# Operating Room Crisis Checklists

### **Management of Adult Emergencies**

**September 2024 version** 

### >> Do not remove book from this room <<



Brigham and Women's Hospital Founding Member, Mass General Brigham

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All reasonable precautions have been taken to verify the information contained in this publication. The responsibility for the interpretation and use of the materials lies with the reader.



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SUSPECTED EVENT (alphabetical)

INDEX

Air Embolism - Venous	01
Anaphylaxis	02
Bradycardia - Unstable	03
Cardiac Arrest - Asystole/PEA	04
Cardiac Arrest - VF/VT	05
Delayed Emergence	06
Failed Airway	07
Fire	08
Hemorrhage	09
Hypotension	10
Нурохіа	11
Local Anesthetic Systemic Toxicity (LAST)	12
Malignant Hyperthermia	13
Myocardial Ischemia	14
OB Hemorrhage	15
Tachycardia - Unstable	16
Transfusion Reaction	17
Debriefing	18

### 01 Air Embolism - Venous

Decreased end-tidal CO<sub>2</sub>, decreased oxygen saturation, hypotension

#### START

#### 1. Call for help

- Ask: "Who will be the crisis manager?"
- Crisis manager designates checklist reader
- 2. Turn FiO<sub>2</sub> to 100%
  - ► Turn off nitrous oxide

#### 3. Stop source of gas entry

- Fill wound with irrigation and/or apply bone wax to bone edges
- Lower surgical site below level of heart if possible
- Search for entry point (including open venous lines)
- Desufflate if concern for CO<sub>2</sub> embolism

#### 4. Support hemodynamics

- Escalate vasopressor support as needed
- Turn down anesthetic agents

#### 5. Consider...

- Positioning patient with left side down, if feasible
  - Continue monitoring during positioning
- Removing PEEP in patients with PFO at risk for paradoxical embolism
- Avoid spontaneous ventilation; paralyze as needed
- Use ETCO<sub>2</sub> to monitor progression and resolution of embolism or for assessment of cardiac output
- ▶ If diagnosis is unclear, call for TEE
- ▶ If ongoing hemodynamic instability, call for ECMO or cardiopulmonary bypass
- 6. Continuing care
  - Consider hyperbaric oxygen treatment within 6 hours for evidence of paradoxical embolism

#### **DIFFERENTIAL** diagnosis

Amniotic Fluid Embolism Cement Embolism Venous Thromboembolism / Pulmonary Embolism Non-embolic causes of hypotension (CHKLST 10) Non-embolic causes of hypoxia (CHKLST 11)

#### Critical CHANGES

If **PEA** develops, go to CHKLST 04

INDEX

## 02 Anaphylaxis

Hypotension, bronchospasm, high peak-airway pressures, decreased breath sounds, tachycardia, urticaria

#### START

#### 1. Call for help

- Ask: "Who will be the crisis manager?"
- Crisis manager designates checklist reader
- 2. Give EPINEPHrine bolus
  - Repeat bolus with increasing dose as needed
  - Consider EPINEPHrine infusion

#### 3. Establish/secure airway

- Turn FiO, to 100% or start supplemental oxygen
- 4. Remove potential causative agents
- 5. Give fluid bolus

#### 6. Consider...

- Minimize volatile anesthetics if patient remains unstable
- Consider albuterol as adjunctive therapy for bronchospasm unresponsive to EPINEPHrine
- Vasopressin bolus and/or infusion for patients with hypotension unresponsive to EPINEPHrine
- Terminate procedure
- Once hemodynamically stable:
  - Supplemental treatment with diphenhydrAMINE and corticosteroids
  - Tryptase level: Check within first hour, repeat at 4 and 18-24 hours

#### DRUG DOSES & treatments

EPINEPHrine	BOLUS: 10 - 50 MCG IV (1 mg in 100 mL = 10 MCG/mL) INFUSION: 0.01- 0.1 MCG/kg/min If no IV access, 0.3 mg IM		
Vasopressin	BOLUS: 1 -2 units IV (1 mL of 20 units/mL in 19 mL = 1 unit/mL) INFUSION: 0.03 units/min		
Albuterol	2-3 puffs MDI 2.5 mg via nebulizer		
Supplemental treatment			
diphenhydrAMINE	25 - 50 mg IV		
Corticosteroids	Hydrocortisone 100 mg IV Methylprednisolone 1 mg/kg IV		

#### Common CAUSATIVE AGENTS

Neuromuscular blocking agents Antibiotics Latex products IV contrast and dyes Sugammadex Allogenic blood components, *go to* CHKLST 17 Chlorhexidine

#### Critical CHANGES

#### If cardiac arrest develops:

- Asystole/PEA, go to CHKLST 04
- VF/VT, go to CHKLST 05
- If airway obstruction develops, go to CHKLST 07

*HR* < 50 bpm with hypotension, acutely altered mental status, shock, ischemic chest discomfort, or acute heart failure

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7.

