

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

**YOU KNOW THAT FEELING WHEN
YOU MEET SOMEONE AND YOUR
HEART SKIPS A BEAT?
YEAH, THAT'S ARRHYTHMIA.
YOU CAN DIE FROM THAT.**

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

IT'S NOT NICE



TO FIB

allnurses.com

A.Fib Risk Factors:

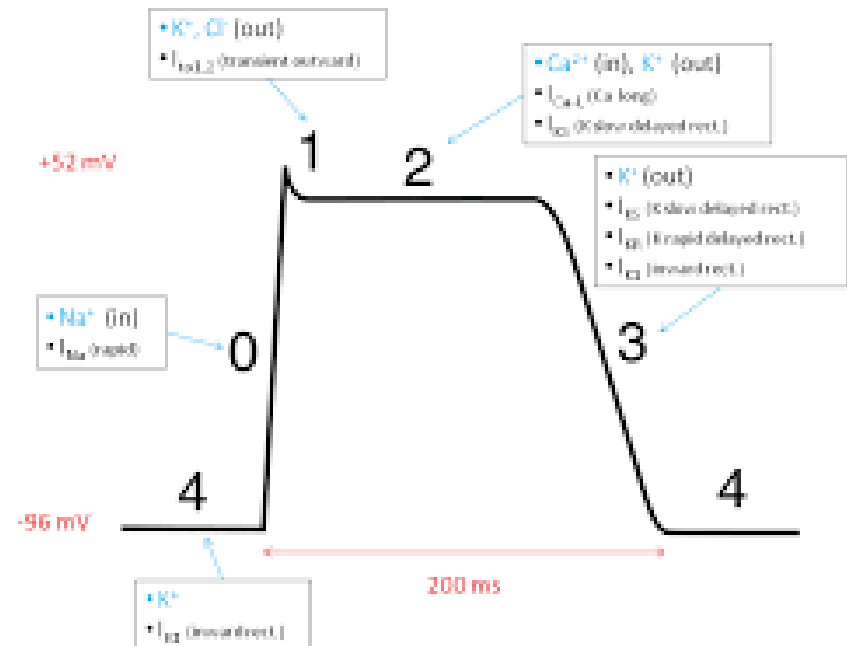
- Surgery Related Risk Factors:
 - Related to trauma, inflammation, pericardial effusions
 - 63% of patients with pericardial effusions had SVT, compared to 11% of patients without effusions
- Hemodynamic Stress:
 - Atrial changes occurring during the time of surgery
- Ischemic Injury:
 - Hypoxemia, hypercarbia, catecholamines, acid/base 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 chronotropic 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

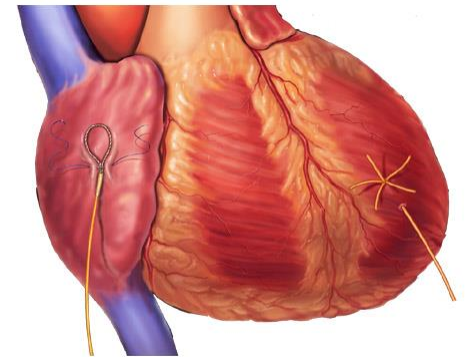
A.Fib Management: Rhythm Control

- 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



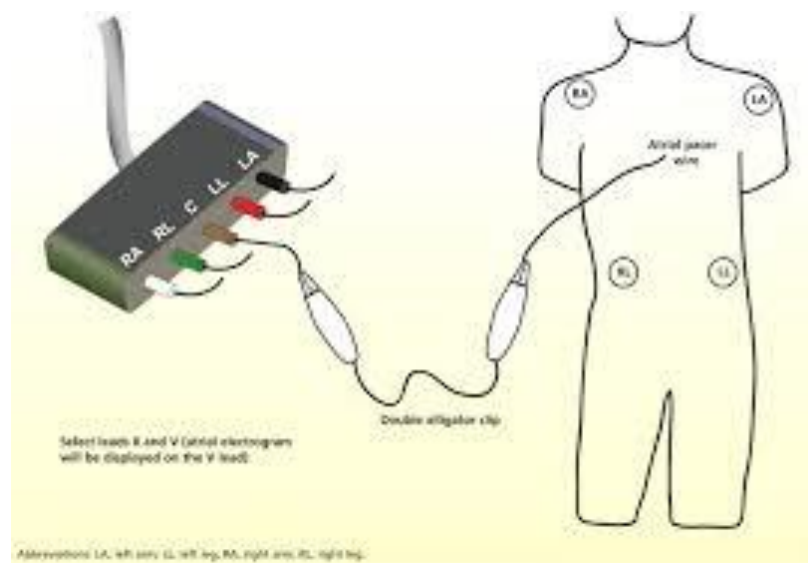
Epicardial Wires:

