Cardiovascular Medicine
from Basic to Clinical

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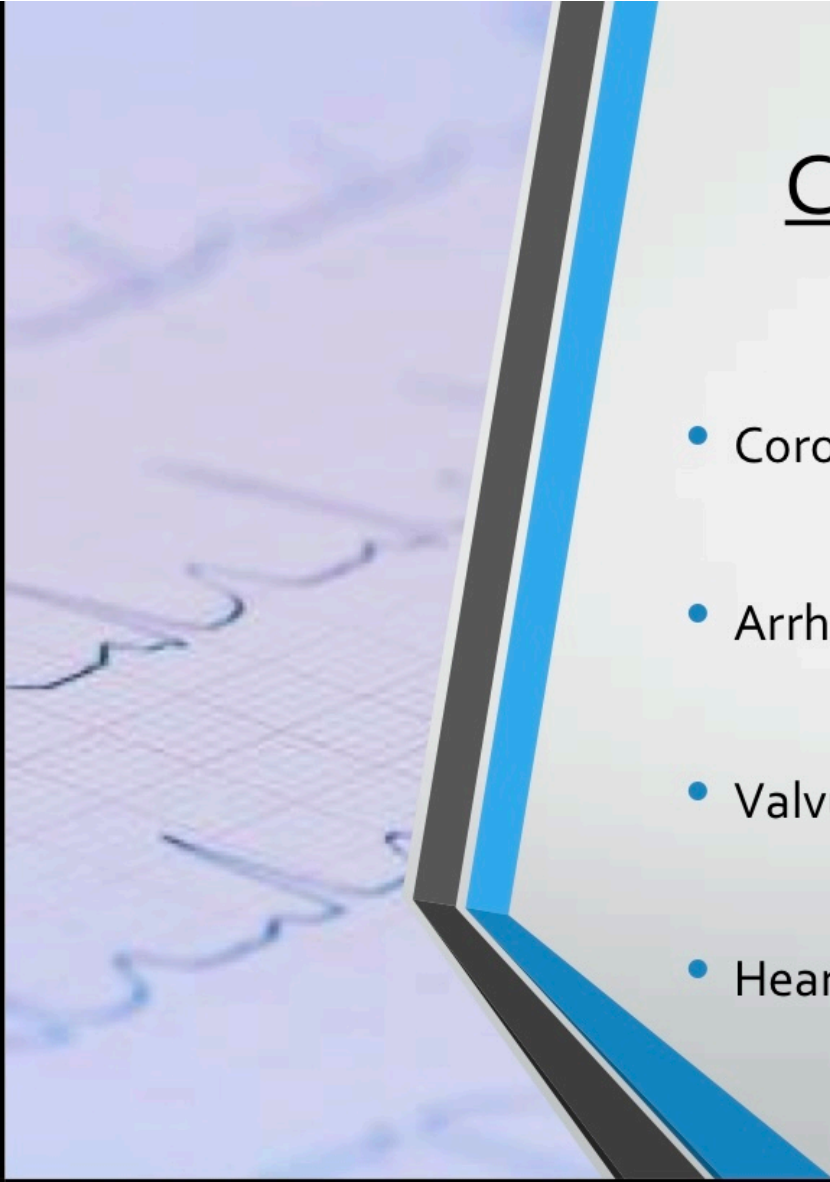


Cardiovascular Medicine from Basic to Clinical

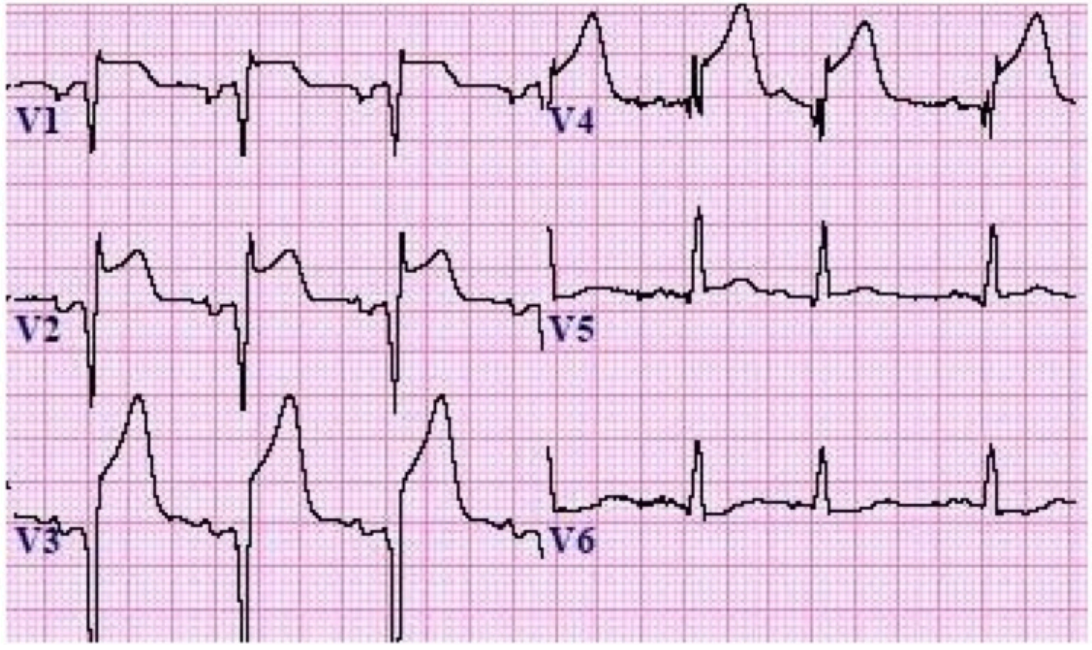
- Coronary Artery Disease
- Arrhythmias
- Valvular Heart Disease
- Heart Failure

Case 1

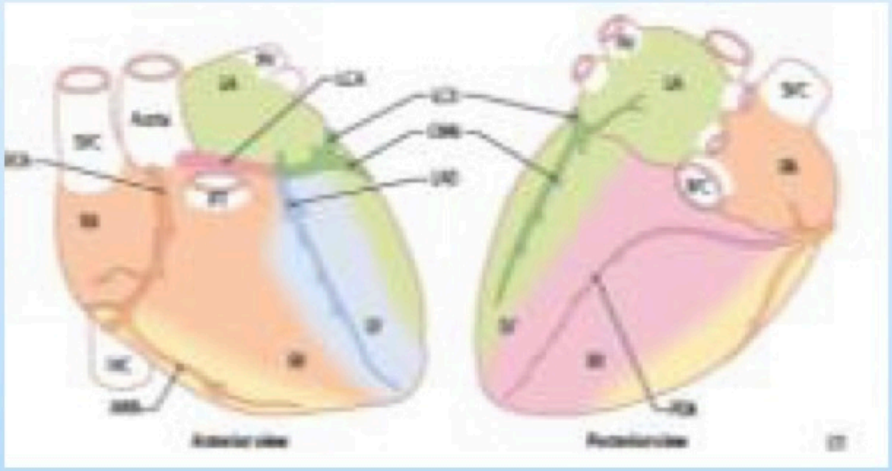
Coronary Artery Disease

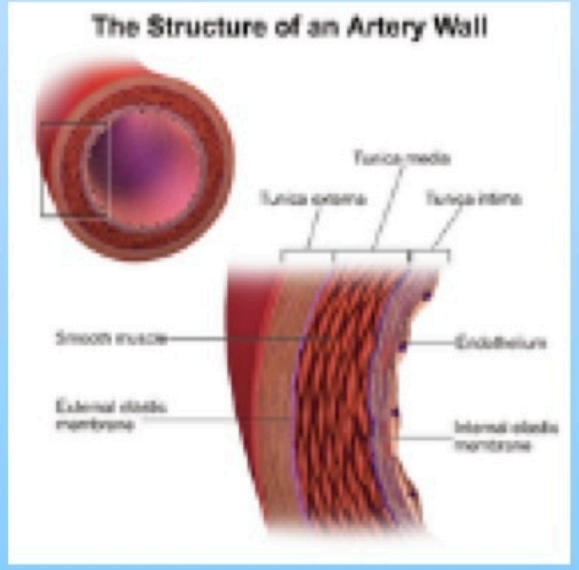
Case 1

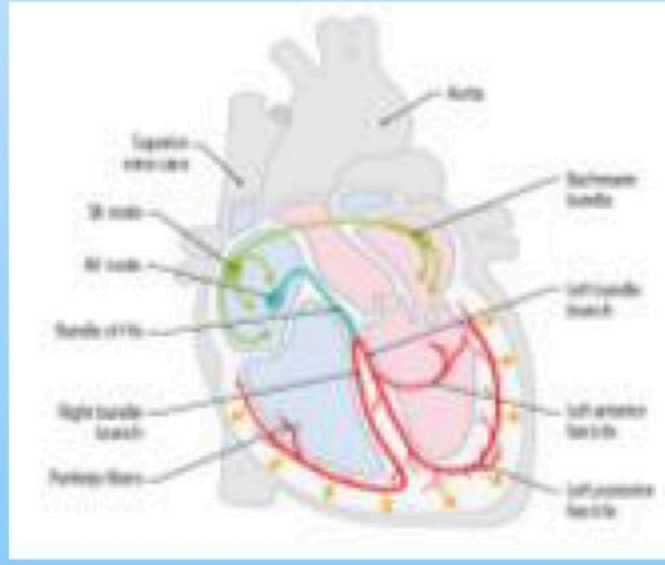
The patient is a 65-year-old male, known case of Hypertension, Diabetes, Dyslipidemia, came to ED complaining of **Chest Pain** of 6 hours duration.

