamine** (2-20mcg/kg/min)
- **For pacing:**
  1. **Place electrodes on chest** from trancutaneous pacer.
  2. **Place pacing pads on chest** per package instructions.
  3. **Turn monitor/defibrillator ON,** set to **PACER** mode.
  4. **Set PACER RATE (ppm) to 80/min.** (Can be adjusted up or down based on clinical response once pacing is established).
  5. **Increase milliamperes (mA) of PACER OUTPUT until electrical capture** (pacer spikes aligned with QRS complex; threshold normally 65-100mA). Set final mA to 10mA above this level.
  6. **Confirm pulse present with capture. ****
- **If pacing ineffective,**
  - Consider **expert consultation**.

During Resuscitation:

- **Circulation** (confirm adequate IV or IO access)
  - Consider IV fluids wide open.
  - Consider 12-Lead ECG.
- **Airway** (assess and secure)
- **Breathing** (100% FiO2)

Overdose Treatments:

Beta-blocker overdose:

- Glucagon (2-4mg IV push).

Calcium channel blocker overdose:

- Calcium chloride (1g IV).

Secondary Treatments:

- Place **arterial line**.
- Check **ABG, hemoglobin, electrolytes**.
- Rule out **ischemia**: Check EKG, troponins.

** If PEA develops, GO TO: Cardiac Arrest – Asystole/PEA checklist

3: Tachycardia - Unstable

Condition: Hemodynamic instability (SBP<80, BP "low" for patient, rapid BP decrease or acute ischemia), tachycardia with pulses.
Objective: Restore hemodynamic stability, adequate perfusion.

- **Call for help. Inform team. Get Code cart.**
- Check for Pulse. If **NO pulse**, GO TO: **Asystole/PEA** event. If **stable**, GO TO: **Tachycardia – Stable SVT** event.
- **Increase FiO_2 to 100%**, high flow.
- Decrease/turn off anesthetic.
- Confirm adequate ventilation and oxygenation. Consider securing airway.
- If unstable, **IMMEDIATE SYNCHRONIZED CARDIOVERSION** – biphasic doses.
- Consider sedation if patient awake.

SVT Rhythm	Biphasic Dose
Narrow complex, & Regular	50-100 J Synchronized
Narrow complex & Irregular	120-200 J Synchronized
Wide complex & Regular	100 J Synchronized
Wide complex & Irregular	Unsynchronized Defibrillation: 200 J

- If **unsuccessful cardioversion**: Re-SYNC and increase Joules incrementally for Synchronized Cardioversion.
- While preparing to cardiovert (do NOT delay), if narrow complex and regular, consider **Adenosine 6mg** rapid IV push with flush via access closest to heart. May give 2nd dose of 12mg IV.

During Resuscitation:

- **Circulation** (confirm adequate IV or IO access)
  - Consider IV fluids wide open.
  - Consider 12-lead ECG.
- **Airway** (assess and secure)
- **Breathing** (100% FiO_2, high flow)

Synchronized Cardioversion Instructions:

- **Turn monitor/defibrillator ON.** Set to DEFIB mode.
- **Place electrodes on chest** per package instructions.
- **Press SYNC button** to engage synchronization mode.
- **Look for mark/spike on R-wave** indicating SYNC mode.
  - Adjust SIZE button if necessary until SYNC markers seen with each R-wave.
- **Cardiovert at appropriate energy level**, begin at lower level and progress as needed: "Energy select" buttons → "Charge" button → "Shock" button [Press and hold].

Atrial Fibrillation	120J → SYNC* → 150J →SYNC* → 200J
Mono-morphic VT	100J → SYNC* → 150J → SYNC* → 200J
Other SVT, Atrial flutter	50J → SYNC* → 100J → SYNC* → 150J → SYNC* → 200J
Polymorphic VT and unstable	Treat as VF, GO TO: Cardiac Arrest – VF/VT Event

4: Cardiac Arrest: Pulseless VF/VT

Condition: Shockable pulseless cardiac arrest.
Objective: Restore pulse, hemodynamic stability

Top Priority = Early Defibrillation

- **Call for help. Inform team. Code Cart.**
- **Get defibrillator.**
- **CPR** (100-120 chest compressions/min, 5-6cm deep + 10 breaths/min).*
  - Ensure full chest recoil with minimal interruptions.
- **Shock at highest setting (200 Joules Biphasic).**
- **Epinephrine** 1mg IV q3-5min.
- **CPR** x 2 min.

- **Check pulse and rhythm** (confirm shockable; limit check to 10 sec). **
- **Shock** at **200J** Biphasic
- **Epinephrine** 1mg IV q3-5min
- **CPR** x 2 min.

- **Check pulse and rhythm** (confirm shockable; limit check to 10 secs). **
- **Shock** at highest setting.
- **Amiodarone** 300mg IV x1.#
- **CPR** x 2 min.

- **Check pulse and rhythm** (confirm shockable; limit check to 10 sec). **

During CPR:

- **Circulation** (confirm adequate IV/IO access).
  - If $ETCO_2$<10, improve CPR quality
- **Airway** (bag mask ok if ventilation adequate)
- **Breathing** (100% FiO_2, high flow)
- **Assign roles for:** Chest compressions, defibrillation, airway, vascular access, documentation, code cart, time keeping.

Orders should be explicitly acknowledged and repeated.

Defibrillator:

1. Turn defibrillator ON, set to DEFIB mode.
2. Place electrodes on chest per packing instructions.
3. Deliver shock ("Charge" button→ "Shock" button)

Drug Doses and additional considerations:

Epinephrine: 1mg IV, repeat every 3-5 min
Amiodarone: 300mg IV/IO once, then consider additional 150mg IV/IO once
#**Lidocaine can be given instead of amiodarone** for VF/pulseless VT unresponsive to CPR, defibrillation or vasopressor therapy (1.5mg/kg).
Magnesium: consider giving for Torsades de Pointes (loading dose 1-2g IV/IO)
For Magnesium Toxicity: Calcium chloride 10% soln 10mL IV/IO or **calcium gluconate** 10% soln 30mL IV/IO

*In patient without an advanced airway: Cycle of CPR =30 compressions at rate of 100/min, followed by 2 breaths. Give 5 cycles of CPR where "CPR x 2 min" is noted. If able, keep $ETCO_2$>10, Diastolic >20
**If Asystole/PEA develops at any point, GO TO Cardiac Arrest: Asystole/PEA checklist.
**If pulse at any point, begin post-resuscitation care.