TART		DRUG DUSES	& treatm	ients
Call for help and a code cart		Atropine	0.5-1 m	g IV, may repeat up to 3 mg total
<ul> <li>Ask: "Who will be the crisis manager?"</li> <li>Crisis manager designates checklist reader</li> <li>Turn FiO, to 100%</li> </ul>		EPINEPHrine	BOLUS: (1 mg ir INFUSIC	: 10 - 100 MCG IV, repeat as needed n 100 mL = 10 MCG/mL) ON: 0.01 - 0.1 MCG/kg/min
<ul> <li>Verify oxygenation/ventilation adequate</li> <li>Consider securing airway</li> <li>Administer atropine</li> </ul>		OVERDOSE trea Beta-blocker Calcium channe	2 -20 MG Itment	Glucagon 5 - 10 mg IV push Calcium chloride 1g IV
<ul> <li>Stop surgical stimulation (if laparoscopy, desufflate)</li> <li>If atropine ineffective:</li> <li>Consider EPINEPHrine or DOPamine</li> </ul>		Digoxin		- or Calcium gluconate 3g IV Digoxin FAB; consult pharmacy for patient-specific dosing
-or $-$	DIFFERENTIAL diagnosis			
<ul> <li>Start transcutaneous pacing (see box)</li> <li>Consider</li> <li>Assessing and treating underlying etiology (see differential diagnosis box)</li> <li>If hemodynamically unstable, minimizing volatile</li> </ul>	Drug effect or overdose Tension pneumothorax Auto-PEEP Surgical stimulation High spinal Acidosis	Hyperkalemia Hypothermia Hypovolemia Local anesthesia Malignant Hyper Myocardial ische	systemic thermia (( mia (CHK	toxicity (CHKLST 12) CHKLST 13) (LST 14)
anesthetics	TRANSCUTANEOUS PACING instru	ctions		
<ul> <li>If bradycardia progresses to asystole or PEA arrest</li> <li>go to CHKLST 04</li> </ul>	<ol> <li>Place pacing electrodes front and b</li> <li>Connect 3-lead ECG from pacing de</li> <li>Turn monitor/defibrillator to PACER</li> <li>Set PACER RATE (bpm) to 80/minut</li> <li>Start at 60 mA of PACER OUTPUT ar QRS complex)</li> <li>Set final milliamperes 10 mA above</li> <li>Confirm effective capture         <ul> <li>Electrically: assess ECG tracing</li> <li>Mechanically: palpate femoral p</li> </ul> </li> </ol>	ack efibrillator e (adjust based on nd increase until el initial capture leve ulse	clinical re ectrical ca	esponse once pacing is established) apture (pacer spikes aligned with

### 14 Cardiac Arrest - Asystole/PEA

Asystole PEA hhhhh

#### Non-shockable pulseless cardiac arrest

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TAR		DRUG DOSES & treatm	ents
(2)	I for help and a code cart	EPINEPHrine	1 mg IV, repeat every 3-5 minutes
Pur	Ask: "Who will be the crisis manager?" Say: "The top priority is high-quality CPR" Crisis manager assigns roles - see ROLE assignments box t backboard under patient	<b>TOXIN</b> treatment Local anesthetic Beta-blocker Calcium Channel Blocker	<i>go to</i> CHKLST 12 <b>Glucagon</b> 5 - 10 mg IV push <b>Calcium chloride</b> 1g IV — or — <b>Calcium gluconate</b> 3g IV
	Turn supine as soon as possible, but do not delay the start of compressions	HYPERKALEMIA treatmen	nt 05 1 gW
Tu Sta	rn FiO <sub>2</sub> to 100%, turn off volatile anesthetic art CPR and assessment cycle	- or	0.5 - 1 g IV 1 - 3 g IV
<ul> <li>Perform CPR         <ul> <li>"Hard and fast" about 100-120 compressions/min to depth ≥ 2 inches</li> <li>Ensure full chest recoil with minimal interruptions</li> <li>10 breaths/minute, do not over-ventilate                 <ul></ul></li></ul></li></ul>	Sodium bicarbonate (if pH < 7.2) Insulin (Regular) – and – Dextrose	50 mEq IV 5 - 10 units IV 50 - 100 mL D50W IV — or — 250 - 500 mL D10W IV	
	Assess every 2 minutes (limit assessment to < 10 seconds)	POLE assignments	
	<ul> <li>Change CPR compression provider</li> <li>Check ETCO<sub>2</sub> <ul> <li>If: No waveform, check for esophageal intubation</li> <li>If: &lt; 10 mmHg, evaluate CPR technique</li> <li>If: Sudden increase to &gt; 40 mmHg, may indicate return of spontaneous circulation</li> </ul> </li> </ul>	Chest compressions Airway Vascular access Documentation	Code cart Time keeping Checklist reader
	<ul> <li>Treat reversible causes, consider reading aloud differential diagnoses</li> <li>Check rhythm</li> </ul>	DIFFERENTIAL diagnos	sis
Со	If: Asystole/PEA continues: • Resume CPR and assessment cycle (restart Step 4) • Read aloud differential diagnosis (see list in right column) If: VT/VF • Resume CPR • go to CHKLST 05 nsider ECMO if refractory cardiac arrest	Hypovolemia Hyper- or hypokalemia Tamponade Tension pneumothorax Auto-PEEP Embolism High neuraxial Intra-abdominal hyperten	Myocardial ischemia (CHKLST 14) Acidosis Hypoxia (CHKLST 11) Hypoglycemia LAST (CHKLST 12) Surgical stimulation sion

Shockable pulseless cardiac arrest

#### START

#### 1. Call for help and a code cart

- Ask: "Who will be the crisis manager?"
- Say: "Shock patient as soon as the defibrillator arrives"
- Crisis manager assigns roles (see ROLE assignments box)
- 2. Put backboard under patient
  - Turn supine as soon as possible, but do not delay the start of compressions
- 3. Turn FiO, to 100%; turn off volatile anesthetics
- 4. Start CPR defibrillation assessment cycle
  - Perform high-quality CPR
    - "Hard and fast" about 100 120 compressions/min to depth ≥ 2 inches
    - Ensure full chest recoil with minimal interruptions
    - 10 breaths/minute; do not over-ventilate
      - Bag-mask ventilation until able to place endotracheal tube
  - Defibrillate
    - Shock at highest setting
    - Resume CPR immediately after shock
  - ► Give EPINEPHrine
    - Repeat EPINEPHrine every 3-5 minutes
  - Give antiarrhythmics for refractory VF/VT after 2 shocks
  - Assess every 2 minutes
    - Change CPR compression provider
    - Check ETCO<sub>2</sub>
      - If: No waveform, check for esophageal intubation
      - If: < 10 mm Hg, evaluate CPR technique
      - If: Sudden increase to > 40 mm Hg, may indicate return of spontaneous circulation
    - Treat reversible causes, consider reading aloud differential diagnoses
    - Check rhythm; if rhythm organized, check pulse
       If: VF/VT continues: Resume CPR cycles (restart Step 4)
       If: Asystole/PEA: go to CHKLST 04
- 5. Consider ECMO