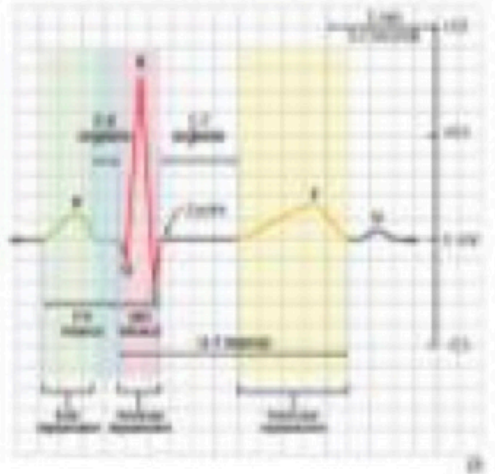


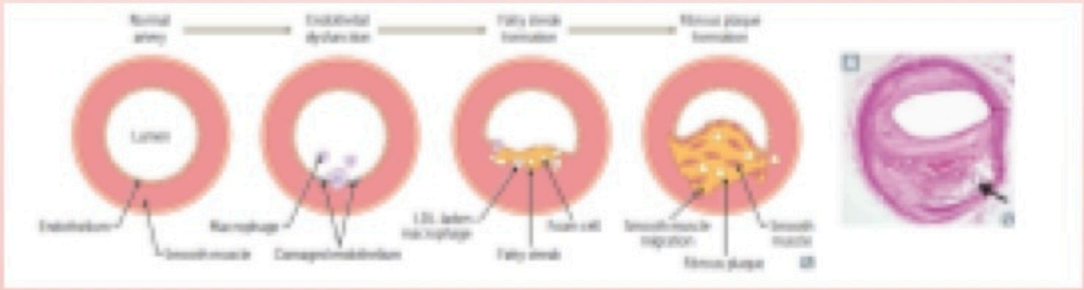
Basic – Anatomy & Physiology

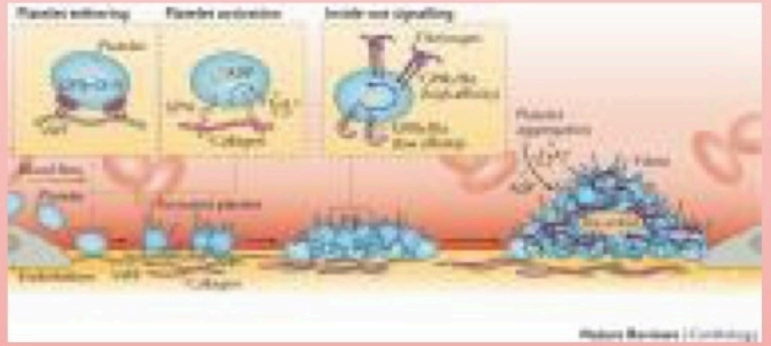


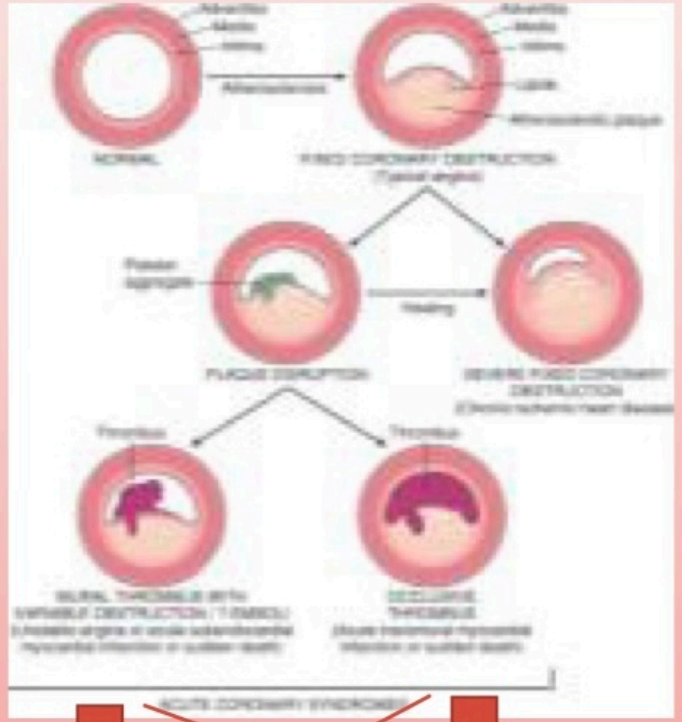






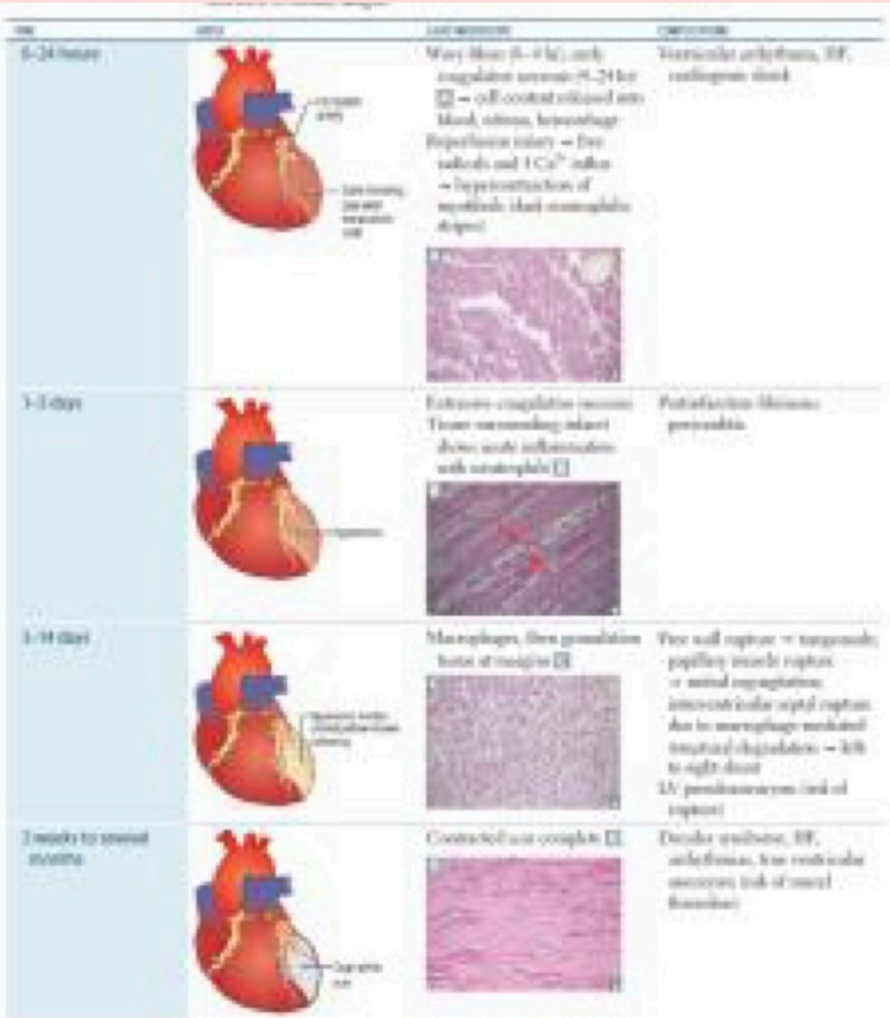


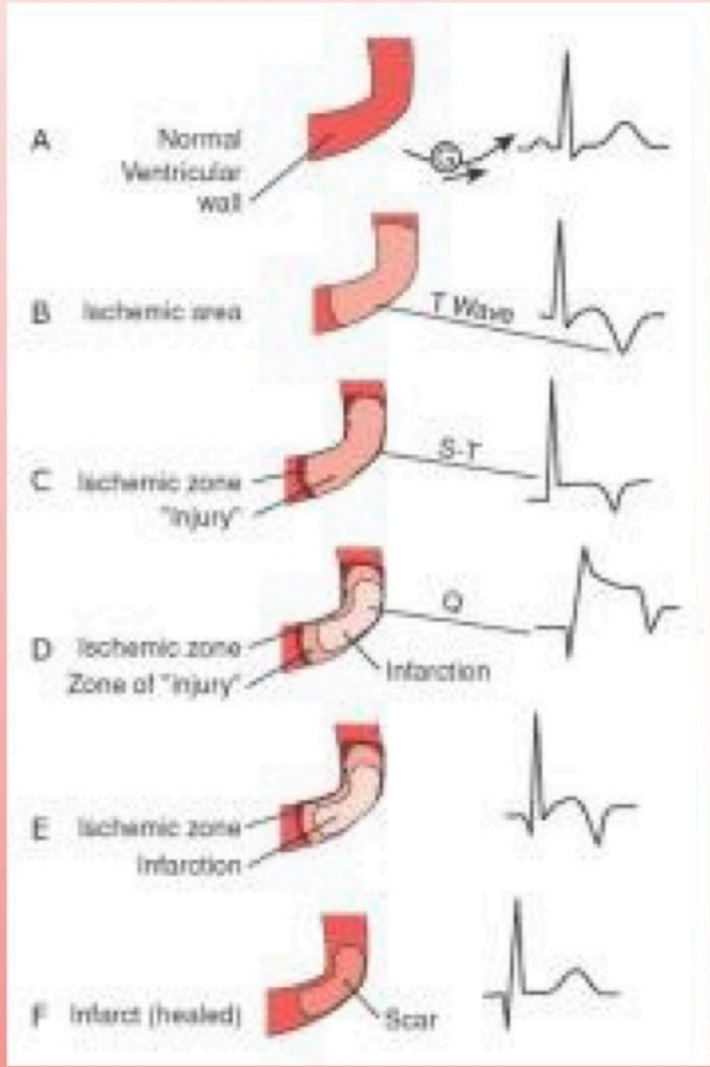





RV
LV

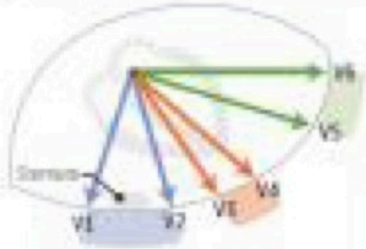

RV
LV

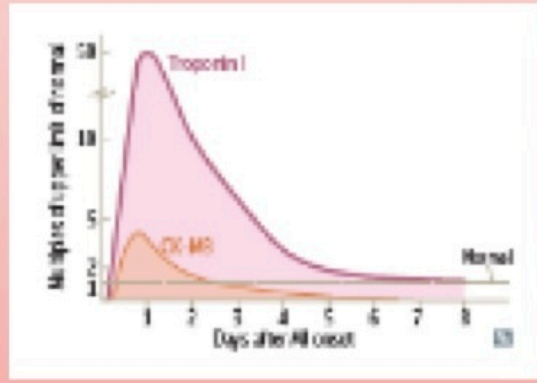


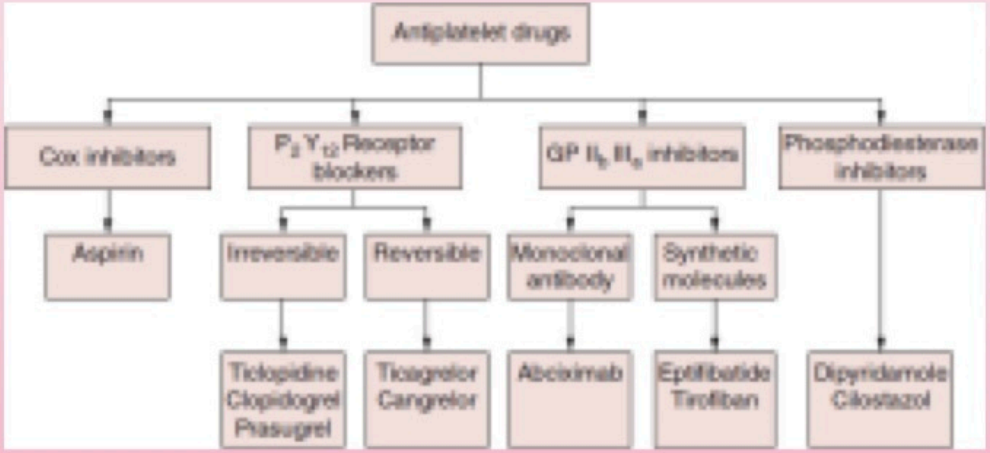

A
Normal
Ventricular
wall
B
Ischemic area
T Wave
C
Ischemic zone
"Injury"
S-T
D
Ischemic zone
Zone of "injury"
Q
Infarction
E
Ischemic zone
Infarction
F
Infarct (healed)
Scar

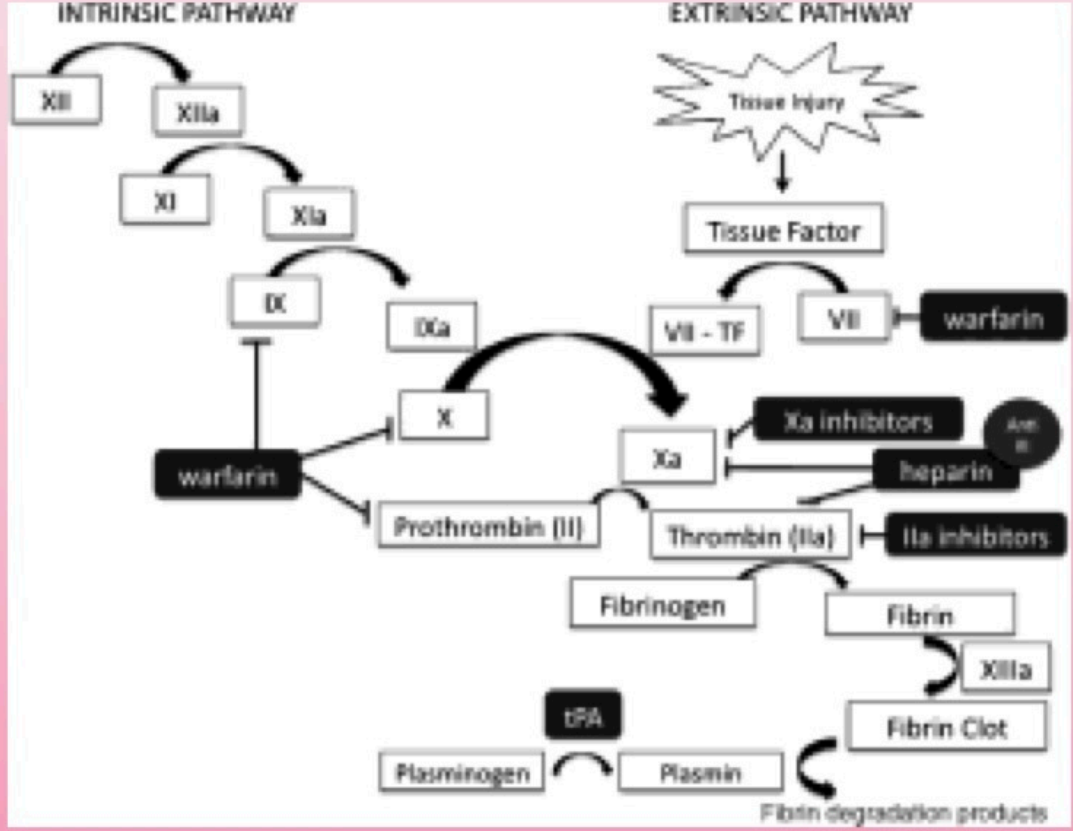
Basic – Pathology

INFARCT LOCATION	LEADS WITH ST-SEGMENT ELEVATIONS OR Q WAVES
Anteroseptal (LAD)	V_1–V_2
Anteroapical (distal LAD)	V_1–V_4
Anterolateral (LAD or LCX)	V_5–V_6
Lateral (LCX)	I, aVL
Inferior (RCA)	II, III, aVF
Posterior (PDA)	V_7–V_9, ST depression in V_1–V_3 with tall R waves





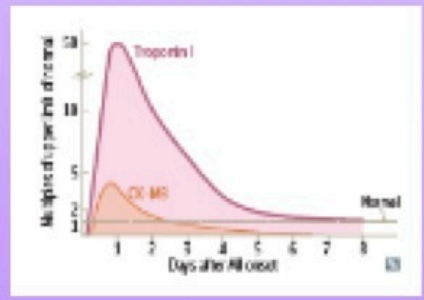

Antiplatelet drugs
Cox inhibitors
P_2Y_{12} Receptor blockers
GP II_b III_a inhibitors
Phosphodiesterase inhibitors
Aspirin
Irreversible
Reversible
Monoclonal antibody
Synthetic molecules
Ticlopidine
Clopidogrel
Prasugrel
Ticagrelor
Cangrelor
Abciximab
Eptifibatide
Tirofiban