5: Anaphylaxis

Condition: Suspected anaphylaxis (consistent hx, rash/hives, hypotension, bronchospasm/wheezing, angioedema, increased PIP, difficulty breathing, hypoxemia).
Objective: Restore hemodynamic stability, abort reaction.

- **Call for help. Inform team. Code cart.**
- **Discontinue/remove potential causative agents.**
- **FiO_2 increased** to 100%?
- **Decrease anesthetic** if hypotensive.
- **Give Epinephrine** IV in escalating doses every 2 min.
  - Start **10-100 mcg IV**
  - Increase dose every 2 min until clinical improvement noted.
  - Consider early epinephrine infusion.
- Consider **early intubation** to secure airway **prior to angioedema** of airway.
- **IV fluids opened** and/or **fluid bolus** given at high rate?
- **If no response: begin IV epinephrine infusion** (rate 1-4mcg/min).
- **IV access** adequate?
- Consider **invasive monitors** (arterial line).

Have we considered:

- **Termination of procedure** to focus on resuscitation?
- **Vasopressin?** (2-4 Units IV; for patients with continued hypotension)
- **Albuterol?** (if bronchospasm is a prominent feature)
- **H_1 blocker - Diphenhydramine?** (25-50mg IV)
- **H_2 blockers?** (ranitidine 50mg IM/IV, cimetidine 300mg IM/IV)?
- **Glucagon?** (1-5mg IV over 5 min, in patients taking beta blockers)
- **Corticosteroids?** (e.g Hydrocortisone 100-200mg IV or methylprednisolone 125mg IV) to decrease biphasic response.

Common causative agents:

Neuromuscular blocking agents, latex products (gloves, Foley catheter), chlorahexidine, antibiotics, colloids, blood products, contrast, protamine.

Drug Doses:

- **Epinephrine doses:**
  - Start with 10-100mcg IV depending on severity
  - Increase incrementally every 2 min until improvement
  - 300mcg (0.3mL of 1:1,000 concentration) IM if no IV access

If cardiac arrest:

Give 1mg epinephrine IV, begin ACLS and **GO TO:** Cardiac Arrest – Asystole/PEA Checklist or Cardiac Arrest – VF/VT Checklist.

Consider and rule out other causes:

- PE
- MI
- Anesthetic OD
- PTX
- Hemorrhage
- Aspiration

POST Event (consider when patient stable):

- Check serum **tryptase level** (useful to guide future management; peaks <60min post-event)
- Check serum **histamine** (peaks <30min post-event)
- If event was moderate/severe, consider keeping patient intubated and sedated.
- Can recur with biphasic response: Consider monitoring for 24 hours post-recovery.
- Refer patient for post-allergy testing.

6: Bronchospasm (Intubated Patient)

Condition: Decreased SpO_2, increased peak pressures, wheezing, increased $ETCO_2$ with upsloping $ETCO_2$ waveform, decreased TV if pressure control.
Objective: Restore normal oxygen saturation and peak pressures.

- **Call for help. Inform team. Code cart?**
- **Increase FiO_2 to 100%,** high flows.
- If hypotensive, **consider disconnecting patient from circui**t to allow for complete exhalation as may be due to air trapping.
- Change I:E time to allow for adequate exhalation.
- Deepen anesthetic (**Sevoflurane** is non-irritating).
- Rule out mainstem intubation or kinked ETT. Suction ETT.
- Give inhaled Beta-2 agonist (**Albuterol**) +/- anticholinergic (**Ipratroprium**)
- If severe, consider **Epinephrine** (start with 10mcg IV and escalate, monitor for tachycardia and HTN).
- Consider **Ketamine** (0.2-1mg/kg IV)
- Consider **Magnesium sulfate** (1-2g IV)
- Consider **Hydrocortisone** (100mg IV)
- Consider **nebulized racemic Epinephrine**.
- Rule out anaphylaxis (hypotension/tachycardia/rash). **GO TO:** Anaphylaxis checklist.
- Consider ABG.

7: Difficult Airway- Unanticipated

Condition: Failed airway (3 unsuccessful attempts or oxygen saturation < 85%)
Objective: Establish adequate oxygenation/ventilation.

Call for help. Get Difficult Airway cart.

Bag-mask ventilate.

Bag-mask ventilation adequate?*

No

Laryngeal Mask Airway (LMA) or other Supraglottic (SG) device

LMA/SG ventilation adequate?

Yes, consider:

- Operation using **LMA** (+ cricoid). **
- Return to spontaneous ventilation.
- Wake patient up.
- Different laryngoscope blades.***
- BURP maneuver (Backwards Upwards Rightward Pressure)
- **Video Assisted laryngoscope**.
- **LMA-Aintree** catheter as conduit.
- **Fiberoptic** intubation.
- Tracheal introducer (**bougie**).

No

- **Cricothyrotomy** (bottom drawer of Anes machine).
- **Transtracheal jet ventilation**.
- Call **ENT or Thoracic Consult** for surgical airway. Get **Tracheostomy Kit**.
- Consider **rigid bronchoscope**.

If bag mask ventilation and LMA become inadequate

Yes, consider:

If alternatives fail, consider:

- **Wake patient up** (for awake intubation, doing procedure under regional/local, or cancelling case).
- **Other options** (i.e. surgery using LMA, face-mask**)
- **Surgical airway** if unable to abort case.

ML ENT Surgery Consult: 443-8724

ML Thoracic Surgery Consult: 443-5864

Sugammadex dosing for immediate reversal of rocuronium**:** 16mg/kg

* Try oral airways, sniff position, ramp, two-handed ventilation. Avoid nasal airways in pregnancy.
** Only if true crash C-section.
*** Limit total DL attempts to 3 in non-pregnant patients, limit to 2 in pregnant patients. Smaller ETT recommended (6.0) in pregnancy. Do not attempt nasal intubation in pregnant patients.

8: Fire

Condition: Signs of fire in OR, in airway, or on patient (smoke, odor, flash)
Objective: Protect patient, contain fire.

Call for help. Inform team.

