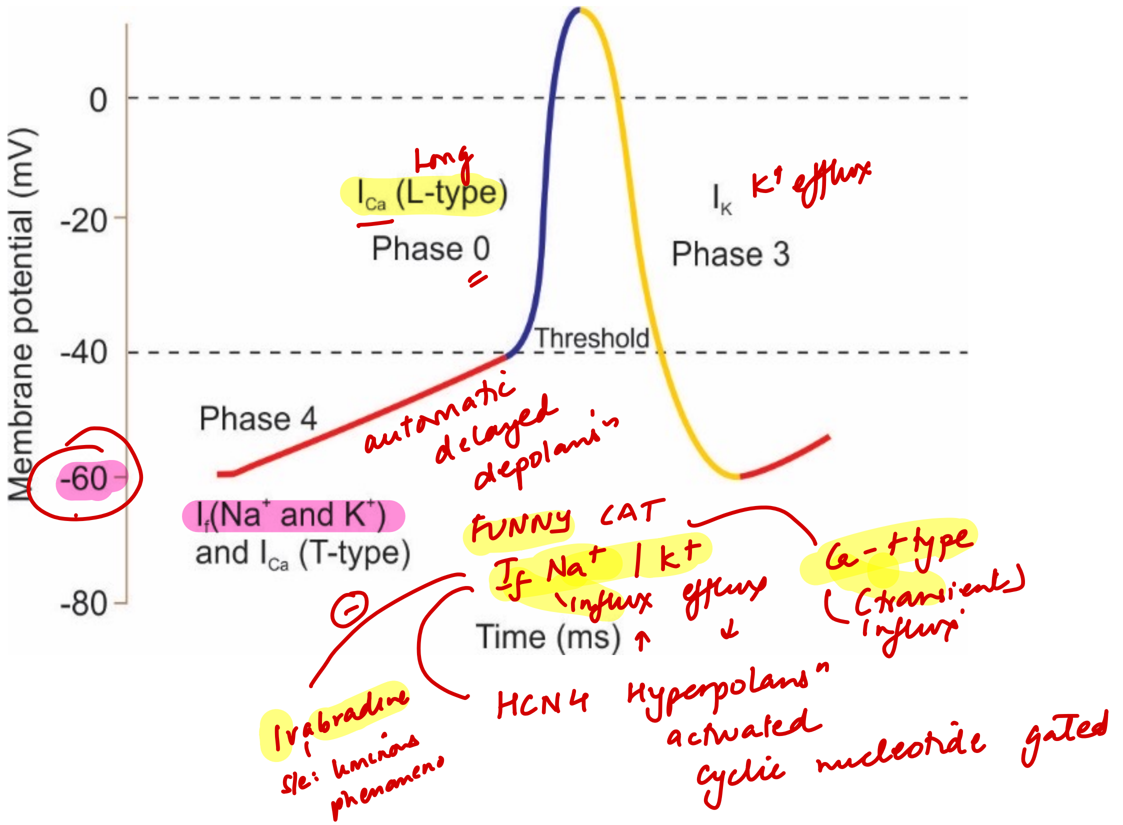
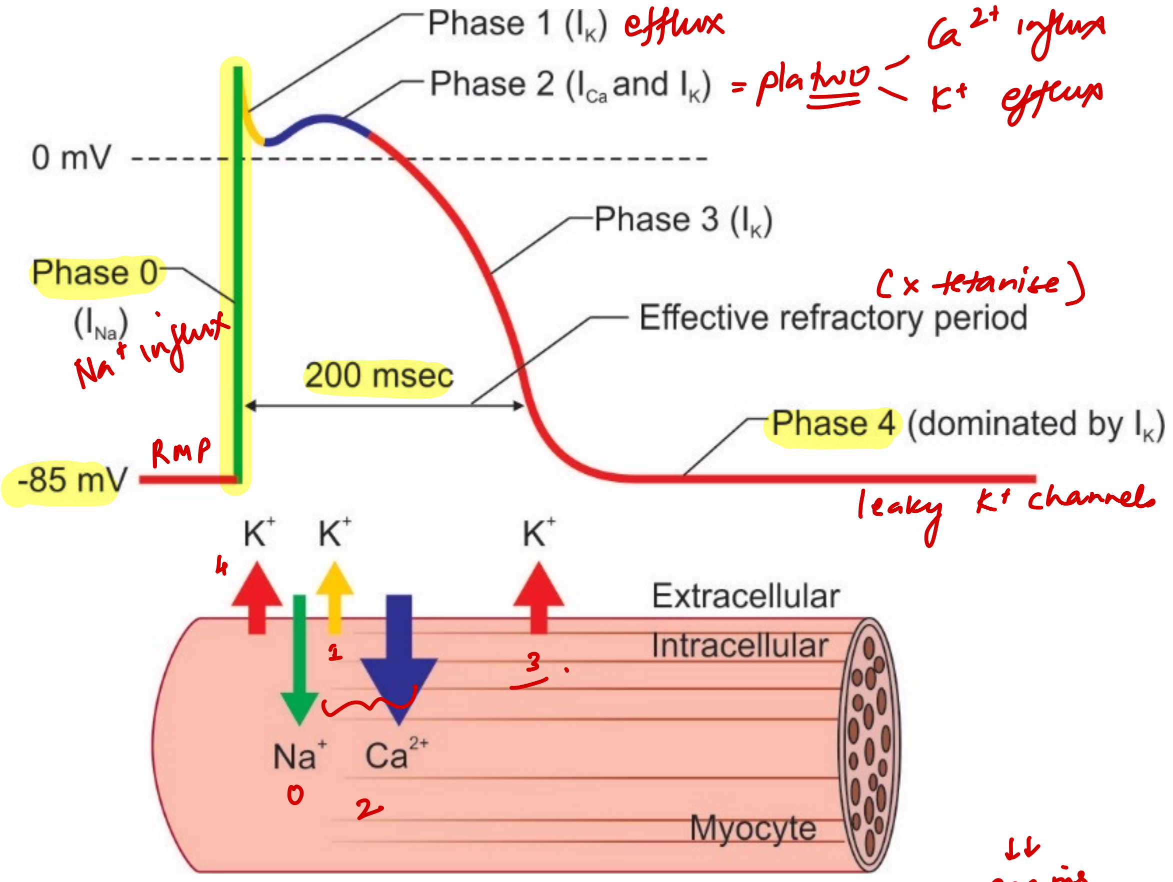
INTEGRATED CVS

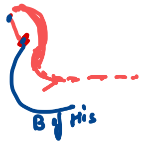
Action Potential





Ach/Adenosine: ↓HR (↓slope of ph 0)
Catecholamines: ↑HR (↑slope of ph 0)
ABCD ↓AV node condⁿ
- Adenosine
- B-blockers (asthma CI)
- CCB (non-DHP) - Verapamil, Diltiazem
- Digoxin

- ↑PR interval
- WPW CI
- SVT ≠ DOC
- Rate control



Speed of conduction:
His-Purkinje > Atria > Ventricles > AVN

Endocardium ⇌ Epicardium (depolanⁿ → ; ← repolanⁿ)

Anti-arrhythmic drugs (Waughan)

I (Avoid with HyperK) Na ⊖

- IA: K - : Quinidine, Procainamide, Disopyramide (QT↑) — SHIP (Drug induced lupus, acetyl'n)
- IB: K + : Lignocaine, Phenytoin — ventr arrhythmias — DOC — Digitalis induced, Ischemia induced
- IC: Fleicanide, Propafenone — CI in (Ischemia)

II — β blockers

III: Amiodarone, Ibulitide Dofetilide, Sotalol (Avoid with HypoK) QT↑ (K⁺ ⊖)

IV - CCB

V: Adenosine (11s) - DOC - PSVT - iv bolus FAST

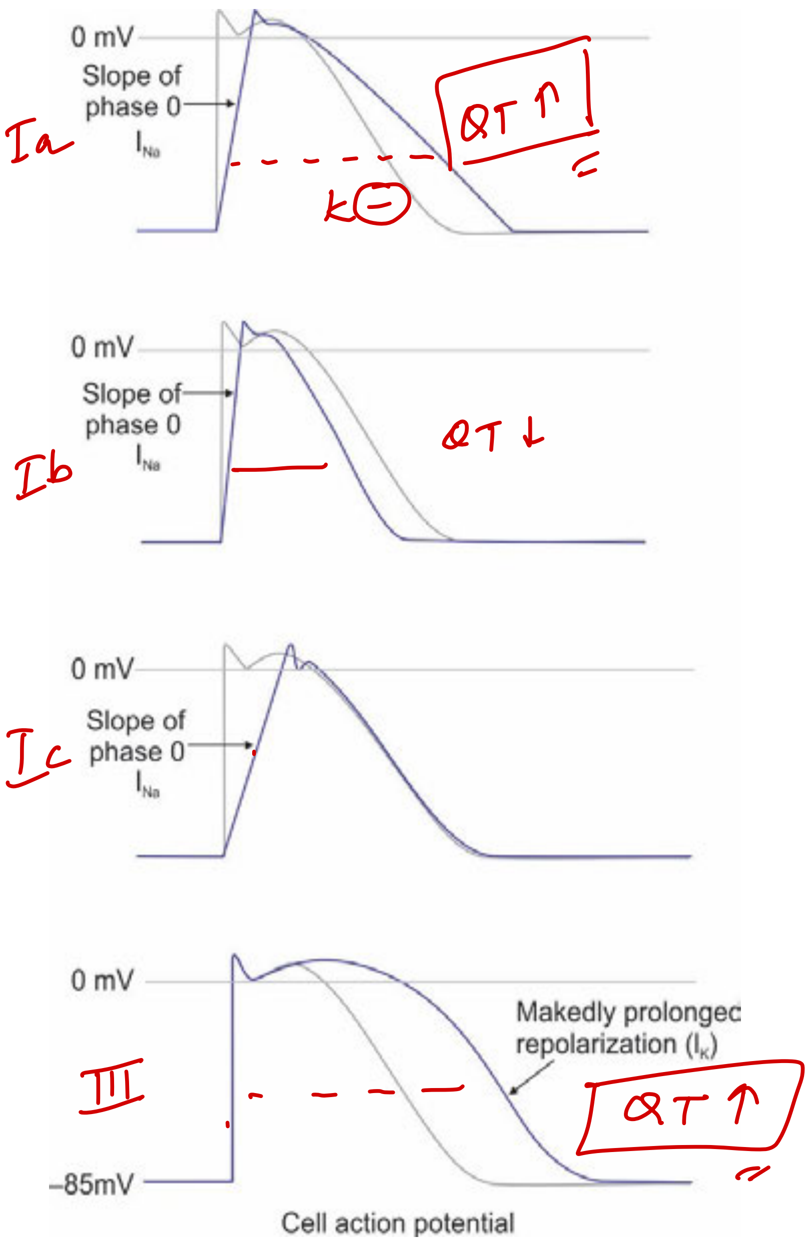
Dose: 6mg → 12mg → 12mg (max: 30mg) Children: 0.1mg/kg.

Theophylline/ Caffeine: 12mg → 12mg → 6mg (max - 30mg) (adenosine R ⊖)

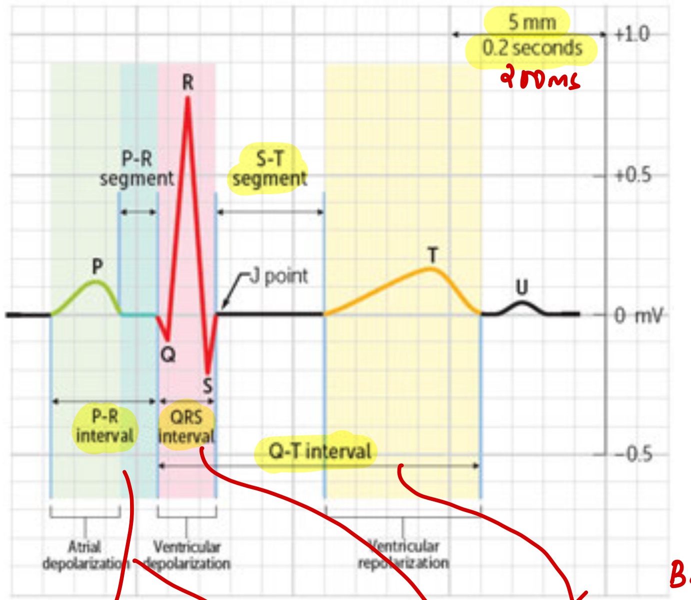
Caffeine (adenosine ⊖): RAS ++, HR↑, ↑GFR, ↑ diuresis

Amiodarone: Longest T1/2 - I/II/III/IV (40% I)

- PIs - Photosn, Pengin neuropathy
- Check - Corneal deposits, Ceruloderma
- PFT - lung fibrosis
- LFT - Hepatotoxic
- TFT - ↓/↑



ECG

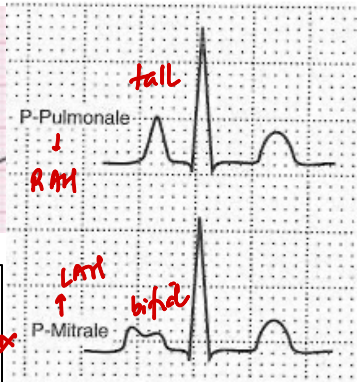


(N) 120-200 ms
AV node cond^n
↑ — ♡ block — ABCD
↓ WPW

(N) 100ms
↑ — V. tachy

Bazzett's
$QT_c = \frac{QT}{\sqrt{R-R}}$
(N) <440ms

Heart rate: 300 / no. of large box
(N): 60-100
<3: tachy   >5: brady.

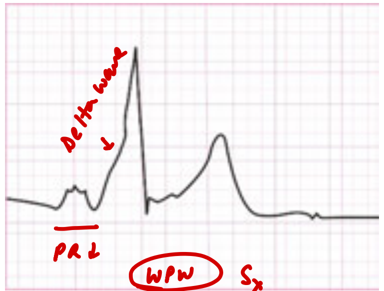


Ebstein anomaly

Himalayan p-waves (RA / RV)

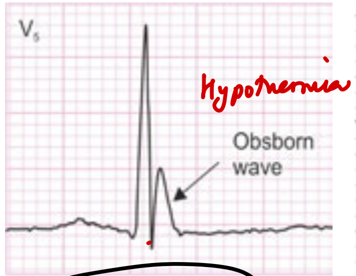
↓ K⁺

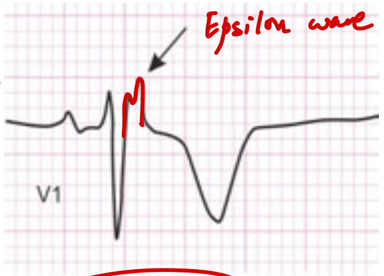
Pseudo-P pulmonale



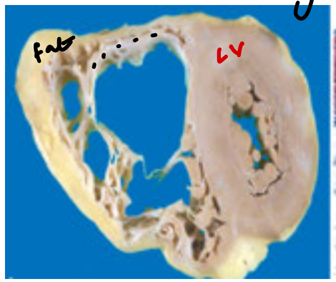
WPW Sx
· accessory bundle of kent
– ABCD CI

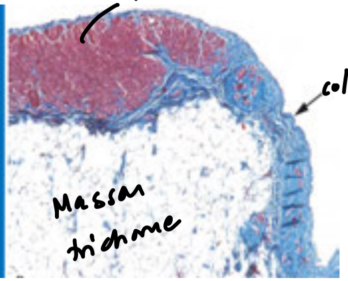
DOC-Flecainide (Ic)
TOC-RFA
Emergency-IV procainamide (Ia)





Naxos Sx ← ARVD
desmosome defect
palmoplantar keratoderma / woolly hair
arrhythmogenic RV dysplasia

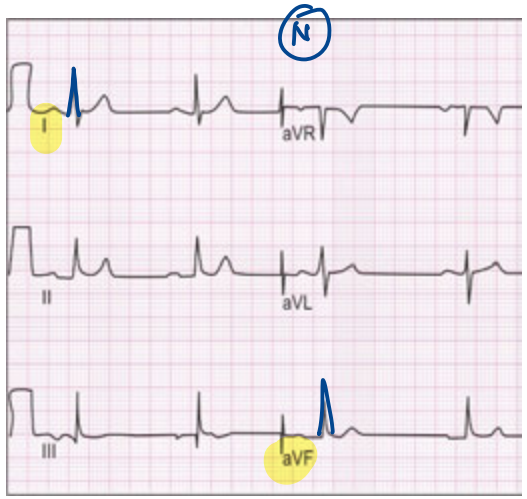


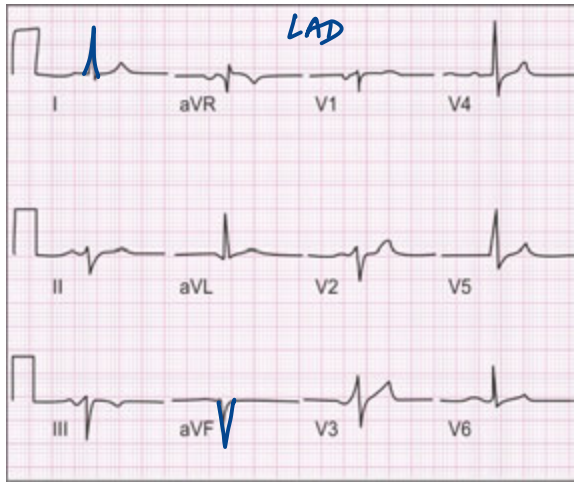


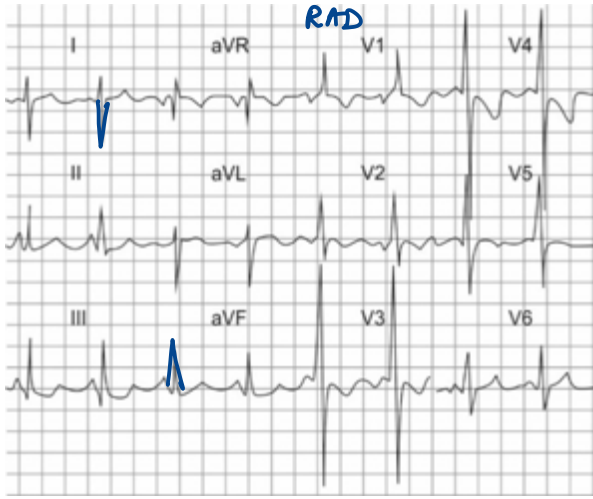
Commotio cordis → SCD
SCD → ↑ Long QT, Brugada Sx, HOCM, ARVD
Rx – ICD
HOCM, ARVD: Rx – (+) β-blockers.

