Episode 44: Intro to cardiac anesthesia with Megan Kostibas

On this episode: Dr. Jed Wolpaw with Dr. Megan Kostibas

In this episode, episode 44, I welcome Dr. Megan Kostibas to the show. Dr. Kostibas is trained in cardiac anesthesia and critical care medicine and is an assistant professor here at Hopkins. She is also the associate program director for the cardiac anesthesia fellowship. We discuss the basics of how to prepare, induce and manage difference cardiac pathology as well as how to go on and off cardiopulmonary bypass.

All Cardiac Episodes

Questions & Notes

Click → jump to answers/notes.

HOW TO GET READY FOR CARDIAC CASE?

WHEN AWAKE A-LINES?

WHEN AWAKE CENTRAL LINES?

WHAT ABOUT SEVERE PULMONARY HTN. CORDIS AWAKE?

SPECIFIC DRUGS READY TO GO?

- **Amicar?**
- **Insulin drip?**

PHYSIOLOGY FOR INDUCTION

- **CAD**
- **Basic valvulopathy**
  - AS/MS
  - AR/MR
  - pHTN

AGENTS FOR ACTUAL INDUCTION?

- **If CABG, stable and nl EF**
- **If valvular**
- **If AS**

POST-INDUCTION, CENTRAL LINE

MANAGEMENT PRIOR TO BYPASS?

TEE CONTRAINDICATIONS

GETTING READY FOR BYPASS

- **If you give heparin and ACT not high enough despite re-bolus of heparin. What do you do?**

WHAT IS BYPASS?

WHAT ARE GROIN LINES?

CARDIOPLEGIA?

GOING ON BYPASS

WHY WORRIED ABOUT AWARENESS WHEN ON BYPASS?

PREPARE TO GO OFF BYPASS?

MILRINONE?

ANYTHING ELSE OFF BYPASS?

PROTAMINE?

OFF-PUMP CABG?

How to get ready for cardiac case?

- Like any care: read about patient bc comorbidities like coronary artery disease (CAD) vs valve will influence management.
- Surgical hx
- Think about physiology:
    - Aortic stenosis (AS) would be managing normal sinus rhythm, avoiding tachycardia, maintain preload, afterload
    - Coronary artery disease (CAD): maintain MAP, awake arterial line

When awake a-lines?

- If stable for CABG, can consider asleep bc stable. However, if proximal lesion like left main, do awake.
- If stenotic lesion, unstable, worried about airway/ hemodynamics

When awake central lines?

- Typically, no, unless extremely unstable like anterior wall mass or tamponade and need central access going to sleep
- May have surgeon in room doing groin access

What about severe pulmonary HTN. Cordis awake?

- Coming from home, with awake a-line, can do asleep
- Have pulmonary vasodilators, surgeon in room in prep for instability

Specific drugs ready to go?

- Institution and provider dependent
- Hopkins: have epi ± norepi ready

Amicar?

- E-Aminocaproic acid
- Studies showed that antifibrinolytic like TXA or Amicar will result in less bleed and less blood products post-surgery

Insulin drip?

- Yes, studies showed 140-180 have better outcomes, less infection following surgery

Physiology for induction

CAD

- Maintain supply 10-20% of MAP at physiology normal
- Avoid tachy that worsens oxygen demand
- Meds of choice? w/ nl EF, phenylephrine is perfect. If depressed EF, use levophed. Epi as backup

Basic valvulopathy

AS/MS

- Go to med: phenylephrine: ↑ AL and keep HR low.

- Vigilant about fluid to maintain preload

AR/MR

- Keep HR higher, less time in systole.
- Reduce afterload to reduce regurgitation
- More forgiving w/ MAP drops.
- Use ephedrine first then norepi/epi.
- Avoid phenylephrine

pHTN

- Awake a-line.
- Avoid hypercapnia, hypoxia.
- Avoid pain, agitation that may ↑ pHTN.
- If some right heart dysfunction, start on epi/norepi/or dopamine w/ induction to give right heart support
- if systemic hoTN, use vasopressin?
    - Not so much for times like induction when it's a failure to pump, not vasoconstrict

Agents for actual induction?

If CABG, stable and nl EF

- Midaz, propofol, slower induction w/ titration of phenylephrine w/ propofol

If valvular

- Avoid propofol use ketamine w/ slow titration (10-20mg at a time) won't see frank HR change. Others use etomidate. Or combined w/ sevo/keta

If AS

- Midaz, awake A-line. 15-20mg ketamine titrate to effect. Once some sedation, turn on sevo to about 0.5 MAC.

Post-induction, central line

- Volume resuscitation, eg Cordis. in addition to large bore peripheral
- "Double stick" with a smaller gauge double lumen for concentrated meds

Management prior to bypass?