1 mg IV, repeat every 3 - 5 minutes

ANTIARRHYTHMICS		
Amiodarone	1 <sup>st</sup> dose: 300 mg IV	
	2 <sup>nd</sup> dose: 150 mg IV	
Lidocaine	1 <sup>st</sup> dose: 1 - 1.5 mg/kg	
	2 <sup>nd</sup> dose: 0.5 - 0.75 mg/kg	
Magnesium	2 - 4 g IV for <i>Torsades de Pointes</i>	

#### **DEFIBRILLATOR** instructions

**DRUG DOSES** & treatments

EPINEPHrine

- 1. Place electrodes on chest
- Turn defibrillator ON, set to DEFIB mode, and increase ENERGY LEVEL. <u>Biphasic</u>: Follow manufacturer recommendation. (If unknown, use highest setting.) <u>Monophasic</u>: 360J
- 3. Deliver shock: press CHARGE, then press SHOCK

#### **ROLE** assignments

Chest compressions Airway Vascular access Documentation Code cart Time keeping Checklist reader

#### **DIFFERENTIAL** diagnosis

Hypovolemia Hyper- or hypokalemia Tamponade Tension pneumothorax Auto-PEEP Embolism High neuraxial Intra-abdominal hypertension Myocardial ischemia (CHKLST 14) Acidosis Hypoxia (CHKLST 11) Hypoglycemia LAST (CHKLST 12)

### 06 Delayed Emergence

Prolonged unresponsiveness following general anesthesia or abnormal neurologic exam following general anesthesia

#### START

#### 1. Call for help

- Ask: "Who will be the crisis manager?"
- Crisis manager designates checklist reader
- 2. Ensure all anesthetic medications have been stopped
- 3. Check for and correct hypoxemia, hypercarbia, hypothermia, or hypotension
  - Consider signs of increased intracranial pressure (widened pulse pressure, bradycardia, irregular respirations)
- 4. Check for and treat residual drug effects
  - Neuromuscular blockade (check TOF)
  - Opiates and hypnotics
- 5. Send labs
  - Arterial blood gas, electrolytes, glucose
- 6. Correct electrolyte abnormalities
- 7. Perform neurologic examination
  - If unresponsive: pupil changes, gag reflex, level of arousal
  - If responsive: stroke assessment
    - Facial droop show teeth in smile
    - Pronator drift eyes closed, extend arms with palms up for 10 seconds
    - Speech assessment say "you can't teach old dogs new tricks"
    - Assess for severe sudden headache
  - Consider STAT head CT and neurology consult for abnormal exam

#### **DRUG DOSES** & treatments

#### Naloxone 40 MCG IV

(0.4 mg to total 10 mL = 40 MCG/mL) Repeat q 2 minutes If no response to 400 MCG, consider non-opiate causes

Flumazenil

Repeat dose q 1 minute Max dose 1 mg AVOID in chronic benzodiazepine use or seizure history

Sugammadex 2 - 4 mg/kg IV

0.2 mg IV

#### DIFFERENTIAL diagnosis

High spinal Serotonin syndrome Myxedema coma or thyroid storm Concomitant head injury Hepatic or uremic encephalopathy Neurosurgical complications

- Hemorrhage
- Vascular occlusion
- Elevated ICP

Postictal state following intraoperative seizure Medication error

Local Anesthetic Systemic Toxicity (CHKLST 12) Central anticholinergic syndrome

### 07 Failed Airway

2 unsuccessful intubation attempts by an airway expert in a patient under general anesthesia

#### START

#### 1. Call for help and a code cart

- Ask: "Who will be the crisis manager?"
- Crisis manager designates checklist reader
- 2. Get difficult airway cart
- 3. Monitor elapsed TIME, intubation ATTEMPTS, and SpO,
  - Limit attempts to 3 by initial provider plus 1 attempt by other airway expert ("3+1")

changes

- 4. Bag-mask ventilate with 100% Oxygen
  - Is ventilation adequate?
    - Maintaining adequate SpO<sub>2</sub>?
    - Capnographic evidence of adequate ventilation?

# Naloxone0.4 mg IVFlumazenil0.2 mg IVMay repeat up to 1 mg

**DRUG DOSES** & treatments

Sugammadex 8 - 16 mg/kg IV

AVOID in chronic benzodiazepine use or seizure history

#### Alternative INTUBATION TECHNIQUES

- Ventilation NOT ADEQUATE
   Consider/attempt supraglottic airway
  - Optimize patient position
  - If unsuccessful, attempt alternative intubation approaches as you prepare for emergency invasive airway
    - Limit to "3+1"
- If you remain unable to intubate and unable to ventilate, implement emergency invasive airway

#### Ventilation ADEQUATE

- Attempt alternative intubation techniques
  - Limit to "3+1"
- Consider doing procedure with a supraglottic or mask airway
- Optimize ventilation/intubating conditions
- Consider invasive airway
- Consider awakening patient
- If awakening patient, consider:
  - Awake intubation
  - Complete procedure under local or regional
  - Cancel the procedure

