Learn. Integrate. Apply.

An Integrative Question-Based USMLE Resource

USMLE Step 1

NBME Top Concepts

Rahul Damania, MD

HyGuru
LEARN. INTEGRATE. APPLY.

DEDICATION

To my students, mentors, and family. Without your support, insight, and guidance, our mission of inspiring the next generation of physicians would not be possible.

Designed by:
Ray Ann S. Sampil

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CHAPTER 1

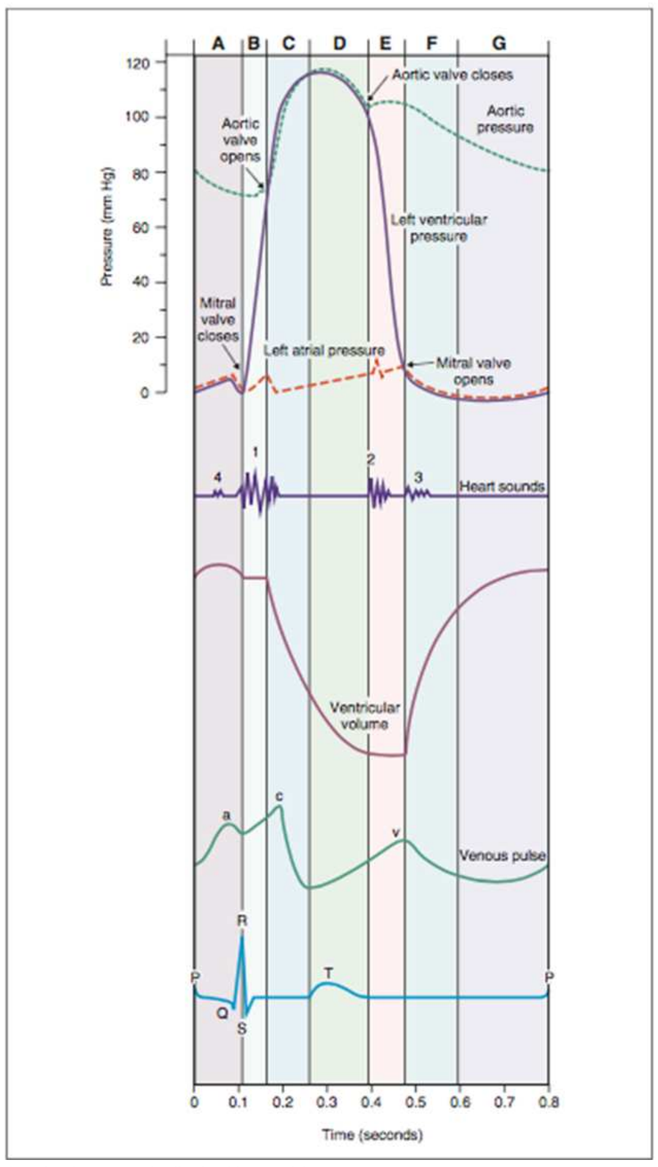
Cardiac Physiology for the USMLE

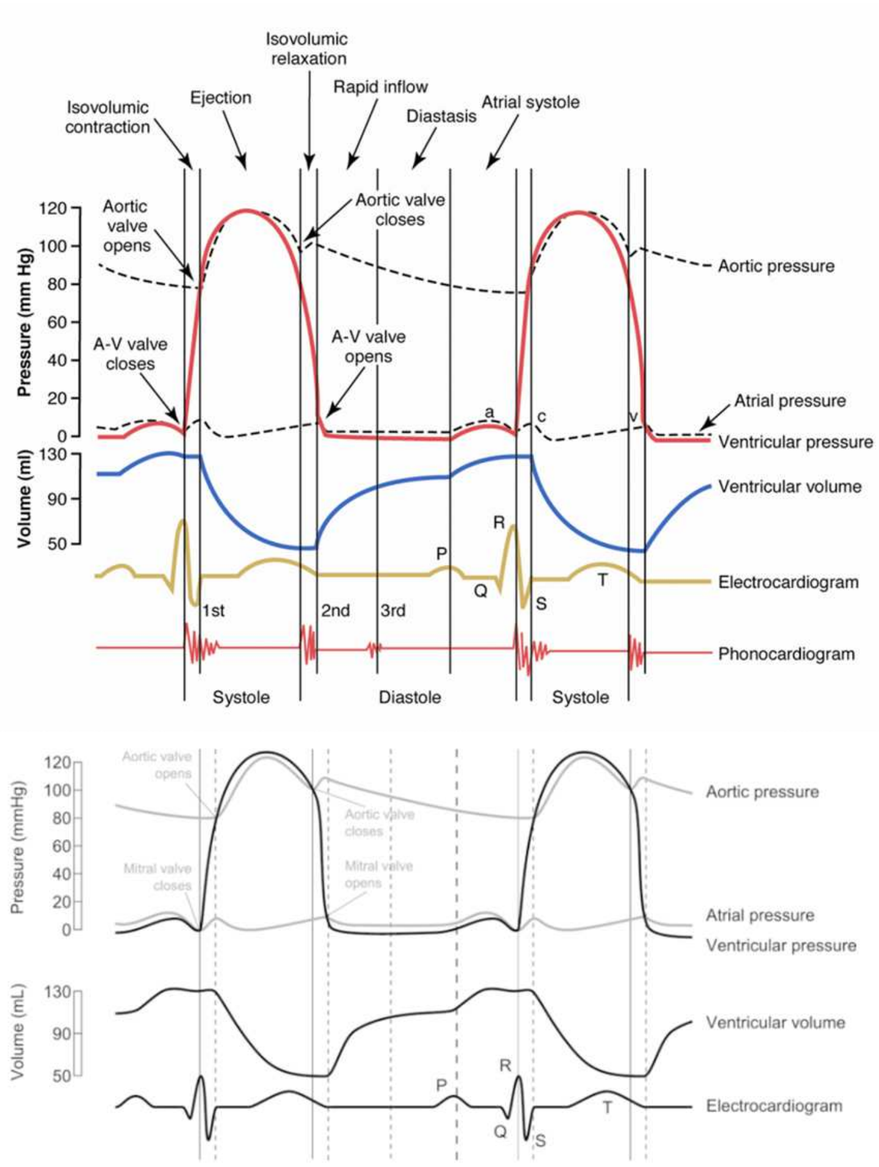
Dr. Carl Wiggers

Dr. Carl Wiggers

- Earliest Descriptions published in 1915
- A comprehensive approach on learning the electrical & mechanical activity of the heart.
- Forms the basis for understanding Cardiac Physiology for the USMLE.

