
Crisis Checklist Package

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Revised Jan 2013 (011613.1)
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.



Design notes

CHECKLIST DESIGN AND LAYOUT

The Operating Room Crisis Checklists are designed to be easy to use in a crisis situation. This document summarizes the design features our team adopted. Understanding these features will help your organization successfully adapt or enhance the checklists to meet your needs.

3 Bradycardia – Unstable
HR < 50 bpm and symptomatic: hypotension, acutely altered mental status, shock, ischemic chest discomfort, acute heart failure

START

- Call for help and a code cart**
 - Ask: "Who will be the crisis manager?"
- Turn FIO₂ to 100%**
 - Verify oxygenation/ventilation
- Give atropine**
- Stop surgical stimulation** (if laparoscopy, desufflate)
- If atropine ineffective:**
 - Start epinephrine or dopamine infusion
 - or –
 - Start transcutaneous pacing
- Consider...**
 - Turning off volatile anesthetics if patient remains unstable
 - Calling for expert consultation (e.g., Electrophysiologist)
 - Assessing for drug induced causes (e.g., beta blockers, calcium channel blockers, digoxin)
 - Calling for cardiology consultation if myocardial infarction suspected (e.g., ECG changes)

DRUG DOSES and treatments

Atropine: 0.5 mg IV, may repeat up to 3 mg total
 Epinephrine: 2 – 10 mcg/min IV
 – or – Dopamine: 2 – 10 mcg/kg/min IV

OVERDOSE treatments

Beta-blocker: Glucagon: 2 – 4 mg IV push
 Calcium channel blocker: Calcium chloride: 1 g IV
 Digoxin: Digoxin Immune FAB. Consult pharmacy for patient-specific dosing.

TRANSCUTANEOUS PACING instructions

- Place pacing electrodes front and back
- Connect 3-lead ECG to the patient
- Turn monitor/defibrillator to PACER mode
- Set PACER RATE (ppm) to 80/minute (Adjust based on clinical response once pacing is established)
- Increase to 60 mA of PACER OUTPUT until electrical capture (pacer spikes aligned with QRS complex)
- Set final milliamperes 10 mA above initial capture level
- Confirm effective capture
 - Electrically: assess ECG tracing
 - Mechanically: palpate femoral pulse (carotid pulse unreliable)

Critical CHANGES

If PEA develops: Go to ▷ CHKLST 4

During RESUSCITATION

Airway: Assess and secure
 Circulation:

- Confirm adequate IV or IO access
- Consider IV fluids wide open

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Identification

- Checklist number
- Suspected event (checklist name)
- Diagnostic description

Actions

- Actions are intended to be read aloud and use language that is easy to say. The layout of action steps varies based on complexity, the need for branching logic, and the amount of content. However, common elements are:
- “START” label gives users a clear focal point for action
 - Top-level items are sequenced to provide structure
 - Bold text is used for key items to facilitate scanning
 - Indents visually group sets of related tasks/considerations
 - Cross-references between checklists are identified by symbol and unique styling

Reference information

This section provides additional information that might be helpful (e.g., drug dosages, equipment instructions, etc.).

Boxed by type of content and color coded to aid differentiation:

- Drug doses and notes
- CPR and resuscitation
- Equipment instructions
- Critical changes
- Other reference info

Design notes

ORGANIZATION

Checklists are alphabetized and numbered sequentially, based on the name of the suspected event, so that it is easy to find the correct checklist.

COLOR

Color coding is used in the checklist set to differentiate reference content *within* a checklist (e.g., drug doses appear in a blue box). This is intended to help users rapidly navigate from action steps to reference information as needed.

Color, once assigned a meaning, should not be used for another purpose in the same materials. To prevent confusion, color should not be used to distinguish *between* checklists (i.e., avoid colored tabs).

Legend of reference content

-  Drug doses and notes
-  CPR and resuscitation
-  Equipment instructions
-  Critical changes
-  Other reference info

TYPE

Helvetica and Helvetica Condensed are used throughout. Font size, style, and weight are varied to visually distinguish different types of information and to fit content on the page. Text additions should be consistent with the existing type style for similar information.

PAPER

A bright white, uncoated heavy-weight paper is recommended (e.g., 80 lb or 100 lb cover stock). The bright white will help optimize readability with maximum contrast. A coated paper may create glare in OR lighting conditions. If the checklists will be used in a binder, lamination and/or hole reinforcements will reduce the potential for tearing during use.

TIPS FOR MODIFICATION

Modifying some of the checklist items may be important for your facility. For example, the defibrillator settings or pacing defibrillator settings that are included in the checklists are general instructions, but you may want to include your machine-specific instructions. You may also want to include phone numbers that are specific to your facility.

When modifying checklists for local practice or equipment, consider the following:

- Carefully evaluate any additions in terms of their impact on usability: *Does the benefit of new information outweigh the cost in added complexity?*
- Use short, direct, unambiguous statements that are easy to say out loud.
- Streamline actions by using the fewest, most important steps.
- Follow established conventions for color, type, and organization if possible.
- Make text as large as possible, consistent with established styles.
- Do not add colored text or tabs; color coding is already used to identify reference information.
- Boxes, arrows, or other graphics make a checklist more visually complicated; add them only if needed to prevent confusion and use a light color to minimize distraction.
- Conserve white space when possible.

