Post Cardiac Surgery Care
What a Hospitalist Needs To Know

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Disclosure

• No disclosures
Lines of Attack

- Electrical Failures
  - Rhythm abnormalities
- Plumbing Failures
  - Anticoagulation
  - Renal issues / Fluid management
- Structural Failures
  - Cardiac
  - Pulmonary
  - Neuro/GI issues
Objectives

• Describe the commonly encountered EKG abnormalities in the cardiac surgical patient
• Explain the optimal strategy for managing anticoagulation and fluid balance after cardiac surgery
• Identify the four life threatening emergencies that present immediate risks to the cardiac surgical patient during the hospital course
Electrical Failure

AV Conduction Abnormalities

Ventricular Arrhythmias

Atrial Fibrillation
Case Presentation
69 Year Old Male

Presentation
• Dyspnea
• Multi-vessel CAD

Past Medical History
• HTN
• Hyperlipidemia
• CKD Stage 3
• OSA (CPAP)
• Type 2 DM

Operation
• CABG x 3
• LIMA to LAD
• SVG to OM
• SVG to PDA
Post Operative Course

- POD2: off all drips, out of ICU
- POD3: Abnormal rhythm detected
What is the next step in management?

A. Amiodarone bolus
B. Rate control with beta blocker
C. Transfer back to ICU
D. Cardioversion
E. Not sure
Atrial Fibrillation
(Rapid Ventricular Response)

• Many risk factors: CV Surgery included
• Incidence: 15-50% of open heart surgery patients
• Surgery insults: atrial injury, atrial ischemia, acute volume changes
• Post-op insults: fluid overload, electrolyte imbalance, increased afterload, inflammatory/oxidative stress
Treatment options:

Unstable

- Emergent cardioversion

Stable

- Rate Control
  - HR < 100: Increase PO BB
  - HR > 100: IV metoprolol, IV amiodarone, IV diltiazem

- Rhythm control
  - Amiodarone, Digoxin
  - Cardioversion

- Anticoagulation
  - AF > 12-24 hrs: IV heparin
  - Warfarin, NOAC

Adapted from Manual of Perioperative Care in Adult Cardiac Surgery 5th edition R.M. Bojar
Subsequent Hospital Course

- POD3: AF/RVR
  - Amio bolus x3, drip, increased beta blocker
- POD4: continued amio drip, rate controlled, IV heparin started, warfarin initiated
- POD6: TEE guided DCCV
  - Single synchronous shock 100 Joules
  - NSR w/ rates 60s bpm
- POD7: discharged from hospital
  - 5 week course of amiodarone, warfarin for 6 weeks
Ventricular Arrhythmias

- VT or VF on monitor
- ACLS Protocol
- Transfer to ICU
  - Defibrillate
  - CPR
  - Epi
  - Lidocaine
- IV Access
  - Central (femoral)
- Defibrillator in Room
- 120-200 J
- Bag/Mask available
- Ventilating if necessary
- Transfer to ICU

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AV Conduction Abnormalities

• Primary AV block (PR interval > 0.2 sec)
  • Common after cardiac surgery
  • May be due to cold cardioplegic solutions, perivalvular edema or pharmacologic agents
  • Rarely requires treatment

• Symptomatic complete AV block treatment alternatives:
  • Pace via operative pacing wires
  • Transcutaneous pacing pads
  • Isoproterenol drip
  • Transvenous pacing catheter
Plumbing Failures

Fluid management

Pressure optimization

Anticoagulation
Case Presentation
81 Year Old Female

<table>
<thead>
<tr>
<th>Presentation</th>
<th>Past Medical History</th>
<th>Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Dyspnea</td>
<td>• HTN</td>
<td>• AVR (tissue)</td>
</tr>
<tr>
<td>• Aortic stenosis</td>
<td>• Hyperlipidemia</td>
<td>• Tricuspid repair</td>
</tr>
<tr>
<td>• Tricuspid regurgitation</td>
<td>• GERD</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Hypothyroidism</td>
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<td></td>
<td>• Arthritis</td>
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Hospital Course

• POD1: extubated, hypotensive, fluids, midodrine,
• POD2: AM: out of ICU, PM: decreasing UOP, short afib (self limiting)
• POD3: minimal UOP, SBP 100s, dopamine started
• POD3-5: increasing UOP, SBP 130-140s
Acute Kidney Injury (AKI)