Mastering the Cardiac Cycle



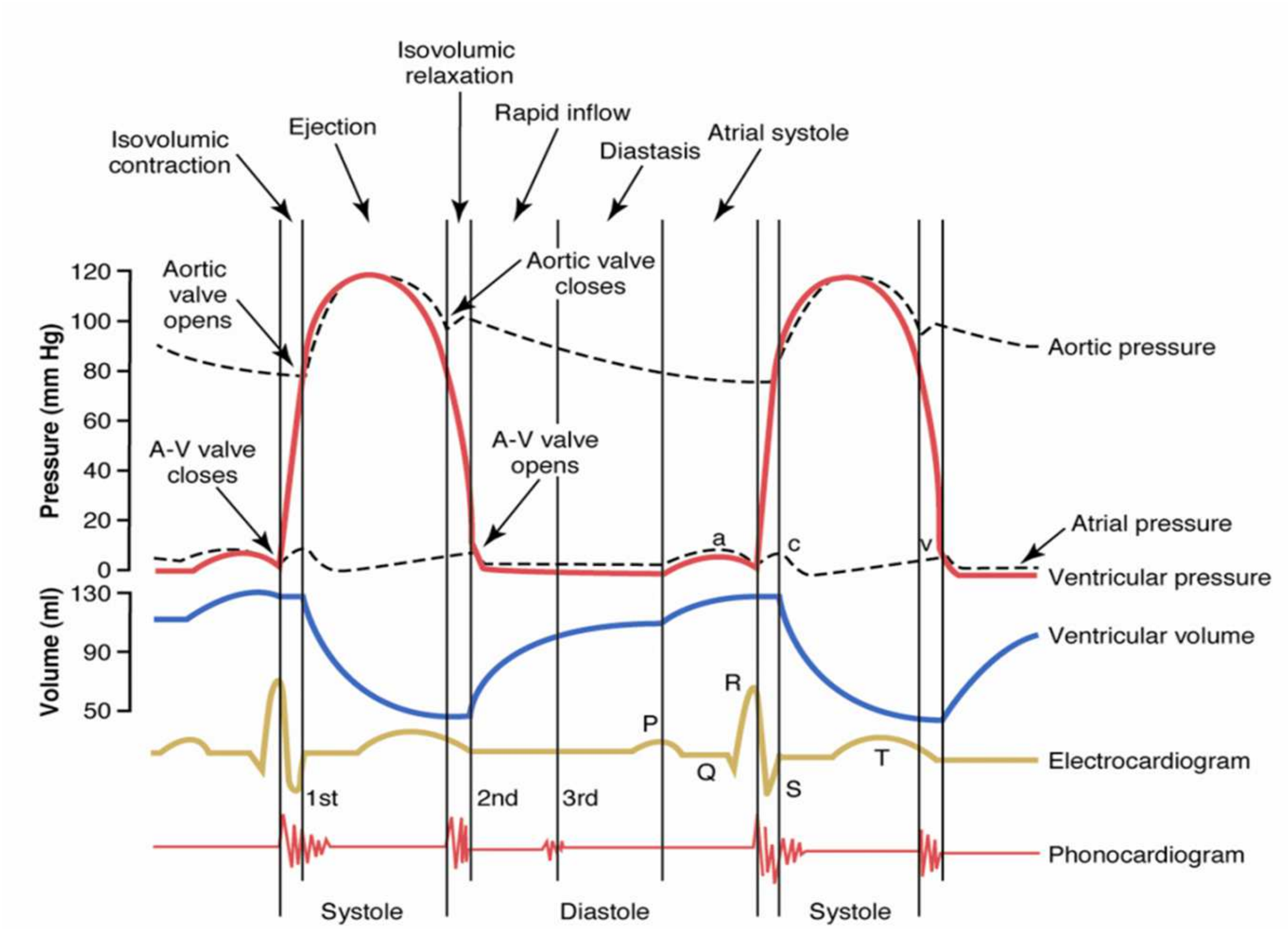


STRATEGIES ON MASTERING THE CARDIAC CYCLE

Active Recall of Events

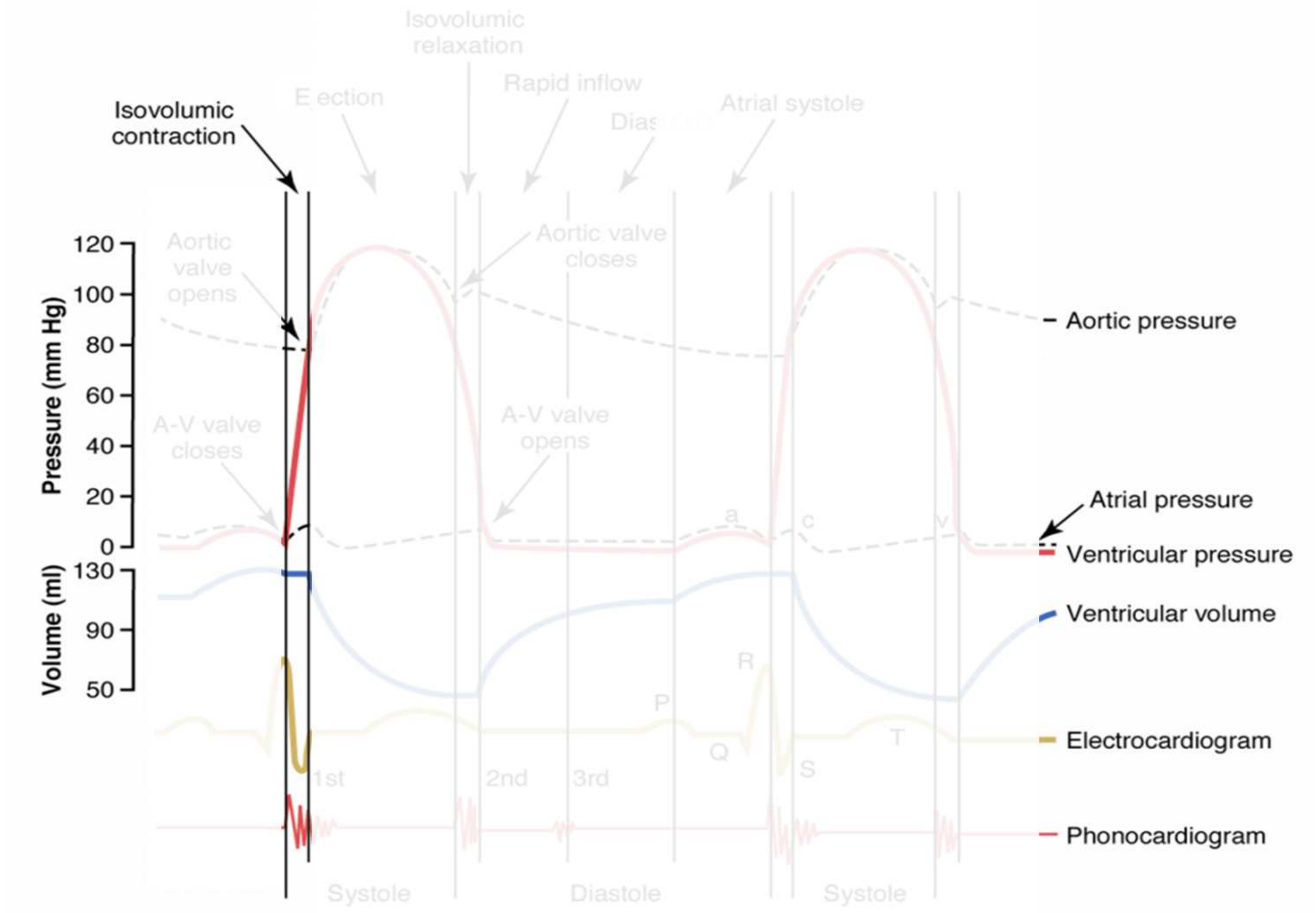
- Ask yourself ‘Where is the blood flow?’
- Isolate each curve in your mind understanding pressure and volume
- Electrical activity of the heart precedes mechanical activity of the heart!