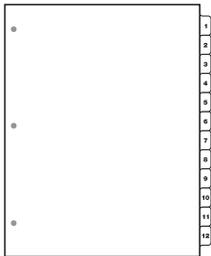
Design notes

TIPS FOR USE IN A BINDER



BINDER

Use any standard 3-ring binder. A “view” binder includes a slit on the cover through which a cover page may be inserted. A smaller size spine, 1/2-inch or 3/4-inch, may be most convenient.



NUMBERED TABS

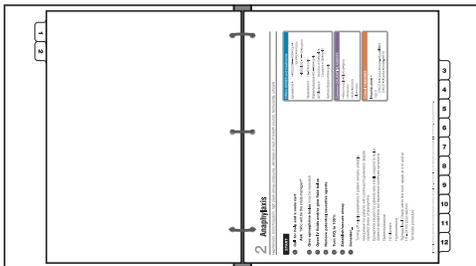
Black and white tabs are recommended. Color coding is used to differentiate content *within* each checklist.

Sets of numbered 12-tab sets are commercially available (e.g., Avery® 12-Tab Ready Index® Classic Black & White Table of Contents Dividers model 11140, or similar).



TABLE OF CONTENTS / SUSPECTED EVENTS

The supplied Table of Contents may be used as the exterior cover of the binder as well as the first page inside the binder.



CHECKLISTS

Checklists will be in landscape orientation when inserted.

Operating Room Crisis Checklists



A JOINT CENTER FOR HEALTH SYSTEMS INNOVATION

SUSPECTED EVENT

1 Air Embolism – Venous

2 Anaphylaxis

3 Bradycardia – Unstable

4 Cardiac Arrest – Asystole/PEA

5 Cardiac Arrest – VF/VT

6 Failed Airway

7 Fire

8 Hemorrhage

9 Hypotension

10 Hypoxia

11 Malignant Hyperthermia

12 Tachycardia – Unstable

Revised Jan 2013 (011613.1)

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1 Air Embolism – Venous

Decreased end-tidal CO₂, decreased oxygen saturation, hypotension

START

- 1 **Call for help and a code cart**
 - ▶ **Ask:** “Who will be the crisis manager?”
- 2 **Turn FiO₂ to 100%**
- 3 **Turn off nitrous oxide**
- 4 **Stop source of air entry**
 - ▶ Fill wound with irrigation
 - ▶ Lower surgical site below level of heart, if possible
 - ▶ Search for entry point (including open venous lines)
- 5 **Consider...**
 - ▶ Positioning patient with left side down
 - Continue appropriate monitoring while repositioning
 - ▶ Transesophageal echocardiography (TEE) if diagnosis unclear

Critical CHANGES

If **PEA** develops: Go to ▷ CHKLST 4

2 Anaphylaxis

Hypotension, bronchospasm, high peak-airway pressures, decrease or lack of breath sounds, tachycardia, urticaria

START

- 1 Call for help and a code cart**
 - ▶ **Ask:** “Who will be the crisis manager?”
- 2 Give epinephrine bolus** (may be repeated)
- 3 Open IV fluids and/or give fluid bolus**
- 4 Remove potential causative agents**
- 5 Turn FiO₂ to 100%**
- 6 Establish/secure airway**
- 7 Consider...**
 - ▶ Turning off volatile anesthetics if patient remains unstable
 - ▶ Vasopressin for patients with continued hypotension despite repeated doses of epinephrine
 - ▶ Epinephrine infusion for patients who initially respond to bolus doses of epinephrine but experience continued symptoms
 - ▶ Diphenhydramine
 - ▶ H2 blockers
 - ▶ Hydrocortisone
 - ▶ Tryptase level: Check within first hour, repeat at 4 hr and at 18–24 hrs post reaction
 - ▶ Terminate procedure

DRUG DOSES and treatments

Epinephrine:	• BOLUS: 10 – 100 mcg, repeat as necessary
	• INFUSION: 1 – 10 mcg/min
Vasopressin:	1–2 units IV
Diphenhydramine:	25 – 50 mg IV
H2 blockers:	Ranitidine: 50 mg IV Cimetidine: 300 mg IV
Hydrocortisone:	100 mg IV

Common CAUSATIVE AGENTS

- Neuromuscular blocking agents
- Antibiotics
- Latex products
- IV contrast

Critical CHANGES

If cardiac arrest:

- *Go to*
 - ▷ CHKLST 4 Cardiac Arrest – Asystole/PEA
 - ▷ CHKLST 5 Cardiac Arrest – VF/VT

3 Bradycardia – Unstable

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

START

- 1 Call for help and a code cart**
 - ▶ **Ask:** “Who will be the crisis manager?”
- 2 Turn FiO₂ to 100%**
 - ▶ Verify oxygenation/ventilation adequate
- 3 Give atropine**
- 4 Stop surgical stimulation** (if laparoscopy, desufflate)
- 5 If atropine ineffective:**
 - ▶ Start epinephrine or dopamine infusion
 - or –
 - ▶ Start transcutaneous pacing
- 6 Consider...**
 - ▶ Turning off volatile anesthetics if patient remains unstable
 - ▶ Calling for expert consultation (e.g., Cardiologist)
 - ▶ Assessing for drug induced causes (e.g., beta blockers, calcium channel blockers, digoxin)
 - ▶ Calling for cardiology consultation if myocardial infarction suspected (e.g., ECG changes)

DRUG DOSES and treatments

Atropine: 0.5 mg IV, may repeat up to 3 mg total
Epinephrine: 2 – 10 mcg/min IV
– or – Dopamine: 2 – 10 mcg/kg/min IV

OVERDOSE treatments

Beta-blocker: Glucagon: 2 – 4 mg IV push
Calcium channel blocker: Calcium chloride: 1 g IV
Digoxin: Digoxin Immune FAB. Consult pharmacy for patient-specific dosing.

