Episode 37: OR Crises

On this episode: Dr. Jed Wolpaw

In this episode, episode 37, I go over crises that can happen in the OR, when to suspect them, and what to do about them. I draw from two excellent sets of OR crisis checklists that are available for free. The Stanford Anesthesia Cognitive Aid Group's lists and the Ariadne Labs/Brigham/Harvard School of Public Health lists.

Questions & Notes

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- Unstable Bradycardia
- Tachycardia
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- Airway Fires
- Massive Hemorrhage
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  - Hypoxemia
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- Intraoperative MI
- Pneumothorax
- Pulmonary Embolism

References

Resources

0:55

- Stanford Anesthesia Cognitive Cid Group:
  - http://emergencymanual.stanford.edu
- Ariadne Labs by Brigham/Harvard School of Public Health
  - http://www.projectcheck.org/crisis-checklist-download.html

Cardiac arrest

2:00

Asystole/PEA

- **Asystole**: EKG flatline (1st check to make sure EKG working), A-line flat, no pulse
- **PEA**: No pulse, but there is activity on EKG that is not VFib or Vtach
- **Either Asystole OR PEA:**

1) Call for help and code cart, let surgical team know
2) Turn off anesthetic
3) Ventilate with 100% O2, turn up flows, about 10 breaths/minute (don't over ventilate)
4) Start chest compressions: 100/minute, 2 inches deep, good chest recoil, rotate compressors every 2 minutes
5) Obtain IV or IO access
6) Push IV epinephrine 1 mg every 3-5 minutes
7) IF at any point, shockable rhythm arises, go down Vfib or Vtach algorithm
8) Call ECMO team
9) TEE/TTE to get better idea of what is causing arrest
10) Establish team leader and designate roles
11) Start to think about most common possible causes of intraop arrest:
    a) Hemorrhage (talk to surgeon)
    b) Effective loss of circulation (surgeon leaning on IVC, caught in retractor)
        i) Auto Peep (patient with bad COPD and ventilating too quickly)
            (1) unhook from circuit and let patient exhale
    c) Anesthetic overdose (did you accidentally leave volatile all the way on?)
    d) Sepsis (rare cause, unless already septic pre-op)
    e) Anaphylaxis: severe hypotension, rash, swollen membranes, bronchospasm
    f) Medication error (nitroglycerin instead of phenylephrine?)
    g) High spinal or bupivacaine accidentally injected into vein?
    h) Pneumothorax (positive pressure in patient w/ lung disease, central line)
    i) Excessive vagal stimulation
        i) cataract or strabismus surgery: oculocardiac reflex → bradycardia
    j) Pulmonary embolism (clot, air embolism, amniotic fluid in OB case)
12) If hemorrhage/hypovolemia → bolus, blood
13) Hypoxemia → increase oxygen, ventilate, suction ET tube
14) Pneumothorax → listen to lungs, no lung sounds, needle thoracostomy
15) PE/thrombus → TTE to look at RV, consider TPA or ECMO (if hx of cancer, more likely)
16) Identify medication error
17) Tamponade → echo, drain
18) Hypo/hyperthermia, dantrolene if malignant hyperthermia
19) Hyperkalemia → calcium, insulin, dextrose (especially in known ESRD)

20) Hypoglycemia → dextrose
21) Acidosis → identify underlying cause, bicarb controversial
22) Hypocalcemia → calcium

VFib/Vtach

12:00

1) Defibrillate, usually 200 joules biphasic
2) Immediately start CPR for 2 min, do not wait or do pulse check until 2 min mark
3) Epinephrine every 3-5 min
4) 300 mg amiodarone 1x push, can give a second time at 150 mg (lidocaine les common)
5) Torsades (or known long QT) → magnesium 2 grams IV
6) Shock every 2 minutes, epi every 3-5 min
7) Go through same list of causes of asystole or PEA and try to treat underlying cause

- If bupivacaine toxicity → consider intralipid

Unstable Bradycardia

14:20

- Unstable (i.e. hypotensive)
    - Increase O2
    - Turn off anesthetics
    - Check monitors
    - Atropine
        - 0.5 - 1.0 mg up to 3 total doses
    - Epinephrine
        - 10-20 mcg push (baby epi = 10 mcg/ml)
    - Dopamine
    - Pacer pads, transcutaneous pacing
    - Call for help
- Have someone place an A-line as you're managing code
- Send continuous labs