- Up to 30% of post-op CVS patients
- Difficult to predict
- Risk factors
  - Preop CKD
  - History of AKI
  - Heart failure
  - Nephrotoxic drugs
  - IV Contrast
  - Age over 65
Classification and Staging

<table>
<thead>
<tr>
<th>System</th>
<th>Serum creatinine criteria</th>
<th>Urine output criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RIFLE class</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Risk</td>
<td>Serum creatinine increase to 1.5-fold OR GFR decrease &gt;25% from baseline</td>
<td>&lt;0.5 ml/kg/h for 6h</td>
</tr>
<tr>
<td>Injury</td>
<td>Serum creatinine increase to 2.0-fold OR GFR decrease &gt;50% from baseline</td>
<td>&lt;0.5 ml/kg/h for 12h</td>
</tr>
<tr>
<td>Failure</td>
<td>Serum creatinine increase to 3.0-fold OR GFR decrease &gt;75% from baseline OR serum creatinine ≥354 μmol/l (≥4 mg/dl) with an acute increase of at least 44 μmol/l (0.5 mg/dl)</td>
<td>Anuria for 12h</td>
</tr>
<tr>
<td><strong>AKIN Stage</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Serum creatinine increase ≥26.5 μmol/l (≥0.3 mg/dl) OR increase to 1.5–2.0-fold from baseline</td>
<td>&lt;0.5 ml/kg/h for 6h</td>
</tr>
<tr>
<td>2</td>
<td>Serum creatinine increase &gt;2.0–3.0-fold from baseline</td>
<td>&lt;0.5 ml/kg/h for 12h</td>
</tr>
<tr>
<td>3</td>
<td>Serum creatinine increase &gt;3.0-fold from baseline OR serum creatinine ≥354 μmol/l (≥4.0 mg/dl) with an acute increase of at least 44 μmol/l (0.5 mg/dl) OR need for RRT</td>
<td>&lt;0.3 ml/kg/h for 24h OR anuria for 12h OR need for RRT</td>
</tr>
</tbody>
</table>

Ricci, Z. et al. (2011) Classification and staging of acute kidney injury: beyond the RIFLE and AKIN criteria
Renal issues/ Fluid management: AKI

- **Diagnosis**
  - UA
  - Serum indicators

- **Prevention**
  - Limit injury
  - Adequate BP
  - Hydration

- **Treatment**
  - Identify cause
  - Diuretics
  - Time

- Nephrology consult
  - Fluid removal
  - Dialysis
Anticoagulation

- Atrial fibrillation:
  - CHA$_2$DS$_2$VASc score
  - HAS-BLED score

- Valve surgery:
  - Mechanical valve: lifelong warfarin
  - Tissue valve: short term, may need to continue warfarin if in atrial fibrillation
**Figure 6. Anticoagulation for Prosthetic Valves**

Risk factors include AF, previous thromboembolism, LV dysfunction, hypercoagulable condition, and older generation mechanical AVR.

AF indicates atrial fibrillation; ASA, aspirin; AVR, aortic valve replacement; INR, international normalized ratio; LMWH, low-molecular-weight heparin; MVR, mitral valve replacement; PO, by mouth; QD, every day; SC, subcutaneous; TAVR, transcatheter aortic valve replacement; UFH, unfractionated heparin; and VKA, vitamin K antagonist.
Which statement most accurately reflects the optimal BP strategy after heart surgery?

A. “A systolic pressure of three digits, the first of which is a one.”—B. Perler

B. “Hypertension? Hypotension? Ain’t no ‘tension that’s gonna get my attention.”—L. Watkins

C. “MAP 60-80”—N. Shumway

D. “If you don’t know your blood pressure it’s like not knowing the value of your company.”—M. Oz

E. More than one of the above, depending on the circumstances.
Blood Pressure Management

- Hypertension: If well controlled pre-op, restart home meds (typically start at lower dose)

- Hypotension: Assess likely cause and treat accordingly
  - Hypovolemia, anemia, arrhythmias, medication induce bradycardia
  - Fluid bolus, transfusions, discontinue medications, etc
Catastrophic Structural Failures