TRANSCUTANEOUS PACING instructions

1. Place pacing electrodes front and back
2. Connect 3-lead ECG from pacing defibrillator to the patient
3. Turn monitor/defibrillator to PACER mode
4. Set PACER RATE (ppm) to 80/minute
(Adjust based on clinical response once pacing is established)
5. Start at 60 mA of PACER OUTPUT and increase until electrical capture
(pacer spikes aligned with QRS complex)
6. Set final milliamperes 10 mA above initial capture level
7. Confirm effective capture
 - Electrically: assess ECG tracing
 - Mechanically: palpate femoral pulse (carotid pulse unreliable)

Critical CHANGES

If **PEA** develops: *Go to* ▶ CHKLST 4

During RESUSCITATION

Airway: Assess and secure
Circulation:

- Confirm adequate IV or IO access
- Consider IV fluids wide open

4 Cardiac Arrest – Asystole/PEA



Non-shockable pulseless cardiac arrest

START

- 1 **Call for help and a code cart**
 - ▶ **Ask:** “Who will be the crisis manager?”
 - ▶ **Say:** “The top priority is high-quality CPR”
- 2 **Put backboard under patient, supine position**
- 3 **Turn FiO₂ to 100%, turn off volatile anesthetics**
- 4 **Start CPR and assessment cycle...**
 - ▶ **Perform CPR**
 - “Hard and fast” about 100 compressions/min
 - Ensure full chest recoil with minimal interruptions
 - 8 breaths/minute, do not overventilate
 - ▶ **Give epinephrine**
 - Repeat epinephrine every 3–5 minutes
 - Can give vasopressin to replace 1st or 2nd dose of epinephrine
 - ▶ **Assess every 2 minutes**
 - Change CPR compression provider
 - Check rhythm; if rhythm organized check pulse
 - If: Asystole/PEA continues:
 - Resume CPR and assessment cycle (restart Step 4)
 - Read aloud Hs & Ts (see list in right column)
 - If: VF/VT
 - Resume CPR
 - Go to ▷ CHKLST 5

DRUG DOSES and treatments

Epinephrine: 1 mg IV, repeat every 3 – 5 mins.
 Vasopressin: 40 U IV can replace 1st or 2nd dose of epinephrine

TOXIN treatment

Local anesthetic:

- Intralipid 1.5 mL/kg IV bolus
- Repeat 1–2 times for persistent asystole
- Start infusion 0.25–0.5 mL/kg/min for 30–60 minutes for refractory hypotension

Beta-blocker: Glucagon 2–4 mg IV push
 Calcium channel blocker: Calcium chloride 1 g IV

HYPERKALEMIA treatment

- | | |
|----------------------------------|----------------------------------------------------|
| 1. Calcium gluconate | • 30 mg/kg IV |
| - or - | |
| Calcium chloride | • 10 mg/kg IV |
| <hr/> | |
| 2. Insulin | • 10 units regular IV with 1–2 amps D50W as needed |
| <hr/> | |
| 3. Sodium bicarbonate if pH <7.2 | • 1–2 mEq/kg slow IV push |

Hs & Ts

- | | | |
|---------------------------|-----------------------------------|-------------------------------------------------------------------|
| • Hydrogen ion (acidosis) | • Hypoxia | • Toxin (local anesthetic, beta blocker, calcium channel blocker) |
| • Hyperkalemia | • Tamponade (cardiac) | |
| • Hypothermia | • Tension pneumothax | |
| • Hypovolemia | • Thrombosis (coronary/pulmonary) | |

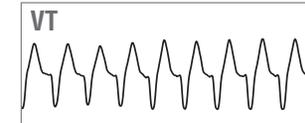
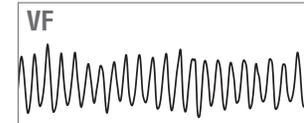
During CPR

Airway: Bag-mask sufficient (if ventilation adequate)
Circulation:

- Confirm adequate IV or IO access
- Consider IV fluids wide open

Assign roles: Chest compressions, Airway, Vascular access, Documentation, Code cart, Time keeping

5 Cardiac Arrest – VF/VT



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 defibrillator arrives”
- 2 **Put backboard under patient, supine position**
- 3 **Turn FiO₂ to 100%, turn off volatile anesthetics**
- 4 **Start CPR — defibrillation — assessment cycle**
 - ▶ **Perform CPR**
 - “Hard and fast” about 100 compressions/min
 - Ensure full chest recoil with minimal interruptions
 - 8 breaths/minute, do not overventilate
 - ▶ **Defibrillate**
 - Shock at highest setting
 - Resume CPR immediately after shock
 - ▶ **Give epinephrine**
 - Repeat epinephrine every 3–5 minutes
 - Can give vasopressin to replace 1st or 2nd dose of epinephrine
 - ▶ **Consider giving antiarrhythmics for refractory VF/VT** (amiodarone preferred, if available)
 - ▶ **Assess every 2 minutes**
 - Change CPR compression provider
 - Treat reversible causes, consider reading aloud Hs & Ts (see list in right column)
 - Check rhythm; if rhythm organized check pulse
 - If: VF/VT continues: Resume CPR–defibrillation–assessment cycle (restart Step 4)
 - If: Asystole/PEA: Go to ▷ CHKLST 4

