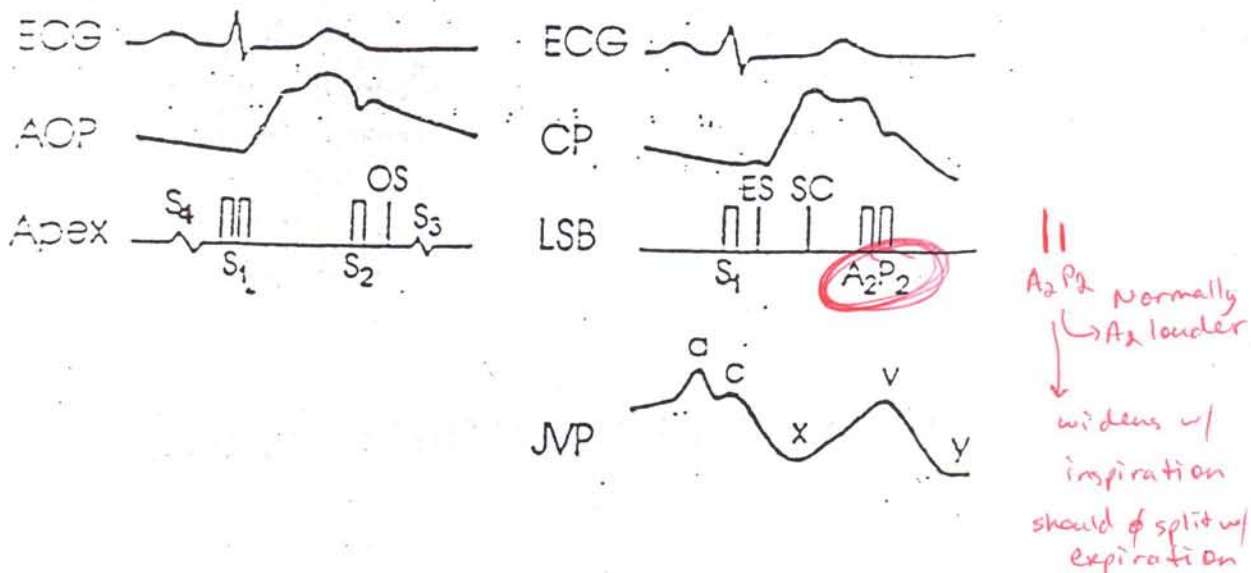


# PHYSICAL EXAMINATION OF THE HEART



## First Heart Sound

### Loud

1. Mitral Stenosis
2. Short PR Interval
3. Tachycardia
4. Thyrotoxicosis

### Soft

1. Mitral Regurgitation
2. Long PR Interval
3. LBBB
4. ↑ LVEDP (AS, AI)
5. Immobile Mitral Valve

## Second Heart Sound

### Wide Splitting    Narrow or Paradoxical    Fixed

- |  |  |  |  |
|--|--|--|--|
| <p>A<sub>2</sub> is early ←</p> <p>Delayed P<sub>2</sub> →</p> <p>soft P<sub>2</sub> ↓</p> <p>loud P<sub>2</sub> →</p> | <ol style="list-style-type: none"> <li>1. MR, VSD</li> <li>2. RBBB</li> <li>3. RV volume overload (L to R shunt)</li> <li>4. RV pressure overload (PS, PAH)</li> </ol> | <ol style="list-style-type: none"> <li>1. Aortic stenosis</li> <li>2. HOCM</li> <li>3. Severe hypertension</li> <li>4. LBBB (paradoxical) → delayed A<sub>2</sub></li> <li>5. Acute myocardial infarction</li> </ol> | <p>split in expiration<br/>single in inspiration</p> <p><b>ASD</b></p> |
|--|--|--|--|

# Third & Fourth Heart Sounds

## S3

1. Normal in children
2. MR
3. TR
4. CHF

## S4

1. Hypertension
2. AS, HOCM
3. Angina, MI
4. Acute MR → both S3 + S4 vs. chronic MR ↓ only S3
5. PAH, PS

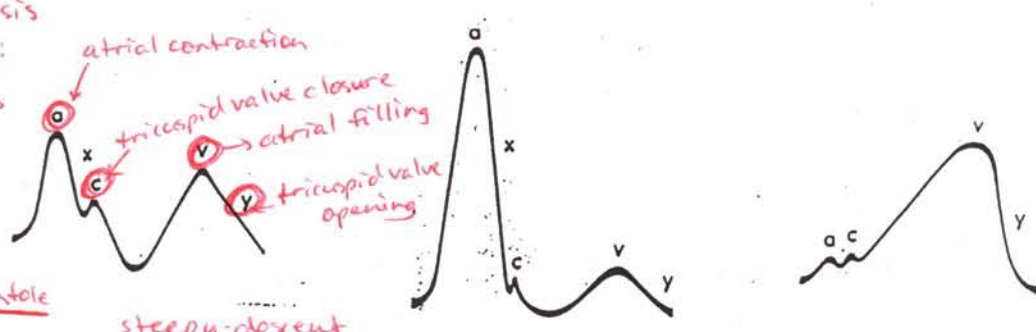
→ ↓ ventricular compliance  
↓ resistance to diastolic filling

Clicks:  
Early systolic click: AS, PS  
Mid-systolic MRP  
opening snap: MS, TS

# Jugular Venous Pulse Tracings

(Abnormal > 9)

friction rub: pericarditis  
Knock: constrictive pericarditis - short, early diastole  
palpable heave: LVT  
parasternal lift: RVT



**Normal**  
**Giant a wave (cannon wave)**

**Large V wave**

Ⓢ-sided  
① TR  
② ASD  
Ⓛ-sided  
① MR

# Causes of Cannon Waves

## Regular

1. TS
2. PAH
3. PS
4. Junctional rhythm
5. SVT with AV nodal reentry

## Irregular

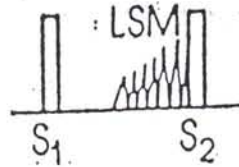
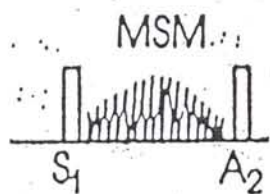
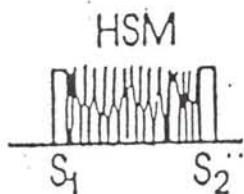
1. Ventricular tachycardia
2. Complete heart block
3. Ventricular pacemaker

Kussmaul Sign  
Inspiration → ↑ JVP  
① Constr Pericarditis  
② RV Infarct  
- normally inspiration ↓ JVP

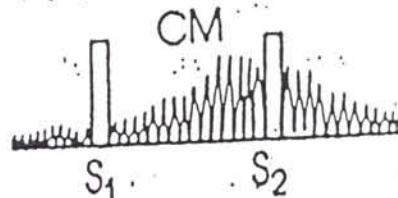
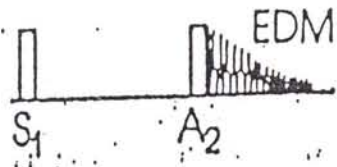
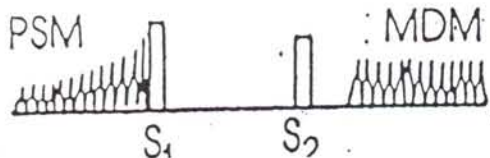
atrial contraction against resistance

# HEART MURMURS

- a. Holosystolic [MR, TR, VSD]    b. Midsystolic [AS, PS, FUNCTIONAL]    c. Latesystolic [MVP, PAP-DYSF]



- d. Middiastolic [MS, TS, AUST-FLINT]    e. Earlydiastolic [AR, PR]    f. Continuous [PDA]



Mammary-suffle  
- murmur of pregnancy (normal)