Major Events and Curves of the Cardiac Cycle



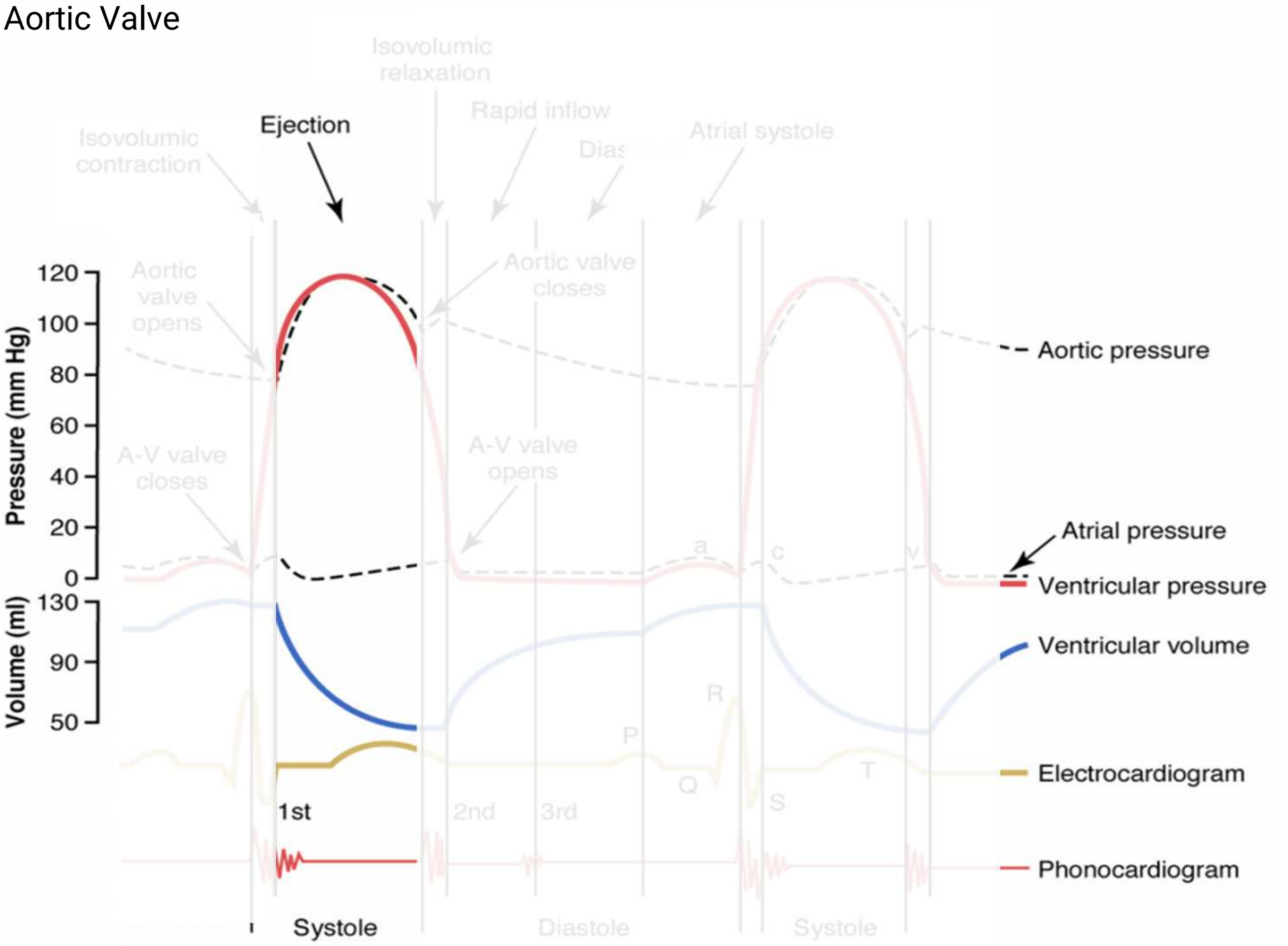
Isovolumetric Ventricular Contraction

- Isovolumetric Ventricular Contraction
  - What is the heart doing?
    - Ventricles contracting → What does this say about pressure?
      - Increases
  - On the EKG, what wave does this correlate to?
    - QRS complex
  - What heart sound do you hear clinically at the beginning of this phase?
    - 1st heart sound



Rapid Ventricular Ejection

- Rapid Ventricular Ejection
  - What is the heart doing?
    - Ventricles contract (max pressure) → blood is flowing into the aorta
    - Aortic pressure is increasing
    - What is happening with ventricular volume?
      - Decreasing
  - On the EKG, what wave does this correlate to?
    - ST Segment
  - Which valve is open during this time?
    - Aortic Valve



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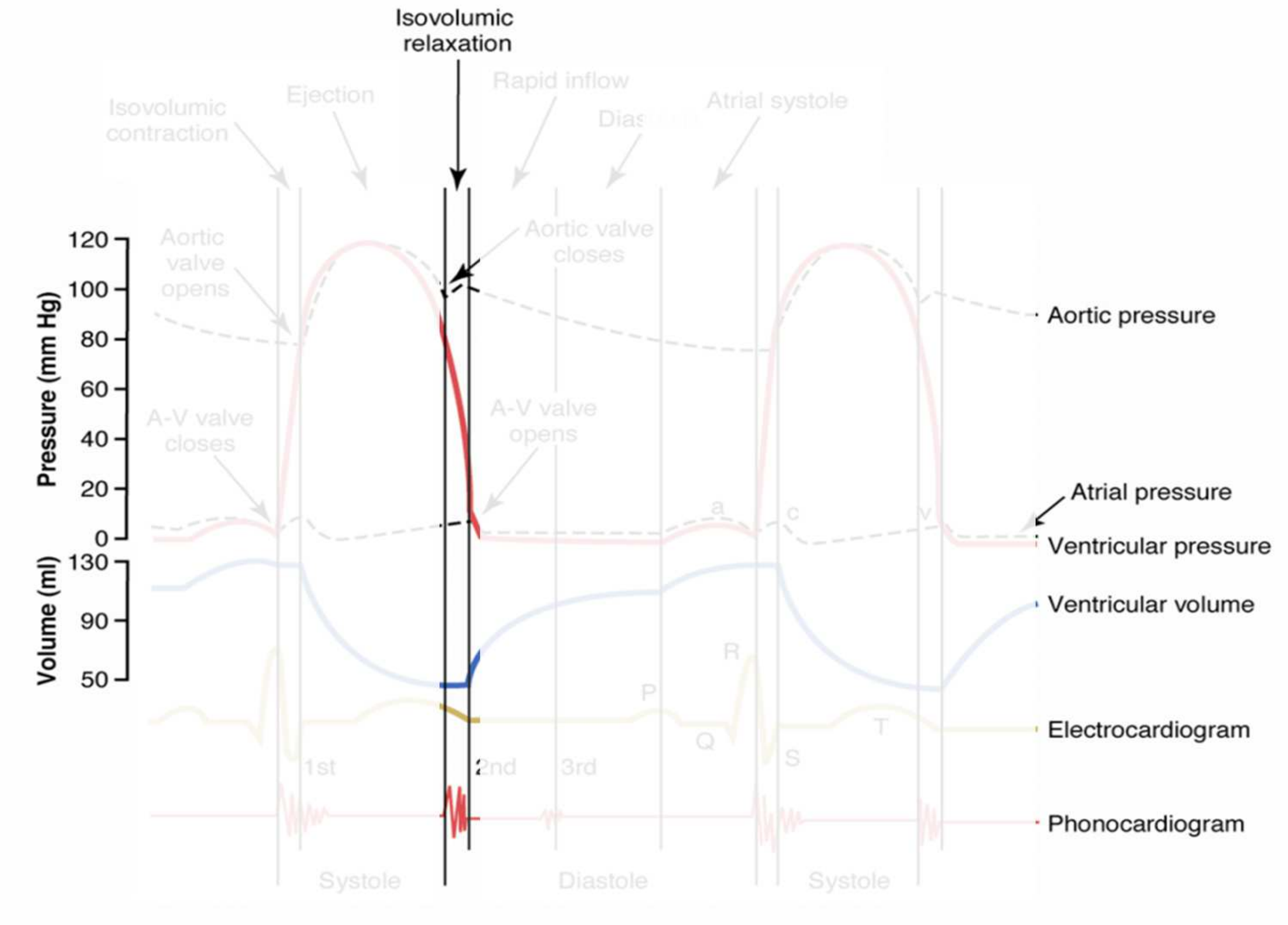
Review Systolic Events of the Cardiac Cycle