#### Evidence of fire (smoke, odor, flash) on patient or drapes, or in patient's airway, or in OR equipment

#### START

#### 1. Call for help

- Ask: "Who will be the crisis manager?"
- Crisis manager designates checklist reader
- 2. Halt surgery, if possible

#### If AIRWAY FIRE

#### 3. Attempt to extinguish fire

- Shut off medical gases
- Remove endotracheal tube
- Remove flammable material from airway
- Pour saline in airway

#### 4. After fire extinguished

- Re-establish ventilation using self-inflating bag with room air
  - If unable to re-establish ventilation, go to CHKLST 07
  - Avoid  $N_2O$  and minimize FiO<sub>2</sub>
- Confirm no secondary fire
  - Check surgical field, drapes, and towels
- Assess airway for injury or foreign body
  - Assess ETT integrity (fragments may be left in airway)
  - Consider bronchoscopy
- 5. Assess patient status and devise ongoing management plan
- 6. Save involved materials/devices for review

#### If NON-AIRWAY patient fire

- 3. Obtain a fire extinguisher
- 4. Attempt to extinguish fire

#### FIRST ATTEMPT

- ▶ Discontinue N<sub>2</sub>O and minimize FiO<sub>2</sub>
- Remove drapes / all flammable materials from patient
- If patient or drapes are on fire: extinguish burning materials with saline or saline-soaked gauze

#### If Fire PERSISTS

- Use fire extinguisher (Class A and BC are safe in wounds)
- Activate fire alarm
- 5. After fire extinguished
  - Assess patient for injury at site of fire, and for inhalational injury if not intubated
  - Confirm no secondary fire
    - Check surgical field, drapes, and towels
- 6. Devise ongoing patient management plan
- 7. Save involved materials / devices for review

#### FIRE EXTINGUISHER use

- **P** pull the pin
- A aim at the base of the fire
- ${\boldsymbol{\mathsf{S}}}$  squeeze the handle
- **S** sweep side to side

#### If **OR EQUIPMENT** fire

- 3. Obtain a fire extinguisher
- 4. Attempt to extinguish fire
  - Use CO<sub>2</sub> (Class BC) fire extinguisher (avoid liquids)

#### If Fire PERSISTS

- Evacuate patient
- Close OR door
- Turn OFF gas supply to room
- Activate fire alarm
- 5. After fire extinguished or patient evacuated
  - Assess patient for injury at site of fire, and for inhalational injury if not intubated
  - Confirm no secondary fire
    - Check surgical field, drapes, and towels
- 6. Devise ongoing patient management plan
- 7. Save involved materials / devices for review

Acute massive bleeding

#### START

#### 1. Call for help

- Ask: "Who will be the crisis manager?"
- Crisis manager designates checklist reader
- 2. Open IV fluids until blood products available
- 3. Obtain large bore IV access, rapid infuser
  - Obtain arterial access
- 4. Turn FiO<sub>2</sub> to 100% and reduce volatile anesthetics
- 5. Call blood bank
  - Activate massive transfusion protocol
    - Consider whole blood
    - Consider uncrossmatched Type O RBC and Type AB plasma
  - Assign 1 person as primary contact for blood bank
- 6. Begin transfusion in 1 PRBC : 1 FFP : 1 Platelet
  - Calcium repletion for massive transfusion
- 7. Consider TXA administration
- 8. Warm patient and fluids

- **9. Discuss management plan** with surgical, anesthesiology, and nursing teams
  - Call for additional surgery consultation as indicated
  - Consider damage control surgery (pack, close, resuscitate)
  - Consider resuscitative endovascular balloon occlusion of the aorta (REBOA) for hemorrhage below the diaphragm
  - Consider ECMO or cardiac bypass to facilitate surgical repair
- 10. Send labs
  - CBC, PT / PTT / INR, fibrinogen, lactate, arterial blood gas, potassium, and ionized calcium
  - Viscoelastography
- **11.** Consider re-dosing antibiotics if EBL > 1500
  - mL

#### **DRUG DOSES** & treatments

#### ANTIFIBRINOLYTIC treatment

Tranexamic Acid (TXA) BOLUS: 1 g IV Over 10 min INFUSION: 1 g/ 500 mL Over 8 hours

#### HYPOCALCEMIA treatment

Calcium Gluconate 1 g per 3 units product - or --

**Calcium Chloride** 1 g per 5 units product Adjust to measured ionized calcium

#### **HYPERKALEMIA** treatment

 Insulin (Regular)
 5 - 10 units IV

 - and - 

 Dextrose
 50 - 100 mL D50W IV

 - or - 250 - 500 mL D10W IV

 Sodium bicarbonate
 50 mEg IV

(if pH < 7.2)

### 10 Hypotension

Unexplained drop in blood pressure refractory to initial treatment

#### START

#### 1. Call for help

- Solution Ask: "Who will be the crisis manager?"
- Crisis manager designates checklist reader
- 2. Check...
  - Measurement artifact
  - ETCO<sub>2</sub> adequacy of perfusion
  - Heart rate
    - If BRADYCARDIA, go to CHKLST 03
    - If TACHYCARDIA, go to CHKLST 16
  - ► Rhythm
    - If PEA, go to CHKLST 04
    - If VF / VT, go to CHKLST 05
- 3. Inspect surgical field for bleeding
  - ► If BLEEDING, go to CHKLST 09
- 4. Run IV fluids wide open
- 5. Give vasopressors and titrate to response
  - MILD hypotension:
    - Give ePHEDrine or phenylephrine
  - SIGNIFICANT / REFRACTORY hypotension:
    - Administer norepinephrine; consider escalating to add vasopressin or EPINEPHrine
- 6. Turn FiO<sub>2</sub> to 100% and minimize volatile anesthetics