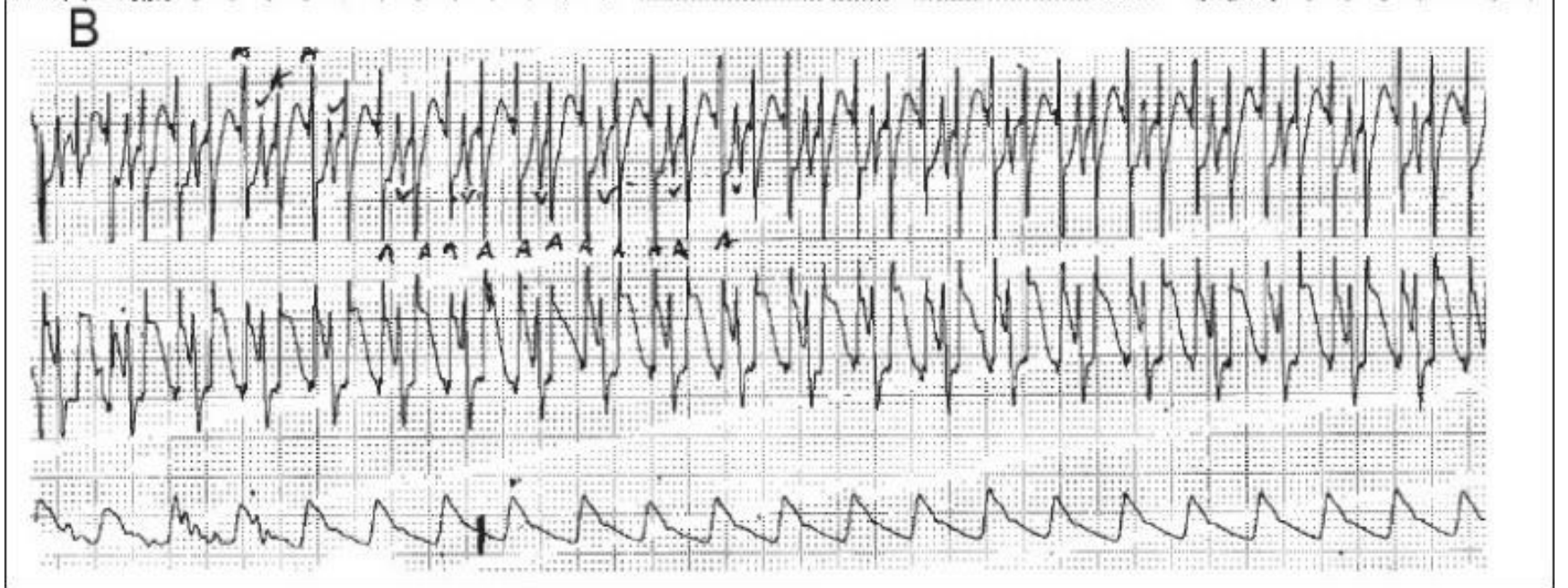
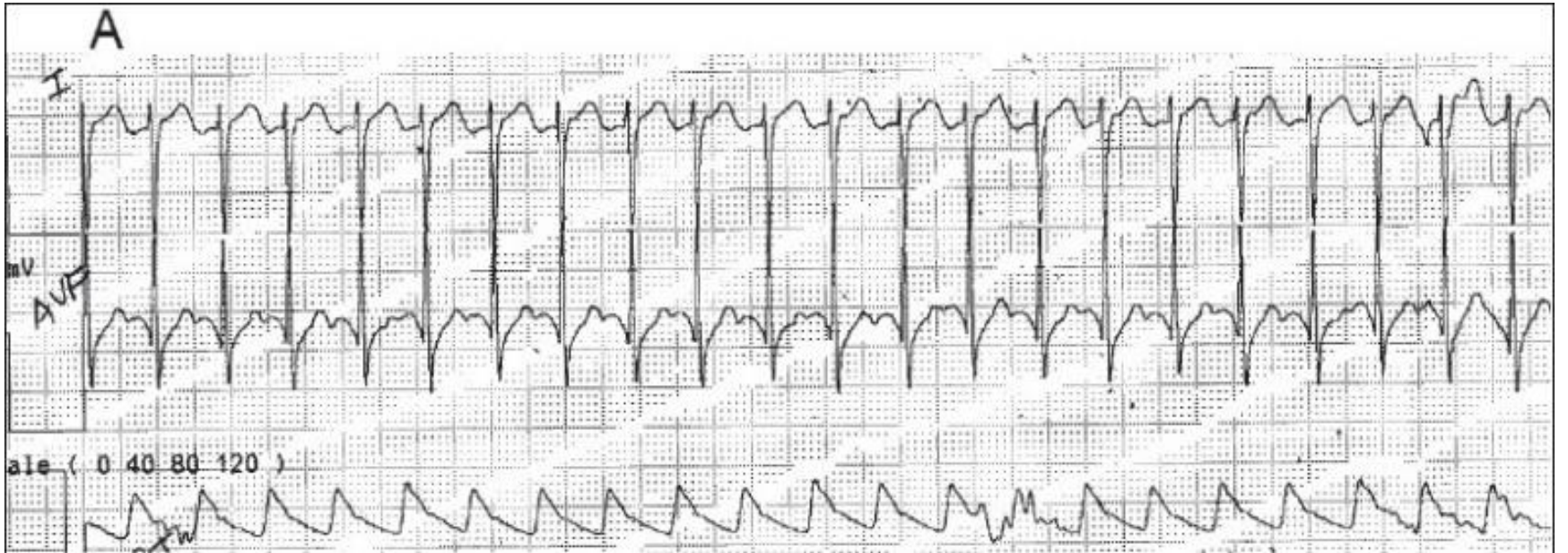
- Placement: historically only placed in the right ventricle
- 25% increase in cardiac output with sequential A-V pacing when compared to just V-pacing
- Two systems in common use: unipolar and bipolar
 - Unipolar: single wire (negative anode) attached to the myocardium with the positive electrode attached 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