Phase	Major Events	EKG	Valves	Heart Sounds
Isovolumetric Ventricular Contraction	Ventricles contract P↑	QRS Complex	All closed	First Heart Sound
Ventricular Ejection	Ventricles contract P↑ V↓	ST Segment	Aortic valve opens	--

Isovolumetric Ventricular relaxation

- Isovolumetric Ventricular Relaxation
  - What is the heart doing?
    - Ventricular pressure decreases
  - What valve just closed during this phase?
    - QRS complex
  - What heart sound do you hear clinically?
    - 2nd heart sound



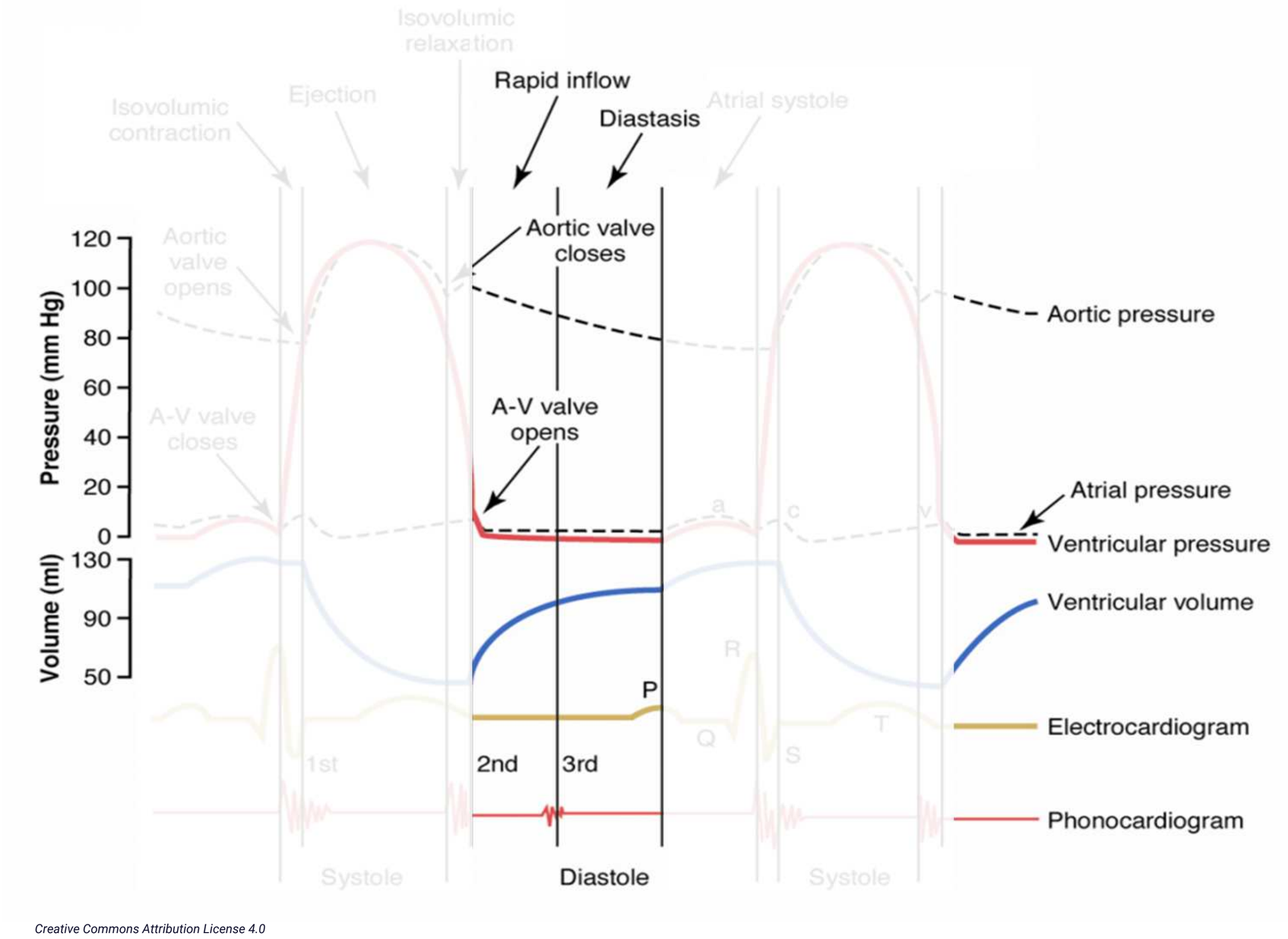
Rapid Ventricular Filling

- Rapid Ventricular Filling
  - What is the heart doing?
    - Ventricles are filling passively with blood
    - Ventricular volume is increasing
    - Ventricular pressure is low and constant to keep the passive flow going
  - What valve is open?
    - Mitral
  - What heart sound do you hear clinically?
    - 3rd heart sound

Reduced Ventricular Filling

- Reduced Ventricular Filling
  - What is the heart doing?
    - Ventricles are relaxed
  - What valve is open?
    - Mitral
- This is the **longest phase** of the cardiac cycle.
- A patient is undergoing an exercise stress test on a treadmill. What effect will this have on this phase of the cardiac cycle?
  - Decreased time available for ventricular filling.