HJR → active or impending CHF

## EFFECT OF VARIOUS INTERVENTIONS ON MURMURS

### INCREASE

### DECREASE

1. INSPIRATION  
↑ ⊕-sided CO

Right Sided Murmurs

Left Sided Murmurs

2. EXPIRATION  
↑ ⊖-sided CO

Left Sided Murmurs

Right Sided Murmurs

3. STANDING  
(↓ preload)

**HOCM, MVP**

All Other Murmurs

4. VALSALVA  
(↓ preload)

**HOCM, MVP**

All Other Murmurs

5. SQUATTING  
(↑ preload)

All Other Murmurs

**HOCM, MVP**

6. AMYLNITRITE  
(vasodilator) (↓ preload)

AS, HOCM, MVP

MR, VSD, AR

7. HAND GRIP EXERCISES  
(↑ afterload)

AR, MR, VSD

**AS, HOCM**

8. PASSIVE LEG ELEVATION  
(↑ preload)  
- same as squatting

All Other Murmurs

**HOCM, MVP**

↑'s LVEDV moves asymmetric hypertrophied segments away from each other



# Location & Type of Murmurs

**MS:** Middiastolic-apex, best heard with the bell

**MR:** Holosystolic-apex, radiates to axilla, ↑ on expiration → ①-sided murmurs ↑ w/ expiration

**TR:** Holosystolic-lower LSB, ↑ on inspiration → ②-sided murmurs ↑ w/ inspiration

**VSD:** Holosystolic-lower LSB, no change with respiration

**AS:** Midsystolic-upper RSB, radiates to carotids, ↑ exp.

**HOCM:** Midsystolic-LSB, ↑ with standing, no radiation

**PS:** Midsystolic-upper LSB, ↑ ins., click ↓ ins. (click ↑ w/ inspiration)

**AR:** Early diastolic-LSB, ↑ exp & sitting up & leaning forward

**ASD:** Midsystolic-upper LSB, middiastolic lower LSB → ↑ flow thru tricuspid valve  
 Fixed S<sub>2</sub> ← ↑ flow thru pulmonic valve

**PDA:** Continuous machinery murmur-upper LSB

**Coarctation:** Delayed & ↓ femoral pulse, AR murmur +

↓ preload → brings asymmetric hypertrophied walls closer together

## Pulse Patterns

**AS**  
Pulsus tardus

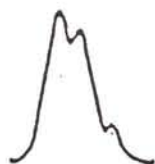


↑ SV  
① → ② shunts

Hyperkinetic



**AR**  
Pulsus Bisferiens



↓ SV

Hypokinetic



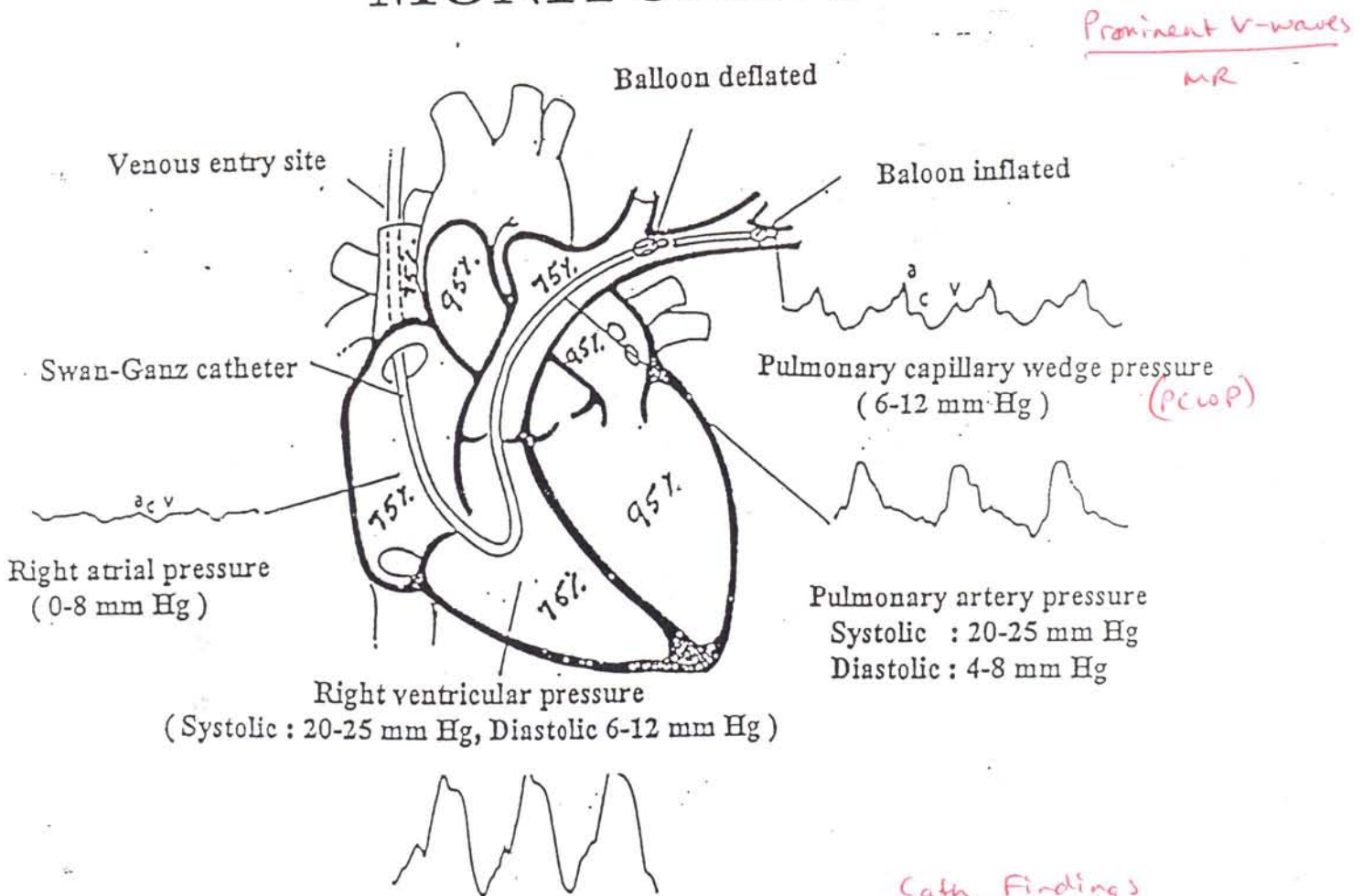
Tamponade  
CHF  
Pulsus Alternans



Paradoxical → Deep breath → SBP ↓ by >10 mmHg

- ① Tamponade
- ② Airway Obstruction
- ③ SVC Obstruction

# CARDIAC HEMODYNAMIC MONITORING



- ①  $\phi$  systolic gradient b/w LV + aorta  
if present  $\rightarrow$  AS
- ②  $\phi$  diastolic gradient b/w CA + RV  
if present  $\rightarrow$  MS
- ③  $\phi$  systolic gradient b/w RV + PA  
if present  $\rightarrow$  PS
- ④  $\phi$  diastolic gradient b/w RA + RV  
if present  $\rightarrow$  TS

# Hemodynamic Monitoring

	<u>RA</u>	<u>RV</u>	<u>PA</u>	<u>PCW</u>
<i>⊖</i> sided diseases	↑	↑	↑	N
1. COPD	↑	↑	↑	N
2. P. Embolism or Primary PAH	↑	↑	↑	N
<i>⊕</i> sided diseases	↑	↑	↑	↑
3. CHF	↑	↑	↑	↑
4. MS	↑	↑	↑	↑
5. RV Infarct	↑	↑	N	N
6. C. Pericarditis	↑	↑	↑	↑
7. C. Tamponade	↑	↑	↑	↑

RA = PCW  
RA = PCW

## Hemodynamic Monitoring In Shock

	PCW	CO	SVR
<u>Constrictive Pericarditis</u>	↑	↓	↑
1. Cardiogenic	↑	↓	↑
2. Hypovolemic	↓	↓	↑
3. Massive PE	N	↓	↑
4. Tamponade	↑	↓	↑
5. Septic	↓N	↑	↓
6. Anaphylactic	↓N	↑	↓