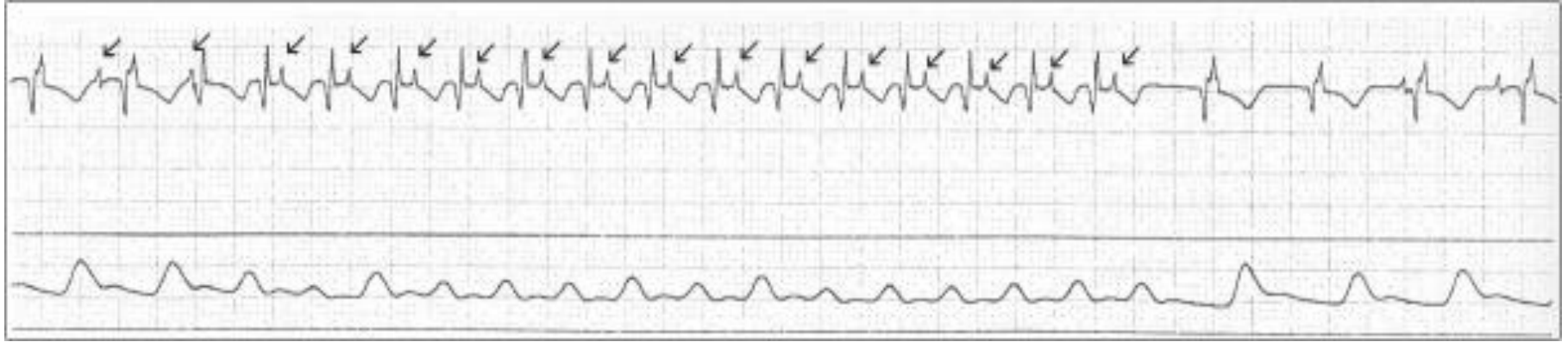


Epicardial Wires: Diagnostic Use

- 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



Figure 2

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

CHA₂DS₂-VASc score

Risk Factor	Score
C - Congestive heart failure	1
H - Hypertension	1
A - Age ≥ 75 yrs	2
D - Diabetes mellitus	1
S ₂ - Prior stroke or TIA	2
V - Vascular disease	1
A - Age 65-74 years old	1
Sc - Sex category (female)	1

Lip GH, Halperin JL. Am J Med 2010;123(6):484-488.

Condition	Points
H – Hypertension	1
A – Ab(N) liver/renal	1 point each
S – Stroke	1
B – Bleeding	1
L – Labile INRs	1
E – Elderly (>65)	1
D – Drugs or ETOH	1 point each

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 >5.2 cm
- 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

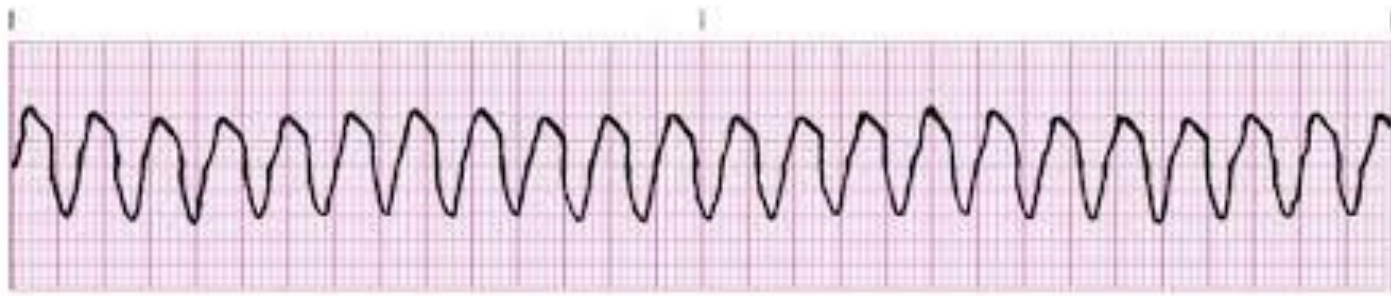


Premature Ventricular Contractions:

- 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%)
 - Hepatic impairment; reduce maintenance infusion