Ventricular Filling



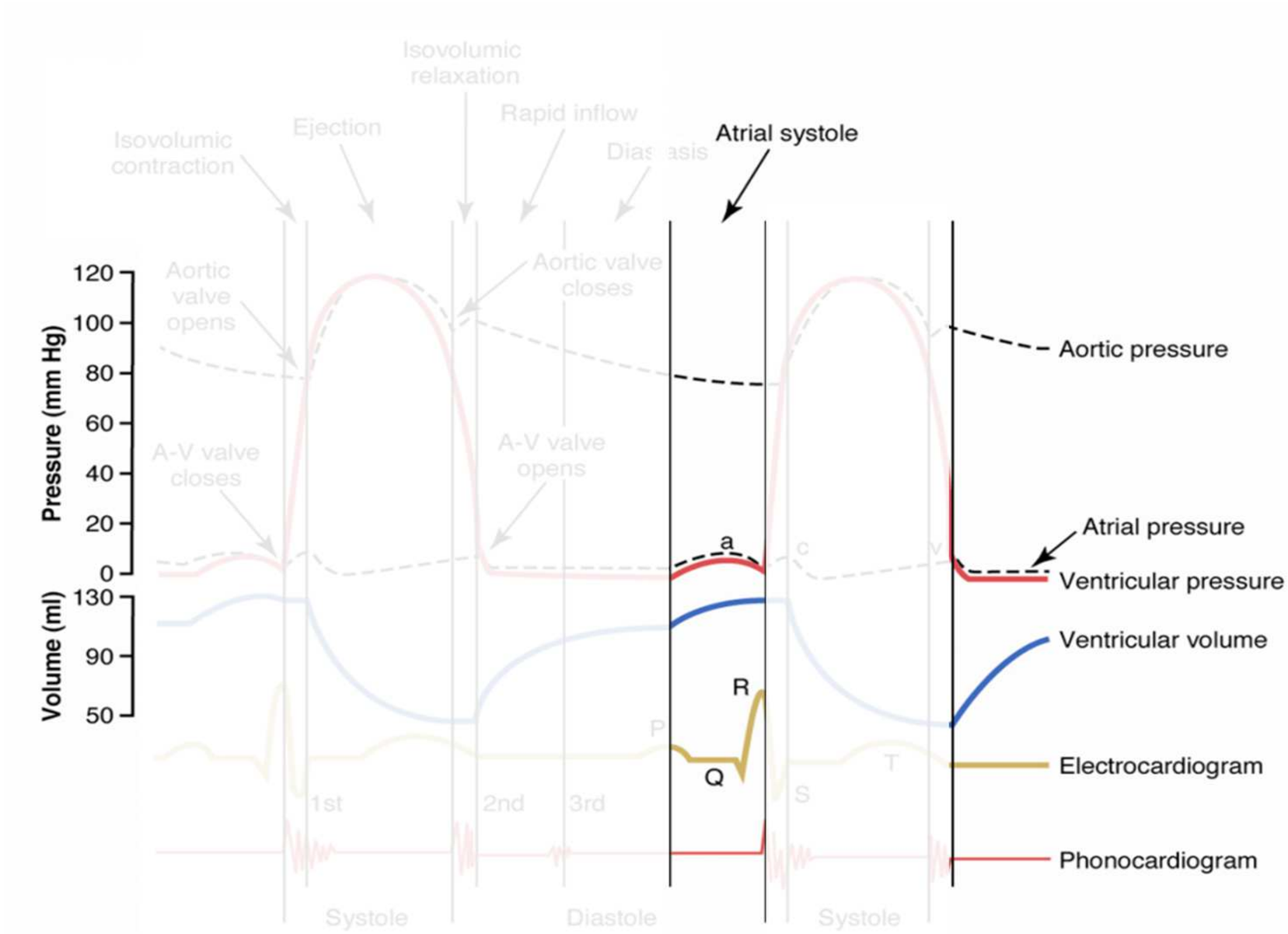
NBME Style Question

A middle-aged male presents with shortness of breath while lying flat. He is found to have a 3/6 holosystolic murmur heard best at the apex. Dilated cardiomyopathy is suspected. Which of the following physical exam findings would be less likely to be associated with this presentation?

A. Apical impulses shifted to the axillary line at the sixth intercostal space.
B. S4 gallop.
C. Bibasilar crackles.
D. Peripheral edema.
E. Hepatomegaly.

Atrial Systole

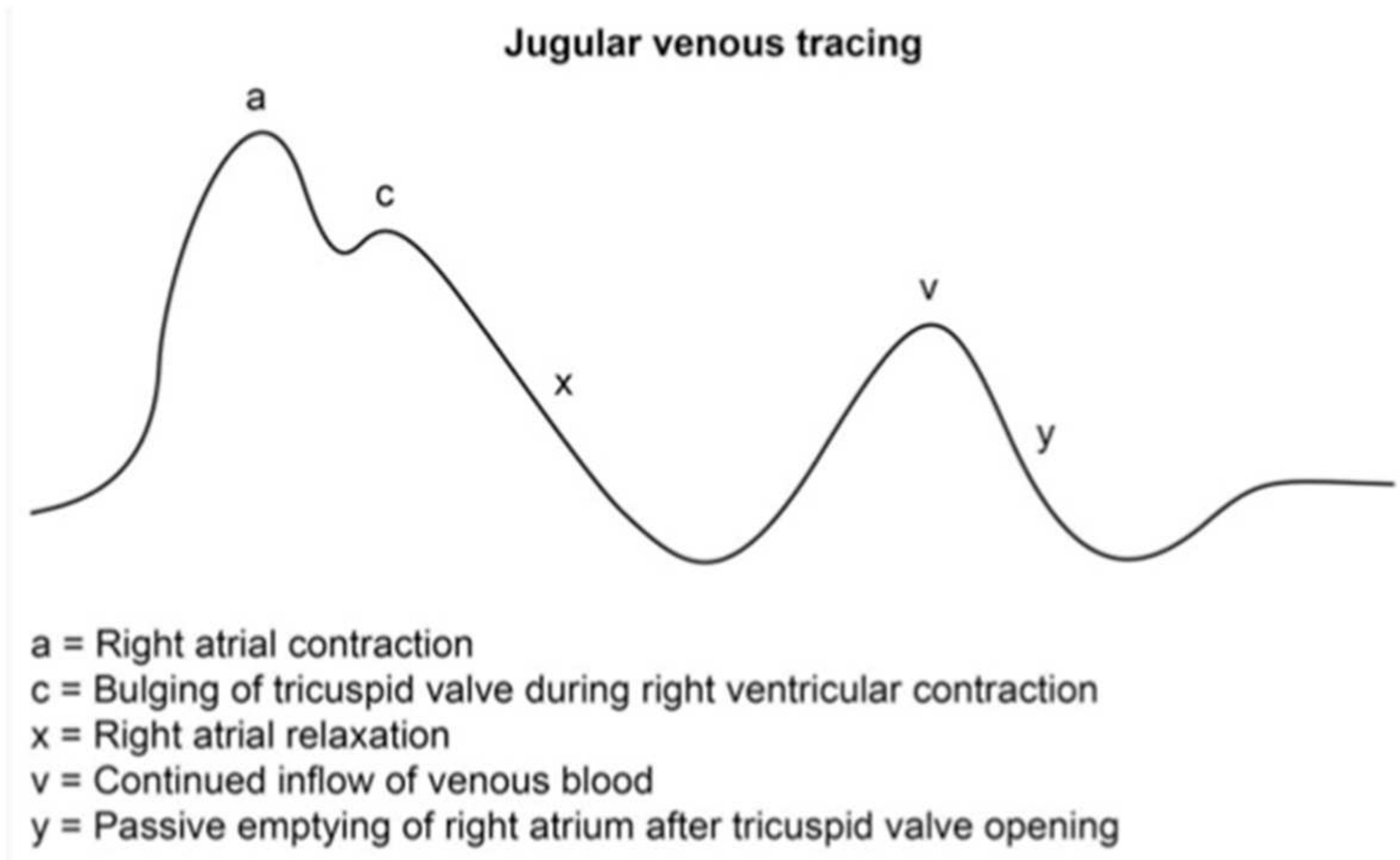
- Atrial Systole
  - What is the heart doing?
    - Atria contracting → final phase of ventricular filling
  - On the EKG, what wave does this correlate to?
    - P wave and PR interval
  - Clinically, what can you hear on cardiac exam?
    - 4th heart sound

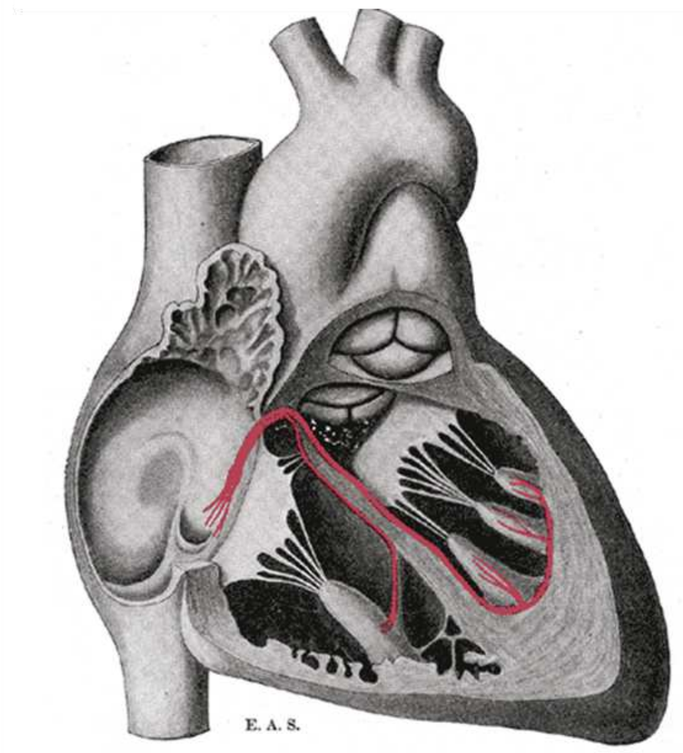


Review Diastolic Events of the Cardiac Cycle

Phase	Major Events	EKG	Valves	Heart Sounds
Isovolumetric Ventricular Relaxation	Ventricles relaxed P⬇	--	All closed	Second Heart Sound
Rapid Ventricular Filling	Ventricles relaxed P⬇ V⬆	--	Mitral Valve Opens	Third Heart Sound
Reduced Ventricular Filling	Ventricles relaxed	--	Mitral Valve remains open	
Atrial Systole	Atria contract	P wave PR interval	Mitral valve is open	Fourth Heart Sound