Activate fire alarm/Get fire-extinguisher/Remove source of heat.

Airway Fire

- **Disconnect breathing circuit**.
- **Stop flow** of medical gases (oxygen/nitrous oxide).
- **Remove endotracheal tube** (must balance against airway loss).
- Remove flammable material from airway.
- **Pour saline** into patient's airway or endotracheal tube, if kept in place.

Non-airway Fire

- **Stop flow** of medical gases (oxygen/nitrous oxide).
- **Remove** drapes and flammable materials from patient.
- **Extinguish fire:**
  - If **electrical equipment** burning (laser, Bovie, anesthesia machine, etc)**,** use **only CO_2 fire extinguisher** (safe in wounds).
  - If **non-electrical**, extinguish with saline and soaked gauze.

** **Do not** use alcohol based solutions.**

If Fire Not Extinguished On First Attempt

- Use fire extinguisher (CO_2) to extinguish fire (safe in wounds).

If Fire Persists

- **Evacuate** patient (per Institutional protocol).
- Close OR door.
- **Turn OFF** external gas supply to operating room.
- **Alert fire department (Call 911).**

If Fire Extinguished

- **Re-establish ventilation**. Consider prompt **reintubation** prior to swelling.
- Avoid oxidizer-rich environment, supplemental O_2 (if possible).
- Consider **bronchoscopy** to assess for inhalational injury and remove residual debris.
- Examine ET tube to see if fragments may be left behind.
- Discuss continuation of case with surgeon.

See back for Fire Prevention Tips →

Fire Prevention

Airway Fire Prevention

If **high risk** procedure, including those listed below:

- Discuss fire prevention & management with team during time-out.
- Avoid $FiO_2 > 0.3$ and avoid N_2O.

For **laser** surgery of vocal cord or larynx:

- Use laser resistant ETT.
- Make sure ETT cuff is sufficiently deep below vocal cords.
- Fill proximal ETT cuff with methylene blue- tinted saline.
- Ensure laser is in STANDBY when not in active use.
- Surgeon protects ETT cuff with WET gauze
- Surgeon confirms $FiO_2 < 0.3$ & no nitrous prior to laser use.

For **non-laser** surgery in oropharynx:

- Regular PVC ETT may be used.
- Consider packing wet gauze around ETT to minimize oxygen leakage.
- Consider continuous suctioning of operating field inside oropharynx.

Non-airway Fire Prevention

- Team communication at Time-Out if high risk procedure.
- Highest risk in MAC head and neck procedure.
  - Use nasal cannula instead of face mask (if possible).
  - Configure drapes to avoid O_2 build-up, consider active scavenging if required.
  - Use minimum O_2 concentration for adequate SpO2.
- If high O_2 concentration required, use LMA or ETT.
- Allow complete drying of EtOH skin prep solutions.
- Surgical fiberoptic light sources should not be placed on paper drapes.
- Consider coating patient's head hair and facial hair with water-soluble surgical lubricating jelly.

Remember: Fuel Source + Oxidizer + Spark = FIRE

9: Hemorrhage

Condition: Acute massive bleeding
Objective: Stop bleeding, maintain hemodynamic stability, avoid coagulopathy

- **Call for help. Inform team. Code cart?**
- **Open IV fluids.** Get **adequate IV access** (at least two 18G PIVs)
- Consider **Trendelenburg** or elevate patient's legs**.**
- **Check Hemacue. Send STAT labs** (T&C, CBC, PT/PTT/INR, Fibrinogen, Lactate, ABG, Potassium, Calcium)
- **Call Blood Bank x31313**:
  - **Activate Massive Transfusion Protocol** (via **ANES Attending** phone call to blood bank)
  - Order **blood products**
    - **RBC/FFP** (1:1 ratio)
    - Consider **Platelets** (if indicated, 1:5 ratio with PRBCs)
    - Consider **Cryoprecipitate**
- Call for **additional Nursing and Anesthesia help**. Call for **dedicated Anesthesia Tech**.
- **Re-evaluate Anesthetic plan.**
- **Use Rapid infuser** (or pressure bags).
- **Maintain normothermia.** Fluid warmer for IV and blood products. Forced air warmer.
- **Maintain normocalcemia.**
- Place **arterial line** as indicated. Follow patient's ABG (acid/base status) as indicator of adequate resuscitation.

Have we considered:

- **Additional surgical techniques and/or personnel?**
  - **Hemostatic agents? Antifibrinolytics** (Tranexamic acid 10mg/kg IV, then 1mg/kg/hr)?
  - **Interventional Radiology?** (Fellow pager 443-9417)
  - **Vascular Surgery?** (pager 443-4461)
  - **Cell-saver** (if noncontaminated, nonmalignant case)?
- **Damage control surgery** (pack, close, resuscitate)?
- **ICU** postop?

If active bleeding, transfuse based on clinical situation. Do not wait for lab results.

Other Considerations:

- Stay in contact with Blood Bank periodically if Massive Transfusion Protocol activated to ensure continued delivery of blood products. Identify one person to speak to one person in blood bank for all product requests to avoid duplicates.
- Consider cell salvage. Call **Cell Saver** (916) 851-5800 for setup.

Hyperkalemia Treatment:

- Calcium gluconate (10mg/kg) or calcium chloride (10mg/kg) IV
- Sodium Bicarbonate 1-2mEq/kg, slow IV push
- Insulin 10 Units regular IV with 1-2 amps D50W

Estimated Blood Loss = EBV X (HCTstart – HCTmeasured)/ HCT start

Estimated Blood Vol (EBV) = 65-70mL/kg (4.5L for 70kg)

10: Hypotension

Condition: Unexplained drop in BP.
Objective: Restore hemodynamic stability.