- Tamponade
- Pneumothorax
- Stroke
- PE
Case Presentation
65 Year Old Female

Presentation
- Dyspnea
- Tricuspid regurgitation

Past Medical History
- Osteoarthritis
- Anemia
- PAC’s

Operation
- Tricuspid valve replacement
Hospital Course

• POD 1: EP consult for bradycardia/sinus pause
• POD 4: Placement of PPM
• POD 5: external temporary PW removed
  • Tachycardia and hypotension
  • Emergent echo
• POD 8: Pericardial drain removed
• POD 9: Discharged
Pericardial Tamponade

- Beck’s triad
  - Hypotension
  - JVD
  - Muffled heart sounds

- Signs
  - Tachycardia, tachypnea, narrowing pulse pressures, JVD, pulsus paradoxus, decreased urine output

- Diagnosis
  - CXR: widening mediastinum
  - TTE: Pericardiocentesis vs sternal reopening
Pneumothorax

- Post-chest tube removal CXR
- Sudden or increased SOB
- Small/asymptomatic
  - Conservative treatment
  - Supplemental O2
- Large/symptomatic
  - Chest tube placement (bedside or CT guided)
Pulmonary embolism

- ~1% of post-op patients
- Risk factors
  - BMI > 30
  - Bed rest
  - COPD
  - Prolonged mechanical ventilation
- New onset pleuritic chest pain, shortness of breath
- Unilateral calf swelling/pain

Wells’ Criteria
Symptoms of DVT (3 points)
No alternative diagnosis better explains the illness (3 points)
Tachycardia with pulse > 100 (1.5 points)
Immobilization (>= 3 days) or surgery in the previous four weeks (1.5 points)
Prior history of DVT or pulmonary embolism (1.5 points)
Presence of hemoptysis (1 point)
Presence of malignancy (1 point)
Management: Pulmonary embolism

- CT PE protocol
- +/- U/S lower extremities for DVTs
- Anticoagulation
  - IV heparin
  - Warfarin
    - At least 3 months
    - Secondary prophylaxis per risk factors
CVA/TIA

- Thromboembolic in 2/3 of post-CVS events
- Typically non-TPA candidate due to recent surgery.
- Mental status changes (r/o hypotension, opioids, dementia, delirium)
- Stat Head CT, Neuro consult
- Typically keep SBP > 140, brain rehab
Additional Sabotage Scenarios
20% of patients

Opioids
Benzos
Pericarditis

- Several days to weeks after surgery
- Fever, pleuritic chest pain, pericardial friction rub, pleural/pericardial effusions
- EKG, +/- Echocardiogram
- Treatment
  - Ibuprofen/indomethacin
  - Colchicine
  - PPI for GI protection
Pleural Effusion

- 60% of post-CVS patients
- Small/asymptomatic
  - Diuresis
  - Slow reabsorption over time
- Large/symptomatic
  - Ultrasound guided thoracentesis
  - Aspiration vs drain placement
GI issues

• Appetite loss/constipation
  • Bowel regimen
  • Supportive care, NG tube for decompression
  • Ileus typically resolved in 2-3 days
• SBO
  • History of prior laparotomy
• GI bleed
  • Anticoagulation
  • Heyde’s syndrome
Caffarelli Cocktail
Sternal Wound Infection

Superficial

• ~1% of patients
• Mild tenderness, erythema, serous drainage
• Course of oral/IV antibiotics, minor wound debridement, wound vac
• Likely #1 dissatisfying complication for patients
Sternal Wound Infection

Deep

- Mortality rate 10-47%
- Risks: DM, Obesity, COPD, tobacco use, redo sternotomy, prolonged ICU stay
- Sternal instability, purulent drainage, fever
- CT scan to assess location/abscess
- Re-operation w/ debridement, wound vac placement, ID and Plastic surgery consults
- 6+ weeks IV antibiotics
Graft site infection

- Erythema, tenderness, +/- drainage
- Cellulitis
- Oral antibiotics
- Remove any suture material if present
Wound care

• Daily cleansing with liquid soap
• No lotions until completely healed
• No submersing (bathtub, hot tubs, swimming) until completely healed
• Early recognition of infection
• Sternal precautions:
  • No lifting/pushing/pulling greater than 10 pounds for 6-8 weeks.
Post-hospital care

- Follow up in 7 days with PCP
  - Wound check, medication adjustments, etc
  - May be sooner for INR checks (Warfarin Clinic)
- Cardiology follow up in ~3 months
Questions & Discussion