Dipyridamole
Cilostazol


INTRINSIC PATHWAY
EXTRINSIC PATHWAY
XII
XIIa
XI
XIa
IX
IXa
X
Xa
Tissue Injury
Tissue Factor
VII - TF
VII
warfarin
Xa inhibitors
heparin
warfarin
Prothrombin (II)
Thrombin (IIa)
IIa inhibitors
Fibrinogen
Fibrin
XIIIa
Fibrin Clot
tPA
Plasminogen
Plasmin
Fibrin degradation products

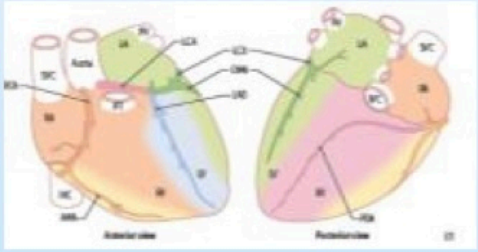
The patient is a 65-year-old male, known case of Hypertension, Diabetes, Dyslipidemia, came to ED complaining of **Chest Pain** of 6 hours duration.

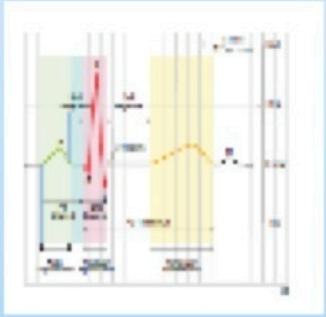
ST Elevation MI

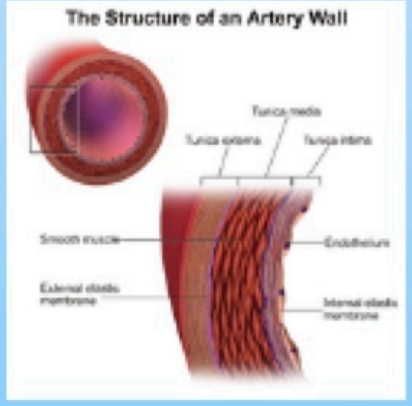
Treatment		
Antiplatelet	Aspirin	P2Y12 Inhibitor
Improve Flow	Nitrates	
Decrease Demand	B-Blockers	
Plaque Stabilization	B-blockers	Statins
Anticoagulant	Heparin	LMWH
Revascularization	Fibrinolytics	PCI



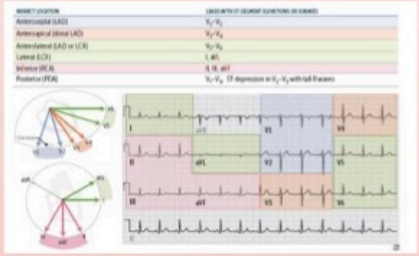
Basic - Physiology

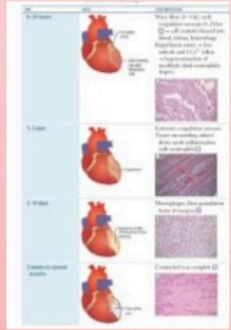


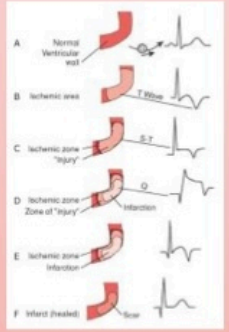


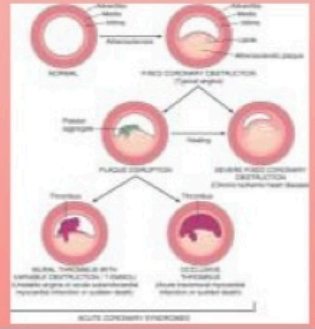


Basic - Pathology

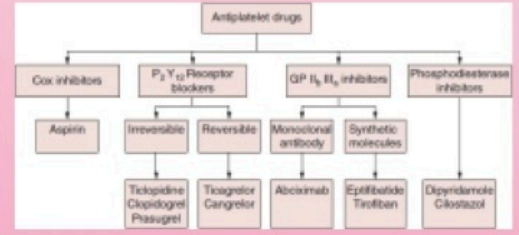


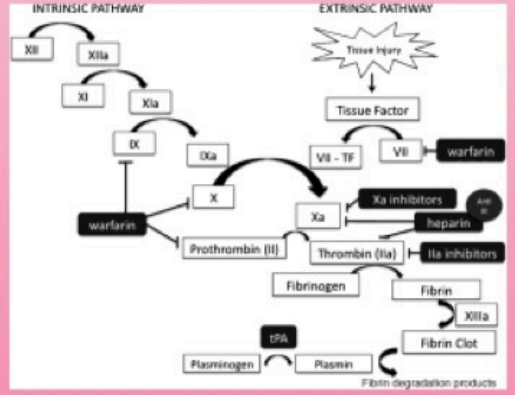






Basic - Pharmacology





Clinical

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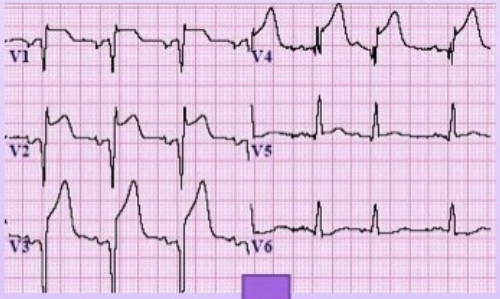
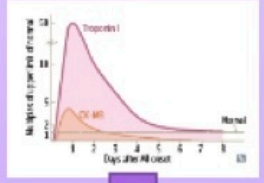