DRUG DOSES and treatments

Epinephrine: 1 mg IV, repeat every 3–5 mins.
Vasopressin: 40 U IV can replace 1st or 2nd dose of epinephrine

ANTIARRHYTHMICS

Amiodarone: • 1st dose: 300 mg/IV/IO
• 2nd dose: 150 mg/IV/IO
Magnesium: 1 to 2 g IV/IO for Torsades de Pointes

DEFIBRILLATOR instructions

1. Place electrodes on chest.
2. Turn defibrillator ON, set to DEFIB mode, and increase ENERGY LEVEL...
 - Biphasic: Follow manufacturer recommendation; if unknown use highest setting
 - Monophasic: 360J
3. Deliver shock: press CHARGE then press SHOCK.

Hs & Ts

- | | | |
|---------------------------|-----------------------------------|-------------------------------------------------------------------|
| • Hydrogen ion (acidosis) | • Hypoxia | • Toxin (local anesthetic, beta blocker, calcium channel blocker) |
| • Hyperkalemia | • Tamponade (cardiac) | |
| • Hypothermia | • Tension pneumothax | |
| • Hypovolemia | • Thrombosis (coronary/pulmonary) | |

During CPR

Airway: Bag-mask sufficient (if ventilation adequate)
Circulation: • Confirm adequate IV or IO access
• Consider IV fluids wide open
Assign roles: Chest compressions, Airway, Vascular access, Documentation, Code cart, Time keeping

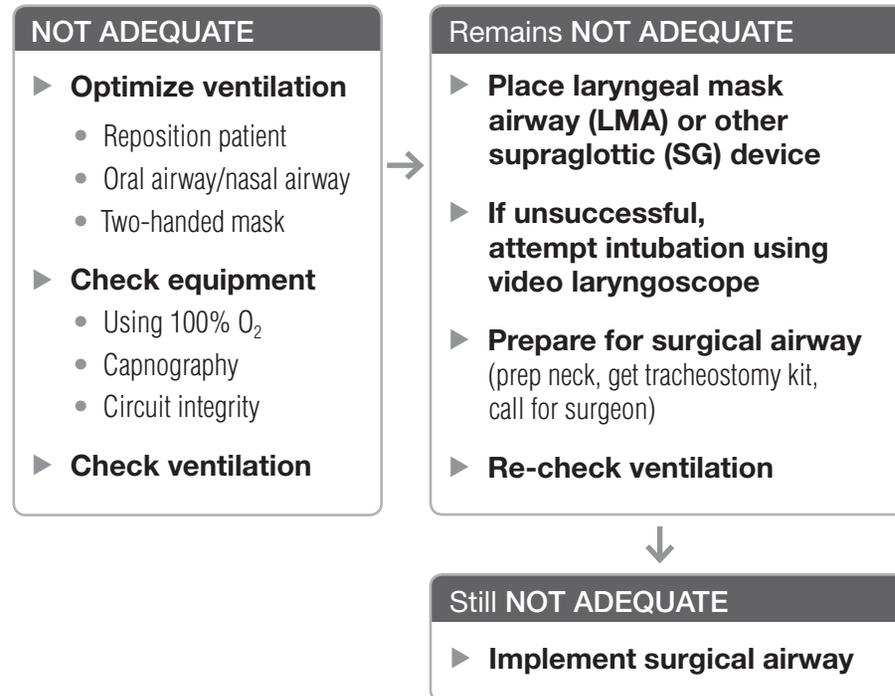
6 Failed Airway

2 unsuccessful intubation attempts by an airway expert

START

- 1 **Call for expert anesthesiology help and a code cart**
 - ▶ Ask: "Who will be the crisis manager?"
- 2 **Get Difficult Airway Cart and a video laryngoscope**
- 3 **Bag-mask ventilate with 100% oxygen**
- 4 **Is ventilation adequate?**

Ventilation **NOT ADEQUATE**



← Switch list if ventilation status changes →

Ventilation **ADEQUATE**

- ▶ **Consider awakening patient or alternative approaches to secure airway...**
 - Operation using LMA, face mask
 - Video laryngoscope
 - LMA as conduit to intubation
 - Return to spontaneous ventilation
 - Different blades
 - Intubating stylet
 - Fiberoptic intubation
 - Light wand
 - Retrograde intubation
 - Blind oral or nasal intubation
- ▶ **If awakening patient, consider:**
 - Awake intubation
 - Do procedure under regional/local
 - Cancel the case

7 Fire

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

START

- 1 **Call for help** and **activate fire alarm**
 - ▶ **Ask:** "Who will be the crisis manager?"
- 2 **Get fire extinguisher to have if needed**