*Constrictive Pericarditis*  
 - impaired cardiac filling  
 - fatigue (dyspnea)  
 - ascites  
 - ↑ JVP's  
 - ⊕ Kussmaul's sign  
 - short early diastolic knock  
 - low voltage EKG  
 - CHR → pericardial calcifications  
 - Echo → thickened pericardium  
 - cath → RAP = PCWP  
 - Tx: surgical stripping

Tamponade  
 - hypotension  
 - ↑ JVP's  
 - faint H's  
 - paradoxical pulse  
 - low voltage EKG  
 - cardiomegaly  
 - Best Dx Test - echo  
 - RA collapse + RR collapse in diastole  
 - Causes:  
 - Renal Failure  
 - malignancy  
 - diastolic equalization in all 4 chambers

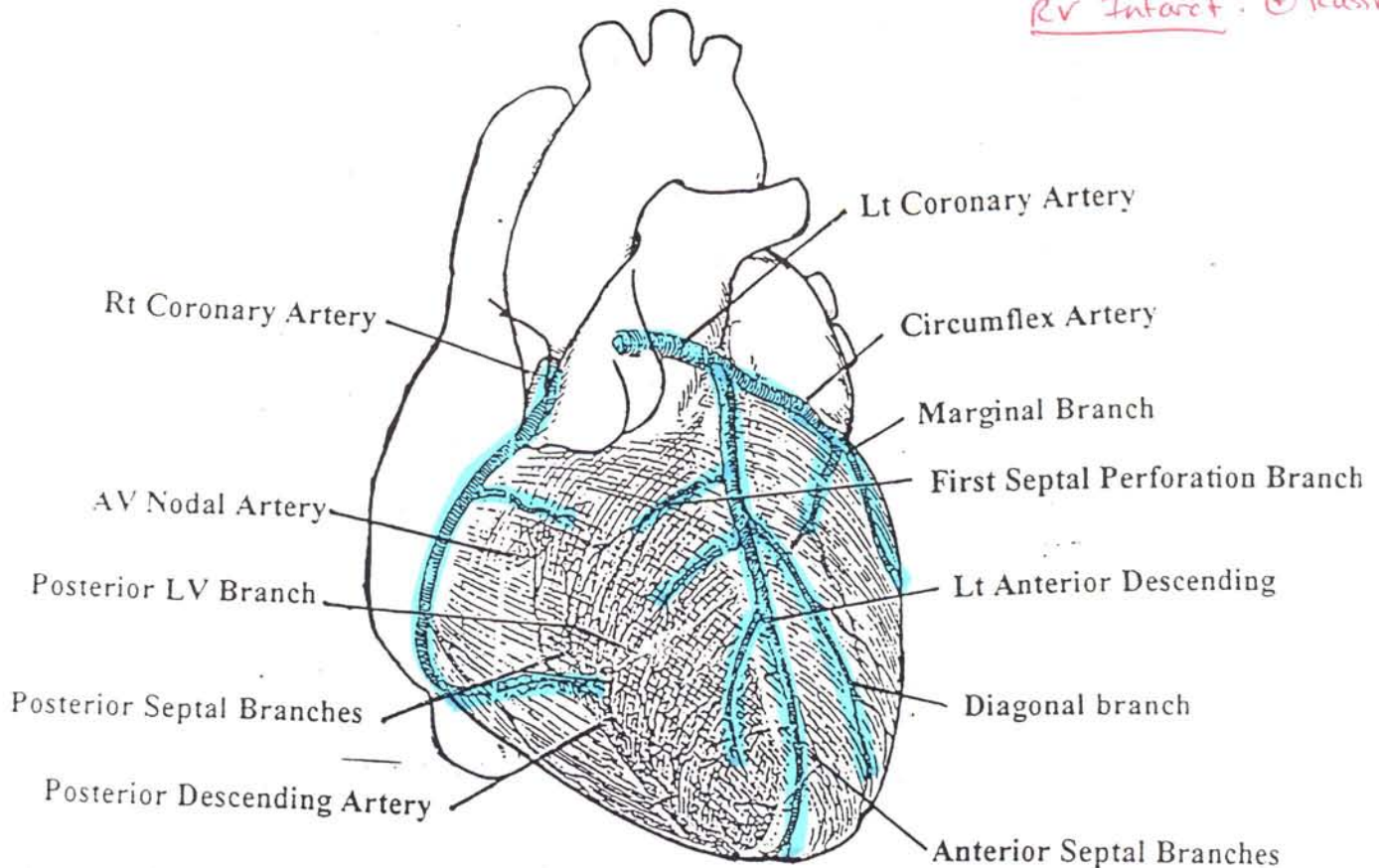
## Vasopressors In Shock

Inotropic Chronotropic Vasoconstriction

Dopamine	++	++	+
Norepinephrine	++	+	++
Dobutamine	⊕	-	-
Phenylephrine	-	-	⊕

# Blood Supply of the Heart

Rv Infarct : ⊕ Kussmaul



Leads With Ischemic Changes	Myocardium Involved	Artery Involved
II, III, aVF	Inferior	Rt coronary artery
V2-V4	Anteroseptal	LAD
V3-V5	Anterior	LAD
V5-V6	Apical or Lateral	LAD or PDA or marginal branch of circumflex (MBC)
I, aVL	High lateral	MBC or diagonal branch of Lt coronary
V1, V2 (Reciprocal)	Posterior	Rt coronary artery
V3R, V4R	Rt Ventricular	Rt coronary artery

↳ (RAP > PCWP)

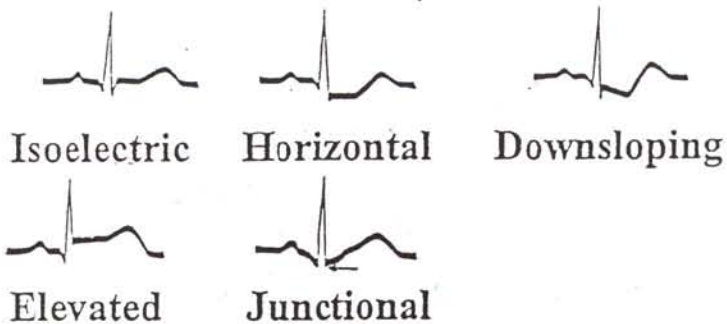
Tx : Volume

Avoid nitrates + diuretics

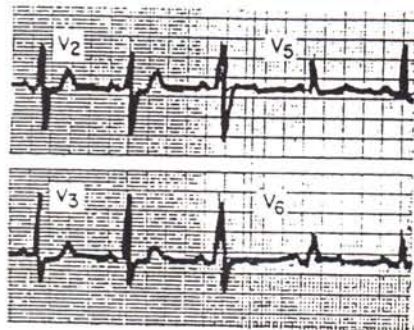
## Poor Prognostic Factors on Stress Test

1.  $> 2$  mm ST depression at low work loads
2. ST depression persisting  $> 5$  minutes post exercise
3. Fall in systolic BP  $> 10-15$  mm
4. Global changes (Changes in ant. & inferior leads)
5. Ventricular ectopy
6. ST segment elevation

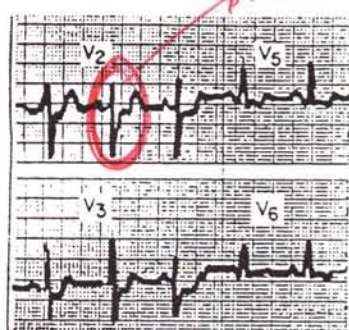
## Interpretation of Stress Test



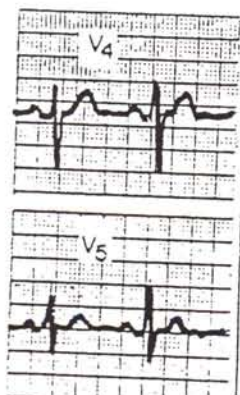
Control



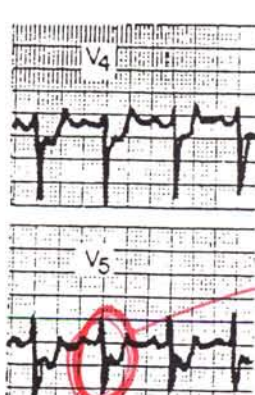
Post Exercise



Control



Post Exercise





# Indications of Radionuclide (Nuclear) Myocardial Perfusion Imaging

1. LBBB
2. WPW syndrome
3. Paced ventricular rhythm
4. Digitalis effect
5. Baseline ST-segment depression  $> 1$  mm
6. LVH with strain ↷
7. Inability to exercise to an adequate work load due to PVD, arthritis or other conditions
8. Prior CABG or coronary intervention