STEMI



Treatment		
Antiplatelet	Aspirin	P2Y12 Inhibitor
Improve Flow	Nitrates	
Decrease Demand	B-Blockers	
Plaque Stabilization	B-blockers	Statins
Anticoagulant	Heparin	LMWH
Revascularization	Fibrinolytics	PCI

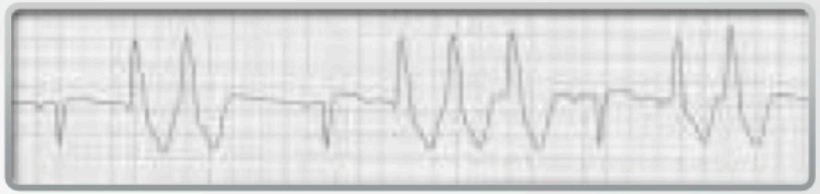
Case 2

Arrythmias

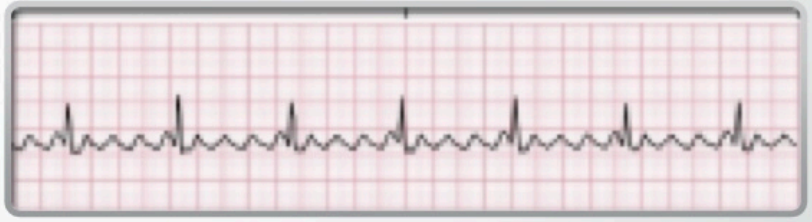
Case 2

The patient is a 38-year-old female, recent history of Bronchitis treated with Azithromycin, heavy EtOH drinker, came to ED complaining of **Palpitations** in last 2 days.

A.

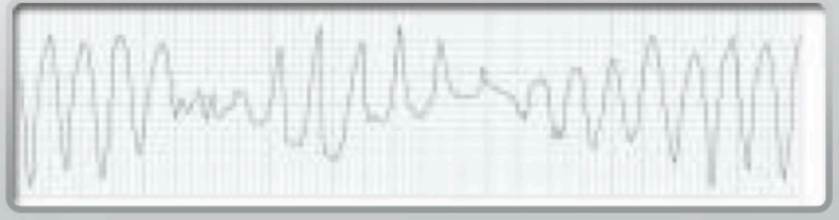


B.

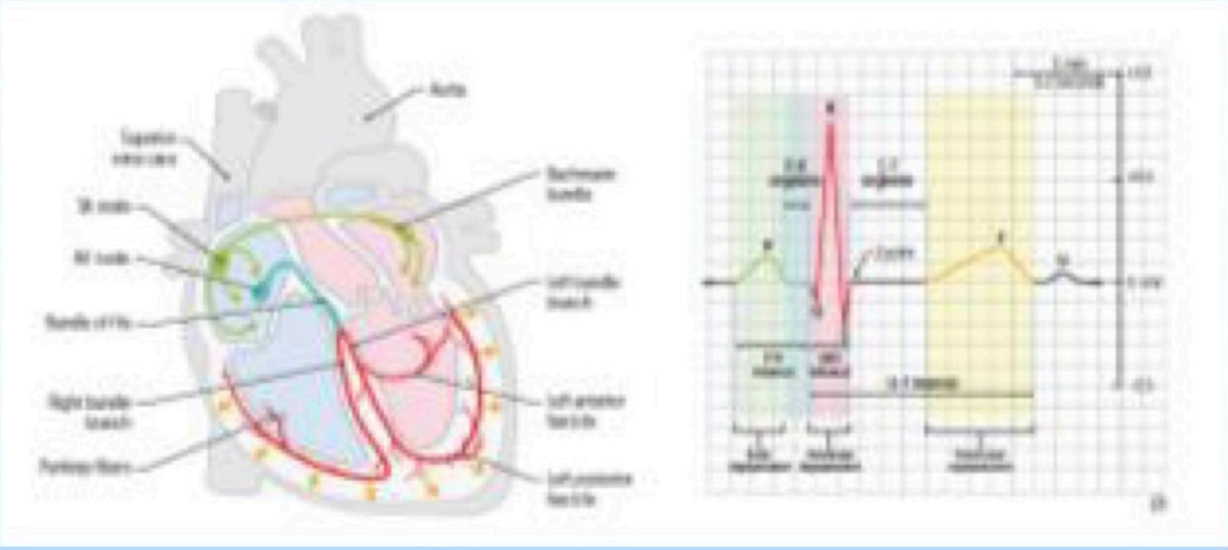


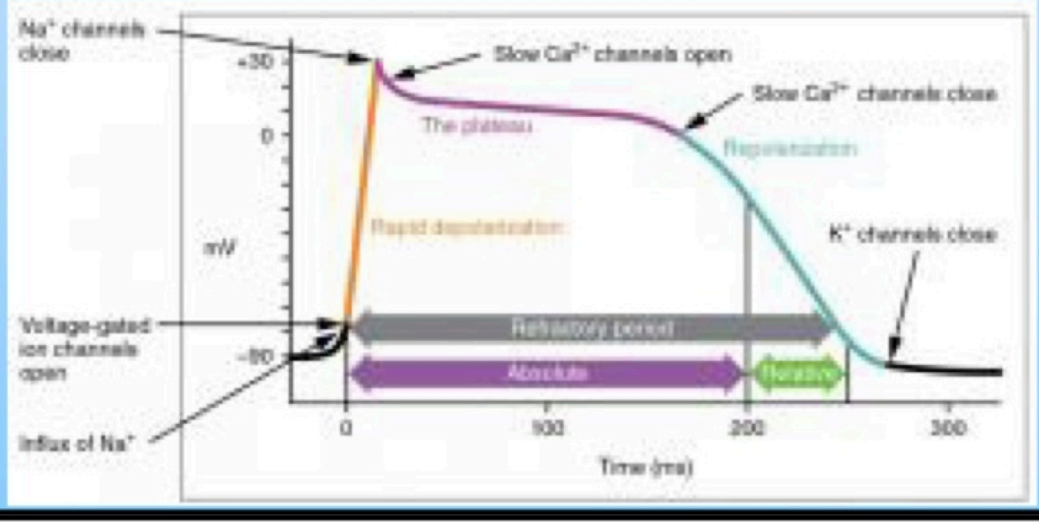
C.

D.

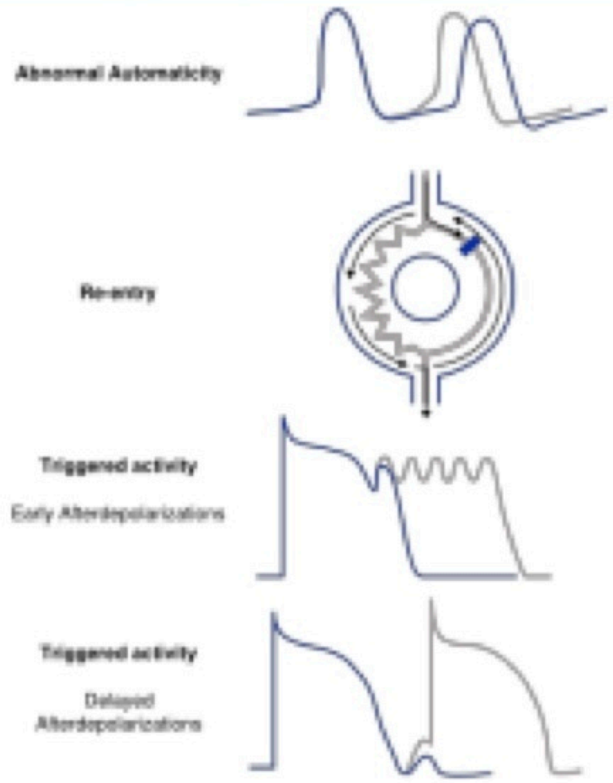


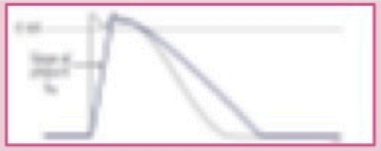
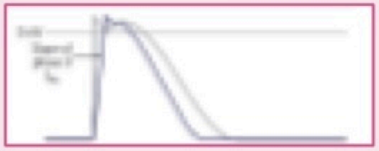
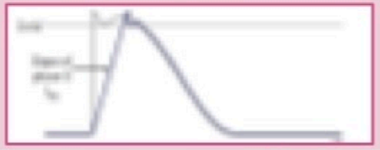
Basic – Anatomy & Physiology



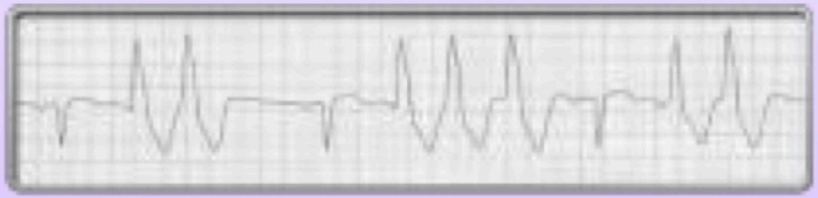


Mechanisms of Arrythmias

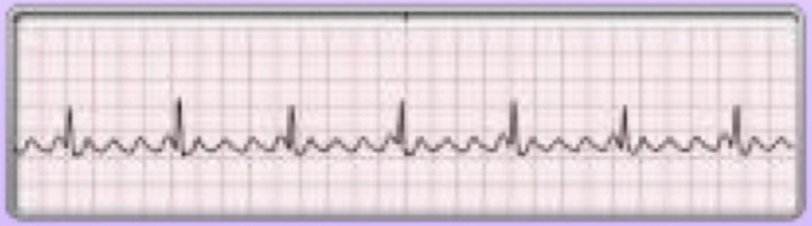


Antiarrhythmic Class	Function	Drugs	Clinical Use	Limitations
Class IA		Quinidine Procainamide Disopyramide	Re-entrant Atrial & Ventricular Arrhythmia	Cinchonism TdP SLE like S/E
Class IB		Lidocaine Phenytoin Mexiletine	Acute VT, esp. Ischemic Digoxin induced Arrhythmias	CNS Toxicity
Class IC		Flecainide Propafenone	SVT	Proarrhythmic
Class II		B-Blockers	Increased Automaticity SVT Rate Control	Bradycardia & Hypotension ED Asthma
Class III		Amiodarone Ibutilide Dofetilide Sotalol	Atrial Fibrillation / Flutter VT	TdP Amiodarone S/E
Class IV		CCB (Verapamil, Diltiazem)	SA / AV Nodal Control	Bradycardia LV Dysfunction

The patient is a 38-year-old female, recent history of Bronchitis treated with Azithromycin, heavy EtOH drinker, came to ED complaining of **Palpitations** in last 2 days.