Uhl's anomaly RY "parchment-like"

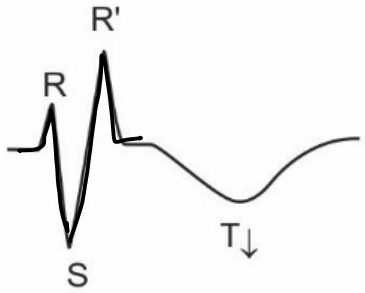
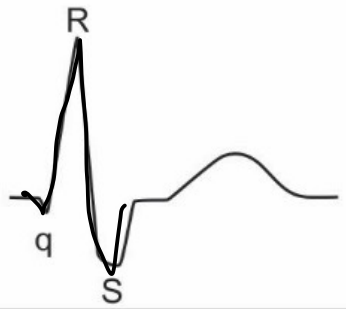
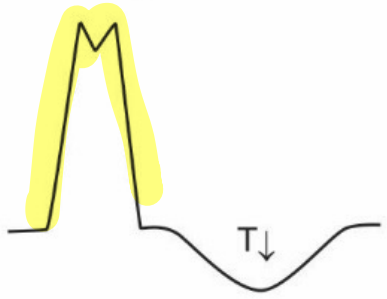
Lead 1	Lead aVF
Positive	Positive (N)
Positive	Negative (LAD)
Negative	Positive (RAD)
Negative	Negative (extreme-axis)







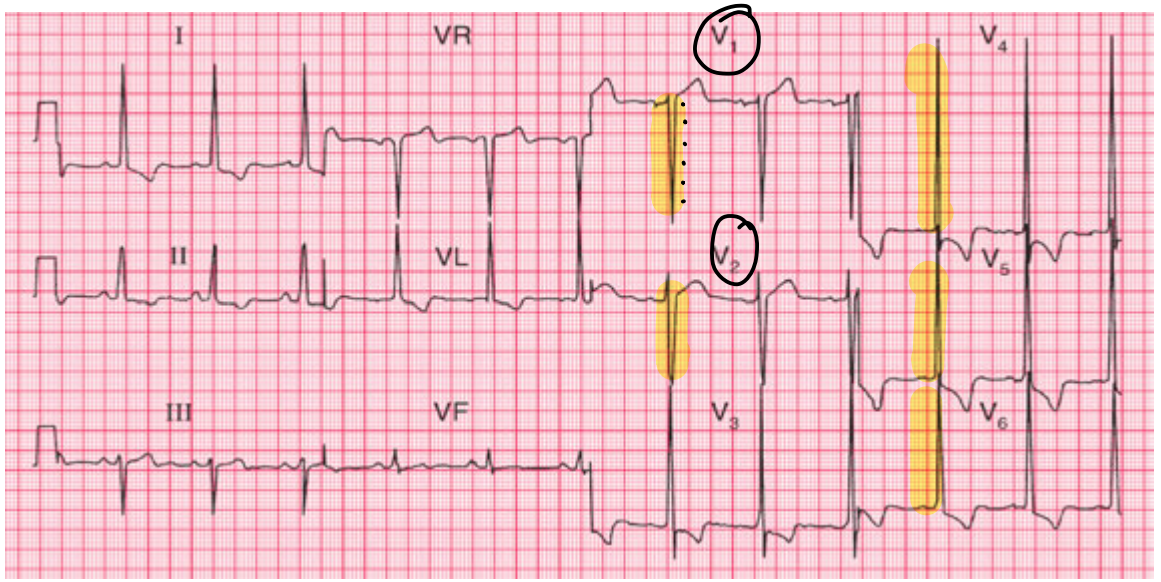
Bundle Blocks

	V1	V6
Normal		
RBBB		
LBBB		

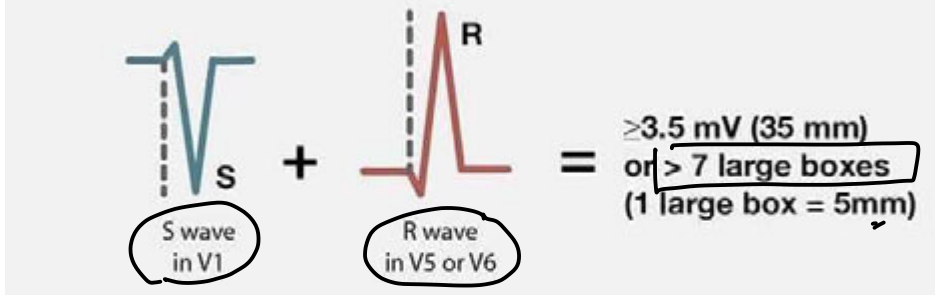
Marrow

William M

LVH-RVH



Sokolow-Lyon criteria



RVH : R V_1 ≥ 7mm

Heart blocks

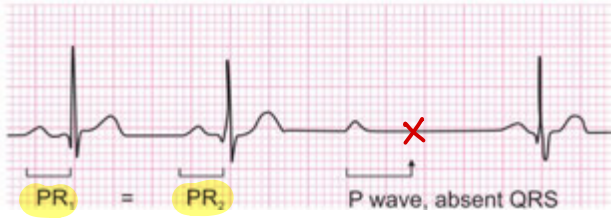
Constant / Prolonged PR (>0.20s)

type 1

type 2 - Mobitz type 1 = Wenkebach

gradual ↑ PR

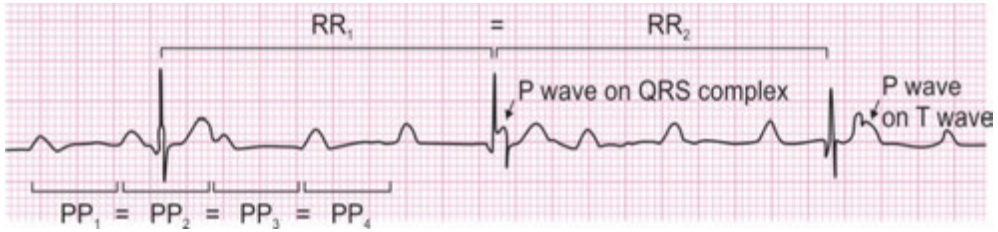
↳ skip beat



type 2 - Mobitz type 2

PR (N)

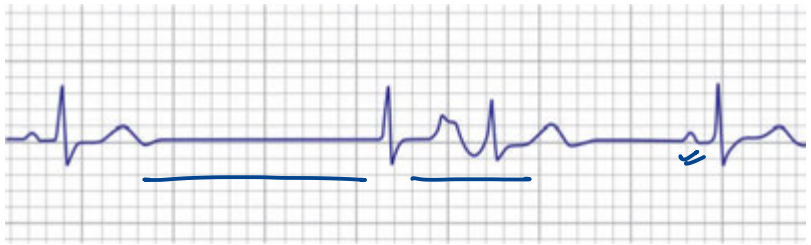
sudden skip beat



type 3 = AV dissoc^ (complete)

Underlying cause

Rx: pacemaker



- Elderly

SICK SINUS Sx

- irregular HR

ACLS Bradycardia protocol

Unstable/ Symptomatic with HR<50

- **Rx underlying cause**

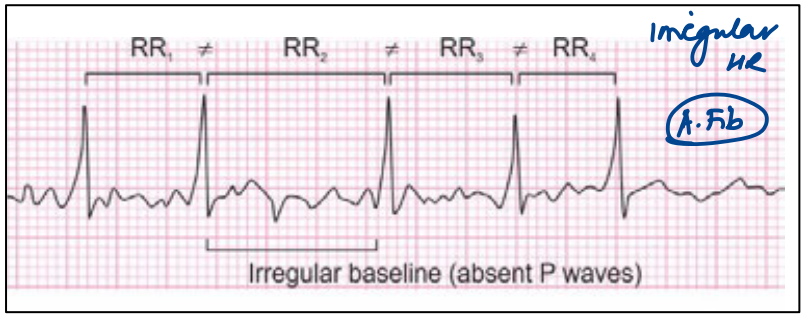
1st : Atropine 1mg IV bolus-1st line

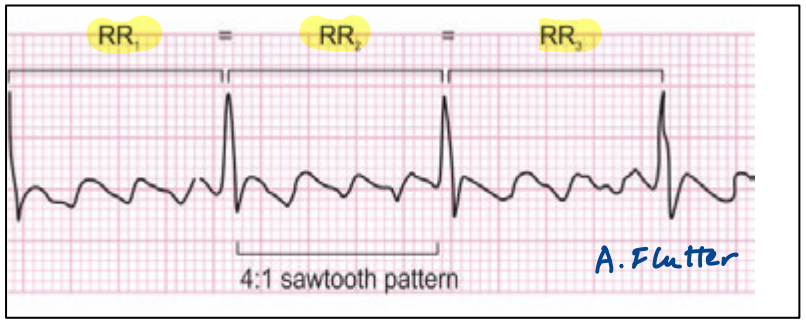
↓

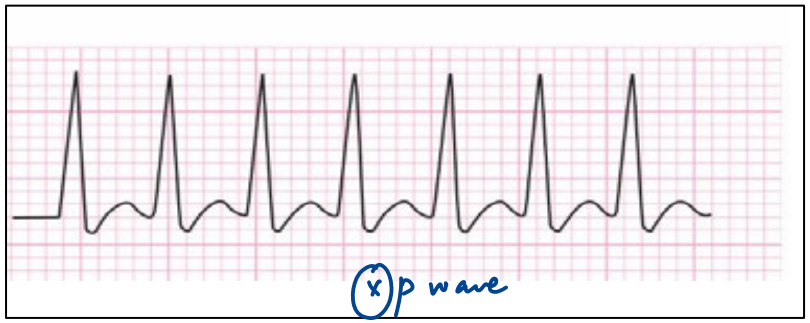
Dopamine
Epinephrine
Transcutaneous pacing

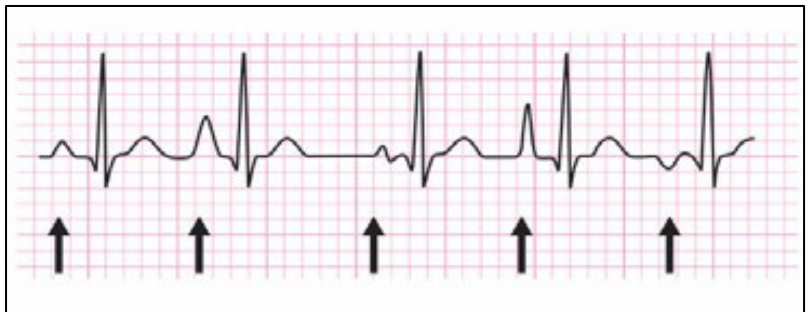
Stokes-Adam Sx: Syncope + complete ♡ block

Supra-Ventricular Tachyarrythmias — QRS (N)









Unstable-Cardioversion 200J (synchronized) QQ
Stable- RATE CONTROL: QQ
Esmolol/Verapamil
DOC — asthma

Acute Heart failure + Afib:
DIGOXIN
QQ
Anticoagulation

CHA_2DS_2-VASc Score		
C	Congestive Heart Failure	1 point
H	Hypertension	1 point
A_2	Age ≥75 y	2 points
D	Diabetes	1 point
S_2	Stroke/ TIA/ Thromboembolism	2 points
V	Vascular disease	1 point
A	Age≥65 y	1 point
Sc	Sex category, female	1 point

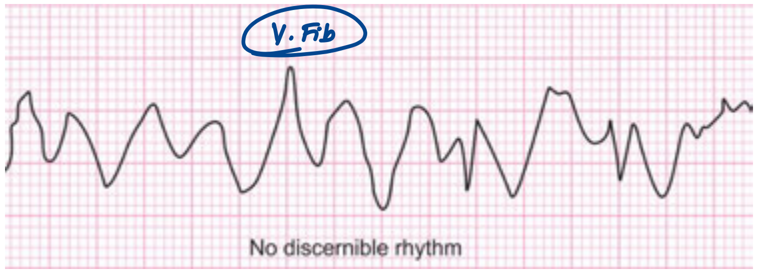
PSVT = AV node reentrant circuit

Unstable-Cardioversion
Stable-Carotid sinus massage
Iv adenosine > Esmolol > Verapamil
FROG SIGN

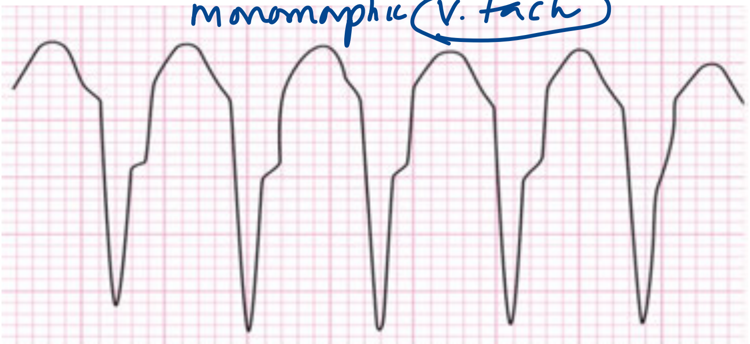
MAT = multifocal atrial tachycardia
COPD
DOC-Verapamil
Cardioversion CI

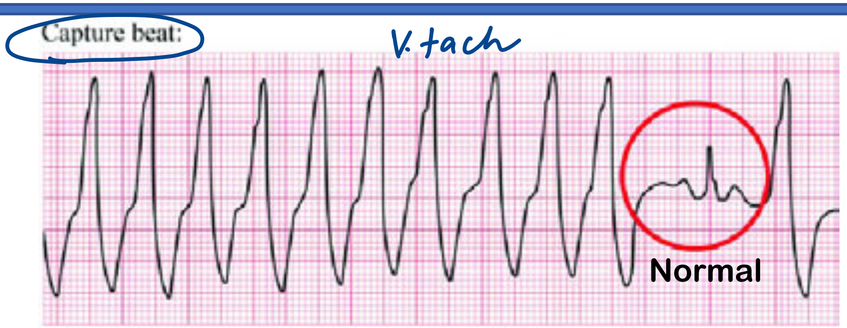
Score-1: Aspirin
Score≥ 2: DOAC – fx⊖ / II⊖ (DT)
Moderate-severe MS
Prosthetic Heart valve
warfarin QQ (2-3 INR)

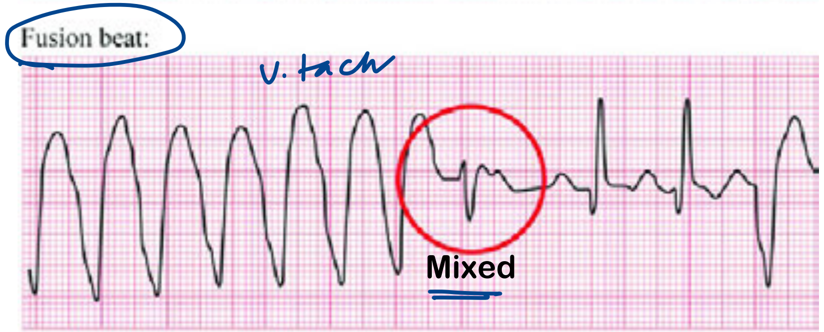
Ventricular Tachyarrythmias — QRS wide



Unstable-Defibrillation
Stable-IV Amiodarone
DOC-Lignocaine







polymorphic V. tach = torsades de pointes — Long QT ↑

Romano-Ward (AD): No SNHL
Jerwell-Lange-Nelson (AR): SNHL
DOC- $MgSO_4$

$MgSO_4$ → eclampsia; neuroprotection <32 wks POG; tocolytic; acute exac^n of asthma; cellulitis -dressing / ALP poisoning

anti Arrhythmics: Ia / III (K ⊖)

antiBiotics/ ATT/ Anti-fungals: Azoles / Macrolides / FQ (cyp ⊖); Bedaq / Pretomanid

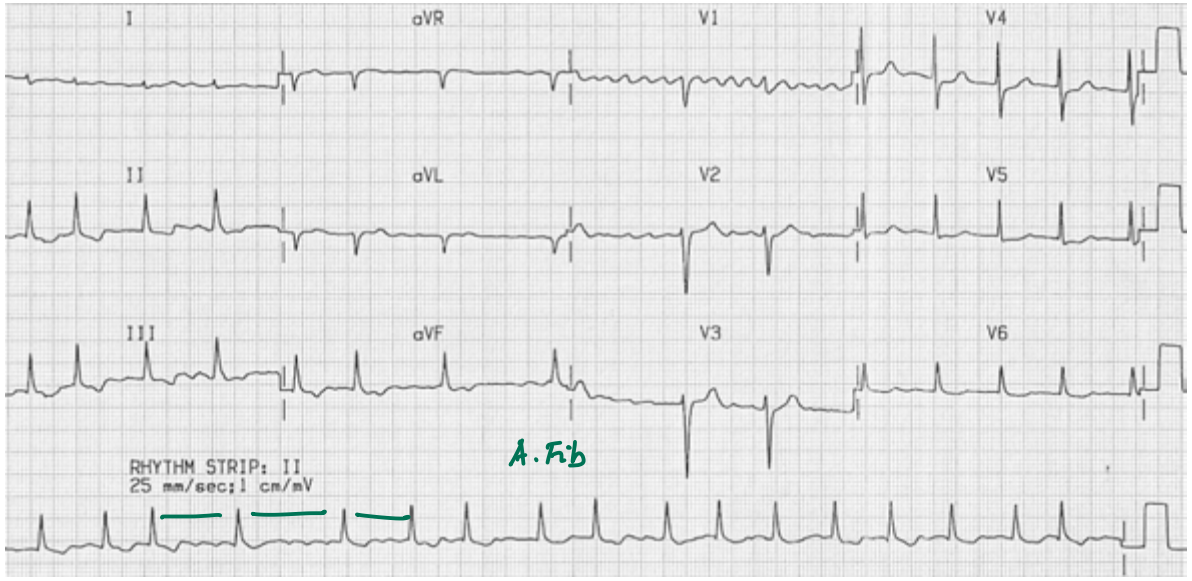
anti"C"ychotics: Haloper Zipras QT

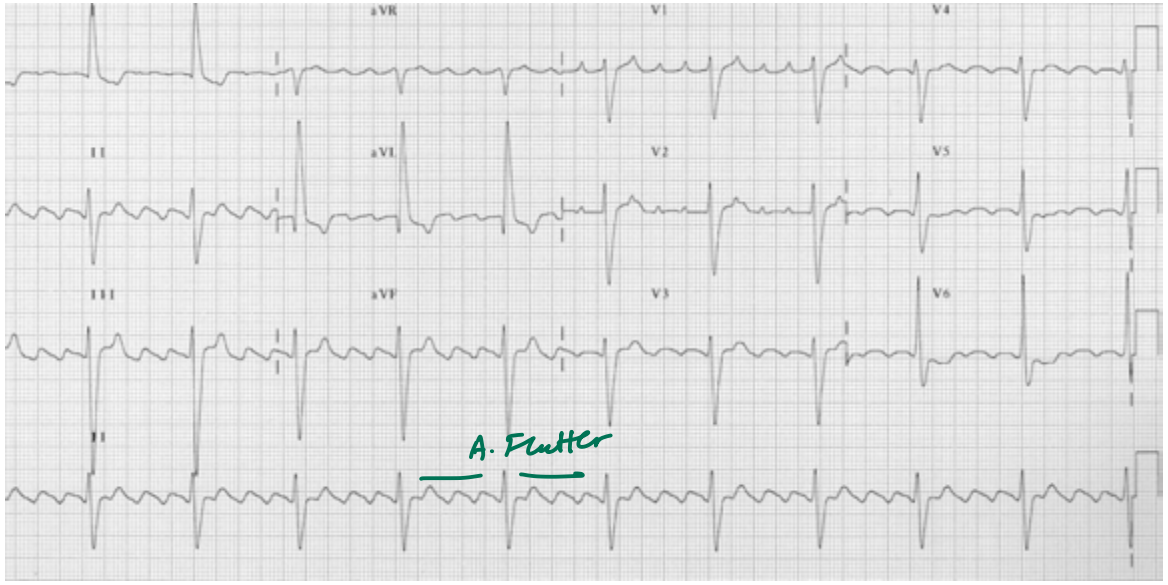
antiDepresents (TCA, SSRI), antiEmetics (eg, ondansetron), (5HT3 ⊖ — except palonosetron — longest)