Tachycardia

16:32

SVT

- >150 bpm
- Sudden in onset (i.e. HR jumps from 80 to 150)
- Stable SVT → obtain 12 lead EKG, obtain access, consider cardiology consult
- Regular and narrow complex
    - Adenosine 6 mg followed by 12 mg, chase quickly with 20 cc syringe
        - Don't use in patients with bad asthma or WPW
    - Esmolol if adenosine doesn't help to break SVT or slow it down

Irregular or Wide Complex Tachycardia

- With a pulse and stable
    - Amiodarone 150 mg slowly over 10 minutes, then infusion at 1 mg/min

Unstable tachycardia

- Unstable = hypotension
    - Synchronized cardioversion
    - Pacer pads, turn to synchronized (dot over each QRS complex, screen will say “synced”)
        - If narrow complex and regular: start at 50 - 100 joules
        - If narrow complex and irregular, maybe a-fib: start 120 - 200 joules
        - If wide complex and regular: start at 100 joules
        - If wide complex and irregular, could be V-tach → unsynchronized cardioversion
    - If first attempt at pacing fails, turn up joules to a higher level and try again
    - Can also give magnesium and amiodarone at the same time

Anaphylaxis

20:25

- Hypoxemia, rash, hypotension, tachycardia, bronchospasm, increased peak airway pressures
- Most common agents are neuromuscular blockers (antibiotics not as common)
- Call for help, code cart, let surgeon know
- If loss of pulse, follow cardiac arrest algorithms
- Assess monitors, ventilation
- Consider other causes: pulmonary embolism, pneumothorax, MI, hemorrhage, anesthetic overdose
- Stop anything that might be contributing (i.e. drips)
- Turn off anesthetics if hypotension
- Give epinephrine (10-100 mcg IV Q2 min until improvement)
    - Could start epi infusion
    - Don’t give code doses of epi unless in cardiac arrest
- If patient with MAC with LMA or spontaneous ventilation, consider intubation
- Albuterol for bronchospasm
- H1 Blocker (diphenhydramine) or H2 Blockers (ranitidine)
- Once patient is stable, draw tryptase level to differentiate allergic reaction
- Watch patient for 24 hours (anaphylaxis can recur)

Bronchospasm

23:20

Signs

- Increased peak airway pressures
- End title CO2 tracing with sleep upslope
- Increased expiratory time
- Wheezing

- Flow time curve, flow does not come back to zero
- Decreased tidal volumes
- Keep an eye out for auto-peep

Treatment

- Give 100% O2, increase I:E ratio, deepen anesthetic, check ET tube for patency, check for mainstem intubation (listen for bilateral breath sounds)
- If wheezing, make sure it's not other causes first
    - All that is wheezing is not bronchospasm!
        - MI (causing pulmonary edema)
        - check for ST elevations
        - Anaphylaxis
            - hypotension
        - Bronchospasm: high likelihood in patient with known asthma
- Albuterol via circuit
- Epinephrine 10 mcg IV (watch out for tachycardia, hypertension)
- Ketamine 0.2 mg/kg - 0.5 mg/kg
- 100 mg hydrocortisone

Airway Fires

26:45

- Any operation with electrocautery around ET tube
- Use lowest possible FiO2 (room air is ideal)
    1) Remove ET tube as fast as possible
    2) Turn off O2 + Nitrous (highly flammable)
    3) Use fiber optic to remove any disintegrated ET tube pieces in airway (use saline)
    4) Consider re-intubation before airway swelling occurs
    5) Ventilate the patient
    6) Can use a special ET tube for laser cases (fill cuff with methylene blue tinted saline)

Massive Hemorrhage

29:25

- *See Episode #31: Massive Transfusion protocol*
- Get type and screen and make sure blood is available in the room
- Obtain A-line if not already
- Obtain rapid transfuser (i.e. belmont)
- Replete in 1:1:1 ratio
    - 1 unit RBC (hgb should increase by 1)
    - 1 unit FFP (watch INR/TEG)
    - 1 unit (6 pack) platelets for every 6 units pRBC/FFP (platelet should increase by 50,000)
    - Cryo: 10 units of cryo usually 1 pack (will raise fibrinogen by 50)
- Communicate with surgeons (can "pack and wait" if you're very concerned)

Hypotension

- Call for help/code cart, let surgical team know
- Feel for a pulse and check monitors