A. 

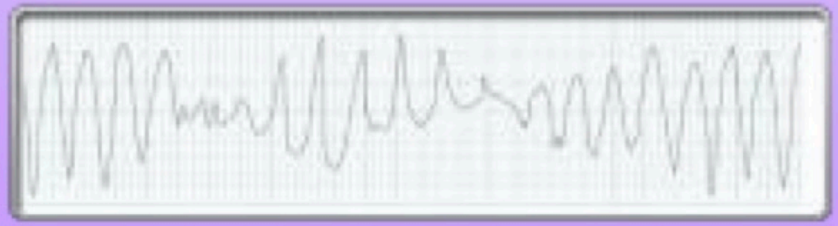
PVC

B. 

Atrial Flutter

C. 

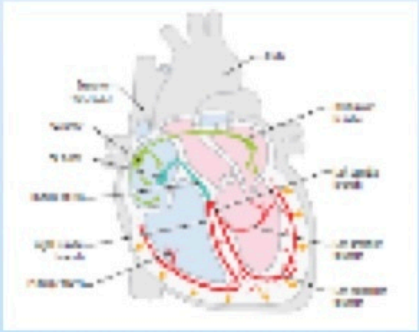
Monomorphic VT

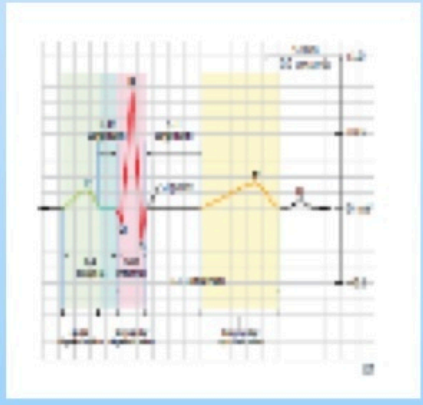
D. 

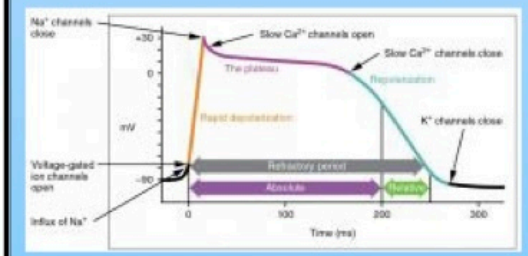
Polymorphic VT (TdP)

Treatment
B-Blockers
Rate Control (B-Blockers, CCB) Rhythm Control (Class III, Class IA/IC)
Amiodarone Class IB
Magnesium

Basic - Physiology

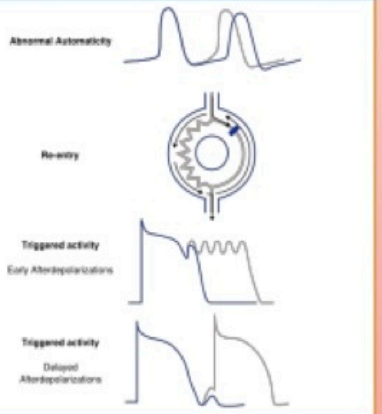






Basic - Pathology

Mechanisms of Arrythmias



Basic - Pharmacology

Antiarrhythmic Class

IA

IB

IC

II

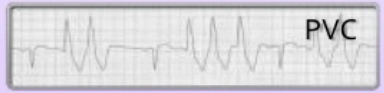
III

IV

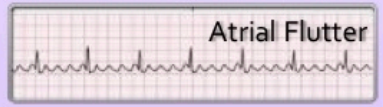
Clinical

The patient is a 38-year-old female, recent history of Bronchitis treated with Azithromycin, heavy EtOH drinker, came to ED complaining of **Palpitations** in last 2 days.

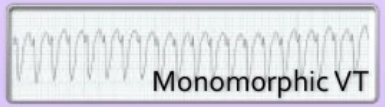
A. PVC



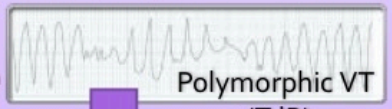
B. Atrial Flutter



C. Monomorphic VT



D. Polymorphic VT (TdP)



Treatment
B-Blockers
Rate Control (B-Blockers, CCB) Rhythm Control (Class III, Class IA/IC)
Amiodarone Class IB
Magnesium