Jugular Venous Tracing





NBME Style Question

A 30 year old male is hit in the chest with a baseball bat. He is tachycardic and he has shallow respirations. On palpation of his abdomen, a prominent jugular vein is appreciated. Bedside echo shows a collapsed atria on diastole. What is the most likely vital sign change which may be present in this patient?

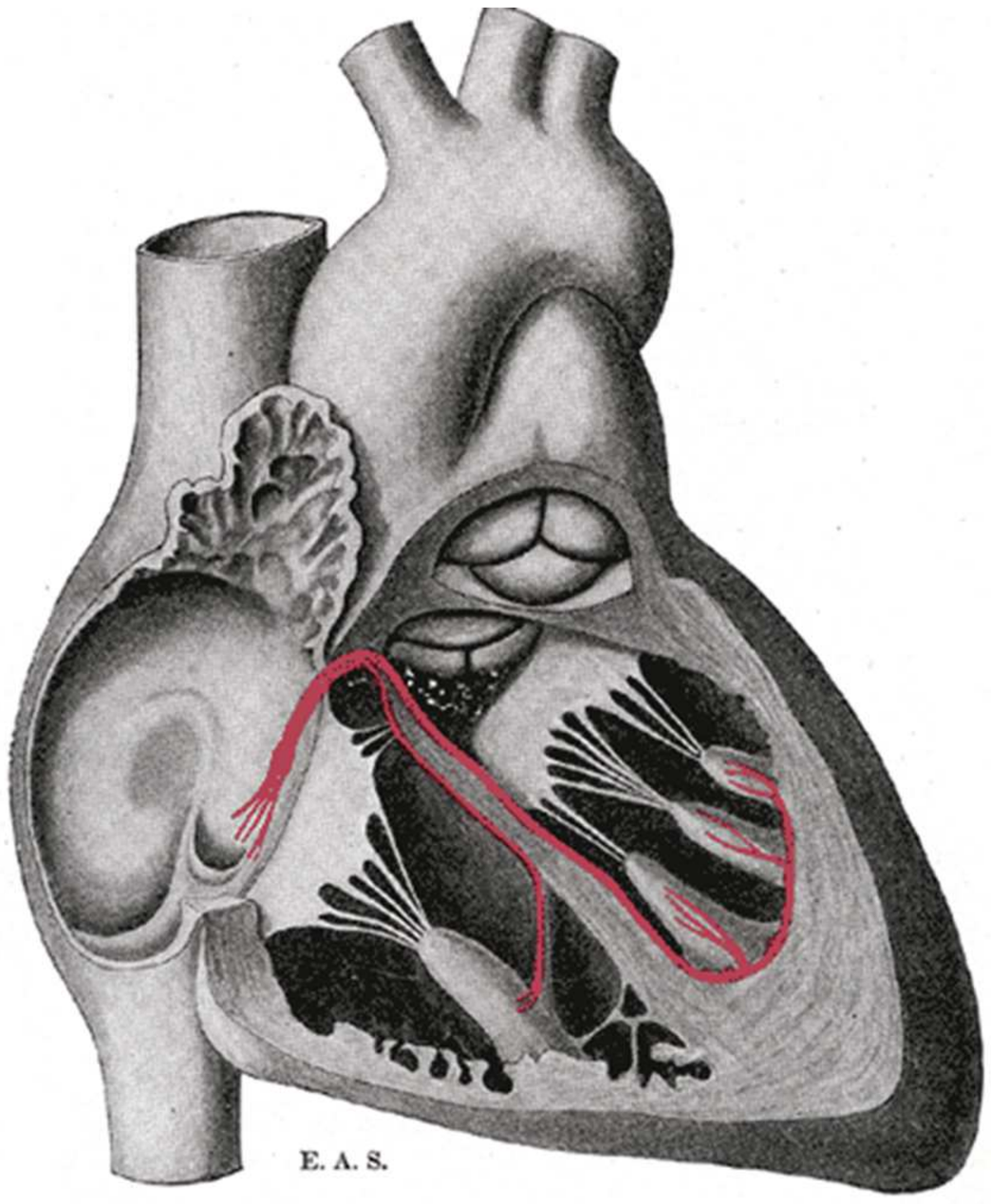
A.Decrease in diastolic blood pressure by 6 mmHg during exhalation.
B.Increase in diastolic blood pressure by 10 mmHg during inhalation.
C.Decrease in systolic blood pressure by 10 mmHg during exhalation.
D. Decrease in systolic blood pressure by 10 mmHg during inhalation.

Pulsus Paradoxes

Decrease in SBP by 10 mmHg during Inspiration

Cardiac Tamponade on the USMLE Step 1:

Recognize Triads
- Physical exam shows a prominent jugular vein.
- BP < 90/60
- Heart sounds are in-audible or muffled.

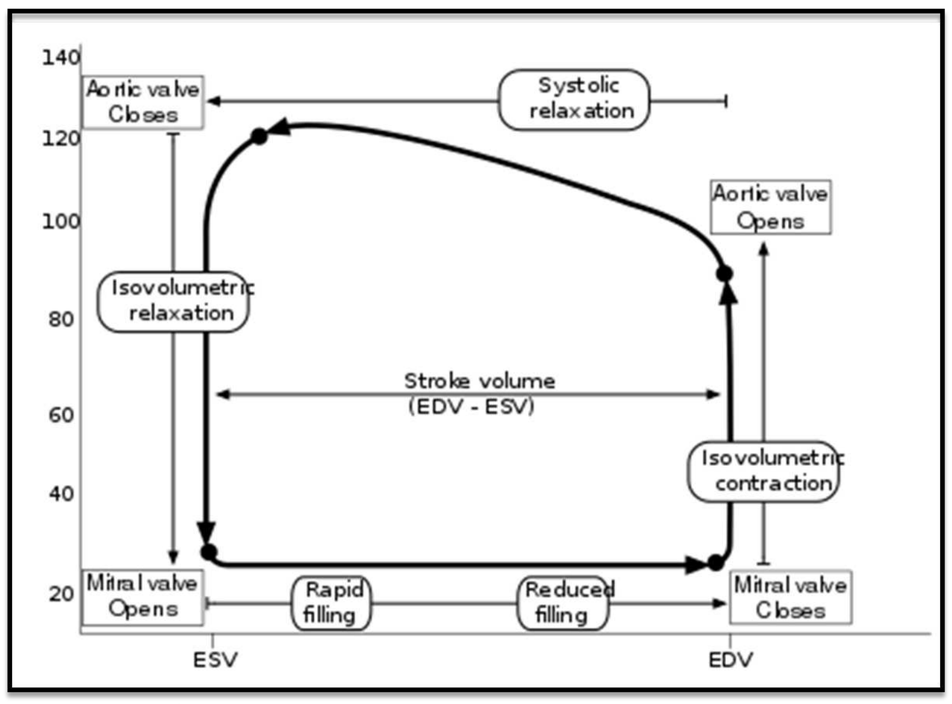


Pressure Volume Loops

A patient has a rumbling diastolic murmur heard at the apex. The snap of this murmur occurs at which point?