**Agents:** Thallium, Sestamibi, Tetrafosmin (myoview)

## Pharmacological Stress Testing:

Dipyridamole or Adenosine + one of the above agents  
Dobutamine Echocardiography

*Contraindicated  
in COPD asthma  
hypotension, SSS  
or high-grade  
heart-block*

*Use for COPD pts*

*Best Initial Tx  
For Angina?*

## Indications of CABG

1. Left main disease  $\geq 50\%$
2. 3-vessel disease  $\geq 70\%$  (survival benefit is greatest with LVEF  $< 50\%$ )
3. Left main equivalent disease  
 $\geq 70\%$  stenosis of the proximal LAD and proximal left circumflex  
2-vessel disease with significant proximal LAD stenosis and either  
LVEF  $< 50\%$  or demonstrable ischemia on noninvasive testing
4. Multivessel disease in diabetes

*\*  $\beta$ -Blockers \**  
*Aspirin*  
*Statins*

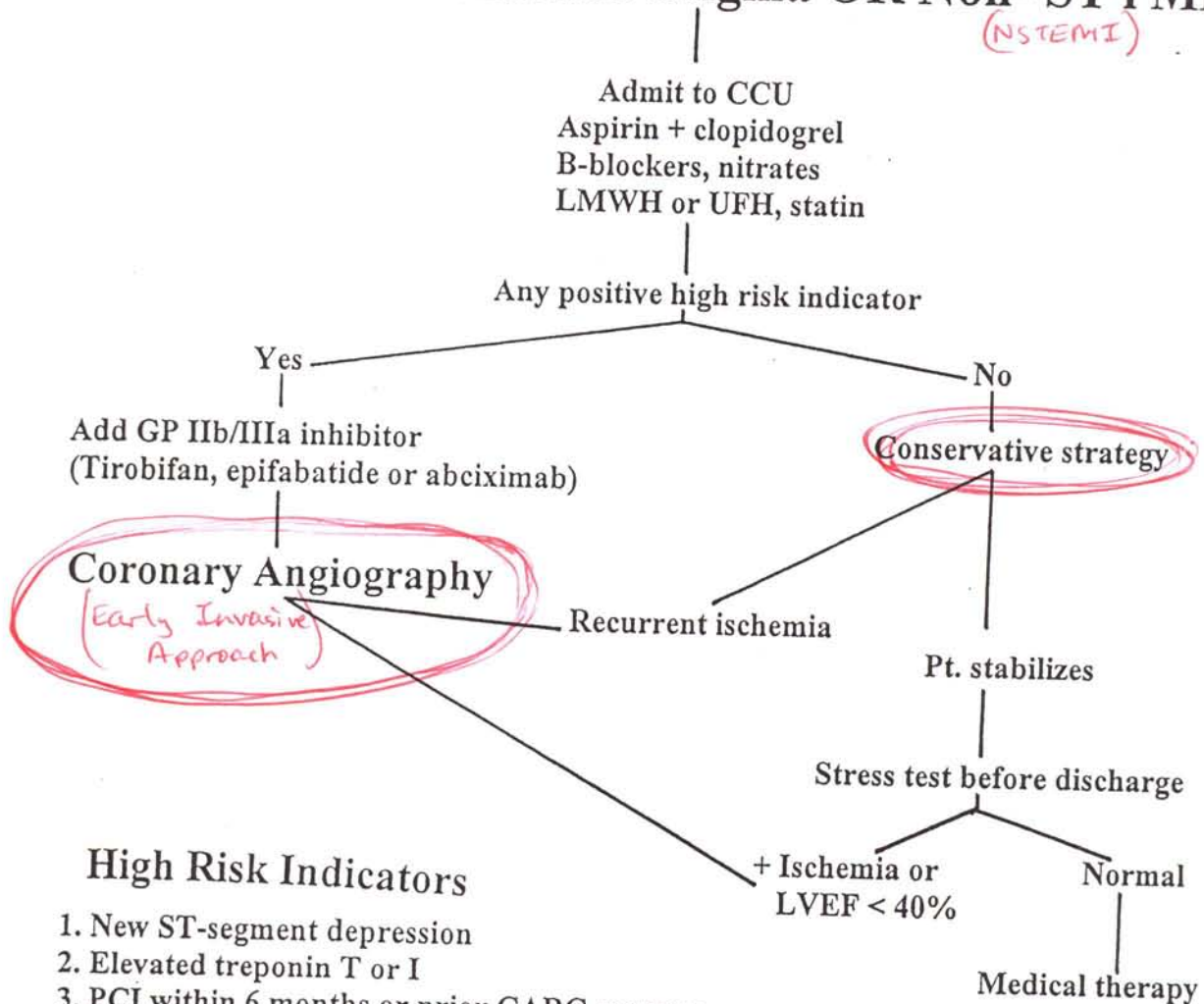
## Indications of Coronary Angiography in Angina

1. Disabling angina symptoms
2. High-risk criteria on noninvasive testing
3. Survivors of sudden cardiac death or serious ventricular arrhythmia
4. Symptoms and signs of heart failure
5. Patient who continues to have ischemia in the early post MI or unstable angina setting

# Unstable Angina

1. New onset angina (< 2 months) that is severe and/or frequent (> 3 episodes per day)
2. Recent ↑ in frequency and/or intensity of chronic angina
3. Angina at rest
4. Post infarction angina

## Treatment of Unstable Angina OR Non-ST↑MI (NSTEMI)



# Indications of Hospitalization in Patients with Chest pain

1. ST elevation on EKG
2. ST depression or T inversion on EKG
3. History suggestive of unstable angina (Normal EKG)
4. Associated with CHF or ↓BP or transient MR
5. Positive CPK MB isoenzymes
6. Positive Troponin I or T

## Treatment of Acute MI with ST ↑ or New LBBB

1. Morphine for pain
2. IV Nitroglycerine
3. Beta blockers
4. Aspirin or Clopidogrel
5. Unfractionated or LMWH (48 hrs)
6. Ace Inhibitors
7. High dose statin (Atorvastatin 80 mg/d)
8. If Cath lab available: IV Abciximab and PCI (angioplasty/stent)
9. If Cath lab not available: Bolus infusion of fibrinolytic agent  
± GP IIb/IIIa inhibitor

## Indications For Fibrinolytic Therapy

1. Chest pain typical of infarction lasting > 30 minutes
2. ST ↑ ≥ 1 mm in two leads in anterior, inferior or lateral location or evidence of true posterior MI (ST ↓ & prominent R waves in V1 & V2) or new LBBB
3. < 12 hours post MI...Routine use

12-24 hours...High-risk, continued chest pain

Agents: Alteplase(tPA), reteplase, tenecteplase, streptokinase

*give Heparin w/ all except streptokinase*

Benefits: 1. ↓ Infarct size 2. Improves LV function 3. ↓ Mortality

# Contraindications to Thrombolytic Therapy

1. Any prior intracranial hemorrhage
2. Known structural cerebral vascular lesion (AV malformation)
3. Known malignant intracranial neoplasm (primary or metastatic)
4. Ischemic stroke within 3 months
5. Suspected acute aortic dissection
6. Active bleeding or bleeding diathesis (excluding menses)
7. Significant closed-head or facial trauma within 3 months

