Arrhythmia Complications in the Post-Op Cardiac Patient

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Outline:

- Most common arrhythmias after cardiac surgery:
  - Atrial tachycardias
  - Ventricular tachycardias
  - Bradyarrhythmias
- Epidemiology, risk factors, management, and prognosis
Atrial Fibrillation
A.Fib Risk Factors:

- Patient Related Risk Factors:
  - Age: 1.5x increase per decade
  - Extra-cardiac co-morbidities: obesity, previous stroke, COPD
  - Structural heart disease:
    - Atrial enlargement and elevation of atrial pressures
    - Previous cardiac surgery, severe RCA stenosis, sinus or AV node disease, MVD
    - Pre-op elevations of BNP
A.Fib Risk Factors:

- Surgery Related Risk Factors:
  - Related to trauma, inflammation, pericardial effusions
  - 63% of patients with pericardial effusions had SVT, compared to 11% of patients without effusions

- Hemodynamic Stress:
  - Atrial changes occurring during the time of surgery

- Ischemic Injury:
  - Hypoxemia, hypercarbia, catecholamines, acid/bace imbalances, mechanical damage
  - Lower incidence of PAOF w/ Off-pump CABG
A.Fib Risk Factors:

- Peri-operative Drugs:
  - Beta Blockers: BB withdrawal may be associated with an increased rate of post-op SVTs
  - Inotropic Agents:
    - Dobutamine: Increases ventricular ectopy in 3-15% of patients
    - Phosphodiesterase Inhibitors: VPB and short runs of VT in up to 17% of patients
A.Fib Risk Factors:

- Electrolyte and Metabolic Derangements:
  - Hypokalemia
  - Catecholamine Release
  - Magnesium
A.Fib Incidence:

- CABG: 37-50%
- Valve + CABG: 60%
- Transplant: 11-24%
A.fib Clinical Course:

- Highest incidence on day two; recurrent episodes on day three
- Usually self limited: 15-30% converted to NSR within 2 hours, 80% converted within 24 hours
- Mean duration: 11-12 hours
- 90% of patients were in NSR 6-8 weeks post-op
- Hemodynamic Effects:
  - Decrease diastolic filling and CO (15-25%)
  - Increased pulmonary pressures
  - Increased myocardial oxygen consumption
A.Fib Prophylaxis:

- Beta Blocker
  - Most widely use prophylactic strategy; Class I recommendation
  - If pt is not already on a BB, can initiate at least 48 hours prior to surgery
  - Metoprolol 25mg BID
  - CABG: Reduces PAOF from 30-40% to 12-16%
  - Valve surgery: 37-50% to 15-20%
  - Continue until at least first post-op visit
  - Risks: Bradycardia, BB withdrawal, negative chronotrophic effects
A.Fib Prophylaxis:

- **Sotalol:**
  - Class III anti-arrhythmic w/ BB activity
  - Risks: Torsades and bradycardia

- **Amiodarone:**
  - Class III antiarrhythmic; BB activity, affects Na, K, Ca channels
  - Lowers incidence of PAOF by 40-50%
  - 200 mg QID x 7 days prior to surgery followed by 200 mg qday post-op
  - Risks: QT prolongation, bradycardia
A.Fib Prophylaxis:

- **Antioxidant Vitamins:**
  - Oxidative stress and ischemia-reperfusion injury
  - Vitamins C/E

- **Colchicine:**
  - Potentially reduce the incidence of postpericardiotomy syndrome
  - Insufficient evidence to recommend routine use of colchicine
  - 2014 AHA guidelines state that colchicine can be considered
A.Fib Management: Rate Control

- Beta Blockers:
  - Augment post-op sympathetic state
  - Prevent BB withdrawal
  - IV Esmolol
  - Cautious use in patients with low output
- For patients receiving inotropic agents post-op, minimize or reduce dose if able
- CCB and digoxin viable options: not more effective than BB
- Amiodarone if still unresponsive
A.Fib Management: Rhythm Control

- Restoration of sinus from well-tolerated PAOF is usually not necessary since most return to NSR within 24 hours
- Indicated in sympathetic patients with difficult rate control
  - Highly consider in patients with reduced EF
- DCCV vs. pharmacologic cardioversion w/ IV sotalol or amiodarone
Epicardial Wires:

- Placement: historically only placed in the right ventricle
- 25% increase in cardiac output with sequential A-V pacing when compared to just V-pacing
- Two systems in common use: unipolar and bipolar
  - Unipolar: single wire (negative anode) attached to the myocardium with the positive electrode attached at a distance in the subcutaneous tissues
  - Bipolar: single wire with two conductors insulated from one another, which run to the epicardial surface
    - Less electrical potential required
- Visualizing the wires:
  - Right atrium wires: right of the sternum
  - Right ventricle wires: left of the sternum
Epicardial Wires: Diagnostic Use