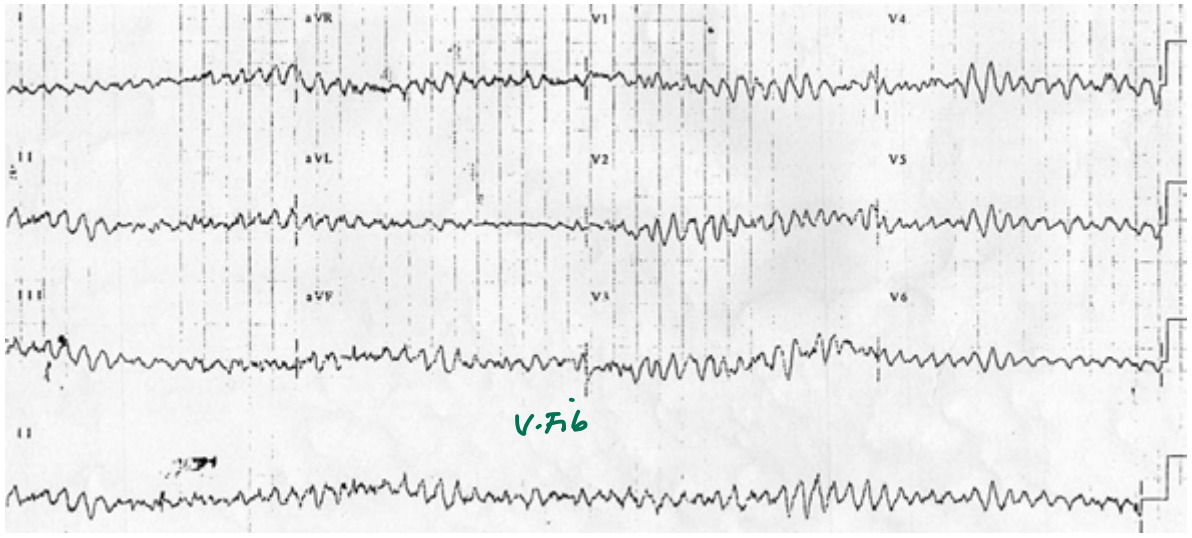
Methadone, Chloroquine, CAT drugs, Navir (Protease inhibitors) (cyp ⊖)

4 Hypo Ca/Mg/K/thermia

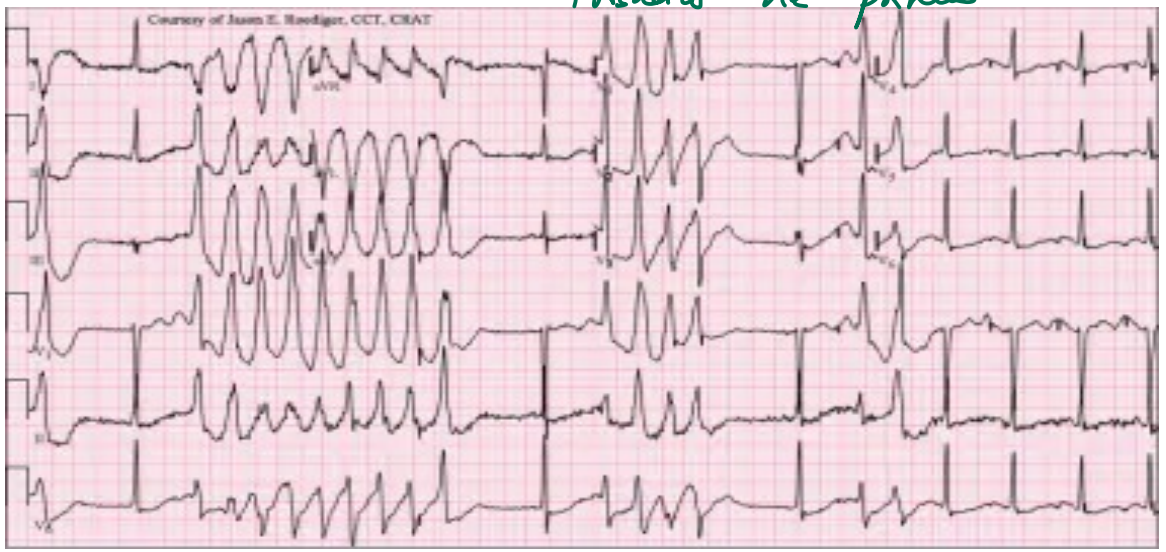
Cisapride – 5HT4 ⊕; Astemizole, Terfenadine — anti-H — cyp 3A4





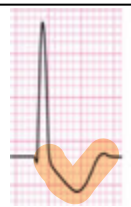


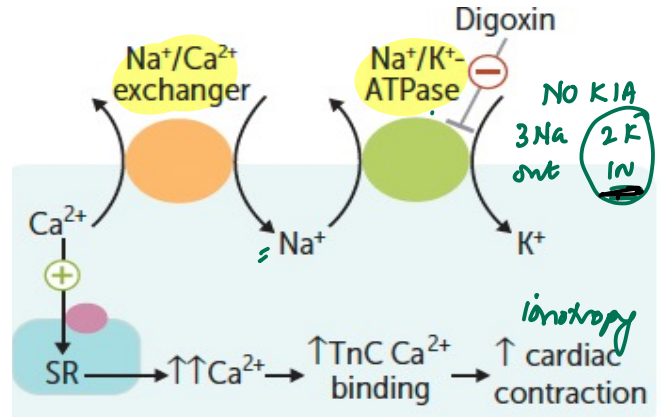
Torades de pointes

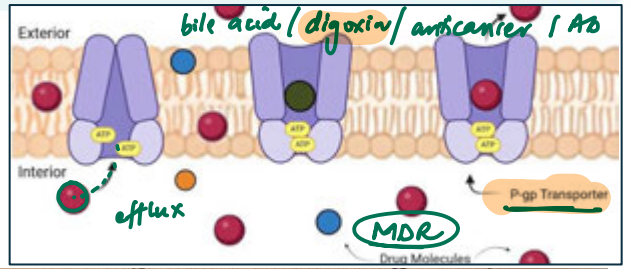


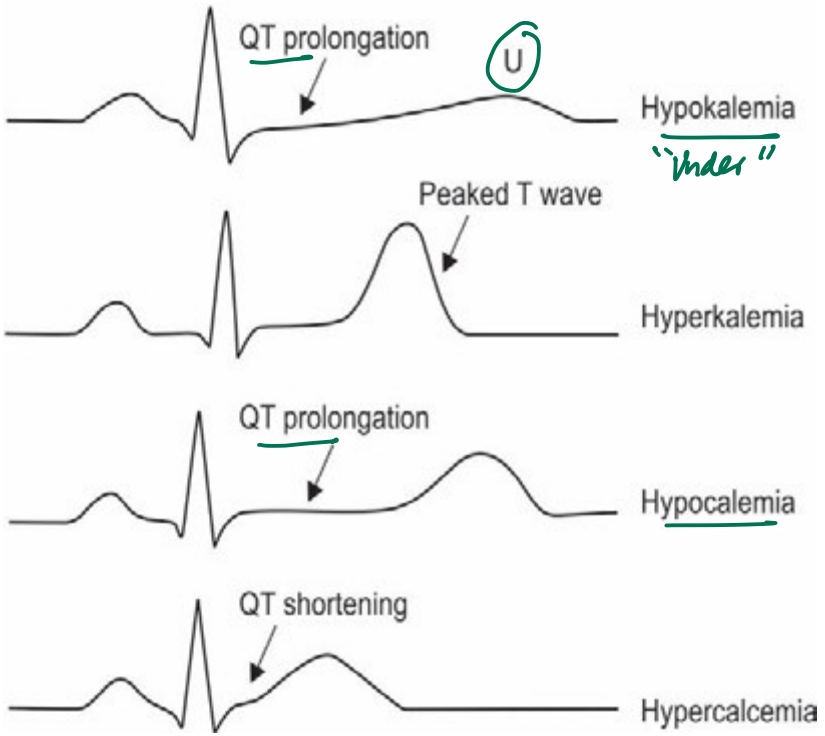
Important ECGs

Digitalis: Foxglove
S/e: Hyperkalemia, Cholinergic, Yellow vision (xanthopsia) — AV node ↓
MC arrythmia: ventricular bigeminy
Most specific: NPAT (nonparoxysmal atrial tachycardia) ± AV block
Shortening of QT interval, Flattened T, Scooped ST depressions-Hockey stick/ Salvador Dali moustache, PR increased
Toxicity ppt: ↓K+ ↓Mg ↑Ca2+ Renal failure
Verapamil / Amiodarone/ Clarithromycin/ Cyclosporine/ Quinidine (ATP binding cassette ⊖)
Rx: DIGI-BIND (Monoclonal Ab) / ventr arry → Lignocaine ↳ cholestatic jaundice





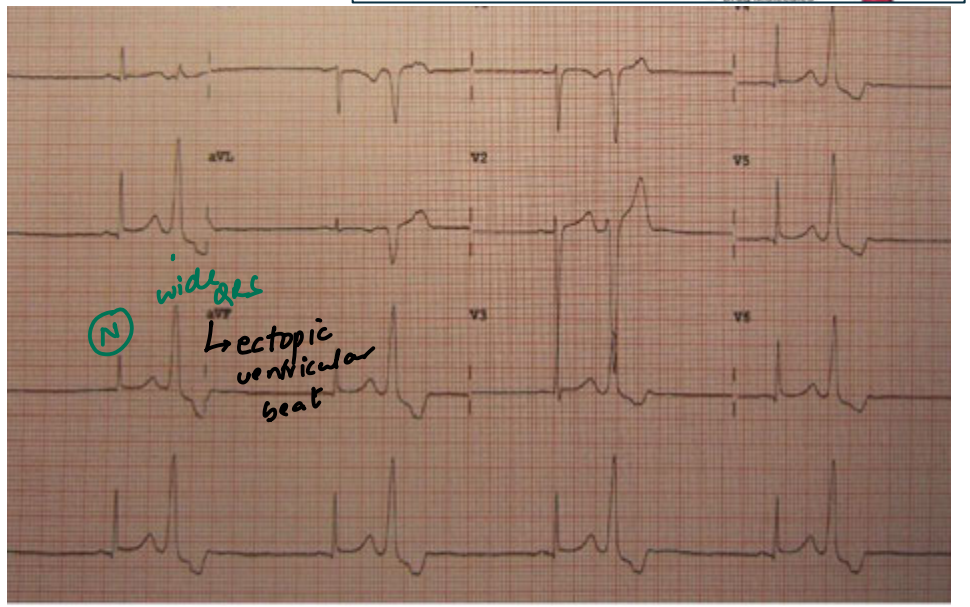




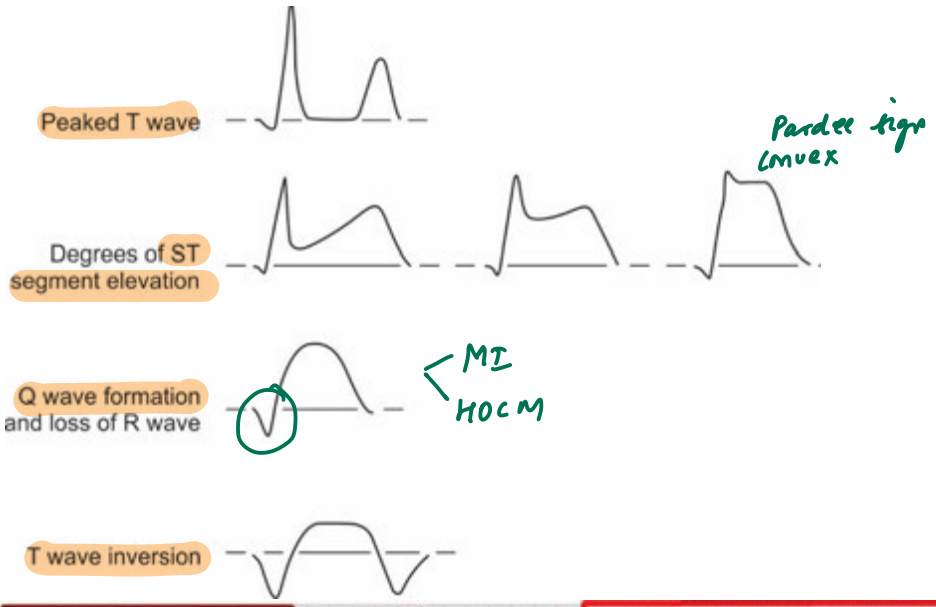
↑K+ K-KILLS

Serum potassium	ECG abnormalities
Mild (5.5-6.5 mEq/L)	Peaked T waves Prolonged PR segment
Moderate (6.5-8.0 mEq/L)	Loss of P wave ST-segment elevation Ectopic beats
Severe (>8.0 mEq/L)	Sine wave Ventricular fibrillation Asystole

↳ 1st: Ca gluconate

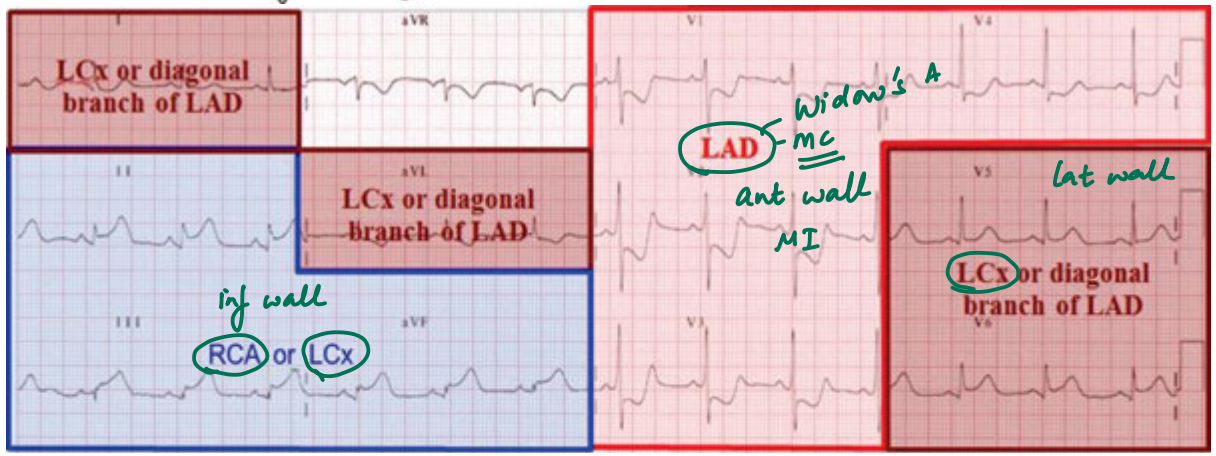


ST elevation



Pardee sign
convex

MI
HOCM



Widow's A
MC
ant wall MI

Posterior (PDA)	V_7-V_9, ST depression in V1-V3 with tall broad R waves, upright T waves VS NSTEMI: Inversion of T waves

Acute pericarditis
- mcc: viral
Coxsackie
mumps.

- sitting forwards

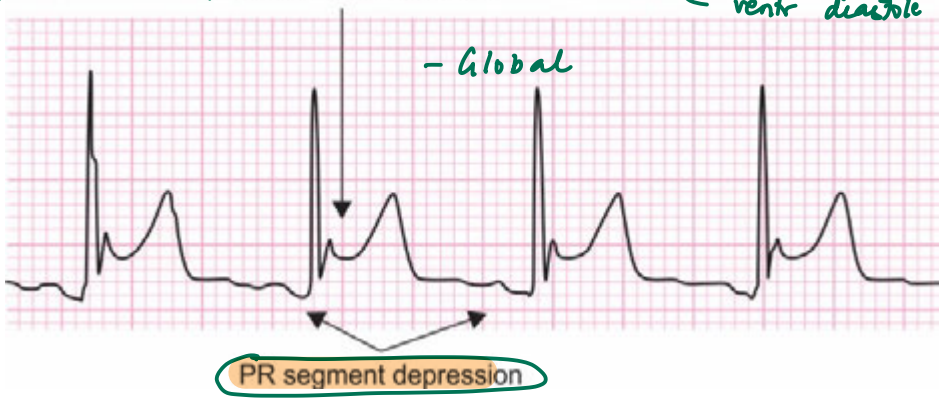
Acute chest pain + Pericardial rub

Rx: NSAIDs

triphasic - atrial syst
ventr syst
ventr diastole

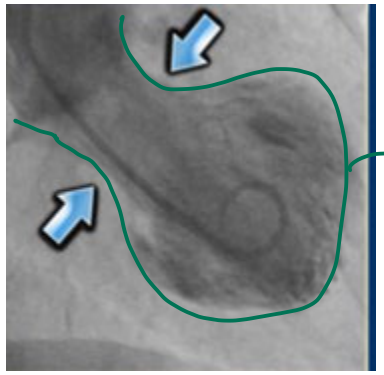
Concave-up ST elevation

- Global



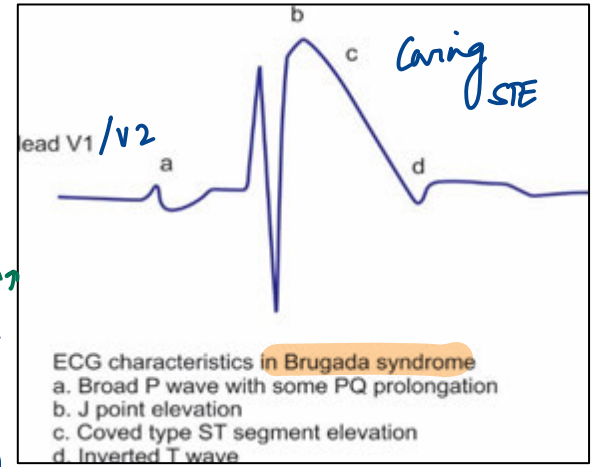
- Ventricular aneurysm
- Prinzmetal angina- vasospasm
  transient
- Takotsubo CMP - stress induced