## Relative Contraindications of Thrombolytic Therapy

1. History of chronic, severely controlled hypertension
2. BP > 180/110 on presentation
3. Prior ischemic stroke > 3 months
4. Prolonged CPR > 10 minutes
5. Major surgery within 3 weeks
6. Internal bleeding within 2-4 weeks
7. Pregnancy
8. Non compressible vascular punctures
9. For streptokinase/antistreplase:  
Prior exposure (> 5 days ago) or prior allergic reactions
10. Active peptic ulcer disease
11. Current use of anticoagulants

## Indications of PCI(Angioplasty/stent) in Acute STEMI

1. Preferred over thrombolytic therapy if it can be performed within 90 minutes
2. Contraindications to thrombolytic therapy
3. Cardiogenic shock (BP systolic < 80, PCW > 20, Oliguria < 20 ml/hour, dulled sensorium, metabolic acidosis)
4. Hypotension and hemodynamic instability
5. Patients presenting > 12 hrs after the onset of chest pain with continuous chest pain or ST elevation
6. Prior CABG surgery

# Treatment That Improve Survival after MI

1. Fibrinolytic therapy or PCI in STEMI
2. Aspirin, clopidogrel
3. Beta blockers
4. ACE inhibitors (Beneficial even with normal LV function & BP)
5. Anti lipid therapy
6. No role of prophylactic lidocaine
7. No benefit from calcium blockers
8. Smoking cessation and exercise
9. ICD insertion if LVEF  $\leq 30\%$

Sustained VTach after 48 hrs.

-EP study

Non-sustained VTach after 48 hrs.

-stress test

-must treat medically for 30-days post-MI first

## Cardiovascular Complications of cocaine

1. Myocardial ischemia and infarction  
( $\uparrow$ O<sub>2</sub> demand, Vasoconstriction,  $\uparrow$ platelet aggregation)
2. LVH
3. Systolic dysfunction and dilated cardiomyopathy
4. Reversible profound myocardial depression after binge use
5. Cardiac dysrhythmias

## Treatment of Cocaine Associated Myocardial Ischemia And Infarction

### First line therapy

O<sub>2</sub>, aspirin, nitroglycerine, benzodiazepine

### Second line therapy

Verapamil, phentolamine

Coronary angiography if conservative treatment is unsuccessful

### Agents to be avoided

B blockers

Routine use of thrombolytic therapy

# Hope Trial (2000)

Ramipril reduces the the risk of MI, Stroke or death from cardiovascular disease in patients with known vascular disease (CAD, PVD, Stroke) or Diabetes

+

One additional risk factor

(↑BP, ↑cholesterol, ↓HDL, smoking or microalbuminuria)

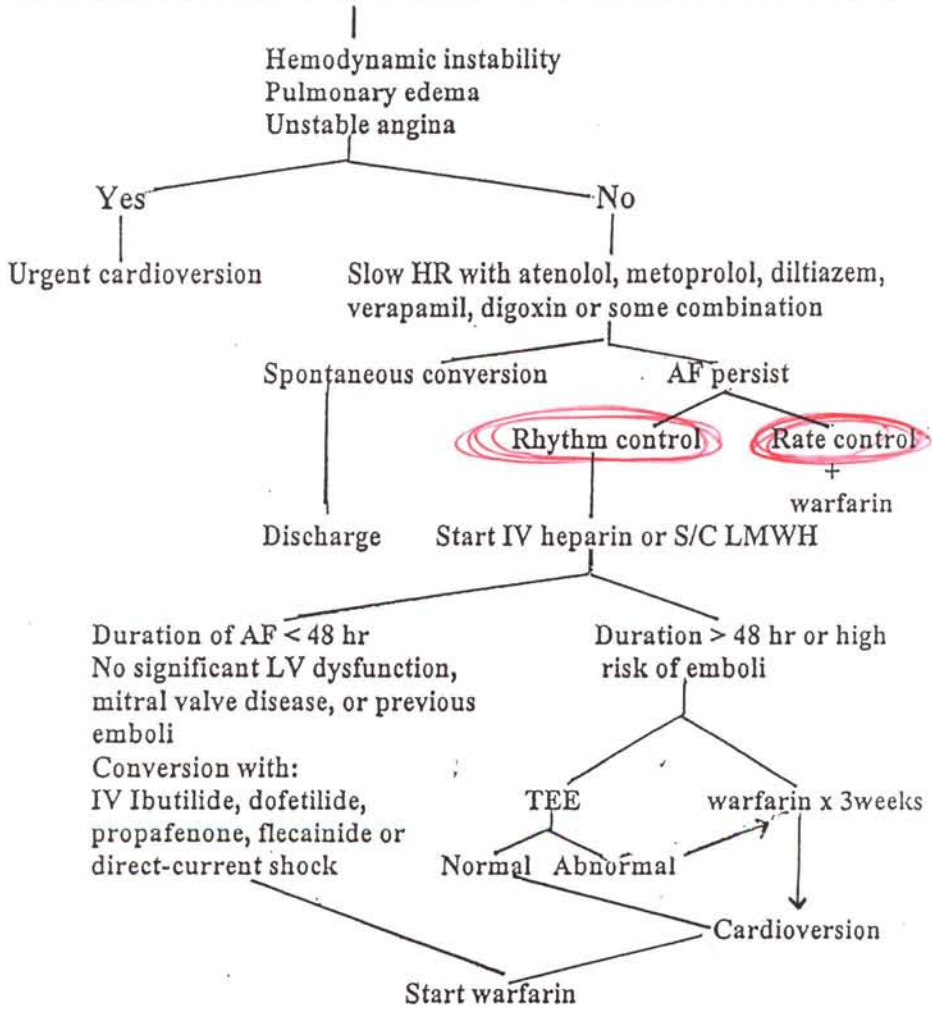
# Heart Protection Study (2002)

In patients at high risk of coronary events because of existing coronary heart disease, diabetes, peripheral vascular disease, history of stroke or other cerebrovascular diseases, simvastatin reduces the risk of death, heart attacks and strokes irrespective of cholesterol levels.

Lancet : 2002 : 360: 7-22

# Treatment Of Atrial Fibrillation

AFib w/ wPW  
 - wide-complex irregular tachycardia  
 - suspect w/ rates > 200  
 - DCC: Procainamide



# Management of Atrial Fibrillation

1. Rate control with chronic anticoagulation is the recommended strategy for the majority of patients. Rhythm control has not been shown to be superior to rate control and may be inferior in some patient subgroups to rate control.
2. Patients with AF should receive long-term anticoagulation with warfarin unless they are at low risk of stroke or have a specific contraindication to the use of warfarin (thrombocytopenia, recent trauma or surgery, alcoholism).
3. Drugs recommended for rate control during exercise and at rest: atenolol, metoprolol, diltiazem, verapamil. Digoxin is only effective for rate control at rest and therefore should only be used as a second-line agent for rate control.
4. For those patients who elect to undergo acute cardioversion to achieve sinus rhythm, both direct-current cardioversion and pharmacological conversion are appropriate options.
5. Short term anticoagulation with heparin and cardioversion if TEE shows no evidence of atrial thrombus or 3 weeks of warfarin followed by cardioversion have similar results.
6. Most patients converted to sinus rhythm should not be placed on rhythm maintenance therapy since the risks outweigh the benefits. In a selected group of patients whose quality of life is compromised by atrial fibrillation, the recommended pharmacologic agents for rhythm maintenance are amiodarone, disopyramide, propafenone, and sotalol

AFlutter:

A Rates 250-350  
V Rates ~150

Tx: Cardiovert  
or  
overdrive  
pacing  
or  
Tx as AFib

Ablation →  
very effective

CHF w/AFib

- Best drug to maintain NSR  
- Amiodarone

## Anticoagulation in Nonvalvular Atrial Fibrillation

CHAD <sub>2</sub> score	Points
<u>CHF</u> (any history)	1
<u>Hypertension</u> (prior history)	1
<u>Age</u> ≥ 75	1
<u>Diabetes mellitus</u>	1
<u>Prior ischemic stroke</u> , TIA or systemic embolic event	2

