OR Critical Event Checklists

READ OUT LOUD:
Has somebody called for help?

Who is going to be the team leader?

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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 material lies with the reader. These checklists are not intended to be comprehensive. Additions and modifications to fit local practice are encouraged.

1: Air Embolism

Condition: Suspected air embolism (decreased end-tidal CO_2 and oxygen saturation).
Objective: Restore normal oxygen saturation and hemodynamic stability and stop source of air entry.

- **Call for help.**

- **FiO_2 increased** to 100%?

- **Nitrous oxide** anesthetic stopped?

- **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?

- **Transesophageal echocardiography** called for (if available)?

Have we considered:

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

2: Anaphylaxis

Condition: Suspected anaphylaxis (consistent history, urticaria, hypotension, bronchospasm).

Objective: Restore hemodynamic stability, abort reaction.

- **Call for help.**
- **Potential causative agents** removed?
- **FiO_2 increased** to 100%?
- **Epinephrine** given?
  (Epinephrine dose may be repeated every 1-2 minutes as clinically indicated).
- **Airway** established/secured?
- **IV access** adequate?
- **IV fluids opened** and/or **fluid bolus** given at high rate?
- **If no response: begin IV epinephrine infusion** (rate: 1-4 µg/minute).

Have we considered:

- **Termination of the procedure** to focus on resuscitation?
- **Vasopressin**? (40 Units IV; for patients with continued hypotension)
- **Albuterol**? (if bronchospasm a prominent feature)
- **Diphenhydramine** (25-50mg IV)?
- **H_2 blockers** (e.g. ranitidine 50mg IM/IV; cimetidine 300mg IM/IV)?
- **Glucagon**? (1-2 mg IV or IM every 5 minutes, in patients taking beta blockers)
- **Hydrocortisone** (100 mg IV)?
- **Tryptase level**? (useful to guide future management)

Common causative agents:
Neuromuscular blocking agents, latex products (gloves,blood pressure cuff, Foley catheter), chlorhexidine, IV colloids.

Drug Doses:

- **Epinephrine doses**:
  1 to 5 cc (0.1-0.5 mg) IV, depending on severity, diluted 1:10,000 before bolus.
- 0.3 cc (0.3 mg) IM if no IV access (diluted 1:1,000).
- **If cardiac arrest:** give 1 mg epinephrine IV, begin ACLS and **GO TO:** Cardiac Arrest – Asystole/PEA Checklist or Cardiac Arrest – VF/VT Checklist.

3: Bradycardia - Unstable

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

- **Call for help.**
- **Get transcutaneous pacer.**
- Give **Atropine** (0.5mg IV; may repeat to 3mg total).
- Stop **surgical stimulation** (If laparoscopy, desufflate).
- **If myocardial infarction suspected** (e.g. ECG changes), treat accordingly. (e.g. oxygen, nitrates, consider terminating procedure)
- **Assess for drug induced causes** (e.g., beta blockers, calcium channel blockers, digoxin).
- **If persistent bradycardia, begin pacing**:
  1. **Place pacing electrodes and pads on chest** per package instructions.
  2. **Turn monitor/defibrillator ON**, set to **PACER** mode.
  3. **Set PACER RATE (ppm) to 60/min**. (Can be adjusted up or down based on clinical response once pacing is established).
  4. **Increase the milliamperes (mA) of PACER OUTPUT until electrical capture** (pacer spikes aligned with QRS complex; threshold normally 65-100mA). Set final milliamperes to 10mA above this level.
  5. **Confirm pulse present**.**
- **If pacing ineffective (or while awaiting pacer)**:
  - **Consider Epinephrine** (2 to 10 µg/min) **or Dopamine** (2 to 10 µg/kg/min).
- Consider **expert consultation.**

During Resuscitation:

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

Overdose Treatments:

Beta-blocker overdose:
- Glucagon (2-4mg IV push).

Calcium channel blocker overdose:
- Calcium chloride (1g IV).

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

4: Cardiac Arrest – Asystole/PEA

Condition: Non-shockable pulseless cardiac arrest.

Objective: Restore pulse, hemodynamic stability.

- **Call for help.**
- **CPR** (100 chest compressions/min + 8 breaths per minute)*
  - Ensure full chest recoil with minimal interruptions.
- **Epinephrine (or Vasopressin).**
- **Check pulse & rhythm** (after every 2 minutes of CPR):
  - 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).
    - Restart checklist.
  - If **pulse:**
    - Begin post-resuscitation care.
    - Read out potential causes (H &Ts).