Broken ♡ Sx
catecholamine ↑↑



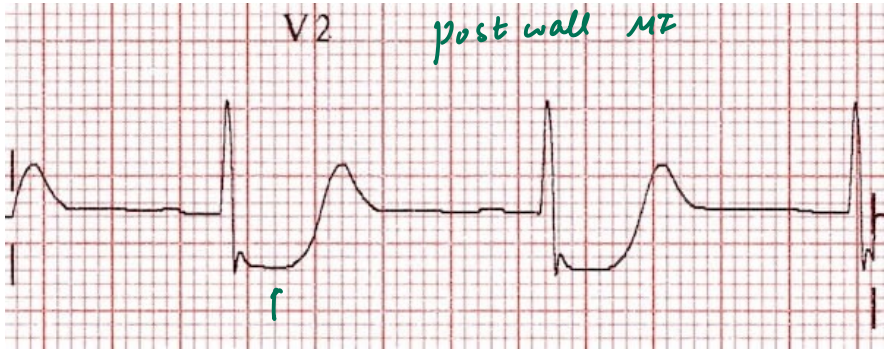
apex ballon
contracn

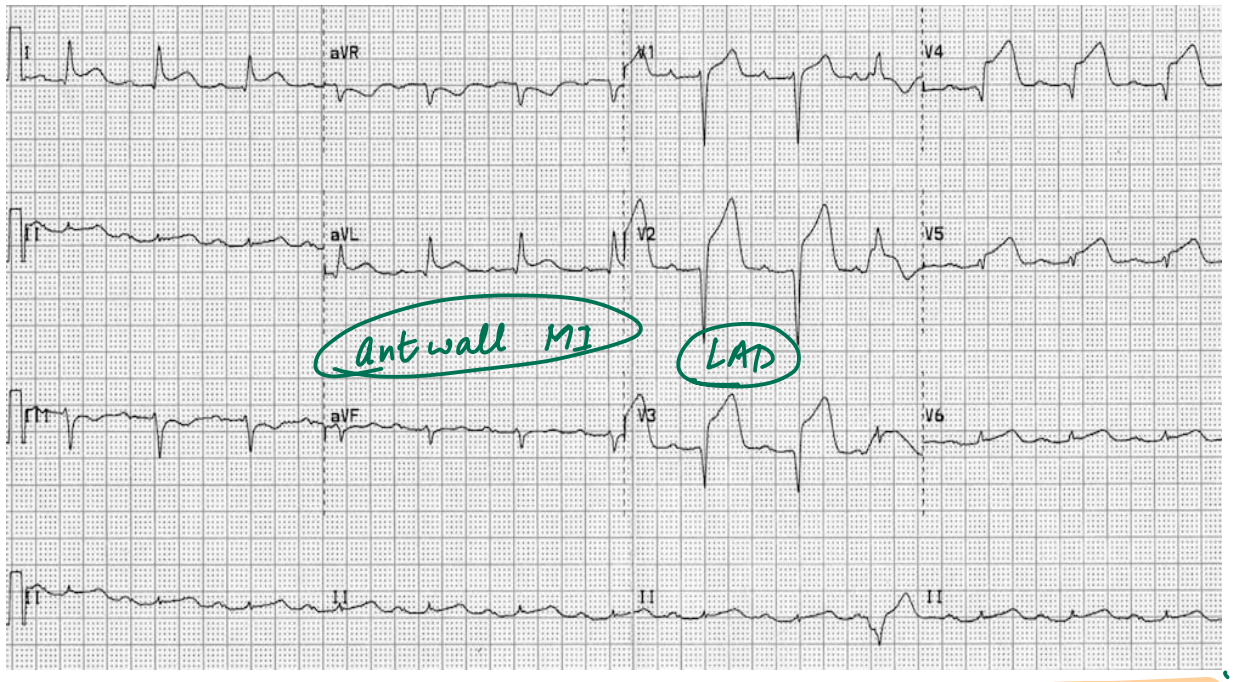
. STEMI
. Trop↑
. coronary angio (N)

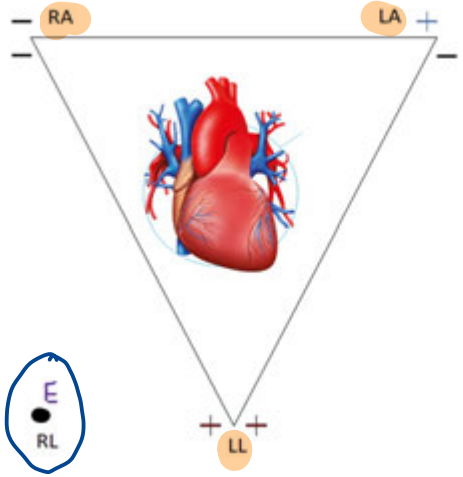


Loss-of-function SCN5A
Pseudo-RBBB
AD

Rx - ICD.

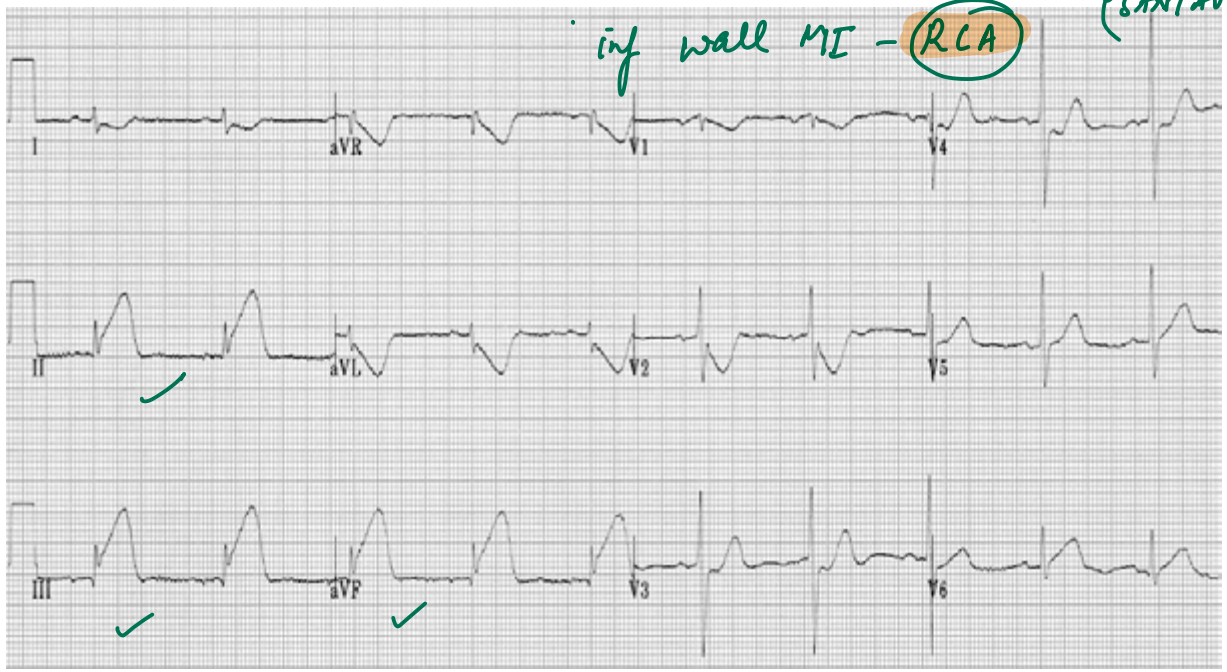




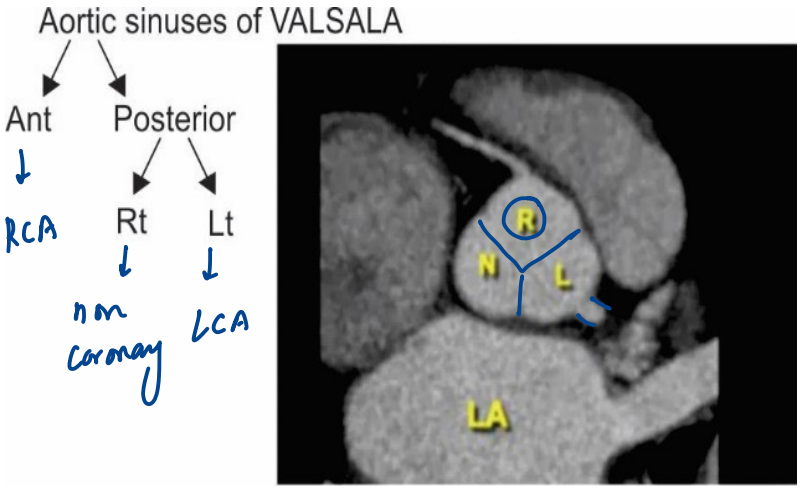


Eithoven law :

$I + III = II$



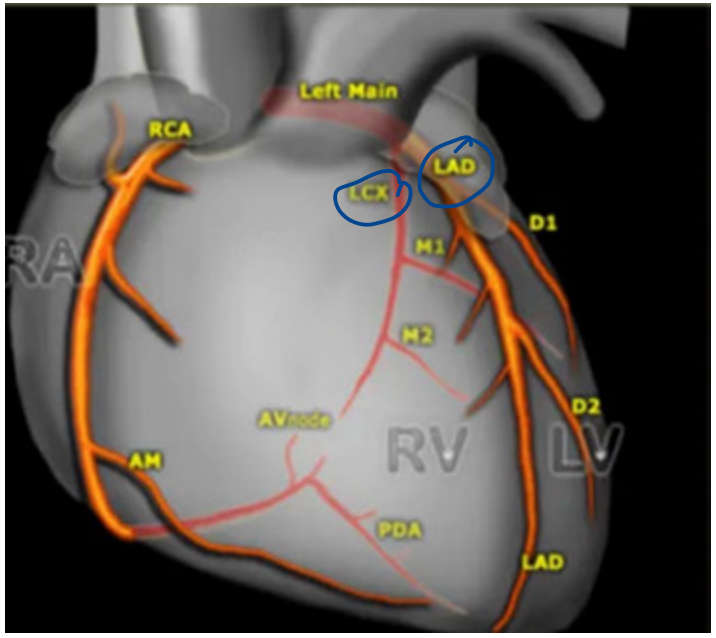
Anatomy of Coronary Circulation



RCA: C - conus

- A - AVN / SAN
- M - Acute marginal - lat wall RV

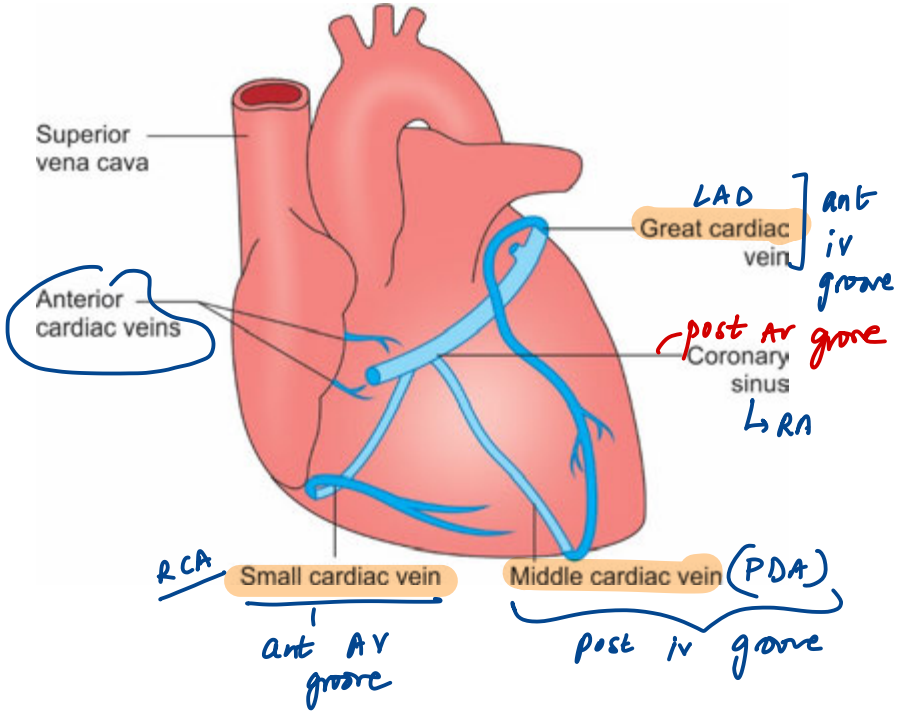
85% P - PDA → PIVA post 1/3 septum, post walls



LCA

LAD: AIVA
- diagonal = ant wall LV
- septal = ant 2/3 septum

LCX: obtuse marginal → lat wall LV



Coronary sinus except:

ant cardiac veins - RA

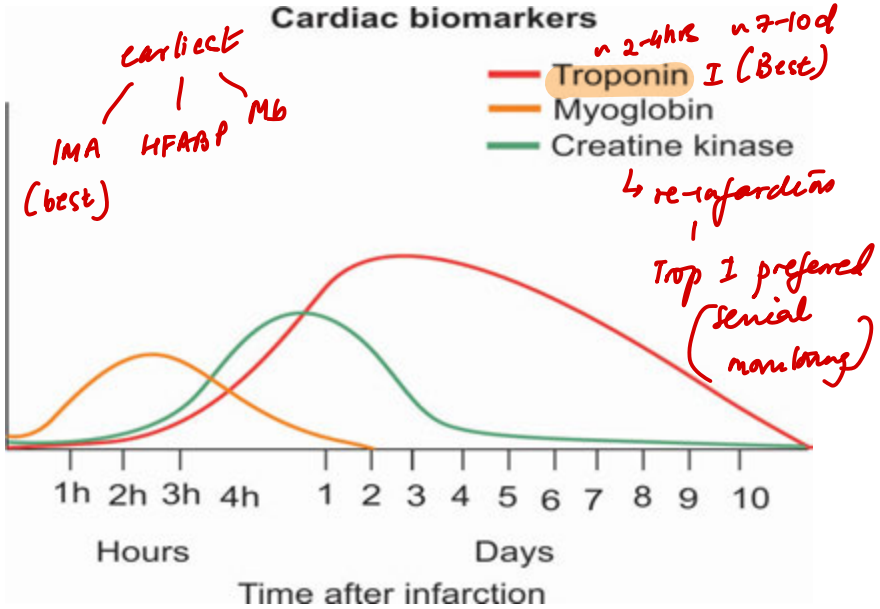
Myocardial Infarction

	Stable angina	Unstable angina	NCTEMI	STEMI	Prinzmetal angina
PAIN	Exercise		Rest / exercise		
TROPONIN	−	−	↑	↑	−
ECG	N	ST T	↓ ↓	ST ↑	transient ST ↑
INFARCTION	−	−	Subendocar	transmural	−
MGT	β-blockers (↓ demand) HR↓ ↓inotropy	Fibrinolytic	CI LMWH DOC aa	PCI / Fibrinolytic	CCB (DHP)

MONA
- morphine
- O_2 (<94%)
- nitrates (↓preload) ⊗ inf wall MI
- aspirin

Statins

Aspirin ± Clopidogrel / Prasugrel

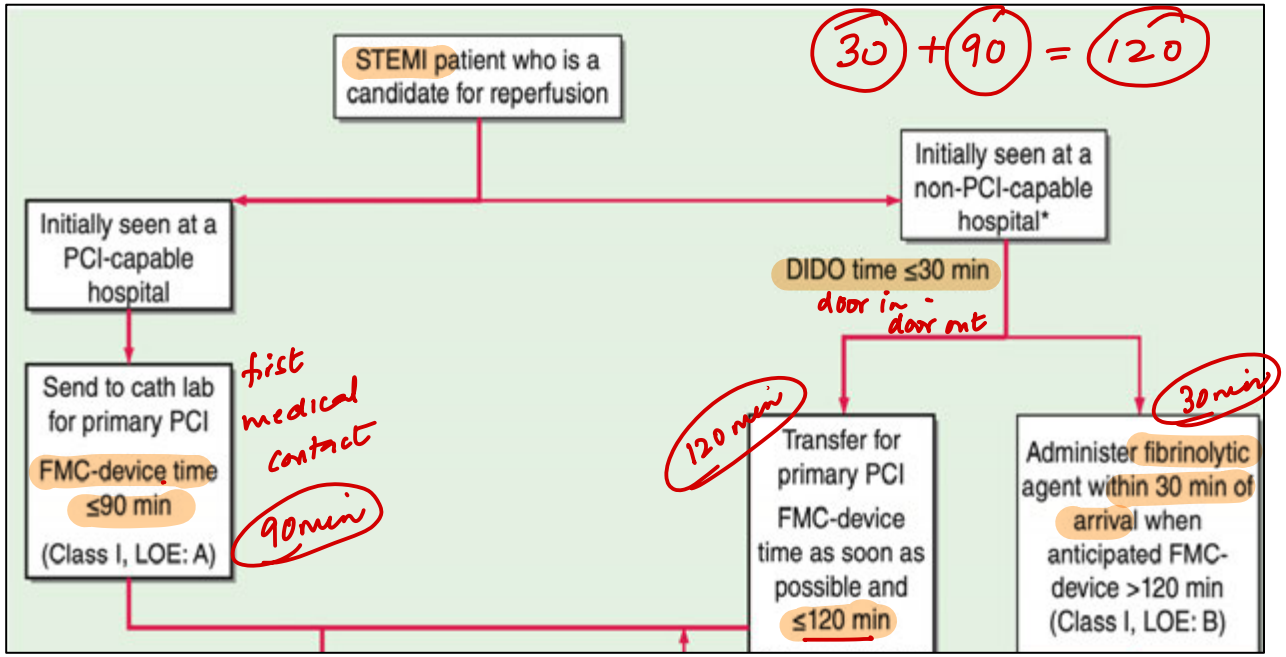


NSTEMI

Immediate PCI:
- Hemodynamic unstable
- V. tachycardia
- Heart failure

Early PCI (<24hrs)
- New ST changes, Trop ↑

Delayed PCI:
- DM (silent MI)
- Prior CABG /PCI

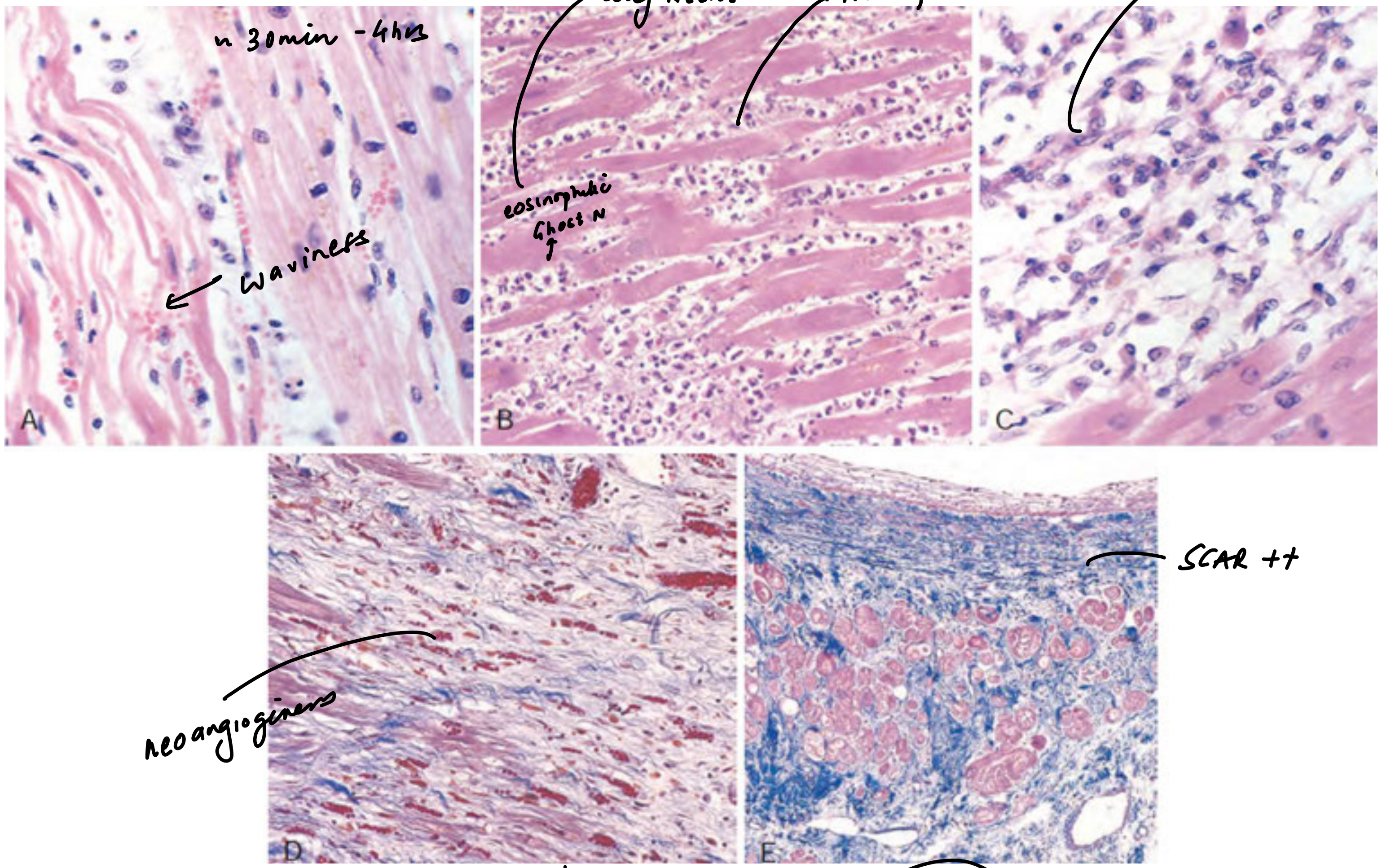


Type 1: Spontaneous MI d/t plaque erosion/ rupture, dissection
Type 2: MI due to ischemia secondary to increased demand or decreased supply
Type 3: Sudden cardiac death due to MI → V. tach / fib
Type 4: MI associated with PCI (4a) / stent thrombosis (4b)
Type 5: MI associated with cardiac surgery