Goal INR

2.5-3.5

- prior Thrombosis  
- LAA Thrombus remains  
- prosthetic valves

Total Score	Treatment
Low Risk	Aspirin
Intermediate risk	Warfarin or aspirin
High Risk	Warfarin (INR 2-3)

or MS + AFib

PE Exam Findings:

- Lost a-wave
- SI varying intensity

Ablation

- AFib + CHF

complications:

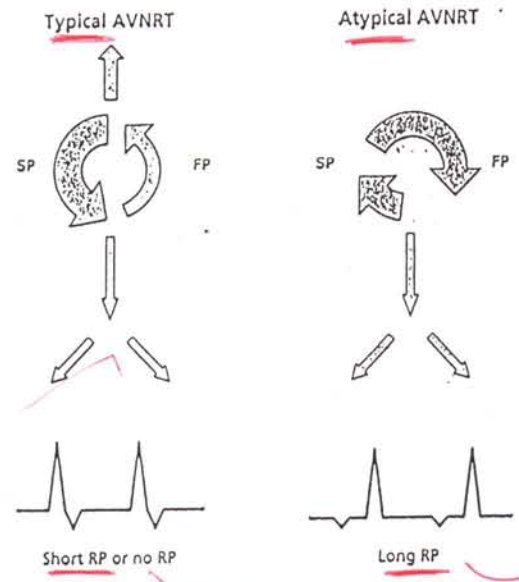
- PV stenosis
- stroke

# Atrioventricular Nodal Reentrant Tachycardia (AVNRT)

Tx: -vagal maneuvers  
-Adenosine or verapamil

Maint Tx:  
CCB's  
β-blockers  
Dig

Ablation → for refractory cases



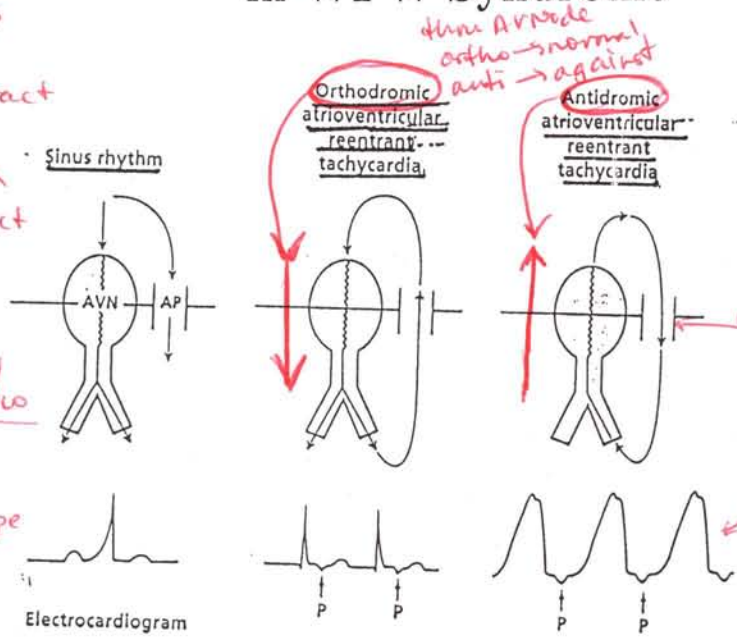
atrial activity is retrograde thru fast pathway  
atrial activity is retrograde thru down pathway

## Atrioventricular Reentrant Tachycardia in WPW Syndrome

wPW  
Type A - tall R-waves in V<sub>1</sub>+V<sub>2</sub>  
ⓐ- sided bypass tract

Type B - Qs in V<sub>1</sub>+V<sub>2</sub>  
ⓑ- sided bypass tract

Indications for Ablation w/ wPW  
- 4/0 Aflutter or SVT  
- unexplained syncope  
- recurrent palp's



once cardioverted then EP study + ablate

Conduction is via accessory pathway  
wide complex

## Broad Complex Tachycardia

Tx: Amiodarone / Procainamide

→ avoid verapamil  
- can induce hypotension and/or shock

Ventricular tachycardia is favoured if:

1. Presence of organic heart disease
2. QRS > .14 s (140 ms)
3. Concordance of QRS in precordial leads
4. AV dissociation
5. Fusion beats
6. Cannon waves on JVP
7. left axis
8. Any change in the morphology of the conduction block from the previous EKG

Tx: Cardioversion or Amio/Procainamide

Multifocal Atrial Tachycardia (MAT)  
vRates: 100-220  
- can slow rates w/ verapamil



# Causes of QT Prolongation & Torsade De Pointes (Polymorphic VTach)

## Drugs :

Antiarrhythmics, phenothiazines, tricyclics, terfenadine & astemizole in combination with erythromycin or fluconazole or ketoconazole

Electrolyte disturbance :  $\downarrow K, \downarrow Mg$

Liquid protein diet

CNS catastrophe ( bleed/ stroke)

Intrinsic heart disease ( CAD, myocarditis )

Congenital QT prolongation

Tx: Magnesium (even if normal) or Overdrive Pacing or Lidocaine / Bretylium

Accelerated Idioventricular Rhythm  
- most common reperfusion arrhythmia  
- char. by fusion beat

## Antiarrhythmic Drugs

All can be pro-arrhythmic except  $\beta$ -blockers / CCBs

Thrombocytopenia SLE

IA : Quinidine, procainamide, disopyramide  
IB : Lidocaine, tocainide, mexiletine  
IC : Flecainide, propafenone  
II : Beta blockers  
III : Amiodarone, bretylium, sotalol, ibutilide, dofetilide  
IV : Verapamil, diltiazem  
Others : Digoxin, adenosine

pulm. fibrosis  
Liver damage  
Hypo / Hyper-thyroid  
 $\downarrow$  Warfarin dose

### Dig Toxicity

- ① SVT w/ Block
- ② AFib w/ Regular Rhythm
- ③ Junctional Tachycardia

## Indications for Permanent Pacemakers

1. Symptomatic complete or second-degree AV block or asymptomatic complete heart block with HR < 40
2. Symptomatic Bifasicular block + intermittent complete or second-degree type II heart block
3. Sinus-node dysfunction with documented symptomatic bradycardia
4. Neurocardiogenic syncope with > 3s pauses induced by minimal carotid-sinus pressure

### Congenital QT Prolongation:

-syncope / sudden death  $\rightarrow$  stress-induced

Tx:  $\beta$ -blockers

then  
ICD if  $\beta$  effective or survivors of cardiac arrest or recurrent syncope

# Radio-Frequency Ablation For Cardiac Arrhythmias

1. Recurrent SVT (all 3 types)
2. WPW syndrome
3. Atrial flutter (type I with saw tooth pattern in II, III, AVF)
4. Controlling VR in atrial fibrillation  
(AV nodal modification or ablation of AV node + VR pacemaker)
5. Idiopathic ventricular tachycardia

Best drug to prevent AFib  
Post-CABG  
β-blockers

## Ablation is not indicated for :

- a) CAD and ventricular tachycardia
- b) Multifocal atrial tachycardia
- c) Polymorphic ventricular tachycardia
- d) Ventricular fibrillation