- **Call for help. Inform team. Code cart?**
- Check **Equipment/monitors** checked for malfunction (arterial line, BP cuff).
- **Check Pulses**. If no pulse, start CPR, GO TO: appropriate ACLS events.
- **Give IV fluid bolus** opened? Ensure IV is working.
- **Increase FiO_2** to 100%, high flow.
- Surgical field inspected for **bleeding**? If bleeding, **GO TO**: **Hemorrhage** Checklist
- Have we considered:
  - Decreasing anesthesia?
  - Patient position? Consider **Trendelenberg** or elevation of patient's leg.
  - Give **phenylephrine** or **ephedrine** to temporize. If severe refractory hypotension, consider **epinephrine** 10-100mcg and/or **vasopressin** 1-4 units.
  - Additional IV access? Arterial line?
  - Send labs: ABG, Hgb, electrolytes, calcium, lactate, type & cross
- **Have we considered the following causes:**

Surgical

- Retraction
- Vagal stimulation
- Mechanical/surgical manipulation
- Vascular compression
- IVC compression (prone, obese, pregnant or surgical)

Nursing

- Other evidence of bleeding:
  - Amount of **blood in suction canister**
  - Number of **bloody sponges**
  - **Blood on the floor**
- Drugs used on the field (i.e. intravascular injection of local drugs)

Anesthesia

Airway:
- Unexplained Hypoxia (**GO TO**: Hypoxia Checklist)
- Increased PEEP, Auto-PEEP (disconnect circuit)

Breathing:
- Hypoventilation
- Pneumothorax
- Pulmonary Edema
- Persistent hyperventilation

Circulation:
- Hemorrhage
- Myocardial ischemia
- Pulmonary Embolism
- Air Embolism (**GO TO**: Air Embolism Checklist)
- Other emboli (fat, septic, CO2, amniotic fluid)
- Anaphylaxis
- Severe sepsis, adrenal insufficiency
- Tamponade
- Bradycardia (**GO TO**: Bradycardia – Unstable Checklist)
- Tachycardia (**GO TO**: Tachycardia – Unstable Checklist)
- Malignant Hyperthermia (**GO TO**: Malignant Hyperthermia Checklist)
- Bone Cementing (Methyl methacrylate effect)

Drugs/allergy:
- **Recent drugs** given/dose error/allergy
- Anesthetic overdose

11: Hypoxia

Condition: Unexplained oxygen desaturation.
Objective: Restore oxygenation.

- **Call for help. Inform team.**
- Check **Pulse oximeter** placement.
- **Increase FiO_2** to 100%, high flow.
- **Hand ventilate** to assess compliance. Rule out leaks, machine factors.
- **Oxygen source** checked? Check other monitors, vitals, PIP, $ETCO_2$. Check for pulse.
- Check **Circuit** for disconnection, kinks, holes.
- **End-tidal CO_2** confirmed?
- Listen for **Breath sounds** (bilateral? clear?). Check **ETT position**.
- **Soft suction** via ETT (to clear secretions and check obstructions).
- Check **ABG.** Consider CXR.

Suspected Airway/Breathing Issue?

Yes

Depending on likely diagnosis, consider:

- Large **recruitment breaths**. Add **PEEP** (caution if hypotensive)
- **Bronchodilators** (albuterol MDI or nebulizer)
- **Neuromuscular blockade** (if indicated)
- Increase FRC: head up (unless low BP), desufflate
- **Fiberoptic** to rule out mainstem intubation or ETT obstruction.
- Removing circuit and using Ambu-bag
- Remove ETT and Mask Ventilation/Re-Intubation
- Consider **terminating surgery** for refractory hypoxemia.

Consider causes:

Airway:

- Right mainstem intubation
- Bronchospasm
- Ventilator settings, leading to Auto-PEEP

Breathing:

- Aspiration
- Atelectasis
- Obesity/positioning
- Pneumothorax
  - CXR. Consider needle decompression, chest tube.
- Hypoventilation
- Pulmonary Edema
- Low FiO_2
- V/Q mismatch or shunt, diffusion problem

No

Consider causes:

Circulation:

- Embolism
  - Pulmonary Embolus
  - Air Embolism? (**GO TO:** Air Embolism Checklist)
  - Other Emboli (e.g. fat, septic, CO_2, AFE)
- Heart Disease?
  - Congestive Heart Failure
  - Coronary Artery Disease
  - Myocardial Ischemia
  - Cardiac Tamponade
  - Congenital/anatomic Defect
    - EKG, TEE, Bypass considered?
- Severe sepsis
- If hypoxia associated with hypotension (**GO TO:** Hypotension Checklist)

Drugs/allergy:

- **Recent drugs** given
  - Drug error/allergy/anaphylaxis

See back for differential diagnosis →

Hypoxia

Physiological Differential Diagnosis:

- **Low FiO_2:** If gas analyzer states low FiO_2 while on 100% O_2 likely have O_2 failure or pipeline crossover of gases. Disconnect from anesthesia machine, use Ambu bag or Jackson Rees circuit attached to E cylinder of O_2.
- **Hypoventilation:** Check for **signs** of low minute ventilation:
  - Low TV or RR
  - High or low ETCO2
  - Poor chest rise
  - Decreased breath sounds
  - Patient bucking ventilator

  Rule out or fix equipment and patient causes:
  - Circuit leak
  - Obstructed or kinked ETT
  - High PIP
  - Residual neuromuscular blockade
  - Patient breathing asynchronously with ventilator.

  Postoperative respiratory failure common causes:
  - Residual neuromuscular blockade, opioid, anesthetic, laryngospasm (sudden), bronchospasm, pulmonary edema, high spinal, pain.
- **V/Q Mismatch or Shunt:** A-a Gradient Common Causes
  - Mainstem intubation
  - Atelectasis
  - Aspiration
  - Bronchospasm (+?Anaphylaxis)
  - Mucus plug
  - Pleural effusion

Consider RARE but Critical:

- **Pneumothorax**
- **Hypotension** – any cause of poor perfusion
- **Embolus** – Air, blood, fat, AFE

- **Diffusion** abnormality: usually chronic lung disease
- **Methemoglobinemia** (O_2 sat ~85%), **COHgb** (O_2 Sat often normal): If suspect, check co-oximetry.
- **Increased metabolic O_2 demand**: MH, thyrotoxicosis, sepsis, hyperthermia, neuroleptic malignant syndrome.
- **Artifacts:** Poor waveform (probe malposition, cold extremity, light interference, cautery), dyes (methylene blue, indigo carmine, blue nail polish). Confirm by ABG.