If AIRWAY fire

- 3 **Attempt to extinguish fire**
 - ▶ Shut off medical gases
 - ▶ Disconnect ventilator
 - ▶ Remove endotracheal tube
 - ▶ Remove flammable material from airway
 - ▶ Pour saline into airway
- 4 **After fire extinguished**
 - ▶ Re-establish ventilation using self-inflating bag with room air
 - If unable to re-establish ventilation
Go to ▶ CHKLST 6
 - Avoid NO₂ and minimize FiO₂
 - ▶ 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 fire

- 3 **Attempt to extinguish fire**
 - FIRST ATTEMPT**
 - ▶ Avoid NO₂ and minimize FiO₂
 - ▶ Remove drapes/all flammable materials from patient
 - ▶ Extinguish burning materials with saline or saline-soaked gauze
 - DO NOT use**
 - Alcohol-based solutions
 - Any liquid on or in energized electrical equipment (Laser, ESU/Bovie, anesthesia machine, etc.)
 - Fire PERSISTS after 1 ATTEMPT**
 - ▶ Use fire extinguisher (safe in wounds)
 - Fire STILL PERSISTS**
 - ▶ Evacuate patient
 - ▶ Close OR door
 - ▶ Turn OFF gas supply to room
- 4 **After fire extinguished**
 - ▶ Maintain airway
 - ▶ 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
- 5 **Assess patient status** and **devise ongoing management plan**
- 6 **Save involved materials/devices** for review

8 Hemorrhage

Acute massive bleeding

START

- 1 **Call for help and a code cart**
 - ▶ **Ask:** “Who will be the crisis manager?”
- 2 **Open IV fluids and assess for adequate IV access**
- 3 **Turn FiO₂ to 100% and turn down volatile anesthetics**
- 4 **Call blood bank**
 - ▶ Activate massive transfusion protocol
 - ▶ Assign 1 person as primary contact for blood bank
 - ▶ Order blood products (in addition to PRBCs)
 - 1 FFP : 1 PRBC
 - If indicated, 6 units of platelets
- 5 **Request rapid infuser** (or pressure bags)
- 6 **Discuss management plan** between surgical, anesthesiology, and nursing teams
- 7 **Call for surgery consultation**
- 8 **Keep patient warm**
- 9 **Send labs**

CBC, PT/PTT/INR, fibrinogen, lactate, arterial blood gas, potassium, and ionized calcium

- 10 **Consider...**
 - ▶ Electrolyte disturbances (hypocalcemia and hyperkalemia)
 - ▶ Uncrossmatched type O blood if crossmatched blood not available
 - ▶ Damage control surgery (pack, close, resuscitate)
 - ▶ Special patient populations (see considerations below)

DRUG DOSES and treatments

HYPOCALCEMIA treatment

Give calcium to replace deficit (calcium chloride or calcium gluconate)

HYPERKALEMIA treatment

- | | |
|-----------------------------------|----------------------------------------------------|
| 1. Calcium gluconate | • 30 mg/kg IV |
| - or - | |
| Calcium chloride | • 10 mg/kg IV |
| <hr/> | |
| 2. Insulin | • 10 units regular IV with 1–2 amps D50W as needed |
| <hr/> | |
| 3. Sodium bicarbonate if pH < 7.2 | • 1–2 mEq/kg slow IV push |

SPECIAL PATIENT POPULATIONS

OBSTETRIC:

- Empirical administration of 1 pool of cryoprecipitate (10 cryo units)
- Check fibrinogen... (goal is fibrinogen > 100 mg/dL)

If first fibrinogen level is:

< 100 mg/dL	Order 2 more pools of cryoprecipitate
100 – 200 mg/dL	Order 1 more pool of cryoprecipitate

TRAUMA:

Give either...

- Antifibrinolytic tranexamic acid: 1000 mg IV over 10 minutes followed by 1000 mg over the next 8 hours
– or –
- Aminocaproic acid: 4–5 g in 250 mL NS/RL IV over first hour followed by a continuing infusion of 1 g in 50 mL NS/RL IV per hour over 8 hours

NON-SURGICAL UNCONTROLLED BLEEDING despite massive transfusion of PRBC, FFP, platelets and cryo:

- Consider giving Recombinant Factor VIIa: 40 mcg/kg IV
 - Surgical bleeding must first be controlled
 - **Use with CAUTION** in patients at risk for thrombosis
 - **DO NOT use** when PH is < 7.2

9 Hypotension

Unexplained drop in blood pressure refractory to initial treatment

START

- 1 Call for help and a code cart**
 - ▶ **Ask:** “Who will be the crisis manager?”
- 2 Check...**
 - ▶ Pulse
 - ▶ Blood pressure
 - ▶ Equipment
 - ▶ Heart rate
 - If BRADYCARDIA, *go to* ▷ CHKLST 3
 - ▶ Rhythm
 - If VF / VT, *go to* ▷ CHKLST 5
 - If PEA, *go to* ▷ CHKLST 4
- 3 Run IV fluids wide open**
- 4 Give vasopressors** and titrate to response
 - ▶ MILD hypotension:
Give ephedrine or phenylephrine
 - ▶ SIGNIFICANT / REFRACTORY hypotension:
Give epinephrine bolus, consider starting epinephrine infusion
- 5 Turn FiO₂ to 100%** and **turn down volatile anesthetics**
- 6 Inspect surgical field for bleeding**
 - If BLEEDING *go to* ▷ CHKLST 8