Sarcoidosis plus syncope

Q: arrhythmia

# Congestive Heart Failure

	<u>Systolic dysfunction</u>	<u>Diastolic dysfunction</u>
Abnormality	↓ Ventricular <u>contractility</u>	↓ Ventricular <u>relaxation</u> , filling & diastolic distensibility
Dyspnea, edema	+	+
Exercise capacity	↓	↓
B-type natriuretic peptide	↑	↑
LVEDP	↑	↑
LVEF	↓	<u>Normal (&gt;50%)</u>
ECHO		
Ventricles	Dilated	Normal
LA size	↑	↑
Hypertrophy	-	+/-
Contractility	↓	N
Doppler		
LV filling pattern	Normal	<u>Abnormal</u>
Treatment	ACE inhibitors, ARBs, diuretics, digoxin, Beta blockers	Diuretics, ACEs, ARBs, Beta blockers, Nondihydropyridine calcium blockers

role for Digoxin

# Treatment of CHF Caused by Systolic Dysfunction

- ★ Improve mortality
1. Ace inhibitors (Even in asymptomatic LV Dysfx)
  2. Angiotensin II receptor blockers
  3. Diuretics (loop--- add thiazide--- add distal K sparing) → exp. Aldactone → improves mortality in class III - IV HF
  - ★ 4. Beta blockers (carvedilol or metoprolol or bisoprolol)
  5. Digoxin (↓ hospitalizations) *nonselective β-blockade*
  6. Vasodilators (hydralazine + isosorbide)
  7. IV sympathomimetic amines (dobutamine, dopamine, amrinone) → once euvolemic + afterload reduces on-board
  8. Nesiritide (B-type natriuretic peptide)
  9. Biventricular pacing
  10. ICD
  11. Left ventricular assist device (VAD)
  12. Cardiac transplantation

## Beta Blockers For CHF

1. Use in all patients who have NYHA class I, II or III symptoms and in class IV patients who are not acutely decompensated and hypervolemic
2. Use agents that have proved beneficial in major mortality trials (carvedilol, bisoprolol, metoprolol)
3. Before adding beta blockers, make sure patient is stable and on standard heart failure therapy
4. Start treatment at low dosage (carvedilol 3.125 BID, metoprolol cr/xl 12.5 mg qd, bisoprolol 1.25 mg po qd)
5. Increase dosages at 2-3 weeks intervals as tolerated to target levels established in major mortality trials (carvedilol 25-50 mg po bid, metoprolol cr/xl 200 mg po qd, bisoprolol 10 mg po qd)

### Contraindications

- Signs of clinically unstable heart failure
- Asthma, COPD
- HR < 60 or BP < 100 systolic
- Second or third degree heart block

## Device Therapy in Heart Failure

**Biventricular pacemaker** (need to meet all of the following criteria)

1. NYHA class III-IV symptoms
2. QRS >120 msec
3. Ischemic or nonischemic dilated cardiomyopathy
4. LVEF <35%

**Implantable cardioverter-defibrillator (ICD)**

1. Any hemodynamic significant or symptomatic ventricular arrhythmia, including resuscitated cardiac arrest or syncope or near syncope
2. Ischemic cardiomyopathy with prior MI (>30 days in past) and LVEF <30%
3. Nonischemic cardiomyopathy with LVEF <35%

# Stages of Heart Failure

## ACC/AHA

- (A) At risk ; no structural disease or symptoms
- (B) Structural disease but no symptoms
- (C) Structural disease with prior or current symptoms
- (D) Refractory symptoms

## NYHA Functional Class

- I Asymptomatic
- II Slight limitation of physical activity
- III Marked limitation of physical activity
- IV Inability to perform any physical activity without symptoms

# Cardiomyopathy

**Congestive** → presents as systolic dysfx

Previous myocarditis or Idiopathic, alcohol, doxorubicin, peripartum, ischemic

**Restrictive**

Myocardial fibrosis, infiltrative diseases (amyloid, sarcoid, hemochromatosis)

**Hypertrophic Obstructive (HOCM)**

# Treatment of Hypertrophic Cardiomyopathy

Best initial  
tx  
↓

→ asymmetric  
IV septal hypertrophy

1. B-blockers, nondihydropyridine calcium blockers or disopyramide
2. Patients who continue to have symptoms despite pharmacological therapy:
  - a) Dual chamber pacing to reduce obstruction
  - b) Percutaneous septal ablation
  - c) Surgical septal myectomy (Gold standard)
3. Indications of ICD insertion
  - a) Patients who have survived cardiac arrest or have documented sustained ventricular tachycardia
  - b) Patients with two or more of the following risk factors:  
Non-sustained Ventricular tachycardia on holtor, abnormal BP response to exercise, syncope in young patients, family history of sudden death in 2 or more family members and marked ventricular hypertrophy (> 30 mm)
4. Things to avoid: → avoid preload ↓
  - Nonpharmacologic: Competitive athletics, alcohol, hot tub or sauna
  - Pharmacologic: vasodilators (nitrates, dihydropyridine calcium blockers, hydralazine, ACES, ARBS, minoxidil, sildenafil)
  - Positive inotropes: epinephrine, norepinephrine, isoproterenol, dopamine, dobutamine, digoxin,

- Screen all  
1st-degree  
relatives w/  
Echo @ 5 yrs.  
beginning @  
12-18 y.o.

# Causes of Sudden Death in Athletes

1. Hypertrophic cardiomyopathy
2. Congenital malformation of coronary arteries
3. Arrhythmogenic right ventricular dysplasia
4. Blunt trauma to chest
5. Others : Dilated cardiomyopathy, AS, ↑ QT, ruptured aortic aneurysm

Normal Exercise  
 - sinus arrhythmia  
 - wandering pacemaker  
 - 1st degree HB  
 - wobble back  
 - functional SEM  
 - mild symmetrical LVH

## Complications of MVP

1. Endocarditis
2. Ventricular tachycardia and sudden death
3. Ruptured Chordae
4. Thrombo-embolic complications

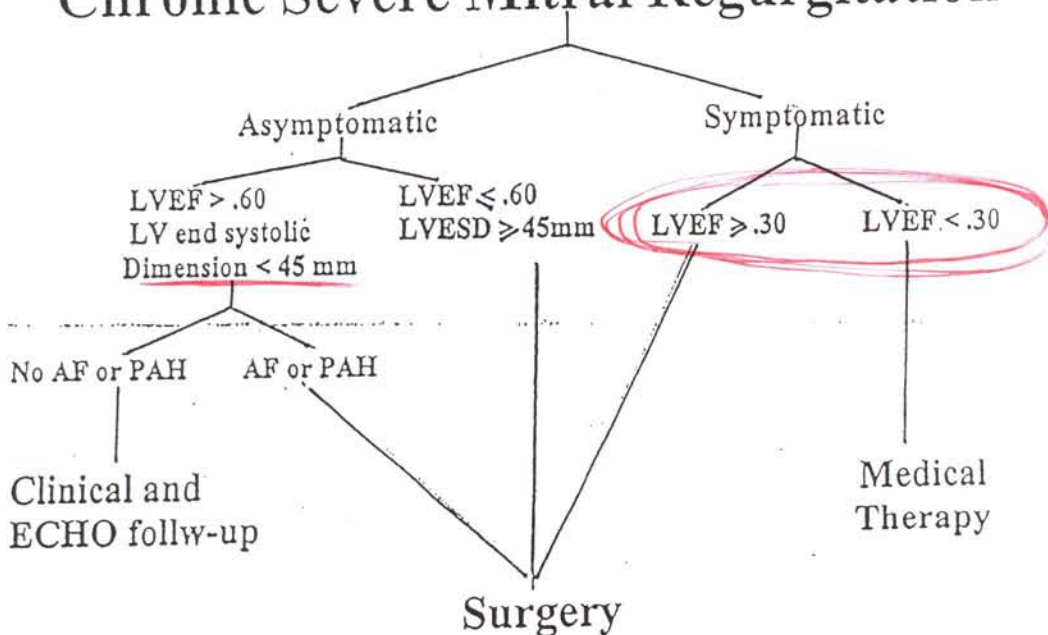
A Regurg  
 EF < 55%  
 LVESD > 55 mm  
 Asc Ao > 55 mm } Surgery

## Signs OF Severe Aortic Stenosis

1. + S4
2. Paradoxical splitting of second heart sound (Pat. A<sub>2</sub>)
3. Late peaking of murmur
4. ECHO: Mean transvalvular gradient > 50 mm or valve area < .8 square cm