Potential Causes (H&Ts):

- **Hypovolemia**
- **Hypoxemia**
- **Hydrogen ion** (acidosis)
- **Hyperkalemia**
- **Hypoglycemia**
- **Hypothermia**
- **Tension Pneumothax**
- **Tamponade** (Cardiac)
- **Thrombosis** (Coronary/Pulmonary)
- **Toxin** (narcotic, local anesthetic, beta blocker, channel blocker)
- **Trauma** (bleeding outside the surgical cavity)

During CPR:

- **Airway** ([bag mask ventilation]).
- **Breathing** (100% FiO_2).
- **Circulation** (confirm adequate IV or IO access) .
  - Consider IV fluids wide open.
- **Assign roles for**: Chest compressions, airway, vascular access, documentation, code cart, time keeping. Orders should be explicitly acknowledged and repeated.

Drug Doses and Treatments:

Epinephrine dosing: 1mg IV, repeats every 3-5 minutes

Vasopressin 40 U IV can be given to replace the first or second dose of epinephrine.

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:

Narcotic Overdose:

- Narcan 2-4mg IV

Local Anesthetic overdose:

Intralipid administration:

- 1.5mL/kg IV bolus
- Repeat 1-2 times for persistent asystole
- Start infusion .25 to 50mL/kg/min for 30-60 minutes for refractory hypotension

Beta-blocker overdose:

- Glucagon (2-4mg IV push)

Calcium channel blocker overdose:

- Calcium chloride (1g IV).

*** In patient without an advanced airway: Cycle of CPR = 30 compressions at a rate of 100/min, followed by two breaths Provide 5 cycles of CPR where "CPR x 2 minutes" is noted**

5: Cardiac Arrest – VF/VT

Condition: Shockable pulseless cardiac arrest.

Objective: Restore pulse, hemodynamic stability.

Top Priority = Early Defibrillation.

- **Call for help.**
- **Get defibrillator.**
- **CPR** (100 chest compressions/minute + 8 breaths per minute).*
    - Ensure full chest recoil with minimal interruptions.
- **Shock** at highest setting.
- **Epinephrine.**
- **CPR** x 2 minutes.

- **Check pulse & rhythm** (confirm shockable).**
- **Shock** at highest setting.
- **Epinephrine.**
- **CPR** x 2 minutes.

- **Check pulse & rhythm** (confirm shockable).**
- **Shock** at highest setting.
- **Amiodarone**.
- **CPR** x 2 minutes.

- **Check pulse and rhythm** (confirm shockable).**

During CPR:

- **Airway** ([bag mask ok if ventilation adequate]).
- **Breathing** (100% FiO_2).
- **Circulation** (confirm adequate IV or IO access).
    - Consider IV fluids wide open.
- **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 dosing: 1mg IV, repeat every 3-5 minutes.

Vasopressin 40 U IV can be given to replace the first or second dose of epinephrine.

Amiodarone dosing: 300 mg IV/IO once, then consider additional 150 mg IV/IO once.

Lidocaine can be given if Amiodarone unavailable:
1 to 1.5 mg/kg first dose, then 0.5 to 0.75 mg/kg IV/IO, maximum 3 doses or 3 mg/kg.

Magnesium dosing: Consider giving (loading dose 1 to 2 gm IV/IO) for torsades de pointes.

*** In patient without an advanced airway: Cycle of CPR = 30 compressions at a rate of 100/min, followed by two breaths. Give 5 cycles of CPR where "CPR x 2 minutes" is noted**

** **If Aystole/PEA** develops **at any point, GO TO** Cardiac Arrest: Asystole/PEA checklist

** **If pulse at any point,** begin post-resuscitation care

6: Failed Airway

Condition: Failed airway (2 unsuccessful attempts or oxygen saturation less than 85%).

Objective: Establish adequate oxygenation/ventilation.

Call for help. Get Airway Cart.

Bag-mask ventilate.

Bag-mask ventilation adequate?

No

Laryngeal Mask Airway (LMA) or other supraglottic (SG) device.

LMA/SG Ventilation adequate?

No

- **Prepare for surgical airway** (prep neck, call airway team).
- Get **Tracheostomy Kit.**

Consider:

- Bronchoscope.
- Transtracheal jet ventilation.
- Surgical airway.

If bag mask ventilation and LMA become inadequate

Yes, **consider:**

- Operation using LMA
- Return to spontaneous ventilation.
- Awakening patient.
- Different blades.
- LMA as conduit.
- Videolaryngoscope.
- Fiberoptic intubation.
- Intubating stylet.
- Light wand.
- Retrograde intubation.
- Blind oral or nasal intubation.

Yes, **consider:**

If alternatives fail, consider:

- **Awakening patient** (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.

7: Fire

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

Objective: Protect patient, contain fire.