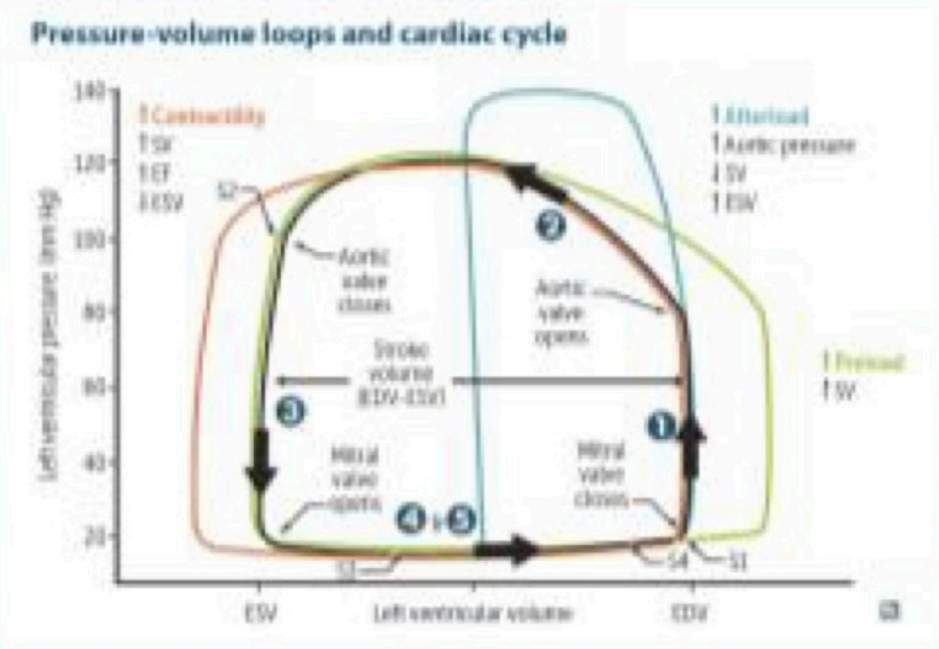
Case 3

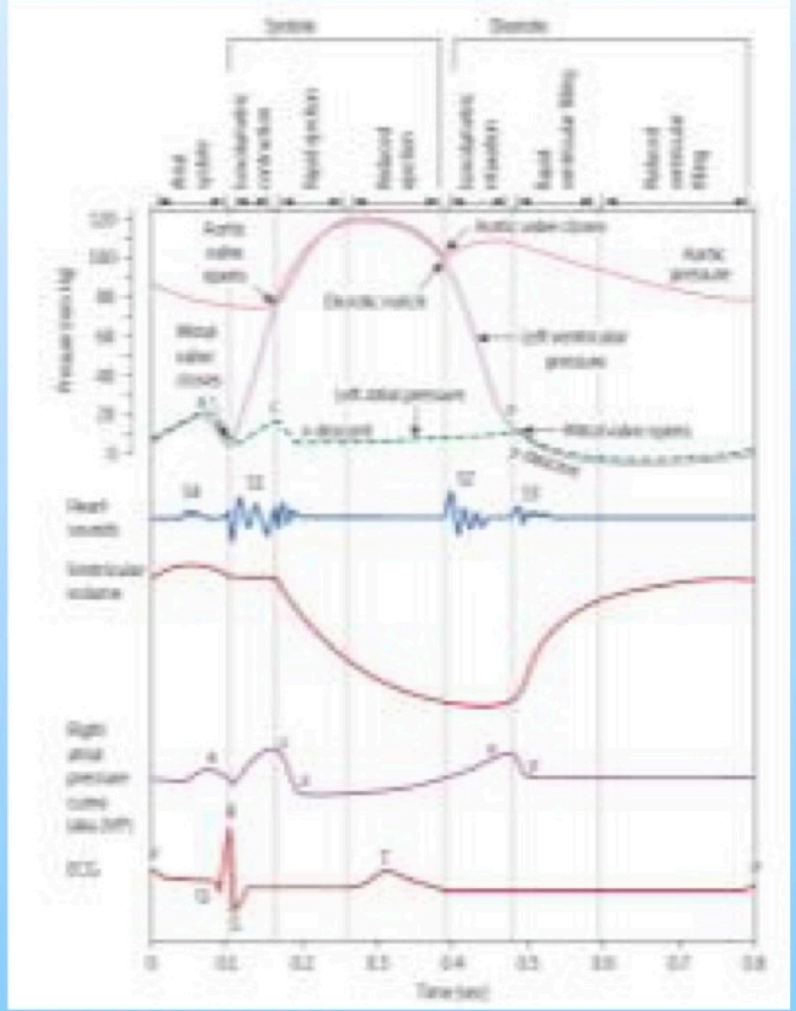
Valvular Heart Disease

Case 3

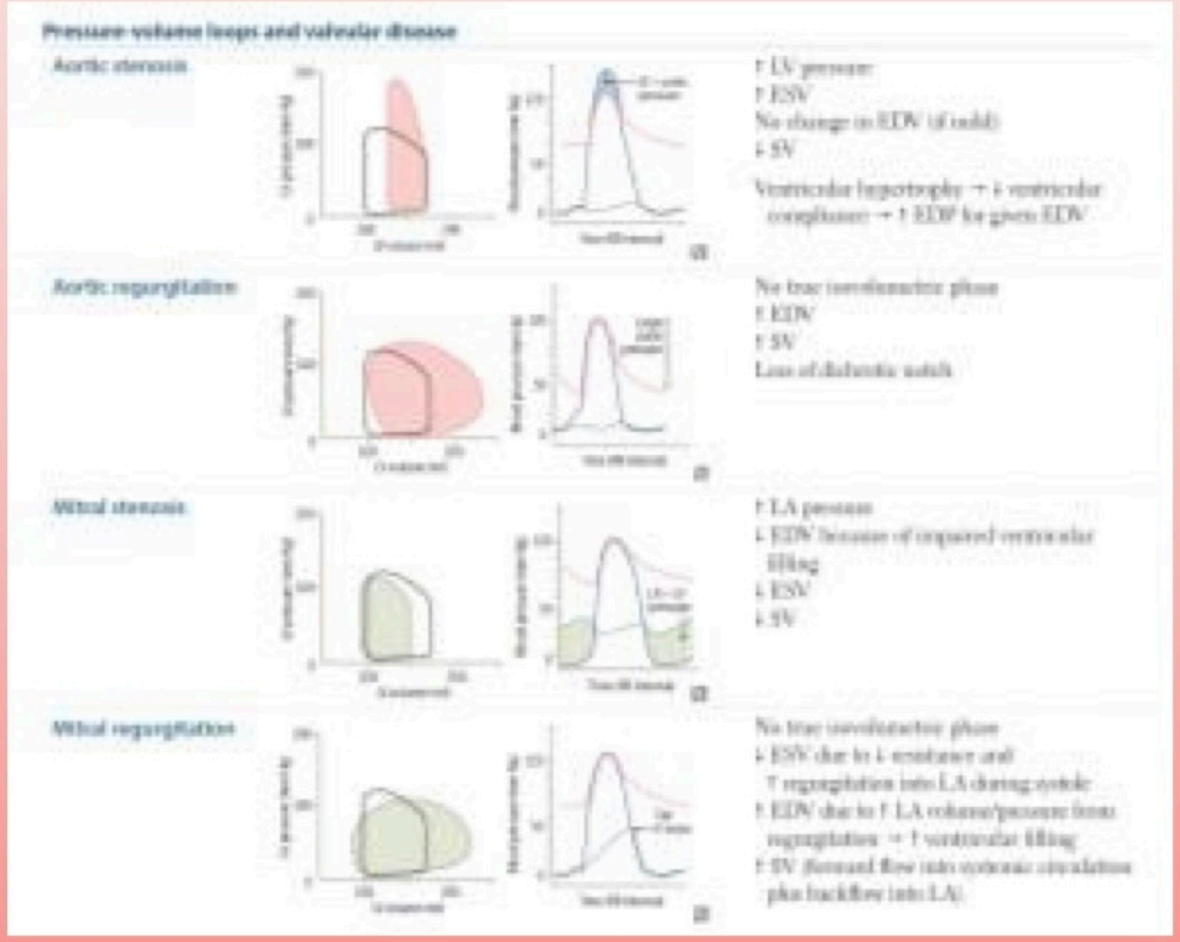
The patient is a 50-year-old male, came to clinic complaining of **Chest pain on Exertion and Recurrent Syncope** in last 2 months. On Physical Exam, he had an crescendo-decresendo systolic murmur with ejection click.

Basic – Anatomy & Physiology





Basic – Pathology



VHD	Key Concepts	Result	Clinical
Aortic Stenosis	↑ LVP	Subendocardial Ischemia	Angina
	↓ SV	↓ Afterload	Syncope
Aortic Regurgitation	Bradycardia	Longer Regurg. Time	↑ HF
Mitral Stenosis	Tachycardia	Shorter Filling time	Pul. Edema
Mitral Regurgitation	↑ Afterload	Increased Regurgitation	↑ HF

The patient is a 50-year-old male, came to clinic complaining of **Chest pain on Exertion and Recurrent Syncope** in last 2 months. On Physical Exam, he had a crescendo-decresendo systolic murmur with ejection click.

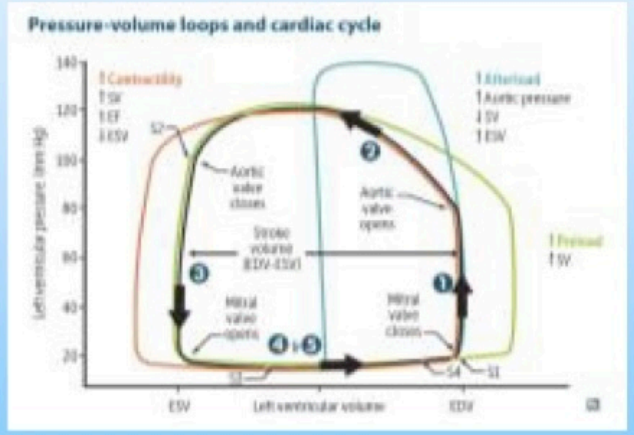
Valvular Heart Disease	Symptoms	Physical Examination
Aortic Stenosis	Angina, Dyspnea, Syncope, HF	
Aortic Regurgitation	HF	
Mitral Stenosis	Pulmonary Congestion	
Mitral Regurgitation	HF	

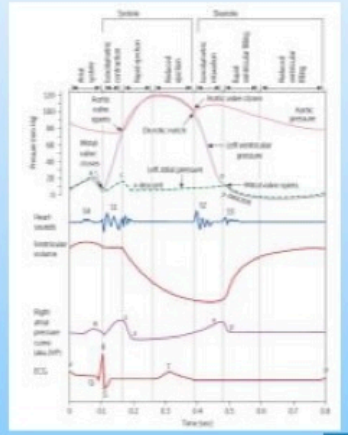
Clinical – Treatment

The patient is a 50-year-old male, came to clinic complaining of **Chest pain on Exertion and Recurrent Syncope** in last 2 months. On Physical Exam, he had an crescendo-decresendo systolic murmur with ejection click.

Valvular Heart Disease	Symptoms	Key Treatment	Treatment
Aortic Stenosis	Angina, Dyspnea, Syncope, HF	↓ LVP Avoid ↓ Afterload	Relief Mech. Obstruction Avoid Vasodilators
Aortic Regurgitation	HF	↓ Afterload Avoid Bradycardia	Diuretics Vasodilators Avoid B-blockers, CCB
Mitral Stenosis	Pulmonary Congestion	Avoid Tachycardia	B-Blockers Diuretics
Mitral Regurgitation	HF	↓ Afterload	Vasodilators Diuretics

Basic - Physiology

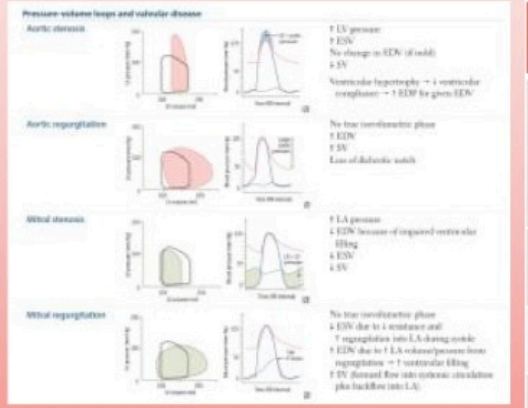




Clinical - Treatment

Valvular Heart Disease	Symptoms	Key Treatment	Treatment
Aortic Stenosis	Angina, Dyspnea, Syncope, HF	↓LVP Avoid ↓ Afterload	Relief Mech. Obstruction Avoid Vasodilators
Aortic Regurgitation	HF	↓ Afterload Avoid Bradycardia	Diuretics Vasodilators Avoid B-blockers, CCB
Mitral Stenosis	Pulmonary Congestion	Avoid Tachycardia	B-Blockers Diuretics
Mitral Regurgitation	HF	↓ Afterload	Vasodilators Diuretics

Basic - Pathology



VHD	Key Concepts	Result	Clinical
Aortic Stenosis	↑ LVP	Subendocardial Ischemia	Angina
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Mitral Stenosis	Tachycardia	Shorter Filling time	Pul. Edema
Mitral Regurgitation	↑Afterload	Increased Regurgitation	↑ HF

Clinical - Diagnosis

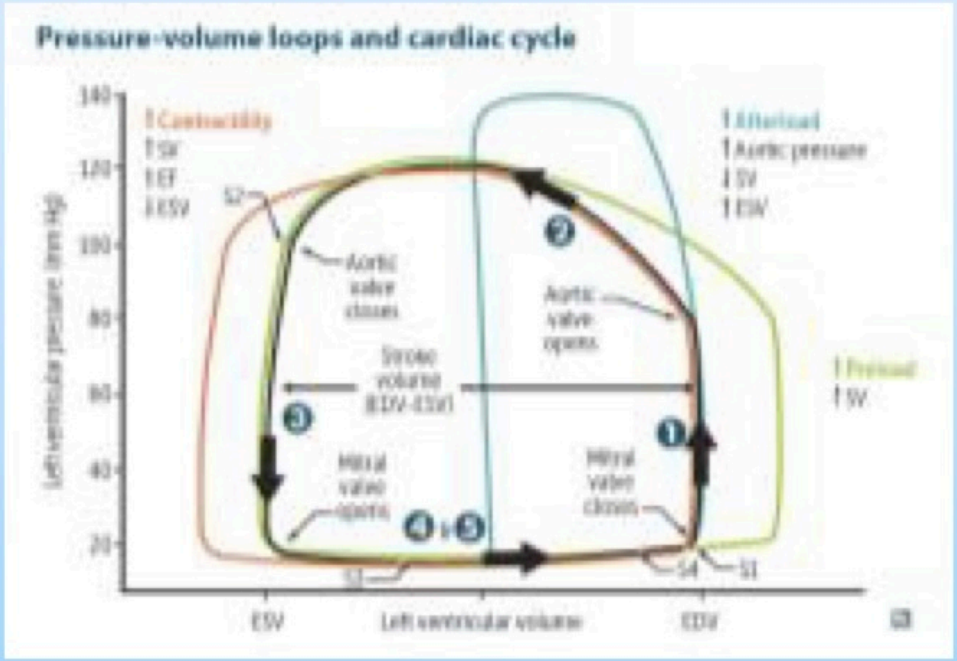
Valvular Heart Disease	Symptoms	Physical Examination
Aortic Stenosis	Angina, Dyspnea, Syncope, HF	
Aortic Regurgitation	HF	
Mitral Stenosis	Pulmonary Congestion	
Mitral Regugitation	HF	