- Atrial Electrogram (AEG):
  - Useful when P waves are not clearly visible on the surface ECG
  - Connect your atrial wires to the left and right arm leads
  - Distinguish atrial arrhythmias, junctional rhythms, heart blocks
Epicardial Wires for Pacing:

- Temporary overdrive pacing:
  - Particularly effective for terminating reentry tachycardias and paroxysmal SVT
  - Pacing for short durations usually takes over the circuit and terminates the tachycardia
  - Pacing rate is set 10-20 beats faster than the intrinsic rate
  - Progressively faster rates can be tried with multiple attempts
Temporary Epicardial Cardiac Pacing:

- **Typical Settings:**
  - Atrial and ventricular output: 10mA
  - Lower rate of 40-50/min
  - Sensitivity 2-5mV
- **Check settings immediately post-op**
  - VOO → VVI
    - Risk of R on T
  - Over/under-sensing
Epicardial Wires: Duration

- Intended for short term use; 7 days or less
- Increase in stimulation threshold occurs around 4 days
A.Fib Management: Anticoagulation

- Risk factors for Stroke:
  - Rheumatic mitral valve disease, HTN, decreased CO, previous thromboembolism
- CHADS2VASC and HAS-BLED score systems
- Multiple episode of AF or one episode that lasts more than 24-48 hours, initiate oral anticoagulation therapy
- Continue anticoagulation at least 4 weeks after return of sinus rhythm
- Long-term anticoagulation should be considered for patients who remain in AF or have PAF at four weeks

\[ \text{CHA}_2\text{DS}_2\text{-VASc score} \]

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Score</th>
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<tbody>
<tr>
<td>C - Congestive heart failure</td>
<td>1</td>
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<tr>
<td>H - Hypertension</td>
<td>1</td>
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<tr>
<td>A - Age ≥ 75 yrs</td>
<td>2</td>
</tr>
<tr>
<td>D - Diabetes mellitus</td>
<td>1</td>
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<tr>
<td>S₂ - Prior stroke or TIA</td>
<td>2</td>
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<tr>
<td>V - Vascular disease</td>
<td>1</td>
</tr>
<tr>
<td>A - Age 65-74 years old</td>
<td>1</td>
</tr>
<tr>
<td>S_e - Sex category (female)</td>
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<table>
<thead>
<tr>
<th>Condition</th>
<th>Points</th>
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<tbody>
<tr>
<td>H – Hypertension</td>
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<tr>
<td>A – Ab(N) liver/renal</td>
<td>1 point each</td>
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<tr>
<td>S – Stroke</td>
<td>1</td>
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<tr>
<td>B – Bleeding</td>
<td>1</td>
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<tr>
<td>L – Labile INRs</td>
<td>1</td>
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<tr>
<td>E – Elderly (&gt;65)</td>
<td>1</td>
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<tr>
<td>D – Drugs or ETOH</td>
<td>1 point each</td>
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A.Fib Management: Anticoagulation

- **Valvular AF:**
  - Warfarin; INR 2.0-3.0 or 2.5 to 3.5 based on type and location of prosthesis
  - Consider bridging with heparin if pt has a mechanical valve

- **Nonvalvular AF:**
  - Pts with prior stroke or TIA or a CHADS2VASC score >\2 initiate coumadin or direct thrombin or Xa inhibitor (dabigatran, rivroxaban, apixaban)
A.Fib Prognosis:

- Difficult to control if the duration of a.fib >1-2 years and the left atrial diameter is >5.2cm
- Common cause of morbidity after cardiac surgery
- Clinical effects depend on ventricular rate, function, and duration
- Stroke: incidence is higher, but associated with underlying co-morbidities
- Prolonged hospital stay
Ventricular Arrhythmias: Epidemiology

- Post CABG: myocardial ischemia
- Post Valve: rare, caused by reentry in a region of a ventricular scar
Premature Ventricular Contractions:

- Isolated PVCs
  - Common (~50%), usually due to electrolyte or metabolic imbalances
- Prognosis:
  - Patients with isolated PVCs post-op do not have an increased risk of malignant ventricular arrhythmias
  - Frequent PCVs: >30/hr may have an impact on short-term outcome by reducing ventricular function
  - No significant differences in mortality if LVEF preserved
  - Impaired LVEF (<40%), increased mortality rate and sudden death
- Management: Asymptomatic and stable PVCs usually don’t need treatment
Ventricular Tachycardia: Incidence