12: Local Anesthetic Toxicity

Condition: Tinnitus, metallic taste, circumoral numbness, altered mental status, seizure, hypotension, bradycardia, ventricular arrhythmias, CV collapse
Objective: Restore hemodynamic stability

- **Call for help. Inform team. Code cart.**
- **Call for Intralipid** (in Block cart). Alert possible Cardiopulmonary Bypass.
- **If pulseless, start CPR.**
- **Stop local anesthetic** injection/infusion.
- If patient unstable, give **epinephrine <1mcg/kg. Avoid vasopressin.**
- Establish airway – ensure **adequate ventilation and oxygenation**. Consider endotracheal intubation.
- Treat seizure with **benzodiazepines** (avoid propofol if hemodynamic instability)
- If signs persist or patient unstable, **rapidly give 1.5mL/kg bolus of 20% Intralipid IV** (70kg adult gets 100mL over 1 min), then start infusion at 0.25mL/kg/min. May repeat loading dose (**max 3 doses or 10mL/kg over first 30 min**). May increase infusion rate to 0.5mL/kg/min if persistent hypotension.
- Monitor for hemodynamic instability. Treat hypotension. **GO TO:** appropriate ACLS event depending on arrhythmia with ASRA modifications*.
- If refractory to treatment, consider **cardiopulmonary bypass**.
- May require **prolonged resuscitation**.
- Monitor patient post-event in **ICU**.

Drugs to AVOID during Local Anesthetic Toxicity:

- Propofol
- Vasopressin
- Calcium channel blocker
- Beta blocker
- Local anesthetic

***ASRA Modifications to ACLS when treating Local Anesthetic Toxicity:**

- **Reduce Epinephrine doses to <1mcg/kg IV.**
- **AVOID:** Vasopressin, calcium channel blockers, beta blockers, and local anesthetics.

Intralipid Dosing:

- **Bolus 1.5mL/kg** (lean body mass) IV over 1 min (~100mL in 70kg patient)
- **Continuous infusion 0.25mL/kg/min** (~18mL/min)
- Repeat bolus once or twice for persistent cardiovascular collapse
- Double infusion rate to 0.5mL/kg/min if BP remains low
- **Continue infusion for at least 10 minutes** after attaining circulatory stability
- Recommended upper limit: 10mL/kg over first 30 min

13: Malignant Hyperthermia

Condition: Unexpected, unexplained increase in end-tidal CO_2; prolonged masseter muscle spasm after succinylcholine; unexpected, unexplained tachycardia, tachypnea, mixed acidosis
Objective: Restore normal hemodynamic parameters, metabolic function, temperature.

- **Call for help. Inform team.**
- **Get Malignant Hyperthermia (MH) cart.** Located in Anesthesia workroom.
- **Stop volatile anesthetics and succinylcholine, transition to non-triggering anesthetic.**
  - Don't delay treatment to change circuit or CO_2 absorber.
  - Request chilled IV saline.
- **Increase FiO_2** 100%, high flow 10L/min.
- **Increase minute ventilation:** 10L/min or more (2-4x patient's minute ventilation)
- **Give Dantrolene** 2.5mg/kg IV bolus!
- **Call MH hotline: 1-800-644-9737**
- **Halt procedure.** If emergent, continue with non-triggering anesthetic.
- Give **Bicarbonate** for metabolic acidosis.
  - Maintain pH > 7.2.
- **Cool patient** if temp > 38.5°C
  - Lavage open body cavities.
  - NG lavage with cold water.
  - Apply ice externally.
  - Cold saline infused intravenously.

  **** Stop cooling if temp < 38°C. ****
- **Hyperkalemia** treated if suspected?
- **Dysrhythmias** treated if present?
  - Standard antiarrhythmics are ok; **don't use Calcium Channel Blockers.**
- Send **Labs:** ABG, VBG, electrolytes, serum CK, serum/urine myoglobin, PT/PTT, lactic acid.
- **Place Foley catheter.** Monitor urine output. Goal 2mL/kg/h.
- **Arrange ICU bed.** Mechanical ventilation usually required.
- Continue Dantrolene 1mg/kg q4-6 hrs for 24-36 hours. Observe closely for 24 hours.

Signs of MH:

EARLY:
- Increased ETCO2
- Tachycardia
- Tachypnea
- Mixed Acidosis
- Masseter spasm/trismus
- Sudden cardiac arrest in young person due to hyperkalemia

May be LATER:
- Hyperthermia
- Muscle rigidity
- Myoglobinuria
- Arrhythmia
- Cardiac Arrest

Drug Doses and Treatments:

Dantrolene:
- Dilute 250mg in 5mL sterile water.
- 2.5mg/kg IV q5min until symptoms subside.
- May require up to 30mg/kg.

Sodium Bicarbonate:
- 1-2mEq/kg for suspected metabolic acidosis (may give even if blood gas values not available).

Hyperkalemia Treatment:
- Hyperventilation
- Calcium chloride (10mg/kg) or Calcium gluconate (30mg/kg) IV
- Sodium bicarbonate 1-2mEq/kg, slow IV push.
- Regular Insulin 10 Units IV with 1 amp D50 (25g Dextrose) – monitor glucose.

Differential Diagnosis:

- Light anesthesia
- Hypoventilation
- Insufflation of CO2
- Over-heating (external)
- Hypoxemia
- Thyroid storm
- Pheochromocytoma
- Neuroleptic Malignant Syndrome (NMS)
- Serotonin Syndrome

14: Myocardial Ischemia

Condition: Chest pain, shortness of breath, depression or elevation of ST segment, arrhythmias (conduction abnormalities, unexplained tachycardia, bradycardia or hypotension).
Objective: Increase myocardial oxygen supply, decrease myocardial oxygen consumption. Restore hemodynamic stability.

- **Call for help. Inform team. Code cart.**
- **Increase FiO_2 to 100%,** high flows.
- Verify ischemia with expanded monitor view, **12-lead EKG**.
- Treat hypotension or hypertension.
- **Beta-blocker** to slow heart rate. Hold for bradycardia or hypotension.
- **Aspirin** 325mg chewed PO or 600mg PR or NG/OG.
- If Acute Coronary Syndrome, call operator, who will activate STEMI pager.
  - Consider Cath Lab
- Treat pain with **opioids** (fentanyl or morphine).
- Consider **nitroglycerin** 0.4mg sublingual and/or **infusion** (start at 0.2mcg/kg/min, titrate to relief of chest pain and hemodynamic stability; hold until hypotension treated).
- Check **ABG, CBC, Troponin**. Consider arterial line if hypotensive.
- If anemic, treat with packed RBCs.
- Consider TTE for monitoring volume status and regional wall motion abnormalities.
- If hemodynamically unstable despite pressors, consider **Intra-Aortic Balloon Pump.**
- Be prepared for **arrhythmias** and have **Code Cart at bedside**.