#### 7. Consider...

- Trendelenburg position
- Additional IV access
- Arterial line
- Point of care ultrasound or echocardiography for diagnosis
- Mechanical circulatory support

#### **DIFFERENTIAL** diagnosis

#### Volume / Vasoplegia (Vasodilation)

- Occult bleeding
- Anaphylaxis, go to CHKLST 02
- Drug overdose or error
- Sepsis
- Hypoxia, go to CHKLST 11
- Hypocalcemia
- Adrenal insufficiency
- Reperfusion

#### **Obstructed Blood Flow**

- Mechanical or surgical manipulation
- Insufflation during laparoscopy
- Vascular compression
- Tamponade
- Increased PEEP
- Pneumothorax

#### **Cardiac Function**

- Myocardial ischemia, go to CHKLST 14
- Heart failure
- Emboli (pulmonary, fat, amniotic, CO<sub>2</sub>, air), go to CHKLST 01
- Bone cementing
- Malignant hyperthermia, go to CHKLST 13

#### **DRUG DOSES** & treatments

- **ePHEDrine** 5 25 mg IV - or -50 mg IM x 1
- Phenylephrine BOLUS: 50 200 MCG IV (1mL of 10 mg/mL in 100 mL = 100 MCG/mL) INFUSION: 0.5 - 1 MCG/kg/min
- Norepinephrine BOLUS: 5 20 MCG IV (4mL of 1mg/mL in 250 ml = 16 MCG/mL) INFUSION: 0.05 - 0.5 MCG/kg/min
- Vasopressin BOLUS: 1 2 units IV (1 mL of 20 units/mL in 19 mL = 1 unit/mL) INFUSION: 0.01 - 0.04 units/min
- EPINEPHrine
  - BOLUS: 4 10 MCG IV (1 mg in 100 mL = 10 MCG/mL) INFUSION: 0.01 - 0.1 MCG/kg/min

#### **REFRACTORY VASOPLEGIA** treatment

Methylene Blue 1 - 2 mg/kg in 100mL NS over 20 - 60 minutes Consider pharmacy consultation

Hydrocortisone 100 mg IV

HYPOCALCEMIA treatment

Calcium Gluconate 1 - 3 g IV

- or --Calcium Chloride
  - 0.5 1 g IV

### 11 Hypoxia

Unexplained oxygen desaturation

#### START

#### 1. Call for help

- Ask: "Who will be the crisis manager?"
- Crisis manager designates checklist reader
- 2. Turn FiO, to 100% at high gas flows
  - Confirm inspired FiO<sub>2</sub> = 100% on gas analyzer
  - Confirm presence of end-tidal CO<sub>2</sub>
- 3. Hand-ventilate to assess compliance
- 4. Listen to breath sounds
- 5. Check...
  - Blood pressure, pulse, airway pressures
  - Capnogram waveform
  - Endotracheal tube/supraglottic device position
  - Pulse oximeter placement and limb perfusion
  - Circuit integrity: disconnection, kinks, holes
- 6. Consider initial stabilization actions
  - Suction secretions
  - Remove circuit and use self-inflating bag
  - Alveolar recruitment maneuver and PEEP titration
  - Bronchodilator therapy
  - Deepen anesthetic and paralysis
  - Optimize positioning and insufflation pressure

- 7. Consider causes see DIFFERENTIAL Diagnosis
- 8. If hypoxia persists, consider ECMO

#### **DIFFERENTIAL** diagnosis

#### Airway / Breathing

- Right mainstem intubation
- Aspiration
- Atelectasis
- Bronchospasm
- Anaphylaxis (CHKLST 02)
- Hypoventilation
- Laryngospasm
- Obesity / positioning
- Pneumothorax
- Pulmonary edema
- Auto-PEEP

#### **DRUG DOSES** & treatments

Albuterol	3 MDI puffs per ETT 2.5 mg via nebulizer
EPINEPHrine	10 - 20 MCG IV, repeat PRN (1 mg in 100 mL = 10 MCG/mL)

#### Additional **DIAGNOSTIC TESTS**

Fiberoptic bronchoscopy Chest x-ray Electrocardiogram Transesophageal Echocardiogram Arterial or venous blood gas Lung ultrasound

#### Circulation

- Embolism (CHKLST 01)
- Heart disease
- Tamponade
- Septic shock
- Severe hypotension (CHKLST 10)

#### Artifacts

- Dyes (e.g. methylene blue)
- Hemoglobinopathies (e.g. methemoglobinemia)

### 12 Local Anesthetic Systemic Toxicity (LAST)

Neurologic or Cardiovascular Signs/Symptoms following use of local anesthetic

#### START

#### 1. Call for help

- Ask: "Who will be the crisis manager?"
- Crisis manager designates checklist reader
- 2. Get LAST rescue kit or lipid emulsion and consider early call for ECMO
- 3. STOP local anesthetic infusion, if running
- 4. START administering lipid emulsion
  - Do not delay airway protection or hemodynamic management while waiting for lipid emulsion

#### 5. If seizing:

- Ensure adequate airway patency and ventilation
- Administer benzodiazepine
- ▶ If only propofol is available, administer low dose, e.g. 20 mg increments
- 6. If hemodynamically unstable, give low-dose EPINEPHrine
  - Doses of EPINEPHrine are LOWER than ACLS recommendations
  - AVOID: beta blockers, calcium channel blockers, local anesthetics, and vasopressin
  - Ensure adequate airway patency and ventilation
- 7. If cardiovascular collapse is unresponsive to EPINEPHrine and lipid emulsion, initiate ECMO or cardiac bypass
- 8. Continue lipid emulsion for at least 15 minutes after achieving hemodynamic stability