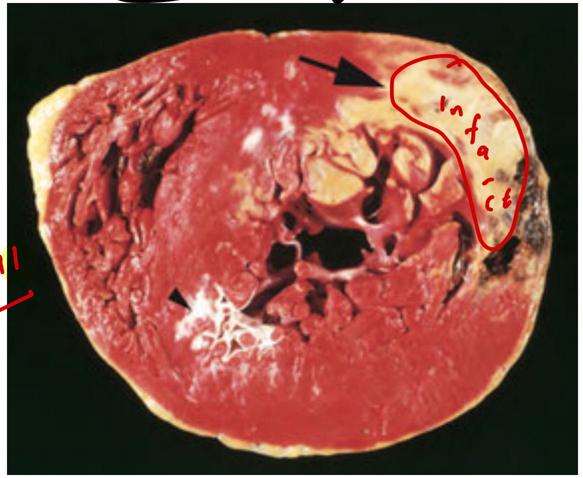
Complications of MI	Timeframe
Cardiac arrhythmias	MCC of death in 1st 48 hr
Peri-infarction pericarditis	1–3 days
Papillary muscle rupture Posteromedial > anterolateral papillary muscle rupture	2–7 days
Interventricular septal rupture (VSD)	3–5 days
Ventricular pseudoaneurysm	3–14 days
Ventricular free wall rupture	5–14 days
True ventricular aneurysm	2 wks to several months
Post-cardiac injury syndrome (Dressler syndrome)	Weeks to several months Autoimmune
Stunning	acute – ischemia ↓↓ metabolism
Hibernation	chronic – ischemia ↓↓ metabolism

Pathology in Myocardial Infarction

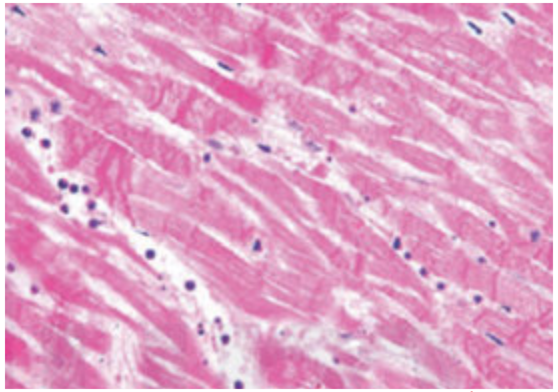
E/M : mitochondrial swelling ~sec
L/M : ≥30min → earliest – waviness
Gross : ≥4hrs.



LDY – TTC triphenyl tetrazolium Cl⁻

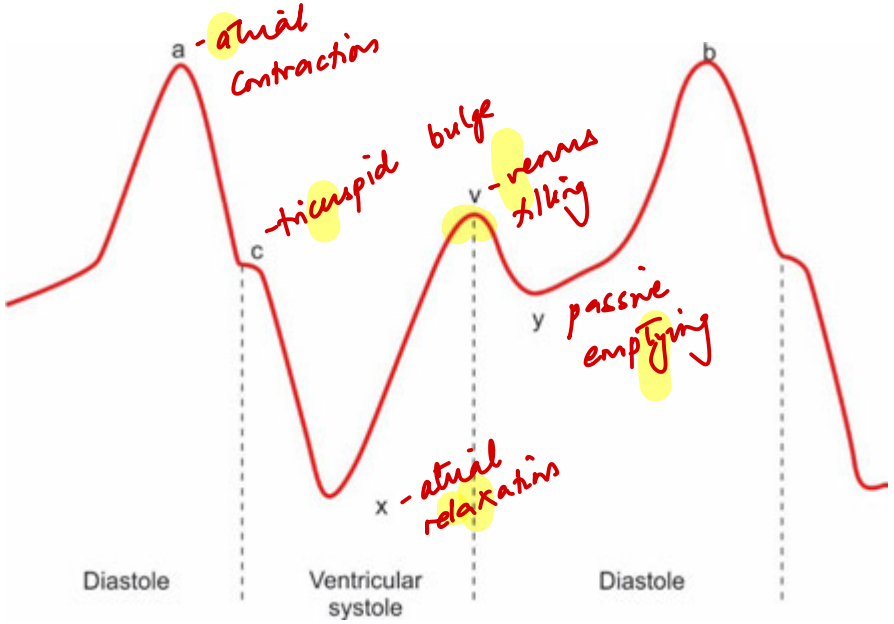


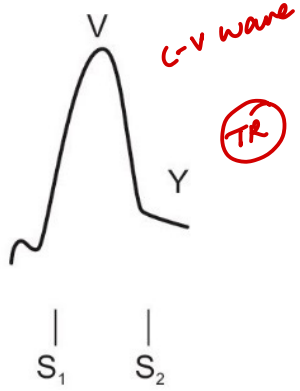
MI: Flipping of LDH
(N) LDH2 > LDH1



contrac^n bands   free radicals
Reperfusion injury

JVP (RAP)

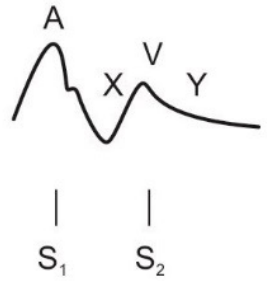




Large "V" wave

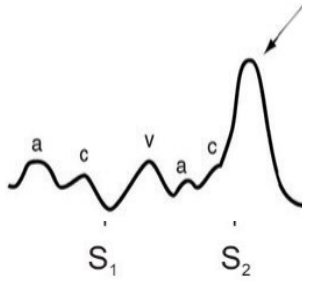
Lancisi sign

& TS / PS / PAH



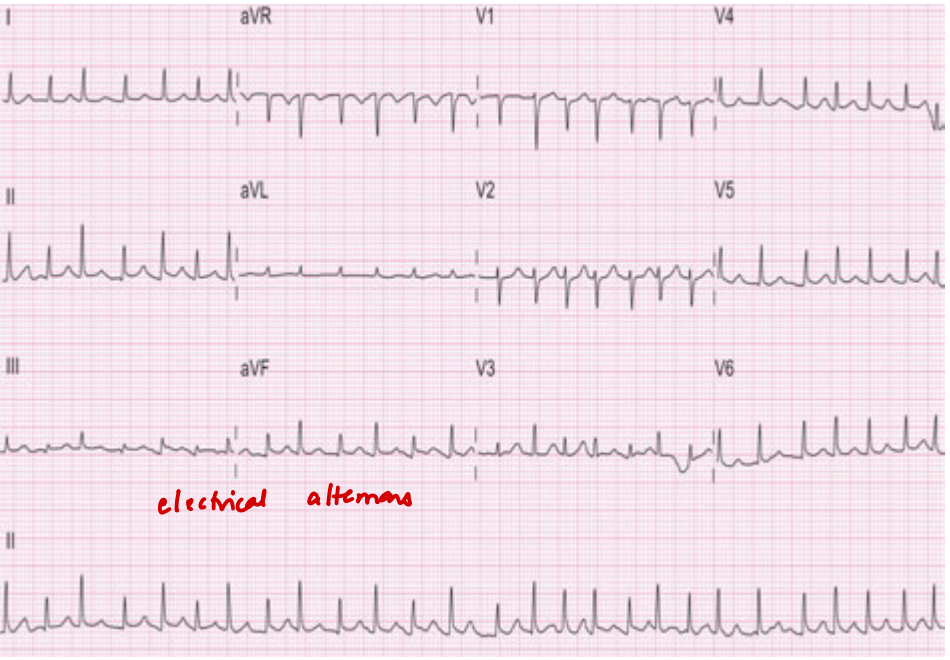
Large "A" wave

AV dissoc^n



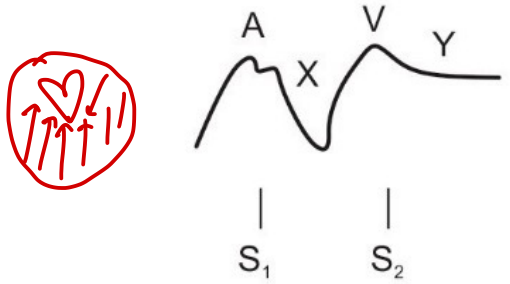
Cannon "A" wave

absent a waves
↳ a Fib



electrical alternans

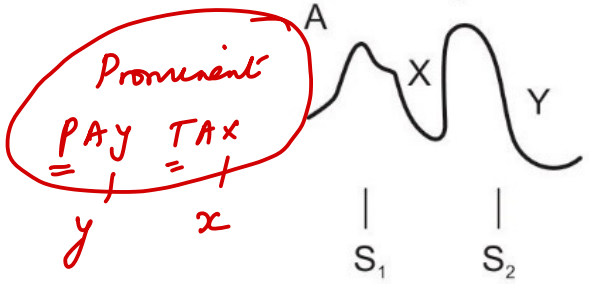
Tamponade



Loss or blunted "Y" descent

Constrictive pericarditis

Prominent PAY TAX



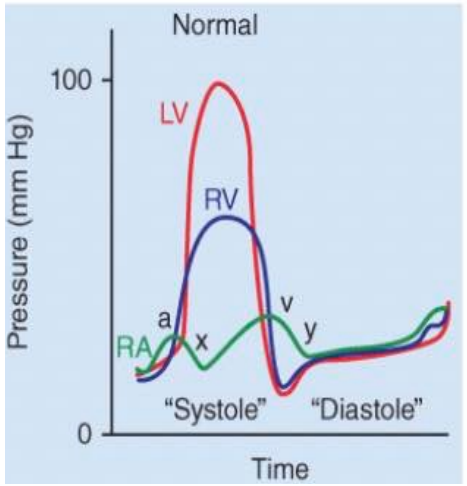
Prominent "X" and "Y" descent

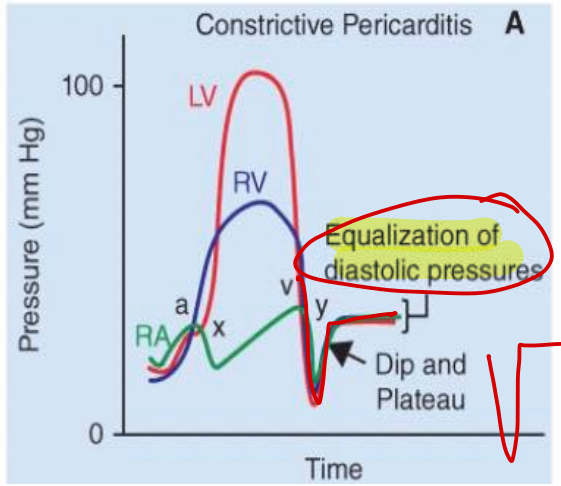
calcified ↑ egg in cup sign

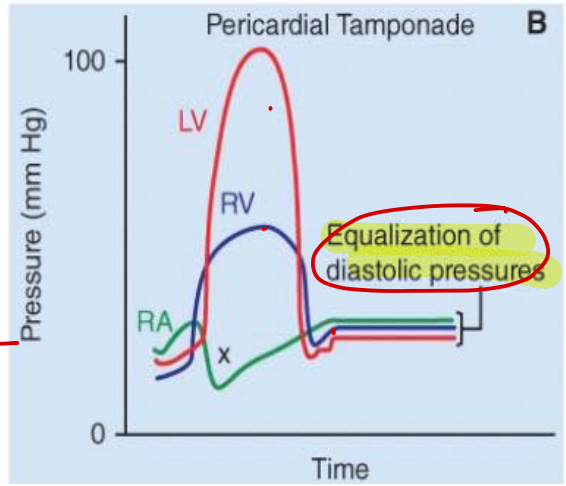
inspir – R ↑ – (N) JVP fall

Beck's triad : shock + JVP ↑ + muffled ♥ sounds
Ewart sign dull - interscap
Diastolic collapse
ECG: electrical alternans

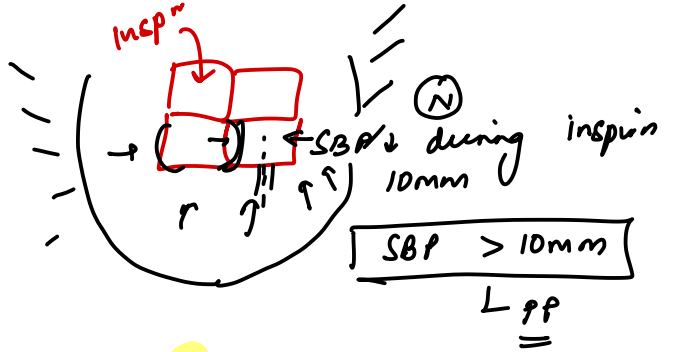
Kussmaul sign : paradox ↑ in JVP during inspir
Pericardial knock – early diastolic sound
ECG: voltage ↓↓ ECG
Square root sign in pressure waveform √







Pulsus paradoxus: tamponade / pericarditis.
└ COPD / asthma / massive PE
Reverse pulsus paradoxus: PPV – squeeze p. Capillaire
└ ↑ in SBP during inspir
HOCM
LA preload ↑



Pulse

A Normal pulse

AS

B Hypokinetic (weak) pulse

Pulsus parvus et tardus

C Hyperkinetic (bounding) pulse

↑↑ volume

Hypovolemic states

pregnancy
AVF
Thyrotoxicosis
Beriberi
AR

S3

D Bigeminal pulse

E Pulsus alternans

LVF

Frank Starling

F Waterhammer (collapsing) pulse

G Pulsus bisferiens

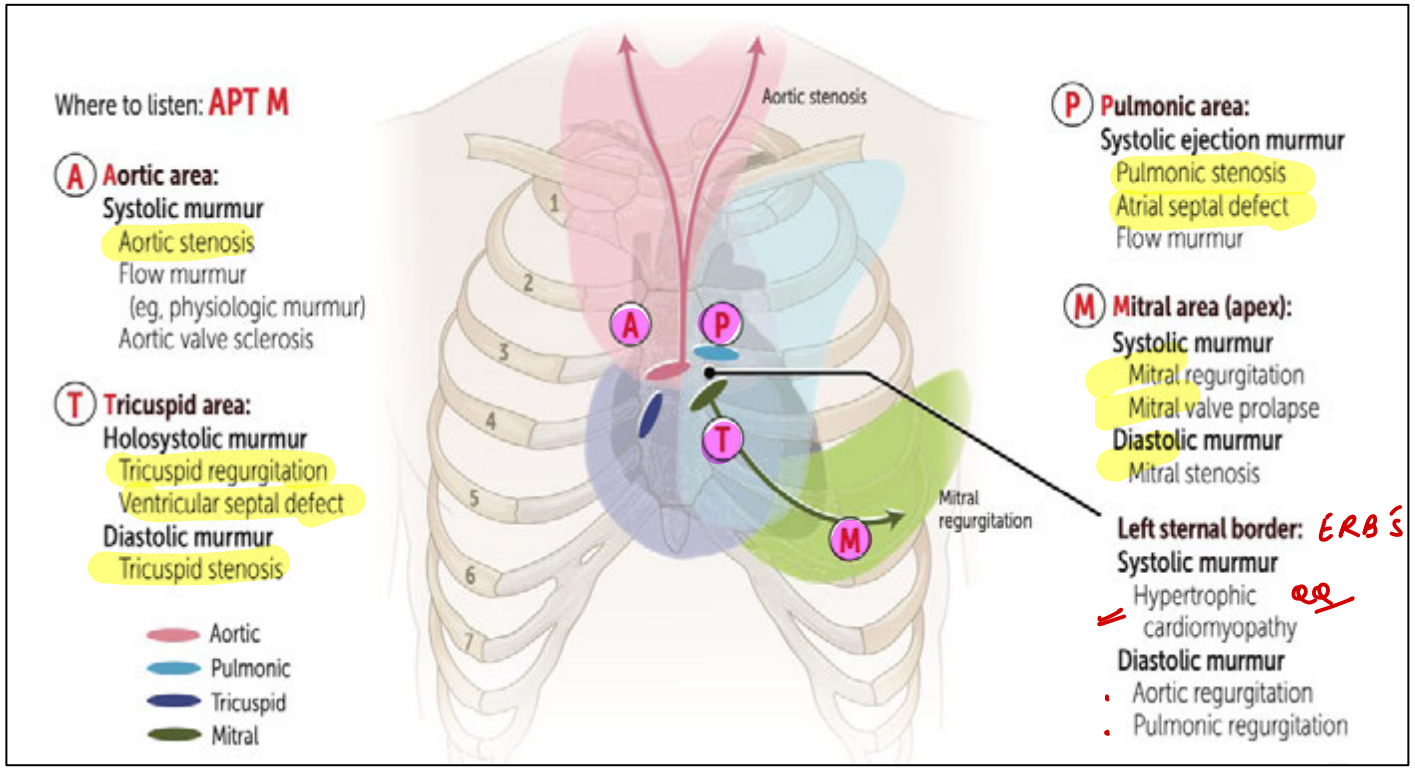
Pseudo-collapsing pulse: MR

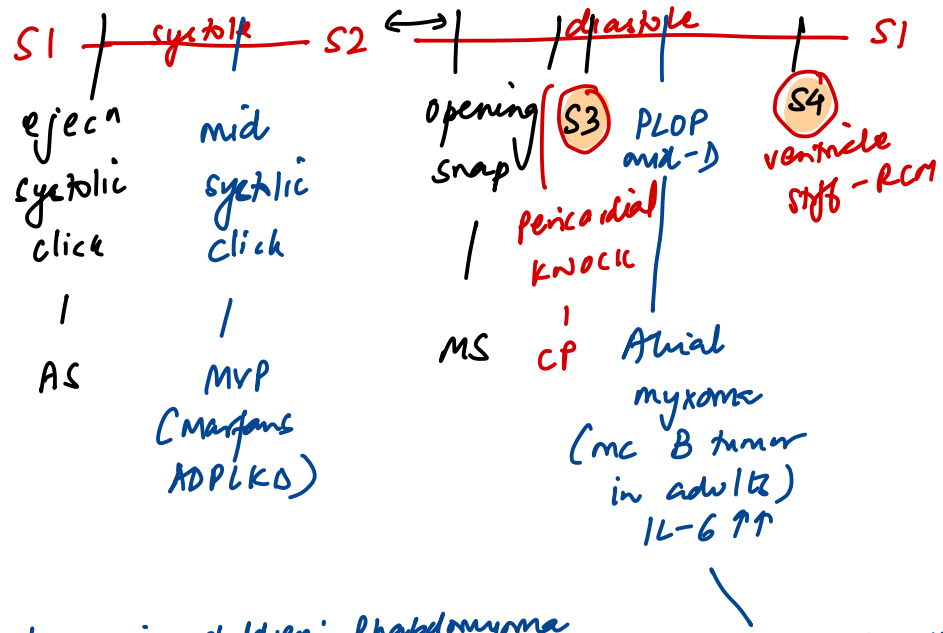
AR

Corrigan sign - Carotid
Muller sign - uvula
Landolfi sign - pupil
Quincke sign - capillary ↑↑
deMusset sign head nodding
Hill sign popliteal / UL pulse