- Give phenylephrine (100-200 mcg) or ephedrine (5-10 mg)
    - 10-20 mcg of epi or vasopressin 1-2 units at a time if phenyl/ephedrine not working
- Trendelenburg
- Increase FiO2 if hypoxic
- Let surgeon know if surgery needs to be terminated
- Start chest compressions if loss of pulse
- Continue to consider causes: air embolism, pneumothorax, tamponade
    - Decreased preload: hypovolemia, auto-peep, Arrhythmia, IVC compression, Air embolism, fat embolism, PE, pneumothorax, tamponade
    - Decreased afterload: too much anesthetic, shock (anaphylaxis, spinal shock), endocrine abnormality (steroid insufficiency)
    - Decreased contractility: new MI, new heart failure, worsened valvular disease, hypoxia causing myocardial ischemia, local anesthetic toxicity, low heart rate
- Echo (TTE or TEE)
- IV access, A-line
- Steroids if concerned for adrenal insufficiency
- Send labs

Hypoxemia

- Turn up flows, turn up O2 to 100%
- Check monitors for adequate ventilation
- Check to make sure Nitrous not on
- If no pulse, go down PEA algorithm
- If no ETCO2, could be disconnected
- Hand ventilate if machine not working
- Hook up to O2 tank if worried about O2 supply
- Listen to bilateral breath sounds (rule out right mainstem)
    - Severe wheezing → bronchospasm?
    - ET tube problems: suction, check for high airway pressures
    - If only one sided breath sound: right mainstem or pneumothorax (central line?)
- If atelectasis (slow decrease in saturation)
    - Recruitment breath (don't do if hypotensive), increase PEEP
- Bronchospasm → bronchodilators
- Send labs (PO2 should reflect O2 sat on ABG)
- Severe air embolism or PE should also cause hypotension (TTE: right heart strain, air)

Malignant Hyperthermia

29:25

- Initially: severe increase in end tidal CO2, tachycardia, tachypnea, masseter spasm
- Later: hyperthermia, rigidity, arrhythmias, myoglobinuria, cardiac arrest
- Treatment: dantrolene (call malignant hyperthermia hotline: 1-800-MHHYPER)
    - 2.5 mg/kg IV dantrolene, then start infusion until patient stable
    - If reached 10 mg/kg with no response, rethink diagnosis
- Treat hyperkalemia to prevent cardiac arrest (insulin, D50, calcium)
- 25% relapse within 24 hours, need 24 hours in ICU

Intraoperative MI

40:51

- Watch for acute changes in acute ST segment changes (elevation or depression), arrhythmia, unexplained tachycardia, PVCs, PACs, bradycardia, regional wall motion abnormalities on echo
- Obtain 12 lead EKG
- If STEMI → cards consult → cath lab if possible with surgeon
- If tachycardic, give esmolol to bring heart rate down
- Get code cart
- Keep normotensive
- Give narcotics if due to pain
- Give nitroglycerin if not hypotensive
- Give PR aspirin or down OG/NG if ok with surgeon
- If hemodynamically unstable, call cath lab to consider balloon pump
- Only turn up O2 if hypoxic (don't cause hyperoxia)

Pneumothorax

42:48

- Increased peak airway pressure, tachycardia, hypotension, hypoxia
- hyperresonance to percussion, increased JVD, increased CVP
- Consider right mainstem intubation (if tube is deep, pull back)
- If high suspicion → needle thoracostomy (14 or 16 gauge needle at mid clavicular line at second intercostal space)
- If stable, obtain CXR

Pulmonary Embolism

43:50

- Amniotic fluid/Venous air embolism
- Decreased end tidal, hypotension, hypoxemia, rise in CVP
- TEE: air or bulging of right heart (increased right heart afterload)
- Supportive care: increase oxygenation to 100%, flood surgical field with saline if air embolism, head down, turn off volatile anesthetic (definitely nitrous - makes air embolism worse), start CPR, avoid code by giving epinephrine (right heart inotropy),
- PE: consider giving tpa (discuss risks with surgeon), consider ECMO
- Amniotic fluid: supportive care,
- Air embolism: consider aspiration from central line, left lateral decubitus position

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References

The Stanford checklists can be downloaded for free here: http://emergencymanual.stanford.edu

The Harvard checklists can be downloaded for free here:
http://www.projectcheck.org/crisis-checklist-download.html

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