- D.Mitral valve opening.

- Cardiac event:
  - A. Mitral valve closure.
  - B. Aortic valve open.
  - C. Aortic valve close.
  - D.Mitral valve opening.



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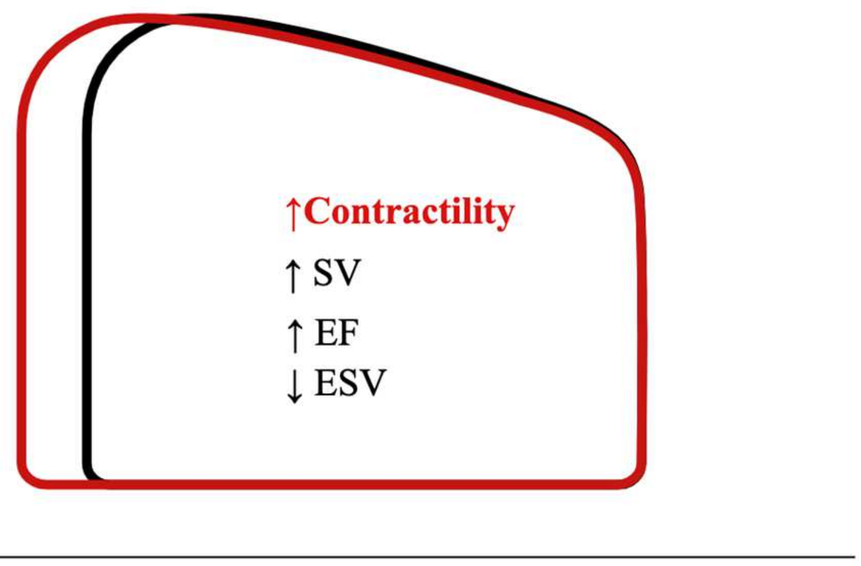
Pressure Volume Loops for the USMLE

USMLE Vignettes relevant to this change:

- ⬆ β1 mediated activity
- ⬆ [Ca2+]
  - PO4 phospholamban
- "A patient started on a medication for heart-failure and suddenly develops vision changes and increased [K]?"
- Digoxin
- Inhibits the Na+/K+ ATPase.
- Makes Ca2+ more difficult to leave myocyte.
- ⬆ contractility.



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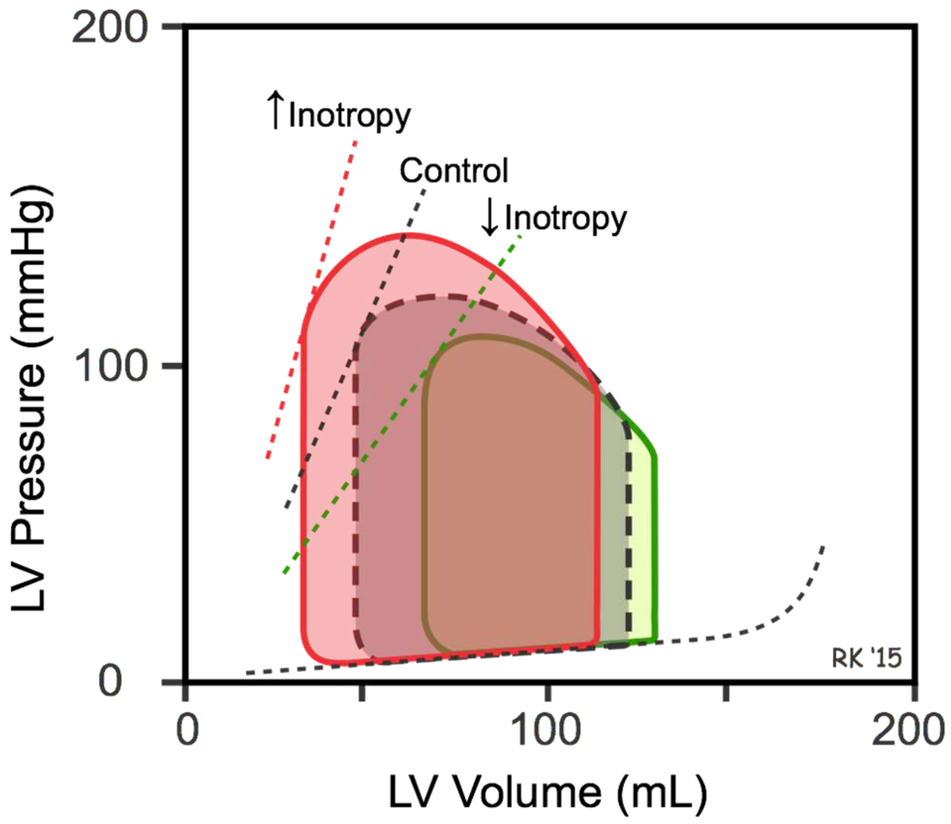
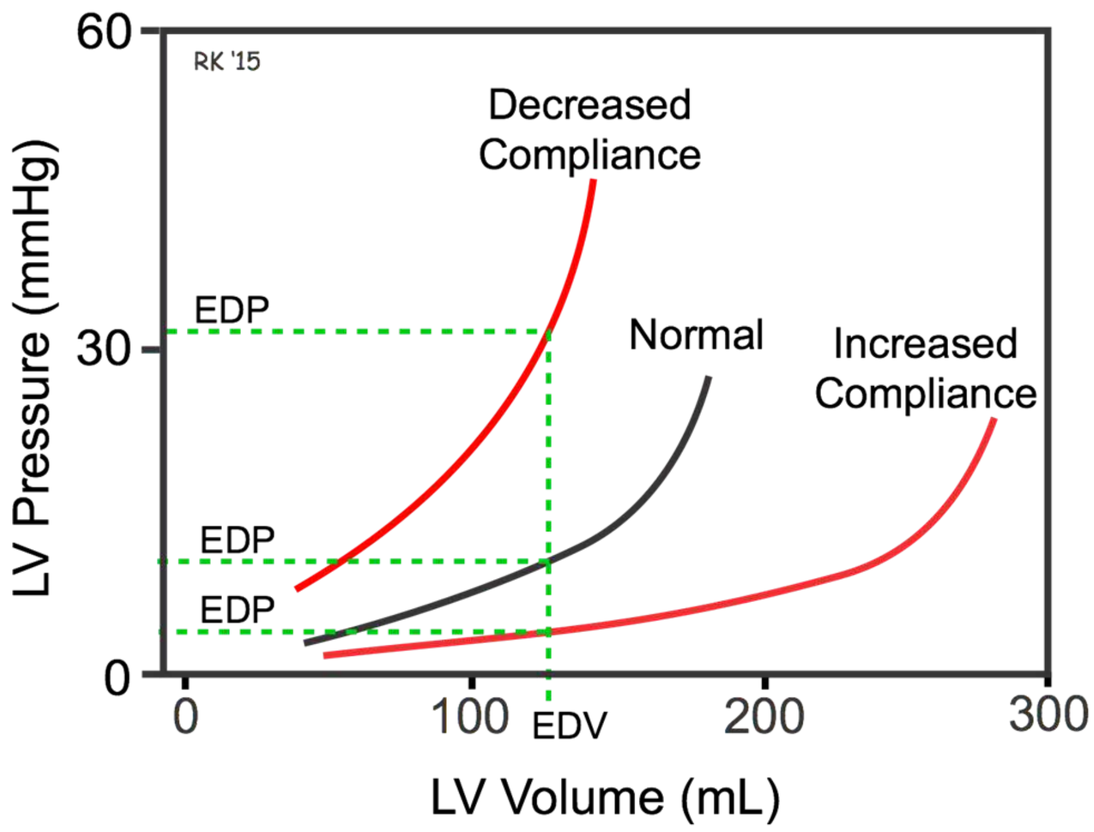
Changes in the ESPVR