#### DRUG DOSES & treatments

Weight  $\ge$  70 kg

#### Lipid Emulsion 20%

#### Weight < 70 kg

BOLUS: 100mL IV over 2-3 min1.5 mL/kg IV over 2-3 minINFUSION: 250mL IV over 15-20 min0.25 mL/kg/min IVRepeat bolus and double infusion if patient remains unstableMax lipid dose 12 mL/kg for initial dosing

**Midazolam** 0.05 mg/kg, max 2 mg per dose, repeat as needed – *or* –

LORazepam 0.1 mg/kg, max 4 mg per dose, repeat as needed

#### EPINEPHrine

10 - 20 MCG IV bolus, increase as needed to max 1 MCG/kg (1 mg in 100 mL = 10 MCG/mL)

#### SIGNS and SYMPTOMS

**Timing:** onset from 60 seconds to 60 minutes following injection of local anesthetic **Neurologic Symptoms:** neurologic excitement (agitation,

metallic taste, auditory changes) -> seizures (generalized or focal) and neurologic depression

**Cardiac Symptoms:** HTN, tachycardia, arrhythmia -> bradycardia, conduction block, asystole

#### Critical CHANGES

If **PEA** develops, *go to* CHKLST 04 (note EPINEPHrine dose modifications in LAST) If **VF/VT** develops, *go to* CHKLST 05 (note EPINEPHrine dose modifications in LAST)

### Malignant Hyperthermia

In presence of trigger agent: unexpected, unexplained increase in end-tidal CO., unexplained tachycardia / tachypnea, masseter muscle spasm after succinylcholine. Hyperthermia is a late sign.

#### START

- Call for help and a code cart 1.
  - Ask: "Who will be the crisis manager?"
  - Crisis manager designates checklist reader
- **Get Malignant Hyperthermia Kit** 2.
- Call MH Hotline 1.800.644.9737 3.
- Assign dedicated person to start mixing 4. dantrolene
- **Open IV fluids** and **consider furosemide** 5.
  - Goal urine output 1 2 mL/kg/hr
- Turn off volatile anesthetics and transition to 6. **non-triggering** anesthetics
  - <u>DO NOT</u> delay treatment to change circuit or CO<sub>2</sub> absorber
  - Insert charcoal filters on inspiratory and expiratory limbs, if available
- Turn FiO, to 100% 7.
- Hyperventilate patient at flows of 10 L / min 8. or more
- Terminate procedure, if possible 9.
- **Give dantrolene** 10.
- Give sodium bicarbonate for suspected 11. metabolic acidosis (maintain pH > 7.2)
- Treat hyperkalemia, if suspected 12.

- Treat dysrhythmias, if present 13.
  - Standard antiarrhythmics are acceptable
  - DO NOT use calcium channel blockers
- Send labs 14.
  - Arterial blood gas
  - Electrolytes
  - Serum creatinine kinase (CK)
  - Serum / urine myoglobin
  - Coagulation profile

#### Initiate supportive care 15.

- Cool patient if >39 C:
  - Lavage open body cavities
- Pla ou
- Pla

Gastric la	wage with cold water	Calcium gluconate	1-3 g IV
Apply ice Infuse co STOP coc ace Foley c tput an for ICU r	externally ld saline IV pling if < 38 C atheter, monitor urine monitoring for 24 hrs	- or Calcium chloride Insulin (Regular) - and Dextrose	0.5 - 1 g IV 5 - 10 units regular I 50 - 100 mL D50W IV — or — 250 - 500 mL D10W
L diagnosis	(consider when using high dos	es of dantrolene without resc	olution of symptoms)
t <b>ory</b> ation	<ul> <li><b>latrogenic</b></li> <li>Exogenous CO<sub>2</sub> source (e.g. laparoscopy)</li> <li>Overwarming</li> <li>Neuroleptic Malignant Syndrome</li> </ul>	<ul> <li>Neurologic</li> <li>Meningitis</li> <li>Intracranial bleed</li> <li>Hypoxic encephalopathy</li> <li>Traumatic brain injury</li> </ul>	<ul> <li>Toxicology</li> <li>Radiologic cont neurotoxicity</li> <li>Anticholinergic syndrome</li> <li>Cocaine</li> </ul>
ocytoma	- Synaronic	- Haamade branningary	amphetamine.

#### **DRUG DOSES** & treatments

Dantrolene	2.5 mg/k until sym Rarely m	g, repeat up to 10 mg/kg ptoms subside pay require up to 30 mg/kg
Ryanodex	tute 250 mg vials with 5 mL ater (shake until orange) g = 0.05 mL/kg ient dose = 3.5 mL (~ 1 vial)	
— or —		
Dantrium or	Reconsti	tute 20 mg vials with
Revonto	60 mL ste 2.5 mg/k 70kg pati (~9 vials)	erile water g = 7.5 mL/kg ient dose = 525 mL
Bicarbonate	50 mEq l'	V
Furosemide	40 mg IV	
HYPERKALEMIA t	reatment	:
Calcium gluconat	e	1-3 g IV
Calcium chloride		0.5 - 1 g IV
Insulin (Regular) — and —		5 - 10 units regular IV
Dextrose		50 - 100 mL D50W IV — or —
		250 - 500 mL D10W IV

- DIFFERENTIA
- Cardiorespirat
- Hypoventila Sepsis

- Endocrine Thyrotoxicos
- Pheochromocytoma

- trast
- salicylate toxicity Alcohol withdrawal

All reasonable precautions have been taken to verify the information contained in this publication. The responsibility for the interpretation and use of the materials lies with the reader.