Cardiology Consult: 443-QRST

If ST Elevation MI, do not call Cardiology Consult first. Call Operator and ask to activate "STEMI" Pager.
(Activates Cath Lab, pages Cath Attending, Interventional Cardiology Fellow, etc.)

Goal: STEMI to PCI (symptom-to-balloon) time of 90 minutes.
Stenting and antiplatelet therapy are not contraindications during pregnancy.

15: Oxygen Failure

Condition: Hear O_2 failure alarm or while on 100% O_2, see "Low FiO_2" value on gas analyzer
Objective: Provide O_2 to patient.

- **Call for help. Inform team. Code cart?**
- **Disconnect patient from machine and ventilate with Ambu bag on Room Air.**
- **Alternative:** Obtain full E cylinder of O_2 with a regulator. Ventilate with Ambu bag or Jackson Rees circuit attached to new O_2 tank.
- Do **not** connect patient to auxiliary flow meter on machine – comes from SAME central source!
- Open O_2 tank on back of anesthesia machine (check not empty) and disconnect pipeline oxygen to force flow from tank into circuit.
- Connect gas sampling adaptor to allow monitoring of respiratory gases. **Is the patient receiving 100% oxygen?**
- Maintain anesthesia (if necessary) with IV drugs.
- Reduce O_2 flow rates to minimum needed to conserve oxygen.
- Obtain extra backup sources of oxygen.
- When patient more stable, contact Bioengineers to alert them to the problem and enlist help with machine diagnosis while you focus on patient.
- Inform OR leadership, ICU, hospital of potential large-scale O_2 problem.
- Discuss with surgeons implication of O_2 failure for this patient's management and OR schedule.

ML OR front desk: 31545
ML Biomed: 38303

16: Pneumothorax (PTX)

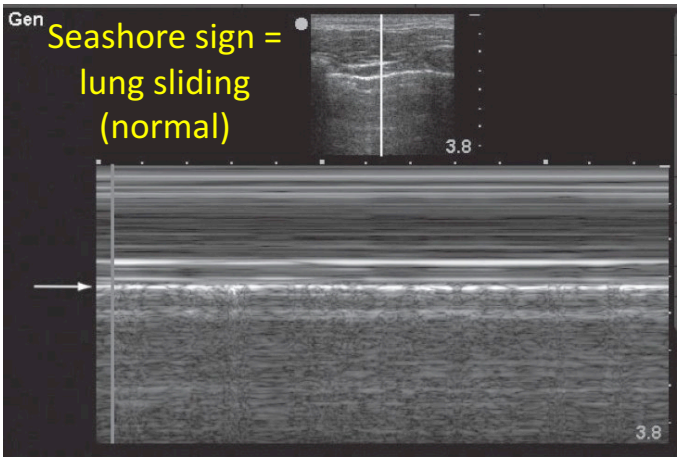
Condition: Increased Peak inspiratory pressures, tachycardia, hypotension, hypoxemia, decreased or asymmetric breath sounds, tracheal deviation, increased JVD/CVP
Objective: Decompress tension PTX; restore hemodynamic stability

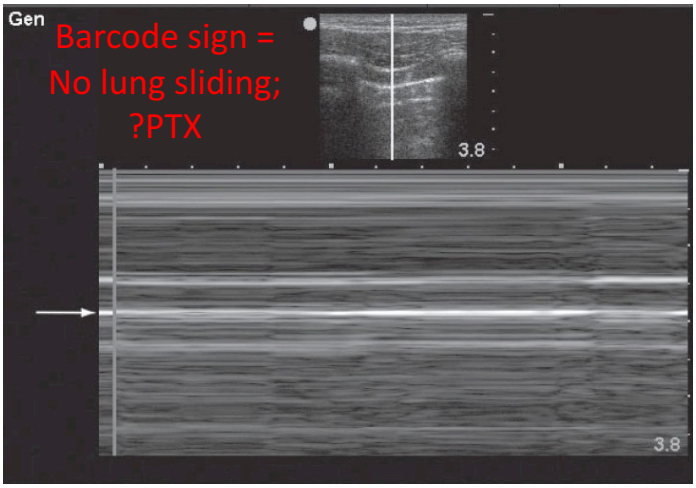
- **Call for help. Inform team. Code cart?**
- **Do not wait for X-Ray to treat if patient is hemodynamically unstable!**
- Increase to 100% O_2, high flow
- Rule out mainstem intubation.
- Consider stat CXR or TTE or Ultrasound to assess
- **Place 14 or 16G needle mid-clavicular line 2nd intercostal space on affected side.** Should hear a whoosh of air if under tension.
- Immediately follow up needle decompression with thoracostomy (chest tube).

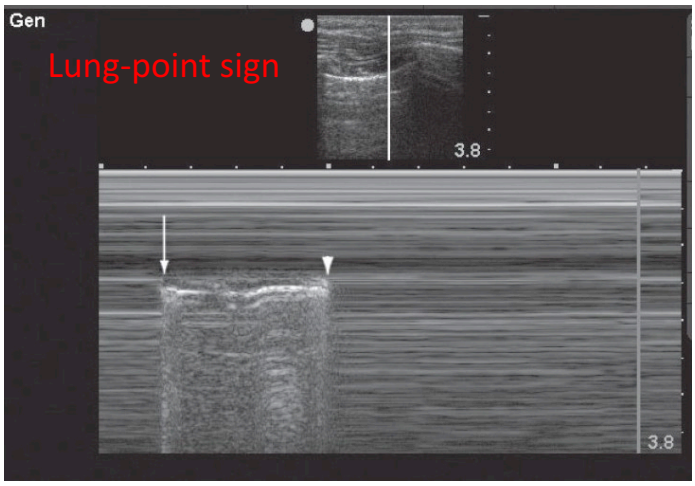
X-Ray at ML: 31962

Signs of PTX on Ultrasound:

- Absence of lung sliding on non-dependent part of lung
- "Barcode" sign on M-mode (see image below)
- Lung-point sign increases sensitivity of ultrasound diagnosis of PTX.