- 7 Consider actions...**
 - ▶ Place patient in Trendelenberg position
 - ▶ Obtain additional IV access
 - ▶ Place arterial line

- 8 Consider causes...**
 - Operative field**
 - Mechanical or surgical manipulation
 - Insufflation during laparoscopy
 - Retraction
 - Vagal stimulation
 - Vascular compression

Unaccounted blood loss

- Blood in suction canister
- Bloody sponges
- Blood on the floor
- Internal bleeding

Drugs / Allergy

- Anaphylaxis *go to* ▷ CHKLST 2
- Recent drugs given
- Dose error
- Drugs used on the field (i.e., intravascular injection of local anesthetic drugs)
- Wrong drug

DRUG DOSES and treatments

Ephedrine:	5 – 25 mg IV, repeat as needed
Phenylephrine:	100 – 500 mcg IV, repeat as needed
Epinephrine:	• BOLUS: 5 – 10 mcg IV • INFUSION: 0.1 – 1 mcg/kg/min IV

Breathing

- Increased PEEP
- Hypoventilation
- Hypoxia *go to* ▷ CHKLST 10
- Persistent hyperventilation
- Pneumothorax
- Pulmonary edema

Circulation

- Air embolism *go to* ▷ CHKLST 1
- Bradycardia *go to* ▷ CHKLST 3
- Malignant hyperthermia *go to* ▷ CHKLST 11
- Tachycardia *go to* ▷ CHKLST 12
- Bone cementing (methylmethacrylate effect)
- Myocardial ischemia
- Emboli (pulmonary, fat, septic, amniotic, CO₂)
- Severe sepsis
- Tamponade

10 Hypoxia

Unexplained oxygen desaturation

START

- 1 Call for help and a code cart**
 - ▶ **Ask:** “Who will be the crisis manager?”
- 2 Turn FiO₂ to 100%** at high gas flows
 - ▶ Confirm inspired FiO₂ = 100% on gas analyzer
 - ▶ Confirm presence of end-tidal CO₂ and changes in capnogram morphology
- 3 Hand-ventilate** to assess compliance
- 4 Listen** to breath sounds
- 5 Check...**
 - ▶ Blood pressure, PIP, pulse
 - ▶ ET tube position
 - ▶ Pulse oximeter placement
 - ▶ Circuit integrity: look for disconnection, kinks, holes
- 6 Consider actions to assess possible breathing issue...**
 - ▶ Draw blood gas
 - ▶ Suction (to clear secretions, mucus plug)
 - ▶ Remove circuit and use ambu-bag
 - ▶ Bronchoscopy

7 Consider causes...

- ▶ Is Airway / Breathing issue suspected?

NO airway issue suspected

Circulation

- Embolism
 - Pulmonary embolus
 - Air embolism – Venous *go to* ▷ CHKLST 1
 - Other emboli (fat, septic, CO₂, amniotic fluid)
- Heart disease
 - Congestive heart failure
 - Coronary heart disease
 - Myocardial ischemia
 - Cardiac tamponade
 - Congenital/anatomical defect
- Severe sepsis
- If hypoxia associated with hypotension *go to* ▷ CHKLST 9

Drugs / Allergy

- Recent drugs given
- Dose error / allergy / anaphylaxis
- Dyes and abnormal hemoglobin (e.g., methemoglobinemia, methylene blue)

YES airway issue suspected

Airway / Breathing

- Aspiration
- Atelectasis
- Bronchospasm
- Hypoventilation
- Obesity/positioning
- Pneumothorax
- Pulmonary Edema
- Right mainstem intubation
- Ventilator settings, leading to auto-peep

Additional DIAGNOSTIC TESTS

- Fiberoptic bronchoscope
- Chest xray
- Electrocardiogram
- Transesophageal echocardiogram

11 Malignant Hyperthermia

In presence of triggering agent: unexpected, unexplained increase in end-tidal CO₂, unexplained tachycardia/tachypnea, prolonged masseter muscle spasm after succinylcholine. Hyperthermia is a late sign.

START

- 1 **Call for help and a code cart**
▶ **Ask:** "Who will be the crisis manager?"
- 2 **Get Malignant Hyperthermia Kit**
- 3 **Call MH Hotline 1.800.644.9737**
- 4 **Assign dedicated person to start mixing dantrolene**
- 5 **Request chilled IV saline**
- 6 **Turn off volatile anesthetics and transition to non-triggering anesthetics**
 - **DO NOT** delay treatment to change circuit or CO₂ absorber
- 7 **Turn FiO₂ to 100%**
- 8 **Hyperventilate patient** at flows of 10 L/min or more
- 9 **Terminate procedure**, if possible
- 10 **Give dantrolene**
- 11 **Give bicarbonate** for suspected metabolic acidosis (maintain pH>7.2)
- 12 **Treat hyperkalemia**, if suspected
- 13 **Treat dysrhythmias**, if present
 - Standard antiarrhythmics are acceptable;
 - **DO NOT use** calcium channel blockers