INDEX

### 14 Myocardial Ischemia

Chest Pain, Shortness of Breath, ST Elevation or Depression, Ventricular Arrhythmias

#### START

#### 1. Call for help

- Ask: "Who will be the crisis manager?"
- Crisis manager designates checklist reader
- 2. Increase oxygen delivery and decrease oxygen demand
  - Increase supply:
    - 100 % FiO<sub>2</sub>
    - Correct anemia (goal hgb 7 9 g/dL)
    - Correct hypotension (see CHKLST 10)

#### Decrease demand:

- Correct tachycardia caution in RCA ischemia (II, III, aVF)
- Correct hypertension
- Restore sinus rhythm (see CHKLST 16)
- 3. Obtain 12-lead EKG and send troponin levels

#### 4. Consult cardiology

- Consideration of anticoagulation and/or antiplatelet therapy
- Consideration of thrombolysis or cardiac catheterization
- 5. Discuss clinical condition with surgical team
  - Safe to abort surgery?
  - Safe to consider anticoagulation and/or antiplatelet therapy?
- 6. Consider hemodynamic monitoring
  - ▶ If ongoing hemodynamic instability, arterial line
  - If persistent vasopressor requirement, central line
  - ▶ If evidence of cardiogenic shock, non-invasive cardiac output monitor or PA catheter
- 7. Consider TEE or TTE if ongoing hemodynamic instability
- 8. Consider ICU disposition

DRUG DOSES & treatments				
Nitroglycerin	0.5 - 5 MCG/kg/min			
Aspirin	325 mg PO/PR x1 dose			
Heparin	4000 - 5000 units IV push			
Norepinephrine	BOLUS: 5 - 20 MCG IV (4mL of 1mg/mL in 250 ml = 16 MCG/mL) INFUSION: 0.05 - 0.5 MCG/kg/min			
EPINEPHrine	BOLUS: 4 - 10 MCG IV (1 mg in 100 mL = 10 MCG/mL) INFUSION: 0.01 - 0.1 MCG/kg/min			
Esmolol	50 - 300 MCG/kg/min			
Metoprolol	5 - 20 mg IV			

#### **DIFFERENTIAL** diagnosis

Coronary artery disease with acute thrombus Coronary artery disease with demand ischemia Coronary artery embolism Local Anesthetic Systemic Toxicity (CHKLST 12) Severe hypoxia (CHKLST 11)

#### Critical CHANGES

If **PEA** develops, *go to* CHKLST 04 If **VF/VT** develops, *go to* CHKLST 05

### 15 OB Hemorrhage

Cumulative Blood Loss (intrapartum and postpartum) > 1000mL in vaginal or cesarean delivery or blood loss associated with signs or symptoms of hypovolemia within 24 hours after delivery

#### START

#### 1. Call for help

- Ask: "Who will be the crisis manager?"
- Crisis manager designates checklist reader
- Crisis manager designates a person to monitor estimated blood loss
- 2. Announce vital signs and cumulative blood loss every 10 minutes
- 3. Open IV fluids and establish adequate IV access
  - Warm patient and fluids
  - Insert bladder catheter
  - Consider arterial access
- 4. Turn FiO<sub>2</sub> to 100% or start supplemental oxygen
  - Minimize volatile anesthetics
- 5. Prepare for transfusion
  - Assign 1 person as primary contact with Blood Bank
  - Activate massive transfusion protocol
  - Request rapid transfuser device
- 6. Send STAT labs
  - CBC, BMP, Type and Screen, fibrinogen, PT, aPTT, lactate
  - Viscoelastography

- 7. Give uterotonic agents and tranexamic acid
- 8. Begin transfusion
  - Transfuse with products in ratio of 4 PRBCS : 4 FFP : 1 Platelet
  - Target fibrinogen > 200 mg/dL
    - 10 units cryoprecipitate, expected rise
       100 mg/dL
    - Fibrinogen concentrate 4g, expected rise 100 mg/dL
- 9. Surgical team: perform exam and uterine massage
  - Consider the differential diagnosis (see box)
  - Consider D+C, laceration repair, uterine tamponade
  - If bleeding unresponsive, consider uterine artery ligation or hysterectomy, or Interventional Radiology for embolization

#### **DRUG DOSES** & treatments

Oxytocin (Pitocin) 3 units IV BOLUS or 5-10 units IM BOLUS — followed by — 10 - 40 units in 500 - 1000 mL IV INFUSION Caution in hypotension

Methylergonovine maleate (Methergine) 0.2 mg IM q 2 - 4 hours DO NOT administer IV *Caution in hypertension, cardiac disease* 

#### Carboprost tromethamine (Hemabate)

250 MCG q 15 - 90 min IM x8 max DO NOT administer IV *Caution in asthma, HTN* 

miSOPROStol (Cytotec) 800 - 1000 MCG PR/buccal/SL x1 dose

Tranexamic Acid (TXA) 1000mg IV over 10 min, repeat x1 after 30 min

**Calcium Chloride** 1 g per 5 units product

- or --Calcium Gluconate

1 g per 3 units product

#### **DIFFERENTIAL** diagnosis

- **Tone** (uterine atony)
- Trauma (lacerations or uterine rupture)
- **Tissue** (retained placenta)
- **Thrombin** (clotting factor deficiency)

Persistent tachycardia with hypotension, ischemic chest pain, altered mental status, or shock