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

Airway Fire

- Stop flow of medical gases (oxygen/**Nitrous Oxide).**
- Disconnect breathing circuit.
- Remove endotracheal tube (must balance against airway loss).
- Remove flammable material from airway.
- Pour saline into endotracheal tube, if kept.

Non-airway Fire

- Stop flow of medical gases (oxygen/**Nitrous Oxide)**.
- Remove drapes and flammable materials from patient.
- Extinguish fire with saline, soaked gauze, or other means.

  Do not use alcohol based solutions**

  Do not use any liquid for fires on or in energized electrical equipment (Laser, ESU/Bovie, Anesthesia Machine, etc.)**

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** gas supply to room.

Fire Extinguished

- Maintain or reestablish airway.
- Avoid oxidizer-rich environment (if possible).
- Assess for inhalation injury, consider bronchoscopy.
- Examine ET tube to see if fragments may be left behind.
- Discuss continuation of case with surgeon.

8: Hemorrhage

Condition: Acute massive bleeding.

Objective: Stop bleeding, maintain hemodynamic stability, avoid coagulopathy.

- **Call for help.**
- **IV fluids opened?**
  - **IV access** adequate?
- **Call blood bank:**
  - **Massive transfusion protocol** activated (if available)?
  - **Blood products** ordered (in addition to PRBCs)?
    - **FFP** (consider 1:1 ratio with PRBCs).
    - **Platelets** (if indicated; consider 1:1 ratio with PRBC's).
    - **Cryoprecipitate** (if indicated; 1 unit).
- **Additional lap sponges** requested?
- **Rapid infuser** (or pressure bags) requested?
- **Labs sent?**
  - CBC, PT/PTT/INR, Fibrinogen, Lactate, ABG, Potassium.

Have we considered:

- **Additional surgical techniques and/or personnel**?
  - **Hemostatic agents?**
  - **Vascular instruments or consultation**?
- **Damage control surgery** (pack, close, resuscitate)?
- **Warming** the room and patient?
- **Factor VII** (per institution protocol)?

Transfusion Considerations:

- **Cryoprecipitate to fibrinogen > 100 mg/dL**

If first fibrinogen level is…	
<100 mg/dL	Order 2 more pools of cryoprecipitate
100-200mg/dL	Order 1 more pool of cryoprecipitate

- **Red blood cells to Hematocrit > 21%**
- **Platelets to serum platelet level >50 K/microliter**
- **Fresh frozen plasma to PT/PTT < 1.5 times control**
- **Cell Saver (for nonmalignant, noncontaminated cases)**

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 (0.1 units insulin/kg and 1mL/kg D50W for pediatric patients).

9: Hypotension

Condition: Unexplained drop in blood pressure.

Objective: Restore hemodynamic stability.

- **Call for help.**
- **Equipment** checked for malfunction (arterial line, blood pressure cuff)?
- **Pulses** checked?

- **Intravenous fluids** opened?
- **FiO_2** increased to 100%?
- Surgical field inspected for **bleeding?** If Bleeding **GO TO:** Hemorrhage Checklist.

- Have we considered:
  - **decreasing anesthesia?**
  - **patient position?**
  - **additional IV**?

- **Have we considered the following causes:**

Surgical

- Retraction
- Vagal stimulation
- Mechanical/surgical manipulation
- Vascular Compression

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/OR Team

Airway:

- Unexplained Hypoxia (**GO TO:** Hypoxia Checklist)
- Increased PEEP

Breathing:

- Pneumothorax
- Pulmonary Edema
- Hypoventilation
- Persistent hyperventilation

Circulation:

- Myocardial ischemia
- Pulmonary Embolism
- Anaphylaxis
- Severe sepsis
- Air embolism (**GO TO:** Air Embolism Checklist)
- Other emboli (fat, septic, CO_2)
- Tamponade
- Bradycardia (**GO TO:** Bradycardia – Unstable Checklist)
- Tachycardia (**GO TO:** Tachycardia –Unstable Checklist)
- Bone Cementing (**Methyl methacrylate effect)**
- Malignant Hyperthermia (**GO TO:** Malignant Hyperthermia Checklist)

Drugs/allergy:

- **Recent drugs** given/dose error/allergy

10: Hypoxia

Condition: Unexplained oxygen desaturation.

Objective: Restore oxygenation.

- **Call for help.**
- **Pulse oximeter** placement checked?

- **FiO_2** increased to 100%?
- **Hand ventilation** initiated?
- **Oxygen source** checked?
- **Circuit** checked? (disconnection, kinks, holes)
- **End tidal CO_2** confirmed?

- **Breath sounds** checked?
- **ET tube** position checked?
- **Blood gas** drawn?

Suspected Airway/Breathing Issue?