- TEE before central line and look at heart before sternotomy

TEE contraindications

- Relative:
    - Hx of esophageal surgery or trouble swallowing
    - Hx of gastric surgery eg bypass, or hiatal surgery
    - Esophageal varix
    - Trauma pt

Getting ready for bypass

- Anticoagulated w/ heparin which blocks Antithrombi-3
- Typically 300-350 IU/kg
- Check ACT
    - Normal = 120-130
    - Bloused heparin goal >= 480
- Discussion w/ perfusionist about dilution of Hb prior to bypass. They will prime pump w/ blood vs some solution. There's a formula perfusionists used based on our first draw. 7-10 is typically acceptable
- Discuss w/ surgeon about preop and TEE echo correlation.

If you give heparin and ACT not high enough despite re-bolus of heparin. What do you do?

- Give FFP or AT3 (you have AT3 deficiency so heparin can't do its job).
- Usually pts who's been on floor for days on heparin drip that "ate up AT3"

What is bypass?

- Take over heart and lung during CT surgery
- Bloodless, motionless field
- In US, typically run by perfusionist
- Pump: roller or centrifugal
- Oxygenator: oxygenate and remove CO2
- Surgeon place venous cannula, which drains blood into bypass reservoir where blood filtered/warmed/cooled/oxygenated / add drugs like pressors/volatiles → return via arterial cannula (usually placed in asc. Aorta)

What are groin lines?

- "Peripheral cannulation" = via femoral artery/vein very long that goes through IVC and arterial side into aorta
- Usually if crashing to bypass or had a hx of cardiac surgery bc right side of heart may adhere to chest wall
- Venous drainage not as good

Cardioplegia?

- Potassium-containing solution that causes heart to arrest
- **Anterograde**: arterial cannula in aorta to sinuses of Valsalva down aortic root
- **Retrograde**: coronary sinus via venous system

Going on bypass

- Everyone ready. Usually after central cannulas placed.
- Perfusionist removes clamp → siphon effect will drain R heart thru venous cannula. Then turn on knob to start pumping back into aortic cannula → arterial wave form will dampen and close bc no flow through heart.

- If perfusionist needs more than phenylephrine, usually something wrong like poor flow or placement of cannula.
- What does anesthesia do?
    - Turn off ventilator and monitors, anesthetic gas.
    - Frequent check and maintenance of ACT
    - Institutionally check regular electrolytes and Hb
    - Watch electrical activity to ensure heart stays arrested after X-clamp which is placed b/w aortic ROOT and cannula. Cardioplegia is re-dosed q20-30 min
    - X-clamp: if leaky valve or LV distension can look on echo and surgeon make sure not distended.
        - Recall: **Law of Laplace** bc ↑ stretch will ↑ oxygen consumption
- LV vent to help drain

Why worried about awareness when on bypass?

- When giving iso via bypass no way to measure MAC.
- Differential of HTN on bypass is awareness: give narcotic and up on gas.

Prepare to go off bypass?

- 7 things after surgeon takes off aortic X-clamp
- 1: **Rhythm** Heart may start beating right away or may need help which requires defib or temp pacing wire
- 2: **Rewarm** to bladder temp of 35 from variable temp based on surgery/surgeon etc.
- 3: **Echo**: Look at heart. RWMA? Valves? Surgeon looks on field to check
- 4: **Electrolytes**
- 5: **Hb**
- 6: **Inotrope/vasopressor?**
- 7: **Ventilate**, turn on vent, anesthetic. Recruit
- Bypass Full flow: 4-5L/min. surgeon will ask flows to be decreased, allowing more blood in heart to recover. If look good, then off bypass
- If need more support:
    - Time, increase inotrope, which part of heart can influence decision point
    - Worried about LV dysfunction:
        - IABP (from femoral AA into ascAo) which offloads work by ↑ CO, CPP, ↓ some afterload → ECMO

Milrinone?

- Helps w/ RV dysfunction, may need inotrope to maintain SVR

Anything else off bypass?

- Most often: MAP low = underfilled → give volume via central line or perfusionist.
    - TEE helpful: Structural? Valve? Effusion?
- Dynamic abnormalities? Eg hypertrophy, can address w/ ↑ afterload, volume and wait it out
- Ventricular dysfunction, new RWMA, global hypokinesis
- Vasoplegia 2/2 inflammatory response which improves

Protamine?

- When coming off bypass to reverse heparin.
- Cation that bind heparin and forms salt.
- Every 100 heparin, 1mg protamine. If 40K U heparin, 400 protamine
- 4 main reactions, give slow or test dose (prior exposure, vasectomy, exposed to NPH)
    - Histamine release
    - Mast cell degranulation → hypotensive. Typically give peripherally
    - Anaphylaxis/anaphylactoid
    - pHTN, RH fail

Off-pump CABG?

- Same setup bc may crash to bypass
- When surgeons start sewing, Dr. Kostibas's choice is norepi bc ↑ afterload → ↑ CPP and not as tachy as epi. Others use neo
- When surgeons manipulate, can distort anatomy and perfusion