Case 4

Heart Failure

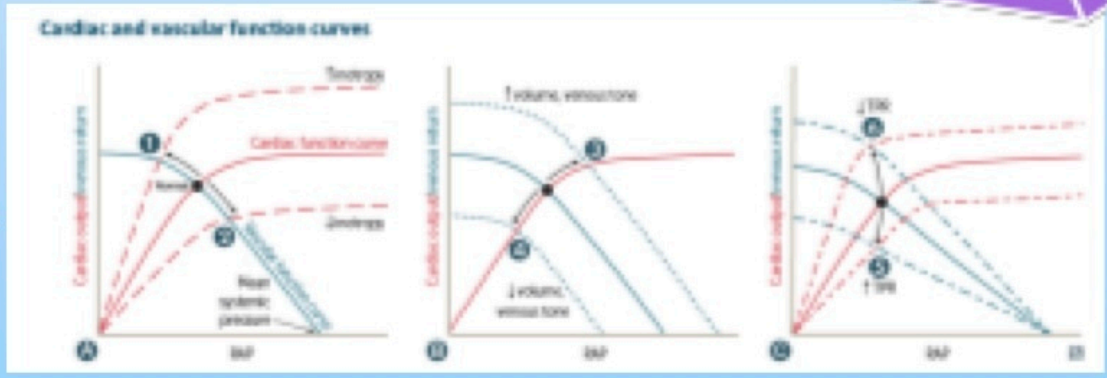
Case 4

The patient is a 55-year-old female, recent history of COVID Infection 2 weeks ago, came to ED complaining of **Dyspnea and Lower Extremity Swelling** in last week.

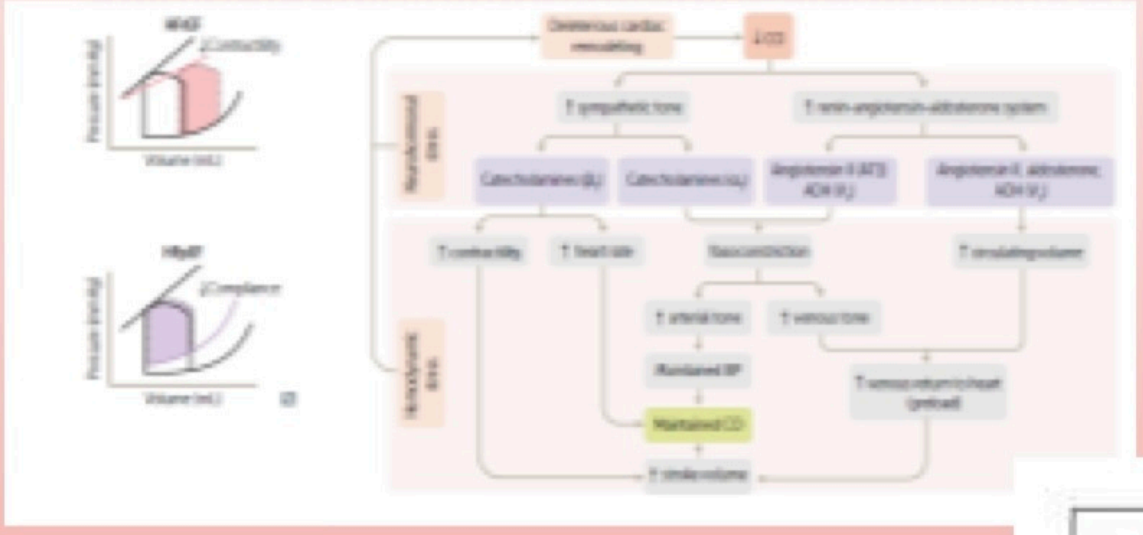

Pressure-volume loops and cardiac cycle
↑ Contractility
↑ SV
↑ EF
↓ ESV
↑ Afterload
↑ Aortic pressure
↓ SV
↑ ESV
↑ Preload
↑ SV
Aortic valve closes
Aortic valve opens
Stroke volume (EDV-ESV)
Mitral valve opens
Mitral valve closes
S2
S1
S4
S1
ESV
Left ventricular volume
EDV

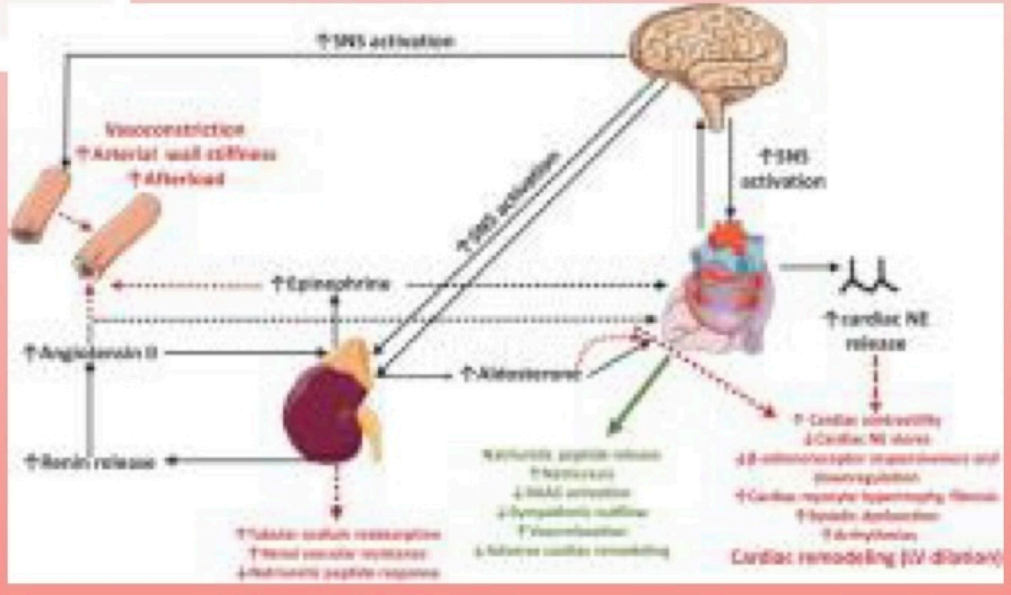
C.O. = HR x SV

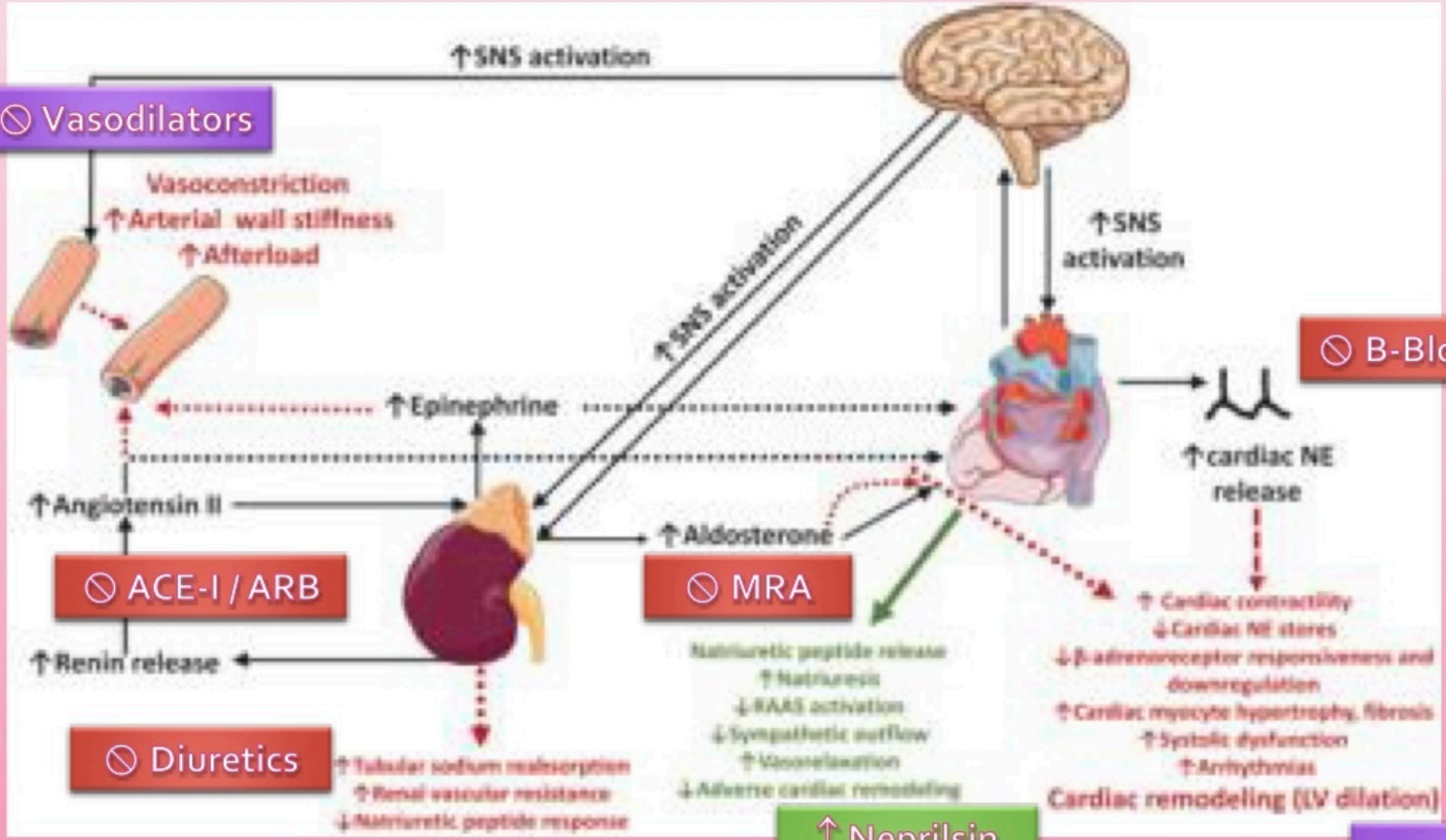

Contractility
Stroke Volume
Preload
Afterload


Cardiac and vascular function curves
Cardiac function curve
Normal
Heart systemic pressure
RAP
↑ volume, venous tone
↓ volume, venous tone
RAP
↓ SV
↑ HR
RAP