Yes

Have we considered:

- **Suctioning** (mucus plug)
- **Removing circuit and using ambu-bag**
- **Bronchoscopy**
- **Pulling ETT and Mask Ventilation/Re-Intubation**

Consider causes:

Airway:
- Right mainstem intubation
- Brochospasm?
- Ventilator settings, leading to auto-peep

Breathing:
- Aspiration
- Atelectasis
- Obesity/positioning
- Pneumothorax
  - Chest X-Ray, chest tube, needle decompression considered
- Hypoventilation
- Pulmonary Edema

No

Consider causes:

Circulation:
- Embolism
  - Pulmonary Embolus
  - Air Embolism? (**GO TO**: Air Embolism Checklist)
  - Other Emboli (e.g. fat, septic, CO_2)
- Heart disease?
  - Congestive Heart Failure
  - Coronary Artery Disease
  - Myocardial Ischemia
  - Cardiac Tamponade
  - Congenital/anatomic Defect
    - Electrocardiogram, Transesophageal echocardiogram, bypass considered?
- Severe Sepsis
- If hypoxia associated with hypotension (**GO TO:** Hypotension Checklist)

Drugs/allergy:
- **Recent drugs** given
  - Dose error/ allergy/anaphylaxis

11: Malignant Hyperthermia

Condition: Unexpected, unexplained increase in end-tidal CO_2; prolonged masseter muscle spasm after succinylcholine; unexpected, unexplained tachycardia.

Objective: Restore normal hemodynamic parameters, metabolic function, temperature.

- **Call for help.**
- **Get Malignant Hyperthermia (MH) Kit.**
- **Volatile Anesthetics stopped/transitioned to non-triggering anesthetics?**
  - Don't delay treatment to change circuit or CO_2 absorber.
  - Request chilled IV saline.
- **FiO_2 increased** to 100%?
- **Hyperventilation initiated?**
  - 10 L/min or more (or 2-4× patient's minute ventilation).
- **Dantrolene** given?
  - Assign dedicated person to mix dantrolene.
- **MH hotline called? 1-800-644-9737.**
- **Procedure terminated** (if possible)?
- **Bicarbonate** given for suspected metabolic acidosis?
  - Maintain pH > 7.2.
- **Patient cooled** if temperature > 38.5°C?
  - Lavage open body cavities.
  - NG lavage with cold water.
  - Apply ice externally.
  - Cold saline infused intravenously.

  **** Stop cooling if temperature < 38°C. ****
- **Hyperkalemia** treated if suspected?
- **Dysrhythmias** treated if present?
  - Standard antiarrhythmics are acceptable; **don't use Calcium Channel Blockers.**
- **Labs sent?** (ABG, venous blood gas, electrolytes, serum CK, serum/urine myoglobin, coagulation profile)
- **Foley catheter placed?**
  - Monitor urine output.
- **ICU called/disposition arranged?**

Drug Doses and Treatments:

Dantrolene: 2.5mg/kg (~1mg/lb) IV every 5 minutes until symptoms subside. (Mix each ampule with 60cc sterile water. May require up to 30mg/kg).

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

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 (0.1 units insulin/kg and 1mL/kg D50W for pediatric patients).

12: Tachycardia - Unstable

Condition: Hemodynamic instability, tachycardia with pulses.

Objective: Restore hemodynamic stability, adequate perfusion.

- **Call for help.**
- **Get code cart/defibrillator.**

Prepare for immediate synchronized cardioversion:

1. **Sedate all conscious patients** unless deteriorating rapidly.
2. **Turn monitor/defibrillator ON**, set to DEFIB mode.
3. **Place electrodes on chest** per packing instructions.
4. **Press SYNC button** to engage synchronization mode.
5. **Look for mark/spike on the R-wave** indicating synchronization mode.
6. **Adjust SIZE button if necessary** until SYNC markers seen with each R-wave.
7. **Cardiovert at appropriate energy level**, begin with lower level and progress as needed:
   ("Energy select" buttons → "Charge" button → "Shock" button [press and hold])

Atrial fibrillation	100J.→120J.→150J.→200J
Mono-morphic VT	50J.→100J. →150J.→200J.
Other SVT, atrial flutter	25J. → 50J. → 100J.→ 150J.→ 200J.
Poly-morphic VT and unstable	Treat as VF, **GO TO: Cardiac Arrest – VF/VT Checklist.**

8. **Check monitor**; if tachycardia persists, increase energy level.
9. Activate **SYNC** mode after delivery of each synchronized shock.
10. **Consider expert consultation**.

During Resuscitation:

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

**** If VF/Unstable VT develops GO TO: Cardiac Arrest – VF/VT Checklist**

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