SBP >20mm

Heart sounds



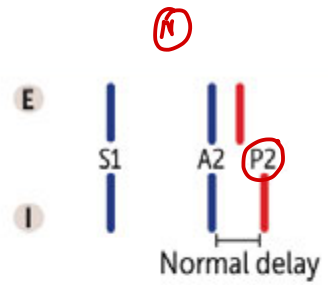


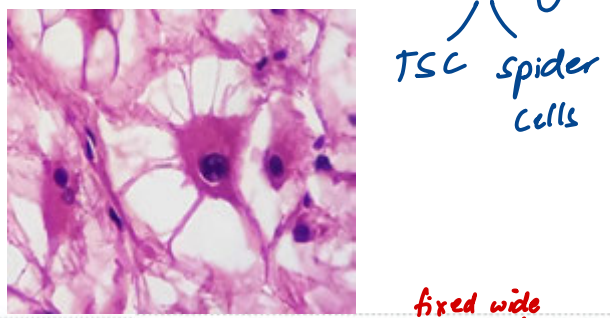
S3, S4, Tumor plop, MS/ TS: Low pitch- Bell

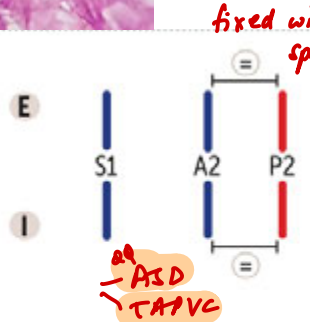
S1 – AV close

Loud S1: MS, Reduced PR (WPW-Child), Hyperdynamic circulation

Soft S1: MR/TR, CHF, Calcified valves, Prolonged PR (1st degree heart block)





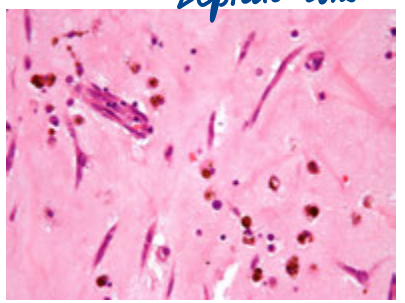


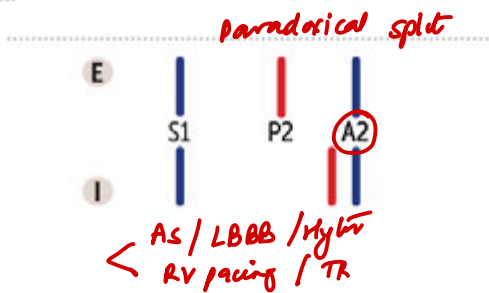
mc tumor in children: Rhabdomyoma

TSC

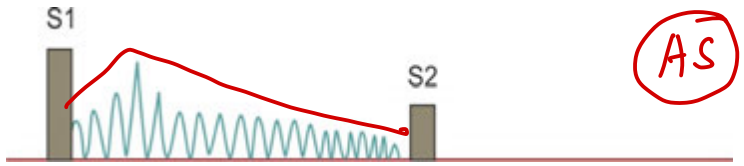
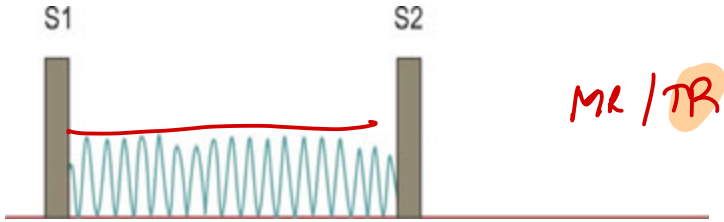
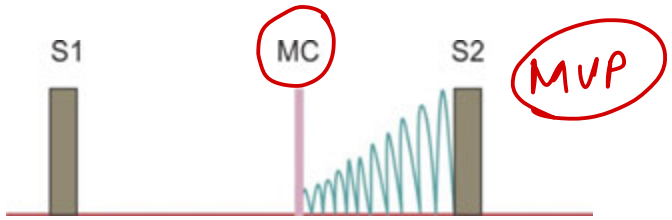
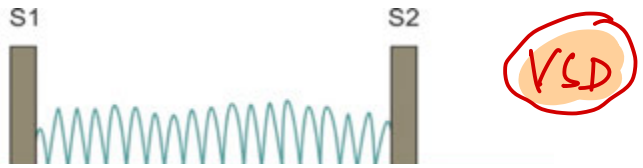
Spider cells

Lepidic cells





Valvular Diseases

Systolic	
	- Crescendo-decrescendo ejection murmur, radiates to carotids - Gallavardin phenomenon = radiatn to apex
	- Holosystolic, high-pitched "blowing" murmur - MR: Loudest at apex, radiates toward axilla - TR: loudest at tricuspid area
	- Late crescendo murmur with midsystolic click (MC) that occurs after carotid pulse - Best heard over apex
	- Holosystolic, harsh-sounding Loudest at tricuspid area

Still's murmur

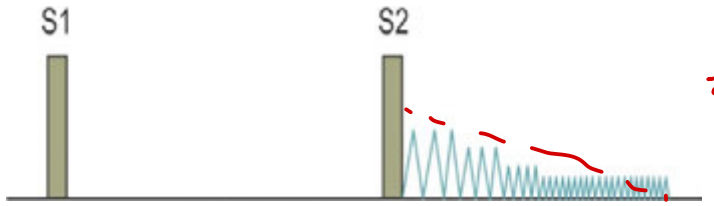
Benign flow murmur due to increase CO in peds

Early systolic murmur: acute MR

Carnvello sign

Early systolic in TR on deep inspiration

Diastolic

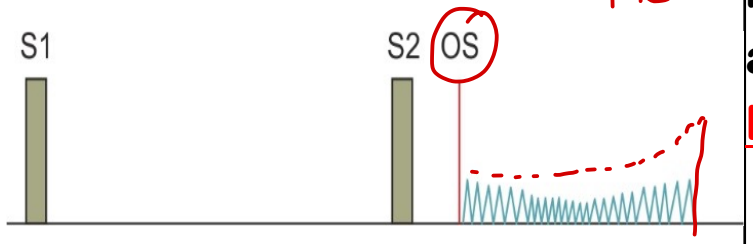


-Early diastolic, decrescendo, high-pitched "blowing" murmur

AR

Graham Steel

Early diastolic murmur in PAH



MS

-Delayed rumbling mid-to-late murmur with presystolic accentutation (Low pitch: Bell)

Lost in: A-Fib

(↓ interval between S2 and OS correlates with ↑ severity)

Symptomatic/ Severe: MVA

<1.5cm² / Afib. / PAH → MV replacement

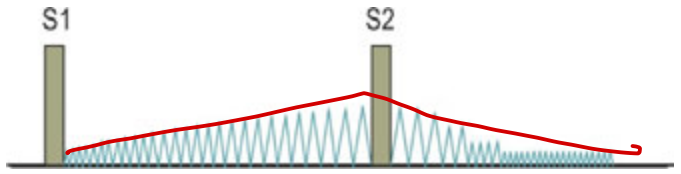
Austin Flint

Mid-diastolic, rumbling, low-pitched in AR

CAREY - comb

Mid-diastolic, short, ARF

Continuous



Continuous machine like murmur, best heard at left infraclavicular area

PDA

Heart Murmurs

Preload reduce (Valsalva/ Standing/ Nitroglycerin): murmur ↓ (vd) =

Preload increase (Passive leg raise/ Squatting/ Phenylephrine): murmur ↑ (vc)

except

HOCM
=
MVP

Afterload reduce (Amyl Nitrite): murmur ↓ (vd)

except

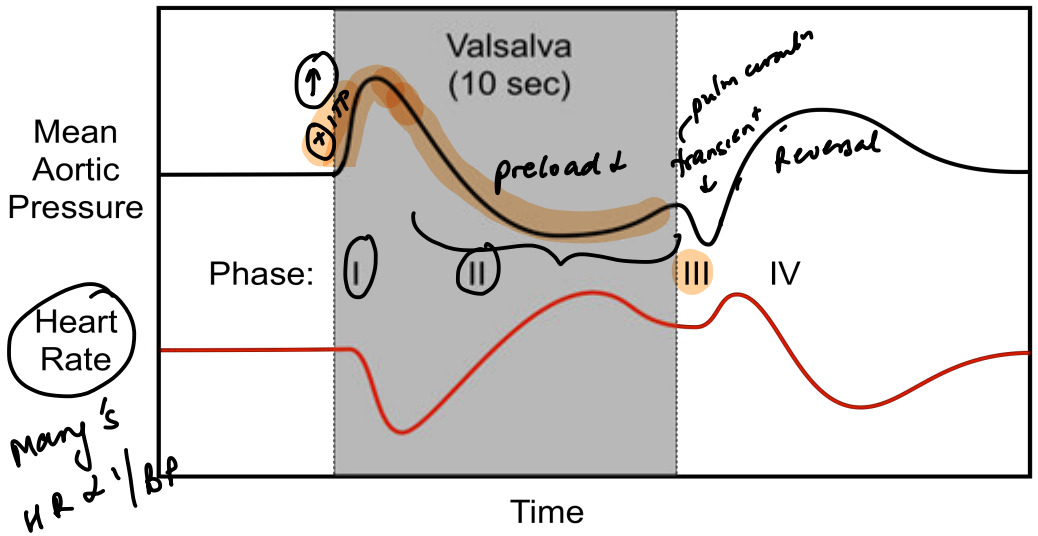
HOCM
AS

Afterload increase (Handgrip): murmur ↑

Inspiration: (R) murmur ↑

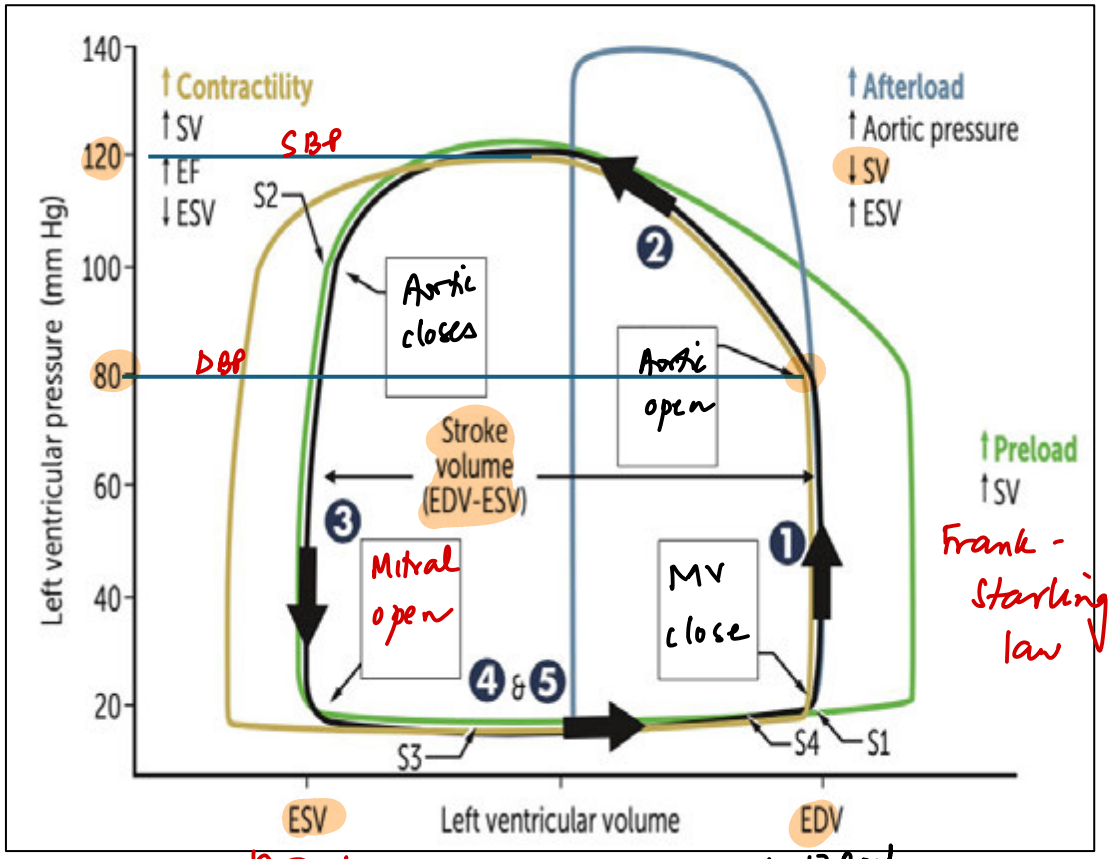
HOCM (Rx) - ICD + β-blockers

CI: Diuretics
Ionotropes



Forceful expiration against closed glottis

Pressure Volume Curves

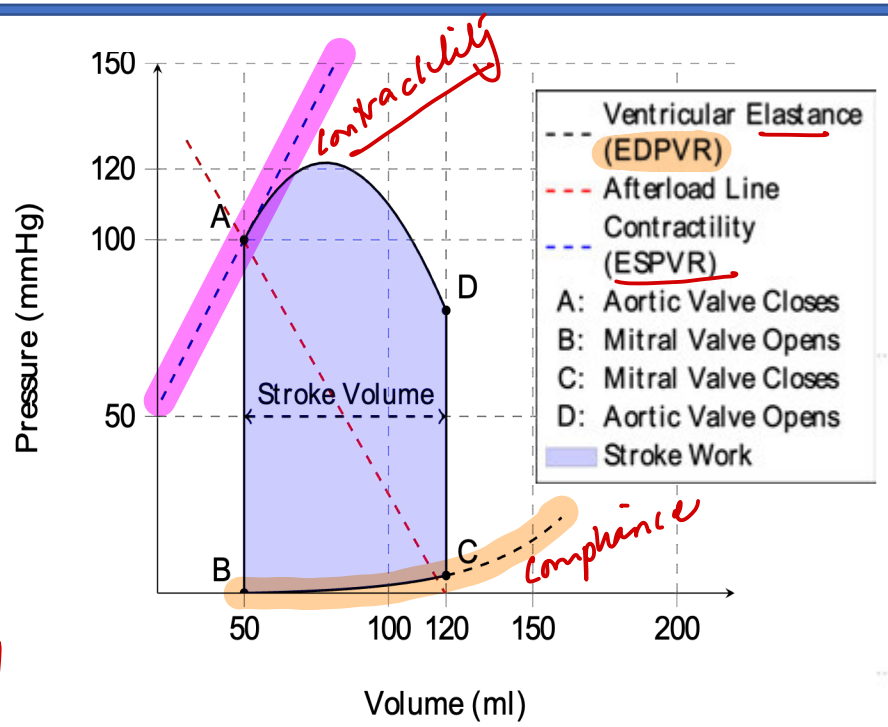


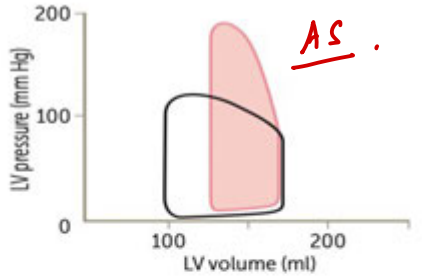
Frank - Starling law

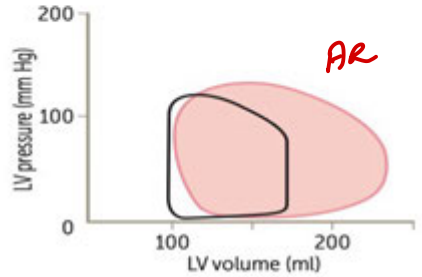
~50 ml

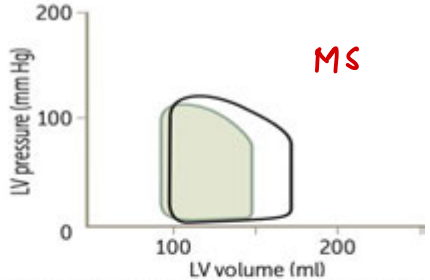
~120 ml

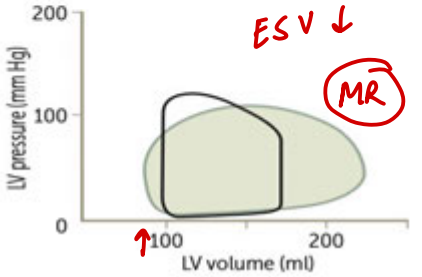
$= \frac{70}{120} \times 100 \sim 58\%$











$$EF(\%) = \frac{EDV - ESV}{EDV} * 100$$

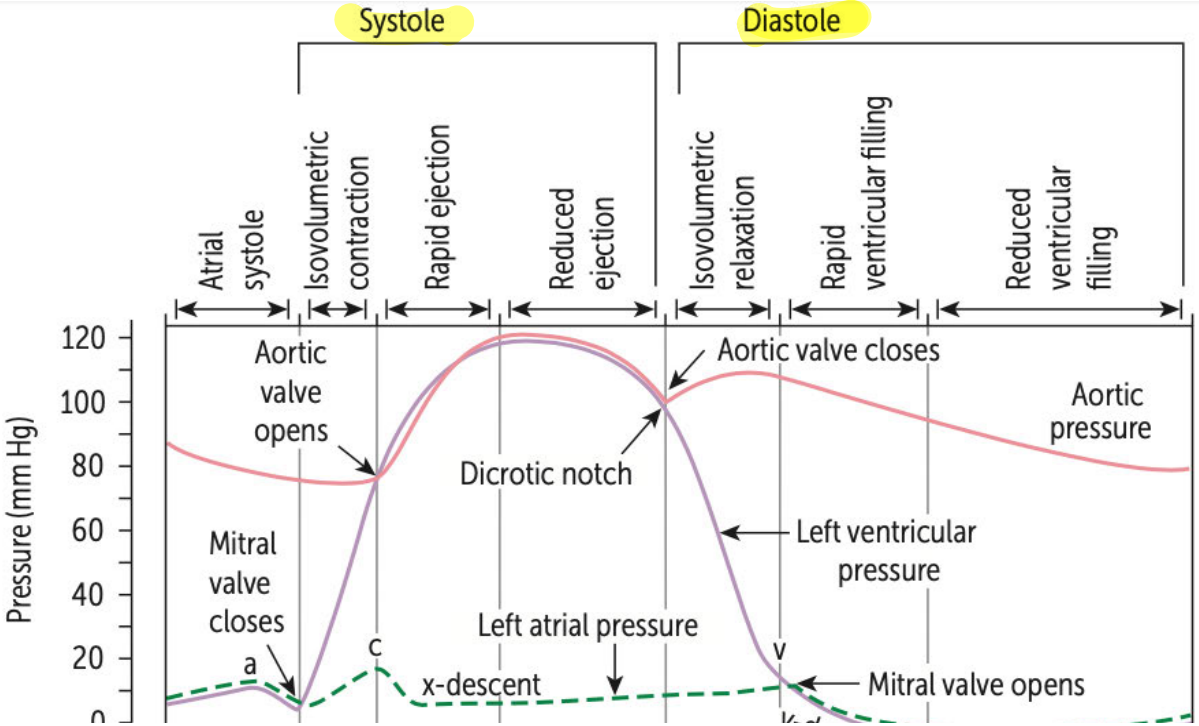
$$CO = SV \times HR$$

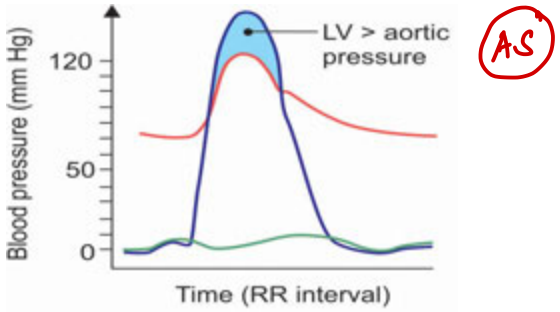
Cardiac index: CO / BSA

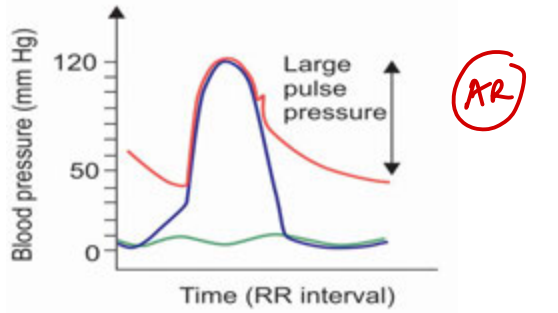
FICK'S LAW

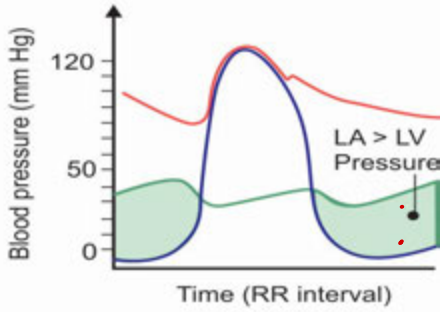
$$\text{Cardiac output} = \frac{\text{Total } O_2 \text{ Consumption}}{[O_2]_{\text{pulmonary vein}} - [O_2]_{\text{pulmonary artery}}}$$

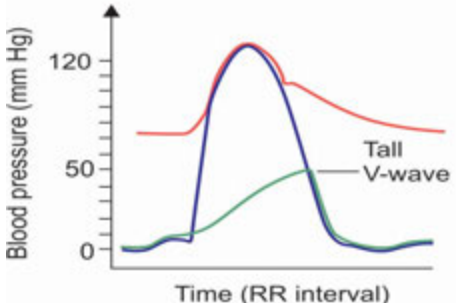
(N) EF = 55-65%.