Medical Tx:  
 Vasodilators

## Chronic Severe Mitral Regurgitation



## Indications for Endocarditis Prophylaxis

1. Prosthetic heart valves, including bioprosthetic and homograft valves.
2. A prior history of endocarditis
3. Unrepaired cyanotic congenital heart defects, including palliative shunts and conduits
4. Completely repaired congenital heart defects with prosthetic material or device, whether placed by surgery, or catheter intervention, during the first 6 months after the procedure
5. Repaired congenital heart disease with residual defects at the site or adjacent to the site of the prosthetic device
6. Cardiac valvulopathy in a transplanted heart

## Conditions Not Requiring Prophylaxis

1. Acquired valvular heart diseases
2. MVP with or without MR, thickened or redundant leaflets
3. Bicuspid aortic valve
4. HOCM
5. 6 months after repair of congenital heart defects

## Procedures Requiring Prophylaxis

1. All dental procedures that involve manipulation of either gingival tissue or the periapical region of the teeth or perforation of oral mucosa
2. Procedures of the respiratory tract that involve incision or biopsy of the respiratory mucosa ( Tonsillectomy and/or adenoidectomy, bronchoscopy with biopsy)
3. GI or GU procedures only in patients with ongoing GI or GU tract Infection
4. Procedures on infected skin, skin structures or musculoskeletal tissue
5. Surgery to place prosthetic heart valves or prosthetic intravascular or intracardiac material

## Procedures Not Requiring Prophylaxis

### Dental

Routine anesthetic injections, dental radiographs, placement and removal of prosthodontic or orthodontic appliances adjustment of orthodontic appliances, placement of orthodontic bracelets

### Respiratory tract

Endotracheal intubation, bronchoscopy without biopsy, tympanostomy tube insertion

### Gasrointestinal tract

TEE, endoscopy with or without biopsy

### Genitourinary tract

Vaginal delivery, cesarean section,

In uninfected tissue: urethral catheterization, uterine dilatation and curettage, therapeutic abortion, sterilization procedures, insertion or removal of intrauterine devices

### Others

Cardiac catheterization, balloon angioplasty, implanted cardiac pacemakers, defibrillators, and coronary stents, circumcision, tattoo/piercing

## Endocarditis Prophylaxis

### Dental or respiratory tract

Standard regimen  
Unable to take oral meds

30-60 minute before procedure:  
Amoxicillin 2 g PO  
Ampicillin 2 g IV/IM: or cefazolin  
or ceftriaxone 1 g IM/IV

Allergic to penicillin

Clindamycin 600 mg PO or  
cefalexin 2 g PO or azithromycin or  
clarithromycin 500 mg PO

Allergic to penicillin  
and unable to take oral meds

Clindamycin 600 mg IV/IM; or  
cefazolin or ceftriaxone 1 g IV/IM

### GI or GU Procedures at a time of ongoing GI or GU infection

Standard regimen

Amoxicillin 2 g PO or ampicillin 2 g  
IM/IV

Penicillin allergy

Vancomycin 1 g IV over 1-2 hours

Avoid cephalosporin if prior penicillin-associated anaphylaxis, angioedema, or urticaria

# Acute Pericarditis

## Causes:

- most common*
1. Idiopathic (85-90%)
  2. Infectious: Viral, bacterial, TB
  3. Acute MI
  4. Aortic dissection
  5. Trauma
  6. Chest radiation
  7. Neoplasm
  8. Uremia
  9. Cardiac surgery
  10. Autoimmune diseases
  11. Drugs: Dantrolene, doxorubicin, hydralazine, INH, phenytoin, procainamide

Tx: NSAID's  
(Ibuprofen)

If pain persists after 2 wks.

↓  
add Colchicine

Then add steroids

## Poor Prognostic Factors

1. Temperature > 38 C
2. Subacute onset (several weeks)
3. Immunosuppressed state
4. Trauma
5. H/O oral anticoagulants
6. Myopericarditis
7. Large pericardial effusion (echo-free space > 20mm)
8. Cardiac tamponade

## Sequelae:

Cardiac tamponade, recurrent pericarditis, pericardial constriction

### Primary Pulm HTN

- young females
- @ - heart failure
- Echo → RVH
- lung scan → ∅ segmental or sub-segmental defects

Tx: Diuretics  
CCB (Nifedipine)  
IV Epoprostenol  
oral Bosentan  
sildenafil

# Treatment of PVD

## Risk Factor Modification

- Treat hypertension
- Treat elevated lipids (goal LDL < 100 mg/dl)
- Quit smoking and regular exercise program
- Control diabetes

↳ most important

## Pharmacological therapy

- Antiplatelet agents: Aspirin or clopidogrel
- Pentoxifylline (Trental)
- Cilostazole (Pletal) → avoid in CHF
- Statin
- Ramipril

## Revascularization (For lifestyle limiting claudications)

- Angioplasty
- Surgery

### Aortic Aneurysms

- ≥ 5.5 → surgery
- ↑ size 70.5 cm/yr
- screen men aged 65-75 w/ h/o smoking

### Dissecting Aneurysm

- Best Initial Tx: Labetalol then Nitroprusside
- ↳ shear stress

# Congenital Heart Diseases

1. ASD → surgery for pulm:systemic flow > 1.5:1
2. VSD
3. PDA → surgery ∅ matter the shunt
4. Pulmonary stenosis → surgery for gradient > 80
5. Coarctation → surgery for trans-coarct gradient > 30 - assoc. w/ bicuspid aortic valve
6. Tetralogy of Fallot
7. Epstein Anomaly → Tricuspid valve into the RV w/ PFO or ASD - cyanotic
8. Eisenmenger's syndrome

- ① VSD
- ② overriding Aorta
- ③ RVOT obstruction
- ④ RVH

Ⓛ → Ⓜ shunt becomes Ⓜ → Ⓛ as PAP's ↑



# EKG Interpretation

**Rate:** Divide 300 by number of boxes in the RR interval or  
RR complexes in 30 large boxes (6 sec) x 10

**Rhythm:** P waves upright in II, aVF & inverted in aVR. Each  
QRS preceded by P wave and PR interval is constant

**PR Interval** (.12-.20 s) Long: First degree AV block, Short: WPW, nodal rhythm

**QRS Interval** (.06-.10s) widened: LBBB, RBBB, VPC's, K<sup>↑</sup>, quinidine toxicity

**QT Interval** (< .43s, < 50% of RR), Prolonged: congenital, ↓K, ↓Ca, drugs

**QRS Axis:**

Lead I +ve & Lead aVF +ve	= Normal axis
Lead I -ve & Lead aVF +ve	= Rt axis
Lead I +ve & Lead aVF -ve	= Lt axis
Lead I +ve & Lead II, aVF -ve	= LAHB

**ST elevation:** MI, pericarditis, and coronary spasm

**Inverted T waves:** MI, Ventricular strain, digitalis effect, ↓K, ↑Ca, ↑  
intracranial pressure (subarachnoid bleeding)

**RVH:** R>S in V1 or R>5 mm in V1, R/S in V6 < 1

**LVH:** S in V1 + R in V5 or V6 > 35 or R in aVL > 11 mm

**RAH:** P waves > 2.5 mm in II, III & aVF (P pulmonale)

**LAH:** P biphasic in V1 with terminal negative force > .04s (P mitrale)

**LBBB:** QRS > .12 sec, broad notched R waves in I, aVL, V5 & V6, QS or rS in V1,  
ST-T wave changes in above leads

**RBBB:** QRS > .12 sec, rSr<sup>1</sup> pattern in V1-V2, ST-T wave changes in right  
precordial leads

**Infarction:** ST elevation, T inversion and Q waves

**Ischemia:** ST depression or symmetric T wave inversion

**Hyperkalemia:** Peaked T waves, PR prolonged, wide QRS

**Pericarditis:** Diffuse ST elevation with concave upward, absence of reciprocal  
changes and concomitant T-wave inversions

**Hypokalemia:** Prominent U wave, ST depression & T inversion. Prominent P  
waves in leads II, III and AVF