- 14 **Send labs**
 - Arterial blood gas
 - Electrolytes
 - Serum creatine kinase (CK)
 - Serum/urine myoglobin
 - Coagulation profile
- 15 **Initiate supportive care**
 - ▶ Consider cooling patient if temperature > 38.5°C:
 - **STOP** cooling if temperature < 38°C
 - Lavage open body cavities
 - Nasogastric lavage with cold water
 - Apply ice externally
 - Infuse cold saline intravenously
 - ▶ Place Foley catheter, monitor urine output
 - ▶ Call ICU

DRUG DOSES and treatments

Dantrolene	<ul style="list-style-type: none"> • Mix each ampule with 60 cc sterile water • 2.5 mg/kg IV every 5 minutes until symptoms subside • May require up to 30 mg/kg
Bicarbonate (for suspected metabolic acidosis)	<ul style="list-style-type: none"> • 1 – 2 mEq/kg, slow IV push

HYPERKALEMIA treatment

Calcium gluconate	• 30 mg/kg
- or -	
Calcium chloride	• 10 mg/kg IV
Insulin	<ul style="list-style-type: none"> • 10 units regular IV • 1 – 2 amps D50W

TRIGGERING AGENTS

- Inhalational (volatile) anesthetics
- Succinylcholine

DIFFERENTIAL diagnosis

Cardiorespiratory	Iatrogenic	Neurologic	Toxicology
<ul style="list-style-type: none"> • Hypoventilation • Sepsis 	<ul style="list-style-type: none"> • Exogenous CO₂ source (e.g., laparoscopy) • Overwarming • Neuroleptic Malignant Syndrome 	<ul style="list-style-type: none"> • Meningitis • Intracranial bleed • Hypoxic encephalopathy • Traumatic brain injury 	<ul style="list-style-type: none"> • Radiologic contrast neurotoxicity • Anticholinergic syndrome • Cocaine, amphetamine, salicylate toxicity • Alcohol withdrawal
Endocrine			
<ul style="list-style-type: none"> • Thyrotoxicosis • Pheochromocytoma 			

12 Tachycardia – Unstable

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?”
- 2 Turn FiO₂ to 100%** and **turn down volatile anesthetics**
- 3 Analyze rhythm**
 - If wide complex, irregular: Treat as VF, *go to* ▷ CHKLST 5
 - Otherwise: prepare for cardioversion
- 4 Prepare for immediate synchronized cardioversion**
 1. Sedate all conscious patients unless deteriorating rapidly
 2. Turn monitor/defibrillator ON, set to defibrillator mode
 3. Place electrodes on chest
 4. Engage synchronization mode
 5. Look for mark/spike on the R-wave indicating synchronization mode
 6. Adjust if necessary until SYNC markers seen with each R-wave
- 5 Cardiovert at appropriate energy level**
 1. Determine appropriate energy level using Cardioversion table at right. Begin with lowest energy level and progress as needed.
 2. Select energy level
 3. Press charge button
 4. Press and hold shock button
 5. Check monitor. If tachycardia persists, increase energy level
 6. Engage synchronization mode after delivery of each shock
- 6 Consider expert consultation**

BIPHASIC CARディオVERSION energy levels

CONDITION	ENERGY LEVEL (progression)
Narrow complex, regular	50 J → 100 J → 150 J → 200 J
Narrow complex, irregular	120 J → 150 J → 200 J
Wide complex, regular	100 J → 150 J → 200 J
Wide complex, irregular	Treat as VF: <i>Go to</i> ▷ CHKLST 5

Critical CHANGES

If **cardioversion needed and impossible to synchronize shock**, use high-energy unsynchronized shocks.

Defibrillation doses:

- Biphasic: Follow manufacturer recommendation; if unknown use highest setting
- Monophasic: 360J

If **cardiac arrest**:

- *Go to*
 - ▷ CHKLST 5 Cardiac Arrest – VF/VT
 - ▷ CHKLST 4 Cardiac Arrest – Asystole/PEA

During RESUSCITATION

- Airway: Assess and secure
- Circulation:
 - Confirm adequate IV or IO access
 - Consider IV fluids wide open

Crisis Checklist Implementation Guide

Version: 1-16-2013

<p>Operating Room Crisis Checklists</p> <p> ARIADNE LABS</p> <p> BRIGHAM AND WOMEN'S HOSPITAL</p> <p> HARVARD SCHOOL OF PUBLIC HEALTH</p> <p>A JOINT CENTER FOR HEALTH SYSTEMS INNOVATION</p> <p><small>Revised Jan 2013 (011413.0) 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. © 2013 Ariadne Labs, A Joint Center for Health Systems Innovation.</small></p>	<p>SUSPECTED EVENT</p>
	1 Air Embolism – Venous
	2 Anaphylaxis
	3 Bradycardia – Unstable
	4 Cardiac Arrest – Asystole/PEA
	5 Cardiac Arrest – VF/VT
	6 Failed Airway
	7 Fire
	8 Hemorrhage
	9 Hypotension
	10 Hypoxia
	11 Malignant Hyperthermia
12 Tachycardia – Unstable	



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Crisis Checklist Implementation Guide

This guide outlines some implementation steps that you should consider including in your plan for your implementation of the crisis checklists. We are still in the process of learning how to put these checklists into meaningful use in operating rooms and we need your help to move this work forward. As you start this process at your hospital please send us feedback about what you have tried, what worked, what didn't work, and any ideas that you have to put the checklists into place. Please send all feedback to our team at: safesurgery2015.hsph.harvard.edu.