Images from Stone MB. J Emerg Trauma Shock. 2008 Jan-Jun; 1(1): 19–20.

17: Power Failure

Condition: Loss of power.
Objective: Ensure adequate oxygenation and ventilation.

- **Get additional light sources:** flashlights (top drawer of anesthesia machine), laryngoscopes, cellphones.
- **Open doors and shades** to let in ambient light.
- **Confirm ventilator is working** and if not, ventilate patient with **Ambu bag** and switch to total IV anesthesia (TIVA).
- If monitors fail, check pulse and manual blood pressure.
- **Request Transport Monitor** or defibrillator monitor.
- **Confirm adequate backup O_2 supply** (e.g. full E cylinder O_2 tanks). Power failure may affect oxygen supply or alarms.
- **Check extent of power failure**. Call OR front desk x31545.
  - Is the problem one OR, all ORs, or hospital-wide?
  - If only in your OR, check if circuit breaker has been tripped.

ML OR front desk: 31545
ML Biomed: 38303

18: Seizure

Condition: sudden shaking, tonic-clonic movements, tongue biting, bowel or bladder incontinence
Objective: stop seizure activity, prevent hypoxia, prevent recurrence of seizures

- **Call for help. Inform team. Code Blue? Code cart?**
- Assess C-A-B (Circulation, Airway, Breathing) and vitals.
- Lateral position to minimize aspiration risk.
- Supplemental O_2 / Obtain IV access.
- If seizure persists, give benzodiazepine (midazolam 2mg IV or ativan 1mg IV)
- If concern for local anesthetic toxicity, do NOT bolus propofol. **GO TO: Local Anesthetic Toxicity Checklist.**
- **Consult Neurology 443-COMA.**
- Check glucose:
  - Treat hypoglycemia with D50.
  - Treat hyperglycemia with insulin if blood glucose >200.
- For persistent seizures, consider:
  - **Fosphenytoin** 15-20mg/kg IV (no faster than 150mg/min bolus, then 100-150mg/min infusion).
  - **Propofol** (2-3mg/kg IV bolus, followed by up to 75 mcg/kg/min infusion).
  - **Phenobarbital** (15 mg/kg IV).
- Check electrolytes (Sodium).
- Consider ICU for further monitoring.

Neurology Consult: 443-COMA (2662)
ICU Triage Fellow: 39209

Seizure Differential:

- Epilepsy
- Local Anesthetic Systemic Toxicity
- Stroke / Transient ischemic attack
- Posterior reversible encephalopathy syndrome (PRES)
- Subarachnoid hemorrhage
- Convulsive syncope

See back of this page for larger differential→

Neuromuscular Blocking Agents do not stop seizure activity in the brain, but may facilitate intubation.

Seizure Differential:

- Epilepsy
- Eclampsia
- Local Anesthetic Toxicity
- Stroke / Transient ischemic attack
- Posterior reversible encephalopathy syndrome (PRES)
- Subarachnoid hemorrhage
- Convulsive syncope
- Encephalitis
- Pseudoseizure
- Hypoglycemia

- Delirium, dementia
- Delirium Tremens
- Migraine
- Sleep disorder, parasomnia (night terrors, sleepwalking)
- Essential tremor
- Restless Leg Syndrome
- Anticholinergic toxicity
- Paroxysmal movement disorder (acute dystonic reaction, non-epileptic myoclonus, propofol or etomidate induced myoclonus)

19: Stroke

Condition: sudden numbness, weakness, dizziness, confusion, facial droop, severe headache or trouble with speaking vision, coordination
Objective: timely evaluation and treatment of acute stroke, possible emergent thrombolysis +/- embolectomy

- **Call for help. Code Blue. Code cart.**
- If concern for acute stroke, call **Neurology Consult 443-COMA**.
- Assess C-A-B (Circulation, Airway, Breathing) and vitals.
- Supplemental O_2
- Order **STAT NCHCT**.
- Continuous EKG monitoring for ischemia or atrial fibrillation
- Monitor BP and only treat after discussion with Neurology
- Check glucose.
  - Treat hypoglycemia with D50.
  - Treat hyperglycemia with insulin if blood glucose >200.
- Check CBC, PT/INR, PTT, Electrolytes
- Treat fever with acetaminophen
- If GCS<8, consider intubation*
- If **stroke is likely and thrombolysis or embolectomy indicated**, **transfer immediately to Moffitt-Long Neuro ICU.**

The window for possible thrombolysis is **within 3 hours** of symptom onset (4.5 hours in some special cases).

Important Numbers:

Neurology Consult: 443-COMA (2662)

ICU Triage Fellow: 39209

*For GCS score and TPA exclusion criteria, see back of page →

Glasgow Coma Score (GCS) = E + V + M		
Eye Opening (E)	**Verbal Response (V)**	**Motor Response (M)**
4 = Spontaneous	5 = Normal conversation	6 = Normal
3 = To voice	4 = Disoriented conversation	5 = Localizes to pain
2 = To pain	3 = words, but not coherent	4= Withdraws to pain
1 = None	2 = No words; only sounds	3 = Decorticate posture
	1 = None	2 = Decerebrate
		1 = None

20: Tachycardia – Stable SVT

Condition: Hemodynamic stability (SBP>80), tachycardia with pulses.
Objective: Restore hemodynamic stability, adequate perfusion.

- **Call for help. Inform team. Get Code cart.**
- Check for Pulse. If **NO pulse**, **GO TO**: PEA event.
- If **Unstable** (at any point), **GO TO**: SVT-Unstable event. Prepare for Synchronized Cardioversion
- **Increase FiO_2 to 100%**, high flow.
- Confirm adequate ventilation, oxygenation.
- Consider 12 lead **EKG, print rhythm strip,** then treat per rhythm (see below).
- If still **STABLE SVT**, consider **Arterial line**, send **ABG & electrolytes**.