Systole
Diastole
Atrial systole
Isovolumetric contraction
Rapid ejection
Reduced ejection
Isovolumetric relaxation
Rapid ventricular filling
Reduced ventricular filling
Pressure (mm Hg)
120
100
80
60
40
20
Aortic valve opens
Aortic valve closes
Aortic pressure
Dicrotic notch
Left ventricular pressure
Mitral valve closes
a
c
x-descent
Left atrial pressure
v
Mitral valve opens


Blood pressure (mm Hg)
120
50
0
LV > aortic pressure
Time (RR interval)
AS

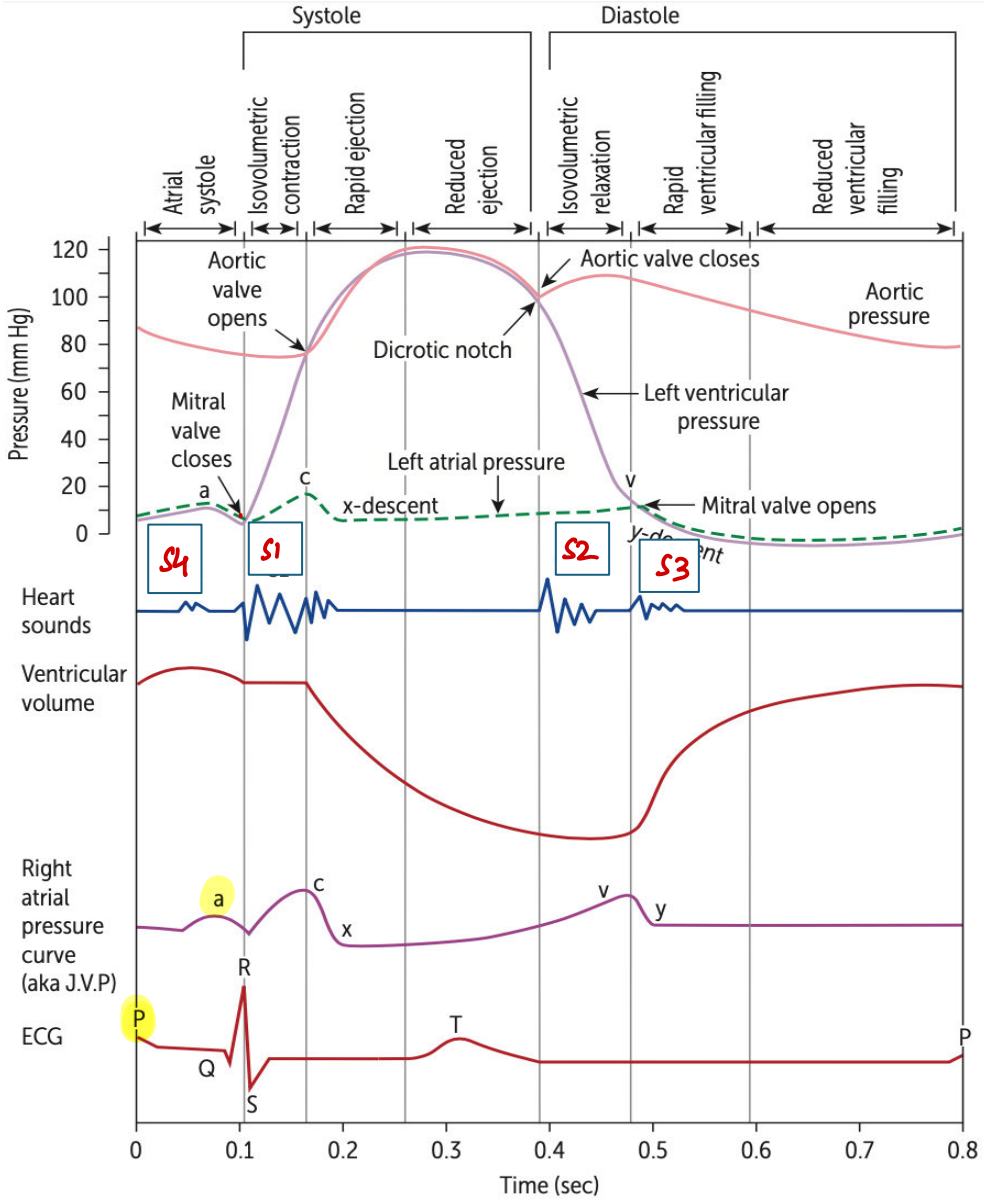

Blood pressure (mm Hg)
120
50
0
Large pulse pressure
Time (RR interval)
AR


Blood pressure (mm Hg)
120
50
0
LA > LV Pressure
Time (RR interval)
MS


Blood pressure (mm Hg)
120
50
0
Tall V-wave
Time (RR interval)
MR

Wigger's Diagram

max HR: 220 - age.

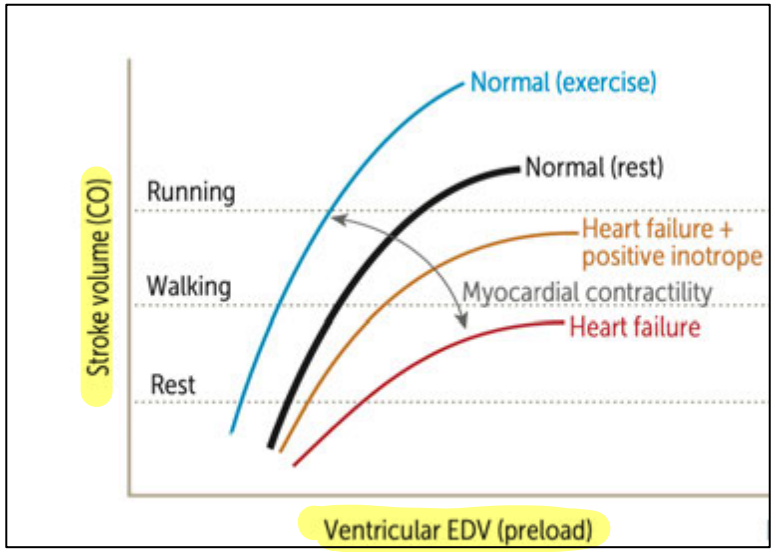


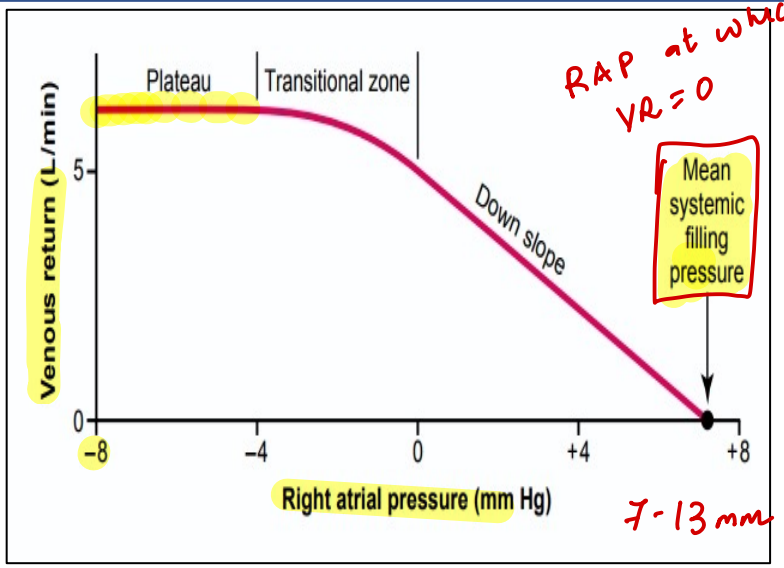
Cardiac cycle: 60/HR		
0.8s	Atria	Ventricle
Systole	0.1s	0.3s
Diastole	0.7s	0.5s

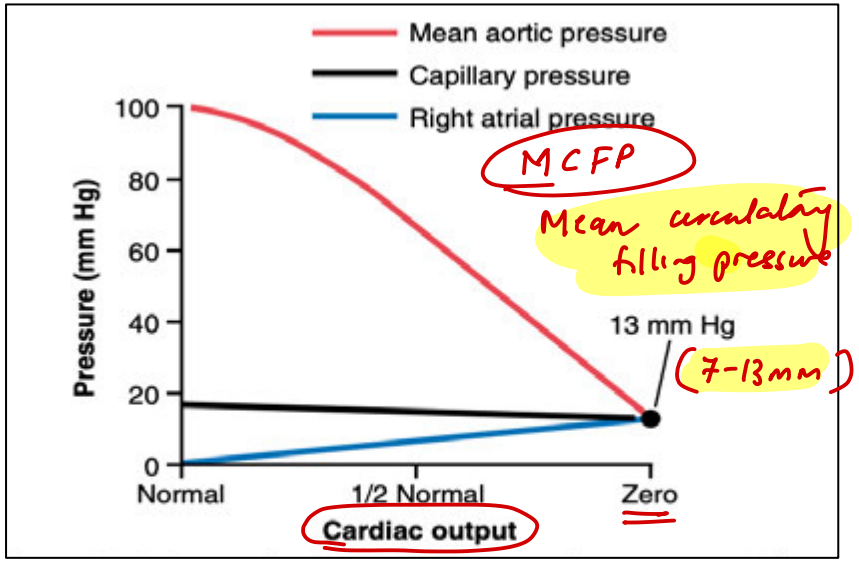
Coronary circ

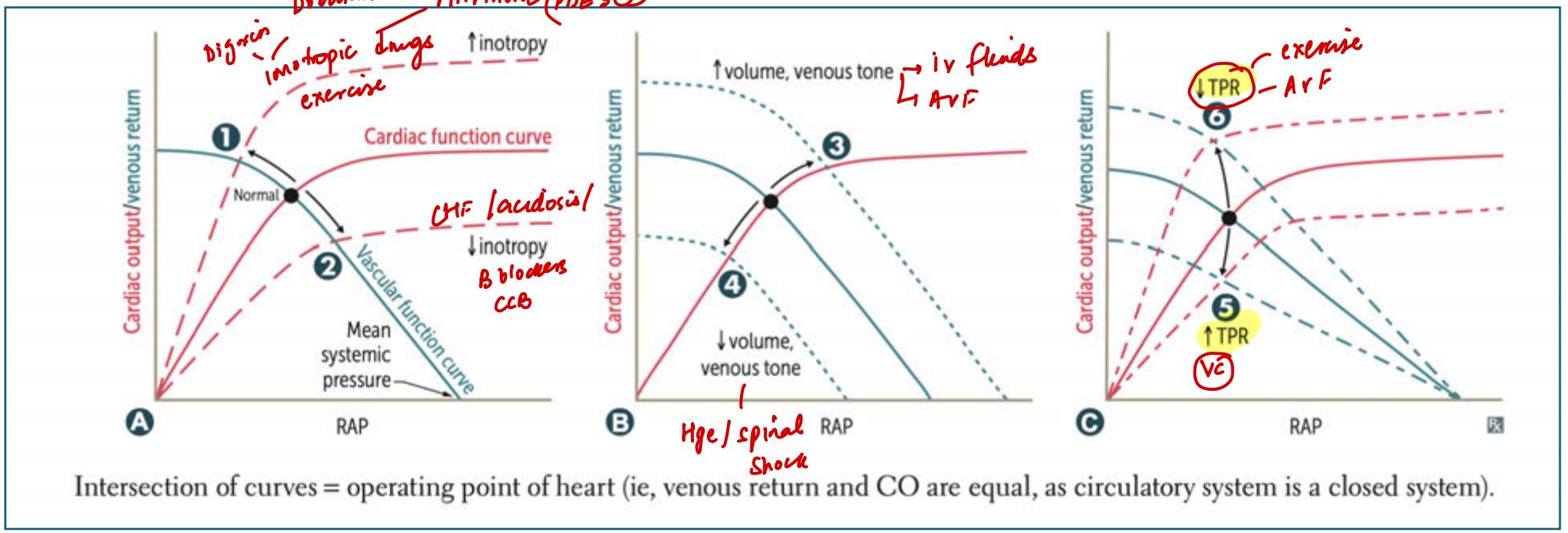
P a4 QRS 1 cx T 2dn v 3y

Graphs


Normal (exercise)
Normal (rest)
Heart failure + positive inotrope
Myocardial contractility
Heart failure
Running
Walking
Rest
Stroke volume (CO)
Ventricular EDV (preload)

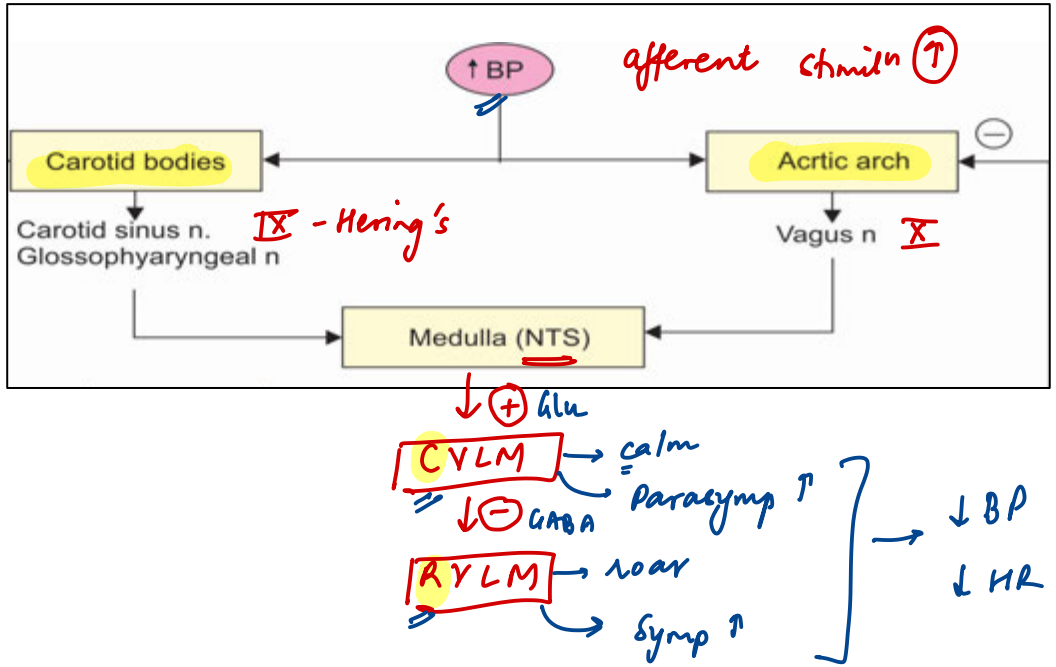

Plateau
Transitional zone
Down slope
Mean systemic filling pressure
RAP at which VR = 0
Venous return (L/min)
5
0
−8
−4
0
+4
+8
Right atrial pressure (mm Hg)
7-13 mm

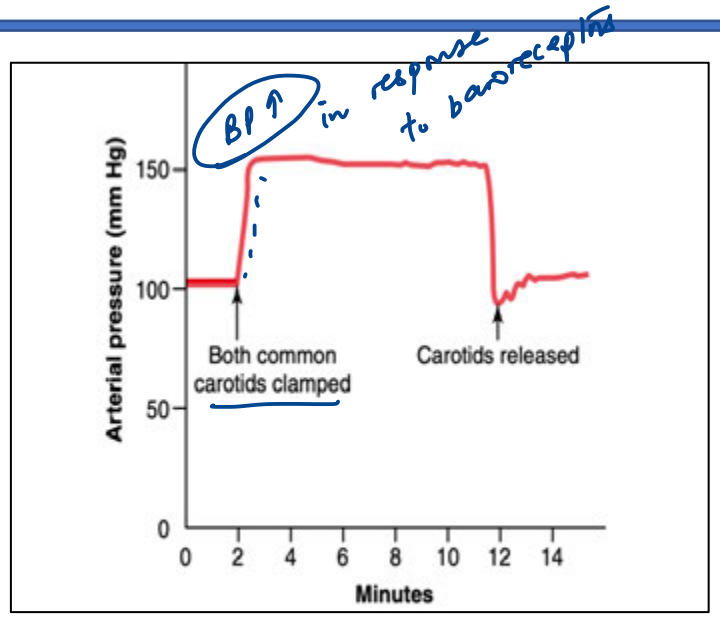

Mean aortic pressure
Capillary pressure
Right atrial pressure
MCFP
Mean circulatory filling pressure
100
80
60
40
20
0
Pressure (mm Hg)
13 mm Hg
(7-13 mm)
Normal
1/2 Normal
Zero
Cardiac output


Digoxin
Dobutamine
Milrinone (PDE3⊖)
inotropic drugs
exercise
↑inotropy
Cardiac function curve
Normal
CHF / acidosis
↓inotropy
β blockers
CCB
Vascular function curve
Mean systemic pressure
Cardiac output/venous return
RAP
A
↑volume, venous tone
↳ iv fluids
↳ AVF
↓volume, venous tone
Hge / spinal shock
B
↓TPR
exercise
AVF
↑TPR
VC
C
Intersection of curves = operating point of heart (ie, venous return and CO are equal, as circulatory system is a closed system).