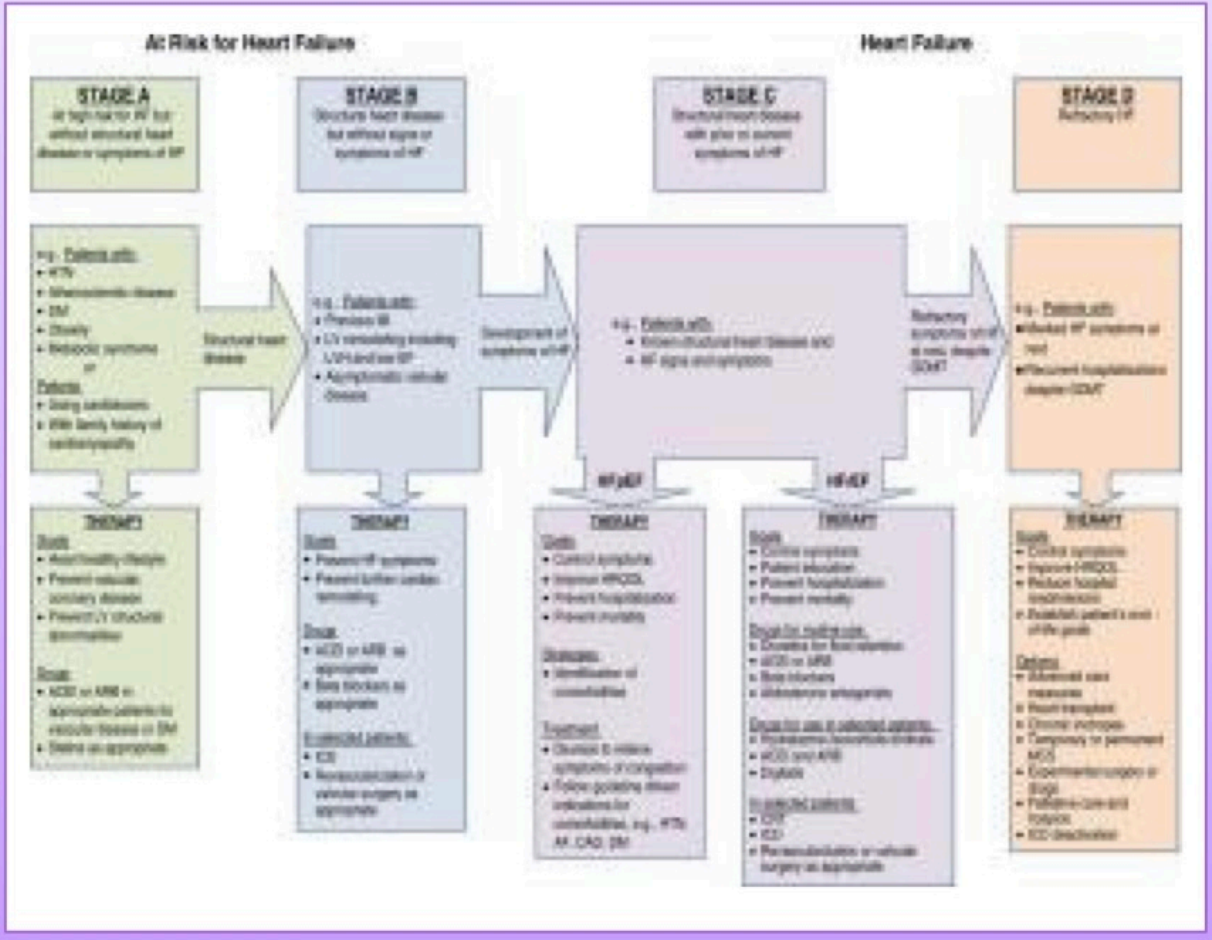
Basic – Pathology

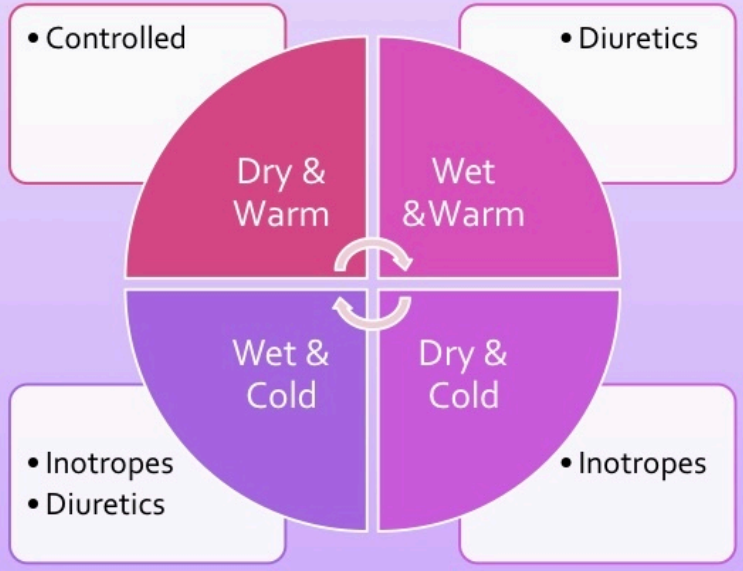




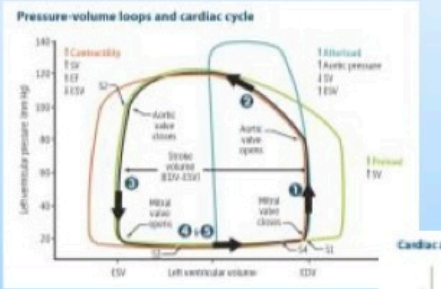

↑SNS activation
⊘ Vasodilators
Vasoconstriction
↑Arterial wall stiffness
↑Afterload
↑SNS activation
↑SNS activation
⊘ B-Blockers
↑Epinephrine
↑cardiac NE release
↑Angiotensin II
↑Aldosterone
⊘ ACE-I / ARB
⊘ MRA
↑Renin release
↑ Cardiac contractility
↓Cardiac NE stores
↓β-adrenoreceptor responsiveness and downregulation
↑Cardiac myocyte hypertrophy, fibrosis
↑Systolic dysfunction
↑Arrhythmias
Cardiac remodeling (LV dilation)
Natriuretic peptide release
↑Natriuresis
↓RAAS activation
↓Sympathetic outflow
↑Vasorelaxation
↓Adverse cardiac remodeling
⊘ Diuretics
↑Tubular sodium reabsorption
↑Renal vascular resistance
↓Natriuretic peptide response
↑ Neprilsin Inhibitor
Inotropes
Cardiac Glycosides

The patient is a 55-year-old female, recent history of COVID Infection 2 weeks ago, came to ED complaining of **Dyspnea and Lower Extremity Swelling** in last week.

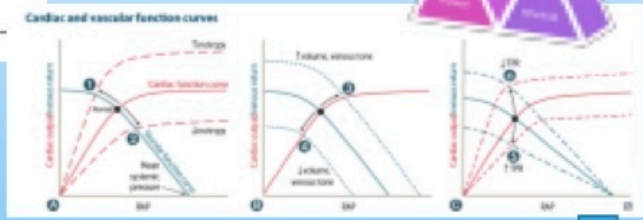




Basic - Physiology

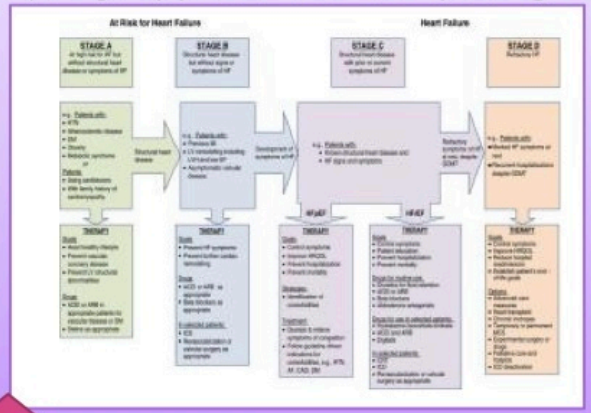


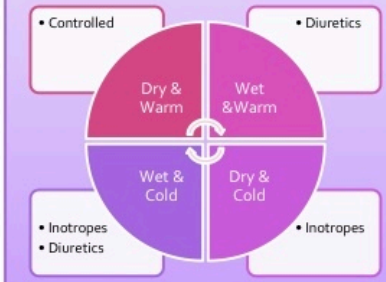
C.O. = HR x SV



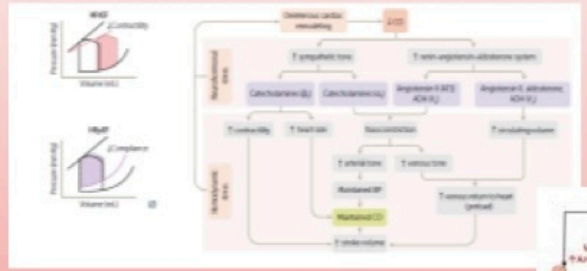
Clinical – Diagnosis & Treatment

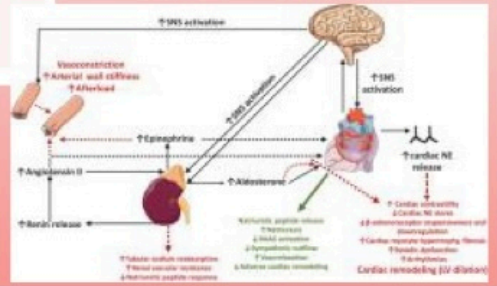
The patient is a 55-year-old female, recent history of COVID Infection 2 weeks ago, came to ED complaining of **Dyspnea and Lower Extremity Swelling** in last week.





Basic - Pathology





Basic - Pharmacology