Sinus Tachycardia is NOT SVT:

- Sinus Tachycardia may be compensatory; search for and treat underlying causes.
- More likely **SVT than sinus if any** of following:
  - Rate > 150
  - Irregular
  - Sudden onset

Signs of UNSTABLE:

- SBP < 80
- BP "low" for patient
- Rapid BP decrease
- Acute ischemia

STABLE SVT Rhythm	Treatment
Narrow complex & Regular	1. To convert: **Adenosine 6mg** IV push with flush. May give 2nd dose: 12mg IV 2. If NOT converted, may Rate Control. Choose Beta Blocker or Calcium Channel Blocker: Beta Blocker: • **Esmolol**: Start 0.5mg/kg IV over 1 min. May repeat after 1 min. May start infusion 50mcg/kg/min. • **Metoprolol**: Start 1-2.5mg IV. May repeat or double after 2.5 min. Calcium Channel Blocker: • **Diltiazem**: 5-10mg IV over 2 min. May repeat after 5 min. 3. **Amiodarone**: 150mg IV **SLOWLY** over 10 min. May repeat x1. Start infusion 1mg/min for 1st 6 hours
Narrow complex & Irregular	1. Choose Beta Blocker or Calcium Channel Blocker: Beta Blocker: • **Esmolol**: Start 0.5mg/kg IV over 1 min. May repeat after 1 min. May start infusion 50mcg/kg/min. • **Metoprolol**: Start 1-2.5mg IV. May repeat or double after 2.5 min. Calcium Channel Blocker: • **Diltiazem**: 5-10mg IV over 2 min. May repeat after 5 min. 2. **Amiodarone**: 150mg IV **SLOWLY** over 10 min. May repeat x1. Start infusion 1mg/min for 1st 6 hours.
Wide complex & Regular	**Amiodarone**: 150mg IV **SLOWLY** over 10 min. May repeat x1. Start infusion 1mg/min for 1st 6 hours. May consider Procainamide or Sotalol.
Wide complex & Irregular (likely Polymorphic VT)	Prepare to **Defibrillate** and **GO TO**: VT/VF event

21: Total Spinal Anesthesia

Condition: Unexpected rapid rise in sensory blockade, numbness/weakness in upper extremities, dyspnea, bradycardia, hypotension, nausea/vomiting, loss of consciousness, apnea, cardiac arrest.
Objective: Restore hemodynamic stability. Ensure adequate oxygenation/ventilation.

- **Call for help. Inform team. Code cart.**
- **If Cardiac Arrest,** start **CPR,** immediate **epinephrine, GO TO**: PEA event.
- Support **ventilation** and intubate if necessary.
- If significant bradycardia, treat with immediate **epinephrine** (start 10-100mcg, increase as needed**, GO TO** appropriate ACLS event).
- If mild bradycardia, consider **atropine** (0.5-1mg), but progress quickly to epinephrine if needed.
- Give **IV fluid** bolus.
- Abort case if possible.

22: Transfusion Reactions

Condition: Hemolytic reaction (tachycardia, tachypnea, hypotension, oozing – DIC?, dark urine), Febrile reaction (fever), Anaphylactic reaction (tachycardia, wheezing, urticaria/hives, hypotension).
Objective: Restore hemodynamic stability.

- **Call for help. Inform team. Code cart?**
- **Stop transfusion.**
- Support BP with **IV fluids** and **vasoactive** medications if needed.
- If **Anaphylactic reaction**, **GO TO:** Anaphylaxis checklist.
- If mild reaction, consider antihistamine and antipyretic.
- For **hemolytic reaction**, place foley. Maintain urine output with IV fluids and diuretics.
- Monitor for and treat DIC if **hemolytic reaction.**
- Monitor for TRALI (lung injury) and treat accordingly, may require post operative ventilation.
- Notify Blood Bank (353-1313) of reaction. They will need further samples. If need consult advice, page Blood Bank Fellow.

Signs of Transfusion Reactions:

- **Hemolytic:**
  - Tachycardia
  - Tachypnea
  - Hypotension
  - Oozing – DIC?
  - Dark urine
- **Febrile:** fever
- **Anaphylactic:**
  - Tachycardia
  - Wheezing
  - Urticaria/hives
  - Hypotension

23: Venous Air Embolism

Condition: Decreased end-tidal CO_2 and SpO_2, decreased BP, dyspnea, respiratory distress, coughing, rise in CVP.
Objective: Restore normal oxygen saturation and hemodynamic stability and stop source of air entry.

- **Call for help. Inform team. Call for Code Cart?**
- **Increase FiO_2 increased** to 100%.
- **Turn off Nitrous Oxide** anesthetic.
- **Decrease anesthetic** level if hypotension.
- **Stop source of air entry stopped.**
  - **Surgical site** lowered below level of heart, if possible?
  - **Wound** filled with irrigation?
  - **Entry point** searched for (including open venous lines)?
  - **Intermittent jugular venous compression** considered if head or cranial case?
- Give **Fluid bolus** to increase CVP.
- **Consider Transesophageal echocardiography** (if available; to assess air and RV function).
- Give **epinephrine** (start 10-100mcg) to maintain CO.
- Start **CPR** if BP catastrophically low.

Have we considered:

- **Left side down** once source controlled?
- **Aspiration of air** from central line?
- **Vasopressors** (e.g. dobutamine, norepinephrine)?
- **Chest compressions** (100/min; to force air through lock, even if not in cardiac arrest)?
- **Termination of surgical procedure** if able?

If cardiac arrest:
Give 1mg epinephrine IV, begin ACLS and **GO TO:** Cardiac Arrest – Asystole/PEA Checklist or Cardiac Arrest – VF/VT Checklist.

Consider hyperbaric O2 therapy (requires transfer to St. Francis Medical Center).

University of California San Francisco

Important Parnassus Phone Numbers

E1 Attending	31581
ML OR Front Desk	31545
ICU Triage Fellow	39209

Overhead page	14756

Blood Bank	31313
Lab - Chemistry	31501
Lab - Hematology	31747
Lab - ABG	31755
Pharmacy - OR satellite	38345
Pharmacy - 13th Flr Satellite	38152
Pharmacy - Main	31028
Xray	31962
IR (pager 443-9417)	31300
Cardiology Consult	443-QRST (7778)
Interpreter	32690
Biomedical Engineering	38303
Needlestick Hotline	353-STIC (7842)

OR prefix	385xx
Anesthesia workroom	31815
Pre-Op	31648
PACU	31292
Pain Office	31484
Anes Lounge	31088