- Sustained VT and VF are uncommon after surgery
- Incidence: 0.41-1.4%
  - More common in elderly, depressed EF, emergent surgery, and PVD
- Of those patients, 8% underwent ICD implant and 34% were started on antiarrhythmics
Ventricular Tachycardia: Risk Factors

- LV dysfunction
- Electrolyte imbalances
- Hypoxia
- Hypovolemia
- Myocardial ischemia/infarction
- Inotrope and antiarrhythmic drug use
Ventricular Tachycardia: Management

- NSVT: look for reversible causes
  - Hypokalemia, hypomagnesaemia
  - Digitalis toxicity, epi
  - Hypoxemia
  - Bradycardia
  - Sepsis/fever
  - Acidosis
  - Anemia
Ventricular Tachycardia: Management

- **Sustained VT:**
  - Reversible causes and consider mechanical complications/myocardial ischemia (acute graft closure)
  - Drug or electrical DCCV

- **Incessant VT/VT Storm:**
  - Occuring >3x/24 hrs
  - Consider ongoing myocardial ischemia
  - LHC, IABP, sedation/intubation, ablation

- **General Recommendation:** Implant ICD in those having VF or hemodynamically unstable VT after the initial 48 h post-op period
Ventricular Tachycardia: Management

- **Drug Therapy:**
  - **Amiodarone:**
    - MOA: Class III anti-arrhythmic
    - Onset of Action: Within minutes, peak effect 10-15 minutes
    - Dosage:
      - Bolus of 300mg/1 hr
      - Avoid frequent boluses in the first 24 hours due to risk of hepatic toxicity
      - If hepatic enzymes exceed 3x normal or double in a pt with elevated baseline, decrease dose or discontinue
    - Cautions:
      - Be cautious of hypotension
      - Usually the better tolerated drug in patients with systolic dysfunction
Ventricular Tachycardia: Management

- Lidocaine:
  - MOA: Class Ib antiarrhythmic
    - Suppresses automaticity of conduction tissue
  - Onset of action: 45-90 seconds
  - Dosage:
    - Bolus of 0.75-1.5 mg/kg followed by an IV continuous infusion of 1-4 mg/min
    - Max dose 3 mg/kg/hr
  - Cautions:
    - Renal impairment: accumulation of metabolites increased in renal dysfunction
    - Not dialyzable (0-5%)
Ventricular Tachycardia: Management

- Procainamide: Second line
  - MOA: Class I Anti-arrhythmic
    - Decreases myocardial excitability and conduction velocity
  - Dosage: Given as 20-50 mg/min for a total dosage of 15mg/kg followed by an infusion of 1-4 mg/min
  - Dose should be stopped early if QRS widens by >50% or limited by hypotension
  - Avoid with renal insufficiency
Ventricular Tachycardia: Management

- Electrical Cardioversion/Defibrillation
- If distinct QRS and T waves are identified, a lower-energy synchronized shock can be given first
- If the VT is rapid and the QRS complex is wide, bizarre, or polymorphic, deliver high energy unsynchronized shock
Ventricular Tachycardia: Prognosis

- Prognosis:
  - Poorer short and long term prognosis
  - An in hospital mortality rate of up to 50% has been reported in patients with sustained VT
  - Among those patients who survive, 40% have recurrence
  - As many as 20% of these patients die from cardiac causes within two years
  - Those who experience POVA after the initial 48 hours seem to be at a greater risk
Bradyarythmias:

- **Epidemiology:**
  - Relatively common; usually include SSS and various degree of AVB
  - More common after valve surgery

- **Risk Factors:**
  - Peri-valvular calcification
  - Older age
  - Prior LBBB
  - LV aneurysmectomy
  - LM coronary artery stenosis
  - # Bypassed arteries
  - Cardiopulmonary bypass time
Sick Sinus Syndrome
Complete Heart Block
Bradyarrhythmias: Management

- Temporary vs. permanent pacing
- SSS: Among patients who receive permanent pacing, 30-40% remain pacemaker dependent
- CHB: 65-100% remain dependent
- PPM is usually implanted if complete AVB or severe SSS persists longer than 5-7 days post-op
Take Home Points:

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<td><strong>A.Fib</strong></td>
<td>Always use a BB when you can&lt;br&gt;Cardiovert if unstable&lt;br&gt;Anticoagulate if sustained for &gt;48 hours</td>
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<tr>
<td><strong>VT</strong></td>
<td>Amiodarone, DCCV&lt;br&gt;Consider ongoing ischemia&lt;br&gt;Consider ICD if hemodynamically unstable VT/VF &gt;48 hours post-op</td>
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<tr>
<td><strong>Bradyarrhythmias</strong></td>
<td>Start thinking about implanting PPM if intrinsic rhythm doesn’t recover between days 5-7</td>
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Thank you!
References:

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