Physiology

BARORECEPTOR (-ve feedback)
Spray-type nerve endings
Stretch receptors in adventitia-TRP channels
Most sensitive stimulant: PP > MAP
B/L Carotid clamped-effect:



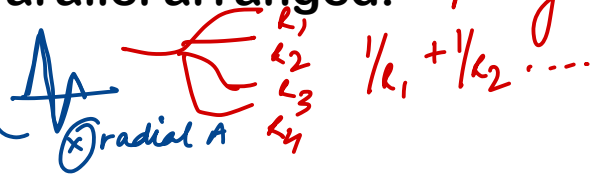


Mary's law HR ∝ 1/BP
Bainbridge reflex ↑ Preload ∝ ↑ HR - Rt atrial stretch
Bezold-Jarisch reflex serotonin / capsaicin - alkaloids - ↓ CO ↓ HR coronary vasod.
Postural hypotension:
SBP-DBP-within 3min of standing
20mm ↓ 10mm ↓

Coronary steal syndrome- Dipyridamole, regadenoson

ischemic → healthier - dilate

- Maximum total cross-sectional area: capillaries
- Minimum blood flow velocity:
- Exchange vessels/ Min resistance/ Parallel arranged: capillary
- Max TPR: arterioles
- Windkessel effect: Aorta & its braches
- Capacitance vessels: storage - veins



Distribution of Cardiac Output (CO)

- Highest blood flow (absolute): Liver
- Highest blood flow per 100 g tissue: β

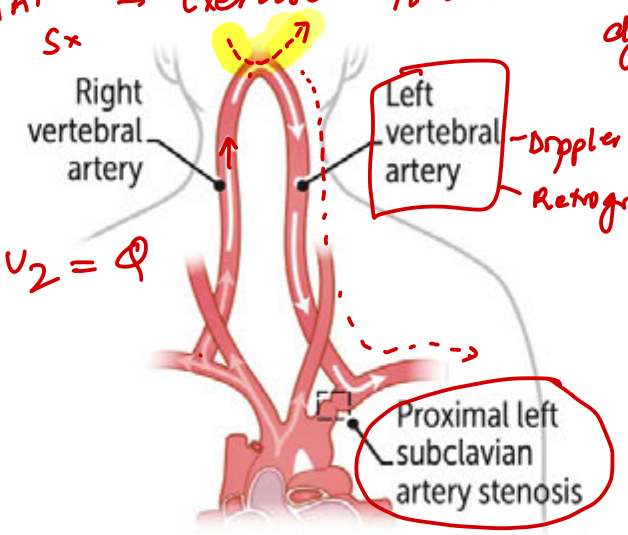
Arteriovenous (A–V) Oxygen Difference

- Highest A–V O_2 difference: ♥ (coronary sinus - most deoxy)
- Lowest A–V O_2 difference: β

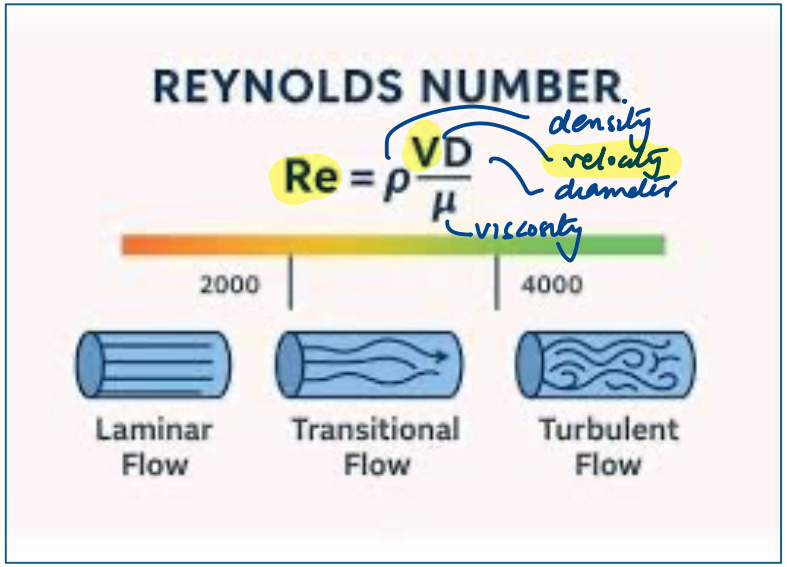
Oxygen Consumption

- Highest total O_2 consumption: Liver
- Highest O_2 consumption per 100 g tissue:

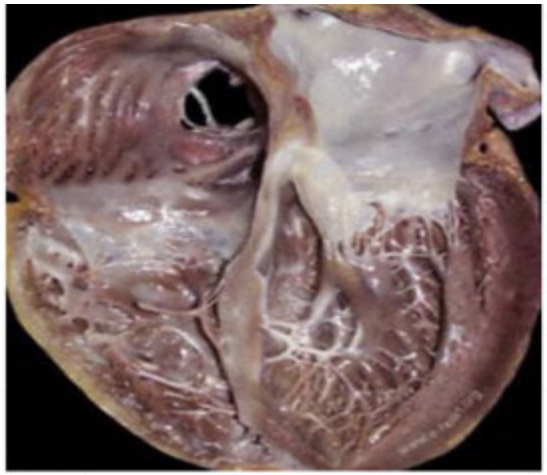
SUBCLAVIAN STEAL Sx → exercise - i/l limb → neurological dysfn

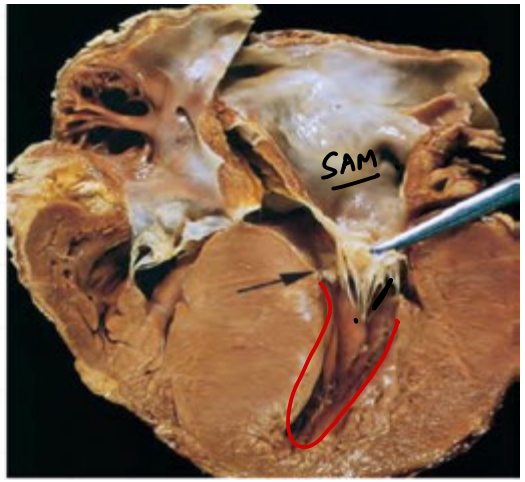


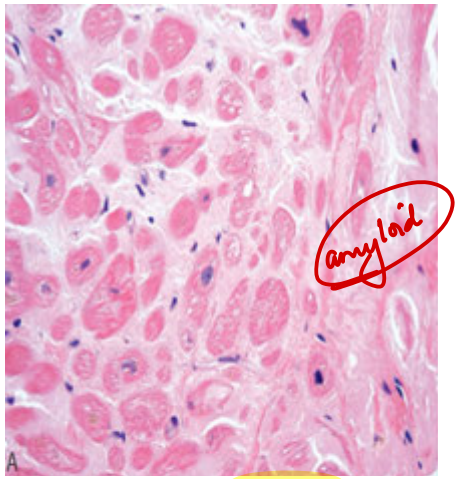
$a_1v_1 = a_2v_2 = Q$

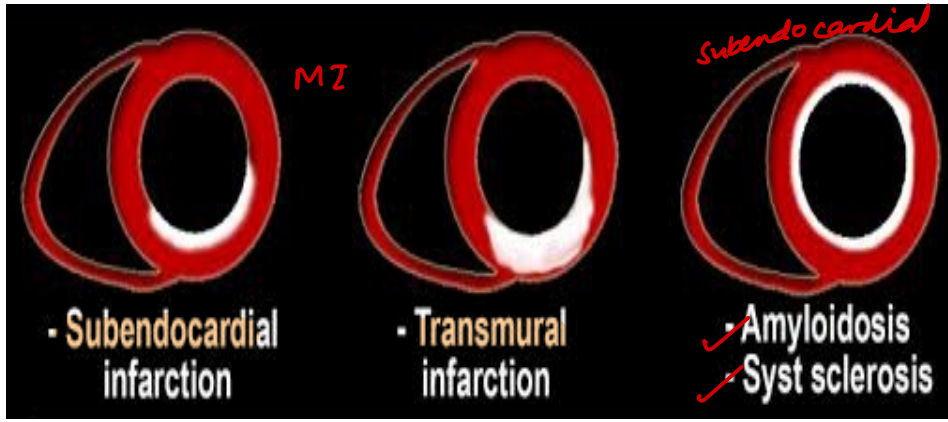


Cardiomyopathy

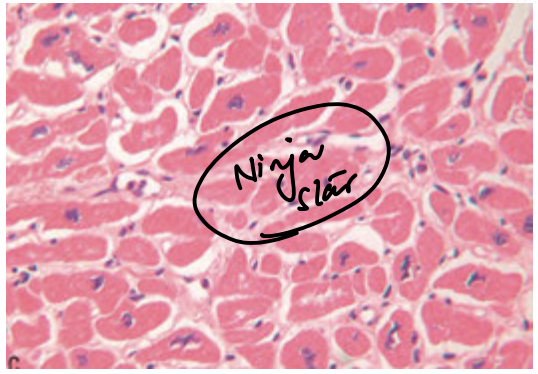








LGE: Late Gd enhancement
SCARRED → Gd retain



RCM

Postradiation fibrosis
Löffler endocarditis,
Endocardial fibroelastosis
Amyloidosis,
Sarcoidosis,
Hemochromatosis } also DCM

DCM – systolic dysfn QQ

- Alcohol, trastuzumab, doxorubicin
- TITIN mutn
- Peripartum CMP – T3/≤ 5mnth
- Hemochromatosis / sarcoid (RCM also)

HOCM
↓
β-myosin heavy chain

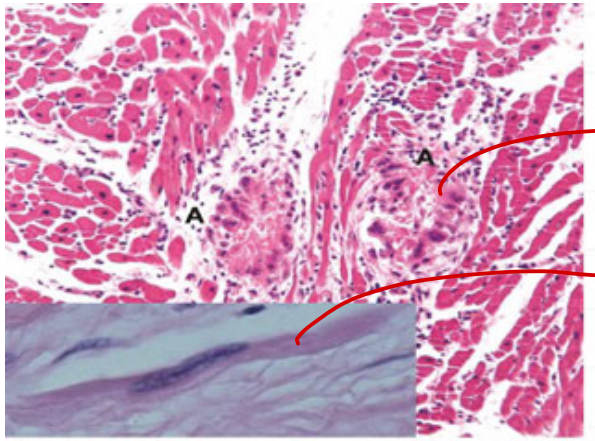
SCD → ventricular arrhythmias
↳ ICD + β-blockers
↳ Mavacamten

- IDDM
- Pompe's
- Friedrich ataxia

DIASTOLIC dysfn

diastolic dysfn
↳ Ioc → MRI
↳ myopathy myocarditis

Acute Rheumatic Fever



Category	Duration from last attack
Rheumatic fever without carditis	5 years or until 21 years of age (whichever is longer)
Rheumatic fever with carditis but no residual heart disease	10 years or until 21 years of age (whichever is longer)
Rheumatic fever with carditis + residual heart disease	10 years or until 40 years of age (whichever is longer)

Major Criteria (JONES)
- J – Jts
- O – ♡
- N – Subcut nodules
- E – E. Marginatum
- S – Sydenham chorea

Minor Criteria
- ↑ CRP, ↑ ESR
- Arthralgia
- Fever
- Prolonged PR

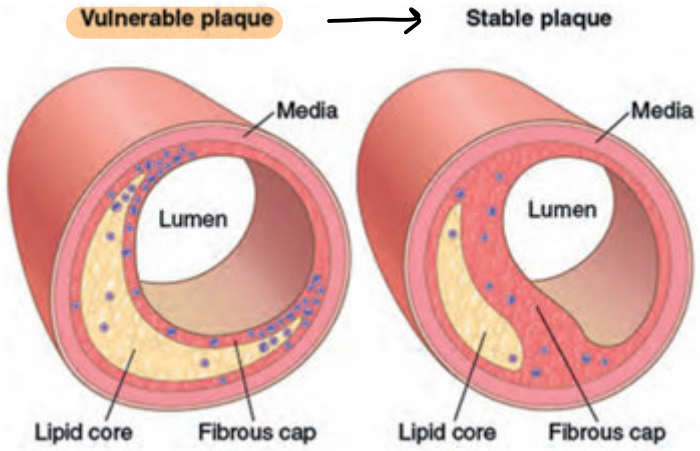
Recent streptococcal infection PLUS either:
- 2 Major criteria, OR
- 1 Major + 2 Minor criteria

im Benzathine Penicillin 0.6-1.2MU 3-4 weekly

Indications for Endocarditis Prophylaxis Before High-Risk Dental Procedures
1. Prosthetic heart valve
2. Previous infective endocarditis
3. Unrepaired congenital heart disease
4. Completely repaired congenital heart disease with prosthetic material for first 6 months
5. Incompletely repaired congenital heart disease
6. Valvulopathy following cardiac transplantation

Atherosclerosis & Dyslipidemias

Endothelial dysfunction → Fatty streak formation → Fibrous plaque formation



Statins-HMG coA reductase inhibitor 1st line s/e : myopathy, (CoQ) hepatotoxic

Pleiotropic-Antiaggregant, anti-inflammatory, NO

All cyp metabolized except: Pravastatin

Longest acting: Rosuvastatin

High intensity statins: ASCVD / LDL >190mg/dl / comorbidities

Atorvastatin 40-80 mg/ Rosuvastatin 20-40 mg

Add-on drugs:

Ezitimibe-NPCL-Absorption-

Alirocumab, Evolocumab-PCSK9- (LPa lower) ↑LDL receptors

Inclisiran- PCSK9 synthesis inhibitor (siRNA)

] SC injn

Bempedoic acid: ATP citrate lyase competitive-

Cholestryamine, Colestipol : BABA

Fibrates (TG >500)-PPAR alpha + (Type I / IV ↑chol.) s/e: myopathy / gallclots Td on ⊖

Icosapent: Lowers VLDL synthesis (add on statin)

Niacin-HSL- (HDL ↑)

S/e: Gout / DM / CME / Flushing ~PG ↑

Evinacumab: ANGPTL3 - : LPL+

Lomitapide:MTTP-

] Familial ↑lipidemia type II

Heart Failure

NYHA Functional Classification (Heart Failure)

Class I
No limitation of physical activity

Class II
Comfortable at rest- Ordinary physical activity causes fatigue, palpitations, or dyspnea

Class III
"going to washroom"
Comfortable at rest-Less than ordinary activity causes fatigue, palpitations, or dyspnea

Class IV
Symptoms present at rest

Rx of CHF

Decompensated Heart failure: CI- β-blocker
Ionotropic: B_1 ⊕ - Dobutamine / Ionodilator - PDE 3 ⊖ 'Milrinone'
P.edema: Diuretics – Lpreload

Prevent remodeeling-Lowers mortality:
1) ARBs + Ni → Sacubitril + ARBs (ARNi)
2) Bblockers → Bisoprolol / Metoprolol / Carvedilol
3) MRA - Spironolactone / Eplerenone
4) SGLT 2 ⊖ → ↓ Intravasc volume

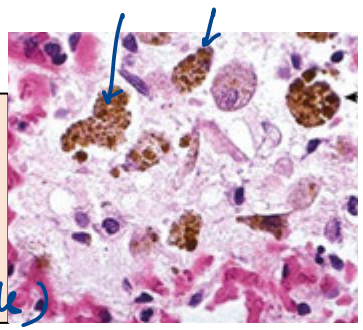
Neprilysin+ ACE inhibitor: Omapatrilat
S/e: Bradykinin↑ – cough / angioedema

HFpEF : LVEF > 50%
HFmrEF : LVEF 41–49%
HFrEF : LVEF < 40%

Left Heart Failure

PCWP ↑ (Swan-Ganz)

- Orthopnea / PND
- Pulmonary edema ♡ p.edema - Bathing
- Hemosiderin-laden macrophages aa (HF cells)



Right Heart Failure

- Congestive hepatomegaly (Hepatojugular reflux)
- Jugular venous distention (JVD)
- Peripheral edema

Investigations:

Ise : BNP (↑NPV) IOC → ECHO

Other drugs for HFrEF

BNP analogue: Necinhde
Direct guanyl cyclase activator: Vereciguat
Calcium sensitize: Pimobendan/ Levosimendan
Direct myosin activator: Omecamitiv

Pharmacology

CCB

DHPs (vd)

Amlodipine, nifedipine, nimodipine

S/E:- Reflex tachycardia
- Flushing

non DHPs

Diltiazem, verapamil

S/E: -AV block
-Constipation
-Pedal edema

Verapamil
-Gingival hyperplasia
-Hyperprolactinemia
-ATP binding cassette

P C V - verapamil
phenytoin cyclosporine

Hydralazine

arteriolar dilator

SHIP

Nitroprusside
Nitrates

venodilation

s/e: cyanide toxicity

s/e: · Methhb
· Monday morning (headache)

ACE-:
Prodrugs except Captopril, Lisinopril

S/E:
Hyperkalemia — metab acidosis
Cough/Angioedema - ACE ⊖

ARB:
Losartan, Valsartan

ARBs:
PPAR-γ agonist - ↑insulin sen - Telmisartan ✓ DM + hypertn
Uric acid excretion increase ✓ Gout
TxA2 inhibition

Aliskiren
Renin ⊖

CHRONIC STABLE ANGINA
Ivabradine: If Na⊖ - bradycardia s/e: visual phen
Nicorandil: K+ opener
s/e: Apthous ulcer
Rho kinase inhibitor: Fasudil fav → glc
Metabolic modulators (PFOX-): Trimetazidine
s/e: aggravating movement disorder
MM + Late inward Na blocker: Ranolazine

, presynaptic brake
α2 ⊕

Clonidine: Rebound hypertension ae

Beta-Blockers

BETA BLOCKERS

B1 selective:

Atenolol, Betaxolol, Bisoprolol, Esmolol, Landiolol, Metoprolol

Nebivolol (most cardioselective):

Celiprolol:

Acebutolol:

Non-selective:

Nadolol:

Propranolol:

Timolol

Pindolol:

A + B blockers: Carvedilol, Labetalol

Tillisolol:

Sotalol:

USES:

CVS

Glaucoma

Performance anxiety

Thyroid storm

Akathisia

Migraine prophylaxis

Essential tremors

CI:

Bradycardia / AV block

Acute CHF

Asthma

PVD

DM

Prinzmetal angina

DOC for toxicity:

Bisoprolol, carvedilol, metoprolol –

Nadolol, Propranolol, Carvedilol –

Hypertension

Hypertension with:

1st line-Young(<55yr): ACE⊖/ARBs Old (>55yr): CCBs (DHPs)

Resistant hypertension- Spironolactone /Eplerenone (MRA)

DM / CKD/ Nephrotic Sx/ Scleroderma- ACE⊖/ARBs

Gout- ARBs

Osteoporosis/ Renal stones- Thiazides

Raynaud/ Cyclosporine induced/Asthma- CCB (DHP)

BPH- α⊖ Prazosin

Migraine/ Thyrotoxicosis/ Angina/ Tremor/Anxiety- β blockers

A / C
↓×
A + C
↓×
Thiazide × → Resistant MRA

Emergency: Severely elevated BP with acute hypertension mediated organ damage (HMOD) (iv)

Urgency: Severely elevated BP without acute hypertension mediated organ damage (HMOD) (oral)

encephalopathy / papilledema / Aortic dissec → iv Labetalol / Nicardipine

CHF – pedema → IV Nitroprusside / Nitrates

Category (AHA 2025)	Systolic BP (mm Hg)	Diastolic BP (mm Hg)
Normal	< 120	< 80
Elevated	120–129	< 80
Stage 1 hypertension	130–139	80–89
Stage 2 hypertension	≥ 140	≥ 90
Severe hypertension	> 180	≥ 120

→ Lifestyle modific^n (if comorb – Drugs)

→ DRUGS