#### START

#### 1. Call for help and a code cart

- Ask: "Who will be the crisis manager?"
- Crisis manager designates checklist reader
- 2. Turn FiO2 to 100% and turn down volatile anesthetic
- 3. Analyze rhythm
  - ▶ If wide complex, irregular: treat as VF, go to CHKLST 05
  - If narrow complex, regular: consider adenosine while awaiting cardioversion
- 4. Prepare for immediate synchronized cardioversion
  - Sedate conscious patients unless deteriorating rapidly
- 5. Cardiovert per instructions in gray box
  - If cardioversion needed and unable to synchronize, use high-energy unsynchronized shocks (biphasic - select highest setting, monophasic - 360 J)
- 6. If resistant to electrical conversion, consider amiodarone
- 7. Consider cardiology consultation

#### INDEX

#### DRUG DOSES & treatments

Adenosine	6 mg rapid IV push If persistent, 12 mg rapid IV push <i>Caution in severe asthma</i>
Amiodarone	150 mg IV over 10 minutes May repeat x1

#### SYNCHRONIZED CARDIOVERSION instructions

- 1. Turn monitor/defibrillator ON, set to defibrillator mode
- 2. Place electrodes on chest
- 3. Engage synchronization mode
- 4. Adjust EKG if necessary until SYNC markers seen with each R-wave
- 5. Select energy level
- 6. Press charge button
- 7. Press and hold shock button
- 8. Check monitor, if tachycardia persists, increase energy level
- 9. Engage synchronization mode after delivery of each shock

#### **ENERGY** Level

CONDITION	ENERGY LEVEL
Narrow complex, regular	50 J - 100 J
Narrow complex, irregular	120 J - 200 J biphasic;
	200 J monophasic
Wide complex, regular	100 J
Wide complex, irregular	Treat as VF, go to CHKLST 05

#### Critical CHANGES

#### If cardiac arrest develops:

- Asystole/PEA, go to CHKLST 04
- VF/VT, go to CHKLST 05

### 17 Transfusion Reaction

*Hemolytic Reaction:* Cardiac instability, bronchospasm, bleeding, dark urine; Non-hemolytic Reaction: fever, rash, pulmonary edema; Anaphylactic Reaction: hypotension, urticaria, bronchospasm

#### START

#### 1. Call for help

- Ask: "Who will be the crisis manager?"
- Crisis manager designates checklist reader
- 2. Disconnect any blood products infusing
  - Check blood product labels for correct patient name and ABO compatibility
  - Send the blood product(s) back to the blood bank for evaluation

#### 3. Support hemodynamics with EPINEPHrine

- Repeat bolus with increasing dose as needed
- Consider EPINEPHrine infusion

#### 4. Manage bronchospasm

- ► FiO, 100%
- Albuterol or EPINEPHrine
- 5. Maintain urine output if hemolysis noted
  - Volume load 20 mL / kg crystalloid. *Caution if signs of volume overload*.
  - Consider furosemide or mannitol to goal UOP 1-2 mL / kg / hr

#### 6. Monitor labs

- Arterial or venous blood gas, electrolytes
- ▶ PT, aPTT, fibrinogen, viscoelastography
- Direct antiglobulin (Coomb's) test, haptoglobin, LDH, free hemoglobin, tryptase
- 7. Consider invasive lines
  - Arterial line for ongoing hemodynamic instability
  - Central venous catheter for vasopressors

#### 8. Further treatment

Consider hematology consult and ICU disposition

#### DRUG DOSES & treatments

EPINEPHrine	BOLUS: 10 -20 MCG IV (1 mg in 100 mL = 10 MCG/mL) INFUSION: 0.01 - 0.1 MCG/kg/min
Furosemide	40 mg IV
Albuterol	2-3 puffs MDI via ETT 2.5 mg via nebulizer

#### **DIFFERENTIAL** diagnosis

Anaphylaxis from other causes (CHKLST 02) Hypotension (CHKLST 10) Transfusion Related Acute Lung Injury (TRALI) Transfusion-Associated Circulatory Overload (TACO) Septic Shock Other hemolytic anemias (idiopathic, HUS, HELLP)

## 18 Debriefing

Real-time point-of-care debriefing by team members after a critical event AFTER the patient has been stabilized and transferred or patient care activities have ceased

#### START

- 1. Lay the ground rules (see What we BELIEVE box)
- 2. Check-in
  - "How is everyone doing?"
  - Assess if team members feel able to continue providing care
- 3. Assess for immediate safety concerns to address
  - Malfunctioning equipment or drugs to sequester?
  - Any remaining patient care needs to address?
  - Scheduling/staffing/resource adjustments for following cases?
- 4. Provide space for team reactions
  - Briefly summarize the case
  - Listen to team member emotional reactions
- 5. Reflect on the care delivered
  - What went well?"
  - "What could have gone better?"
    - "What should we do differently in the future?"
  - "Any lessons learned that we should share more broadly?"
- 6. Remind team of resources available see "Local RESOURCES"
  - Emphasize peer support programs and employee assistance programs
- 7. Consider any needed follow up
  - Team member mental health needs
  - Safety or quality improvement reporting needs
  - OR operational needs

#### What we **BELIEVE**

We believe that everyone involved in this event is capable well trained and committed to delivering the best possible care

Our goal is to support one another and improve the care we give, not to assign blame

#### Elements of Debriefing: "WATER"

Welfare check (Step 2) Acute Corrections (Step 3) Team Reactions and Reflections (Step 4) Education (Step 5) Resource Awareness (Steps 6 & 7)



#### Local **RESOURCES**

#### **Patient Safety Concerns**

- Administrator On-Call
- Quality and Safety Leadership

#### Operating Room Operations

- Administrator On-Call
- Charge Nurse
- Anesthesiologist in Charge
- Division Chief

#### **Emotional Support**

- Peer Support Program Leader
- Employee Assistance Program
- Trained Debriefing Facilitator

#### Legal Concerns

- Risk Management
- Hospital Legal Team

INDEX