Build a Checklist Implementation Team

Before starting this work we recommend that you build a multi-disciplinary checklist implementation team. This team will help lead the effort at your hospital. The team should consist of multiple anesthesia providers (anesthesiologists, CRNAs, anesthesia techs, etc), surgical nurses, and at least one hospital administrator. Think critically about who needs to be engaged at this point of the project. Every hospital has a unique culture and you might consider including representatives from other disciplines perhaps a surgeon.

When you are thinking about which people to include on your team consider asking individuals that will be enthusiastic about this work. These people may not necessarily have a formal leadership role in your hospital.

This team will need to meet regularly and will be responsible for the following tasks:

- Reviewing and modifying the checklists for your facility
- Making critical implementation decisions
- Developing a plan to spread the checklists including how to train clinicians to use them
- Talking to clinicians and staff about the checklists
- Updating hospital administration and leaders on the project
- Developing a strategy for sustaining checklist use.

More information about each of these items can be found below.

Reviewing and Modifying the Checklists

Prior to using the checklists we recommend that your implementation team reviews them thoroughly and if necessary, customizes them for your facility. Modifying some of the checklist items may be important for your facility. For example, the defibrillator settings or pacing defibrillator settings that are included in the checklists are general instructions, but you may want to include your machine specific instructions. You may want to include phone numbers that are specific to your facility. We believe that local ownership of the checklists is important at a minimum consider putting your hospital's name and logo on the checklist cover page. We have also included some tips on the next page:

Modification Tips

- Carefully evaluate any additions in terms of their impact on usability: Does the benefit of new information outweigh the cost in added complexity?
- Use short, direct, unambiguous statements that are easy to say out loud.
- Streamline actions by using the fewest, most important steps.
- Follow established conventions for color, type, and organization if possible.
- Make text as large as possible, consistent with established styles.
- Do not add colored text or tabs; color coding is already used to highlight reference information.
- Boxes, arrows, or other graphics make a checklist more visually complicated; add them only if needed to prevent confusion and use a light color to minimize distraction.
- Conserve white space when possible.

Critical Implementation Decisions

There are multiple ways to use these checklists in your hospital. To get the most out of your checklists the implementation team may need to make some decisions. Please remember, that some of these decisions are best made after trying the checklists in an empty operating room or by having a team role-play some of the checklists and simulate that they are in an emergency. Also consider holding small focus groups with some of your enthusiastic clinicians and asking them how they think the checklists should be used, where they should be kept, and how to best train people. We have outlined some of the decisions that the implementation team will have to make below:

Decisions:

Where should the checklists be placed and how many sets should be in the OR?

There are many places that the checklist can be placed in the OR. Consider having multiple copies of the checklist in the operating room. In the work that we have done so far nurses have expressed wanting a copy of the checklists in addition to having a copy of the checklists on or near the anesthesia machine.

How should the checklists be displayed?

In our work to date the checklists have been paper copies, but some hospitals have given us feedback that they would like them displayed on their OR monitors. We have included some additional information regarding how to best display these

checklists in a binder. Please click [here](#) to download this document.

Who should read the checklists during an emergency?

We recommend that the person who reads the checklist be someone that is not involved in directly caring for the patient. The checklist reader can range from someone outside of the OR (nursing supervisor), medical student, resident, or a member of the surgical team that has the ability to dedicate time to reading the checklists. Generally the people providing the care should not be reading directly from the checklists.

Who needs to be trained and what is the best way to train surgical team members about the checklists?

As a rule everyone who works in the operating room should be aware that these checklists are available for use. Additional training for anesthesia providers and nurses is desirable. We have just started to work with two hospitals to develop a training curriculum. As we move forward with this work we will be updating this portion of the manual. Consideration could be given to integrating crisis resource management training with checklist training.

Creating a Plan for Spread

It is extremely important to create an implementation plan before putting the checklists into place in your operating rooms. Before placing the checklists in the operating room it is important to make sure that everyone that works in the OR knows that they are available. In order to do that consider performing the following activities.

- Present this work at staff, physician, and hospital leadership meetings (e.g. OR council, medical/executive committee).
- Have one-on-one conversations with surgical team members about the checklists and ask them for their help in moving this work forward. If you can, one-on-one conversations are a great way to get people on board with quality improvement projects. Engaging clinicians individually can minimize resistance.
- Advertise that you will be implementing the crisis checklists at your facility. Some of the ways that you can advertise include: hospital newsletters, posters, screen savers, and buttons.

Updating Hospital Leadership

It is very important to keep hospital leadership informed about your work and how it is going. Often the hospital administrator that is part of your implementation team can serve in this capacity. Also think about other ways to engage hospital leadership. For example, ask one of your hospital executives to talk to some of the people that have been helping you test and modify the checklists.

Developing a Strategy For Sustaining Checklist Use

The initial implementation is extremely important to the success of this work. After clinicians have been trained it is helpful to build a system to collect feedback about how the checklists have helped in a case and identify items that should be modified in the future. Also consider holding periodic training with surgical team members.

We are excited to learn from how you move this work forward. Please remember to send us an email with ideas that you have, things that you tried, or any suggestions for how to improve our resources. We look forward to learning with you how to put the checklists into meaningful use.

Email: safesurgery2015@hsph.harvard.edu