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

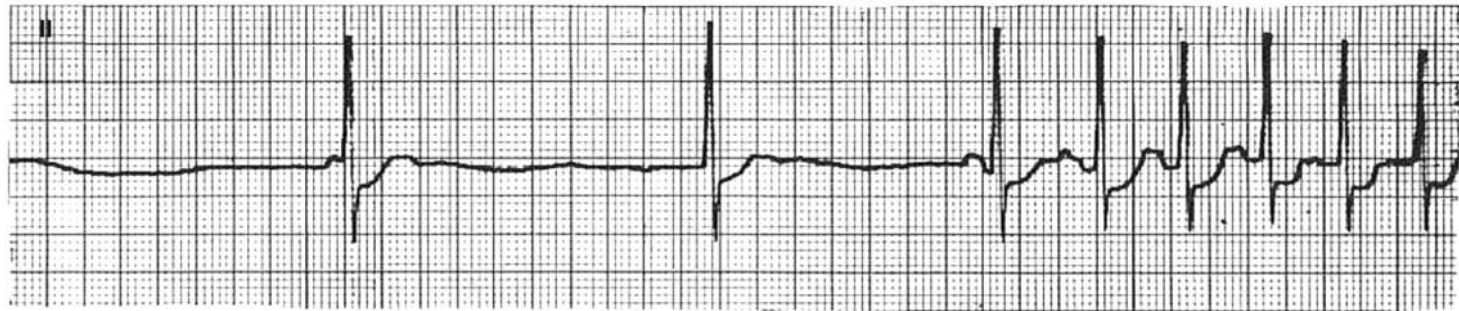
Ventricular Tachycardia: Prognosis

- 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

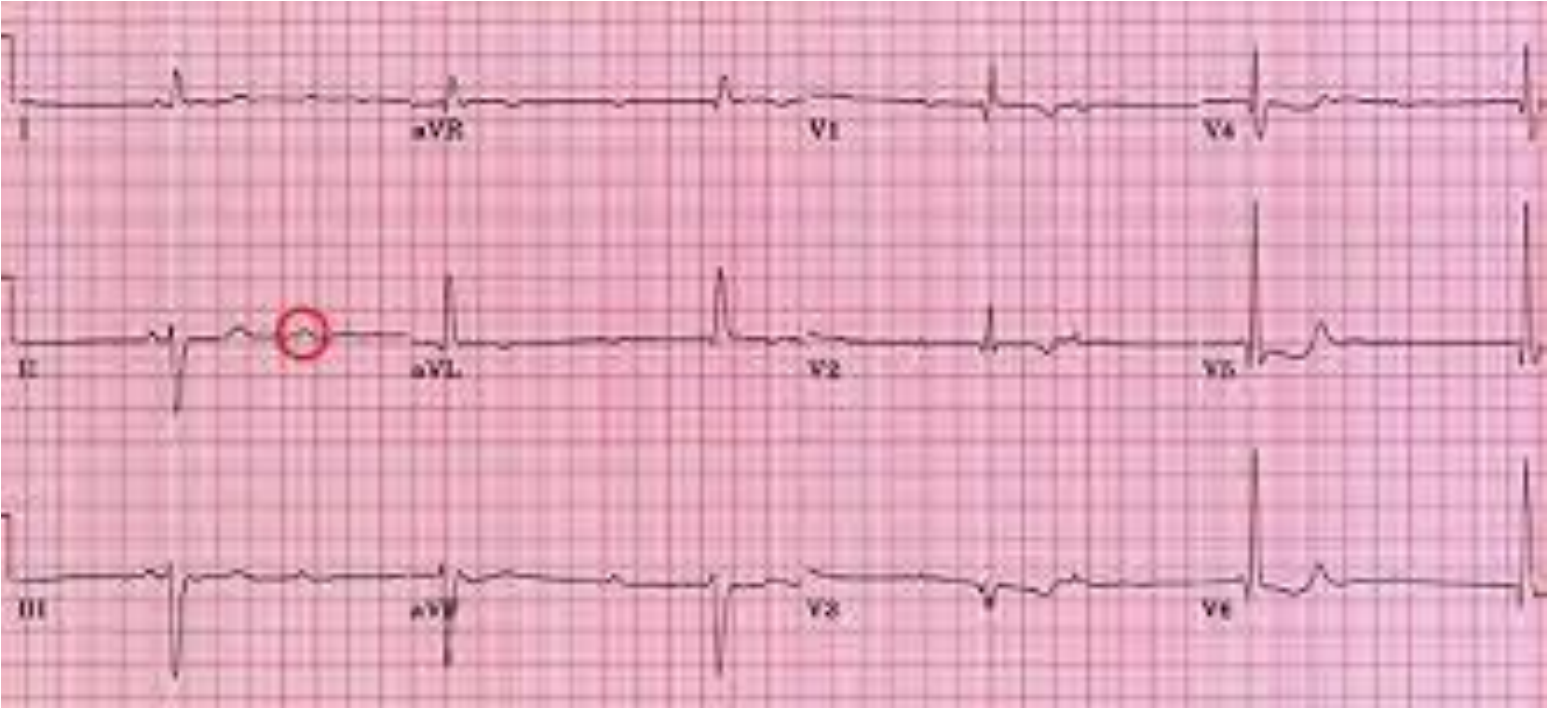
Bradyarrhythmias:

- 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:

A.Fib	Always use a BB when you can Cardiovert if unstable Anticoagulate if sustained for >48 hours
VT	Amiodarone, DCCV Consider ongoing ischemia Consider ICD if hemodynamically unstable VT/VF >48 hours post-op
Bradyarrhythmias	Start thinking about implanting PPM if intrinsic rhythm doesn't recover between days 5-7

Thank you!



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