Changes in EDPVR



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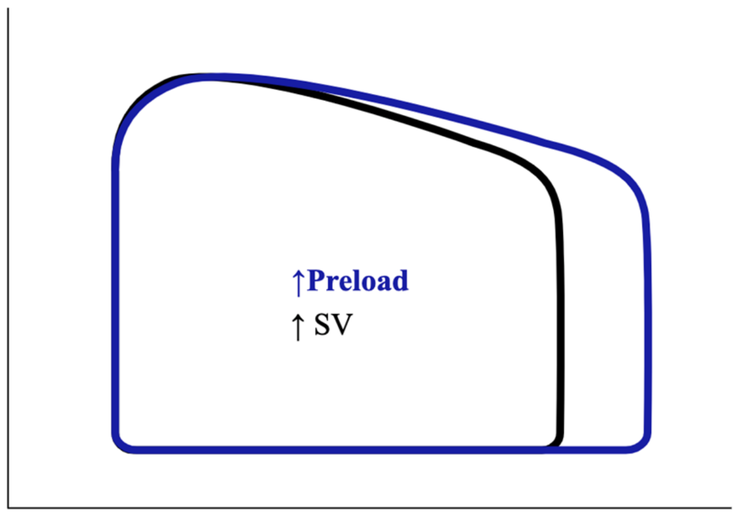
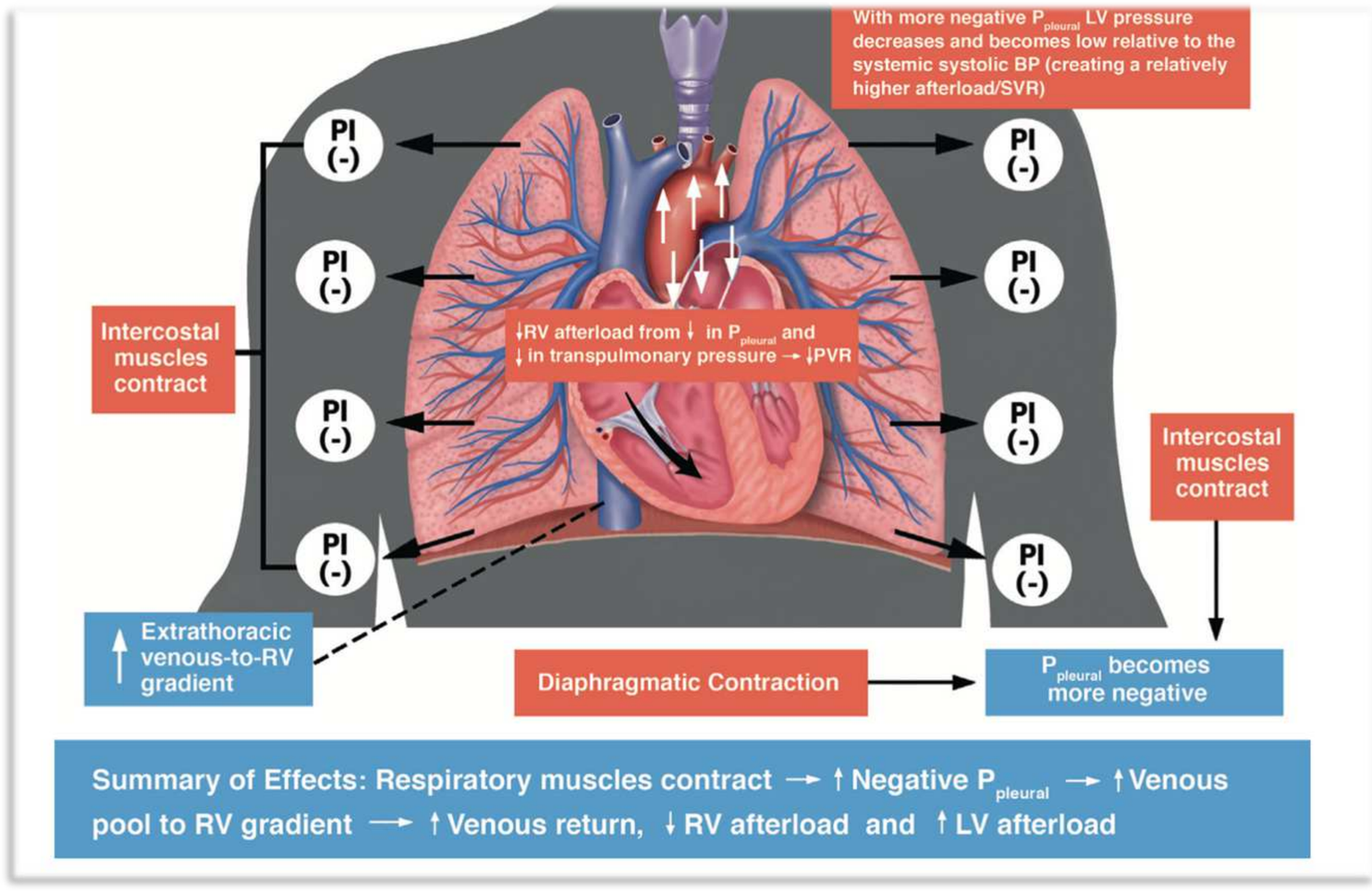
Pressure Volume Loops for the USMLE

USMLE Vignettes relevant to this change:

- ⬆ Endi Diastolic Volume
- ⬆ Venous Tone:
  - Exercise
- **USMLE Vignette:**
  - A patient who recently was placed on hemo-dialysis for CKD.
    The patient is noted to have hyperdynamic precordium. Bounding pulses. Diagnosis?
    - A-V fistula = ⬆ preload
- Passive leg raise



Summary of Effects

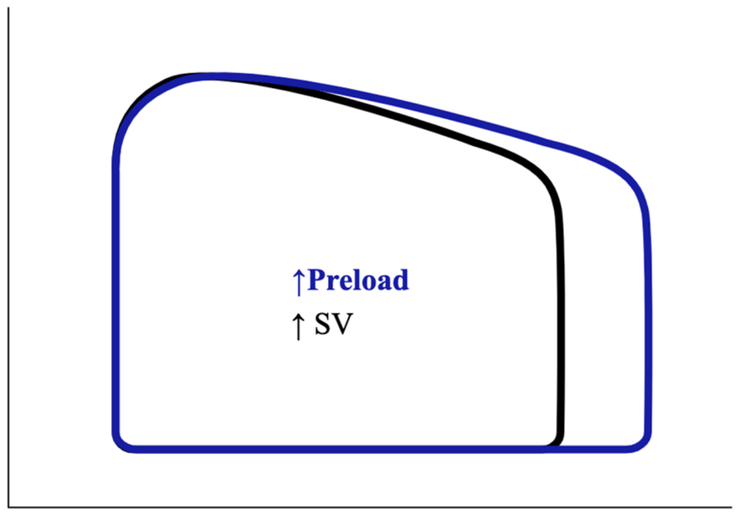


Positive Pressure Ventilation in the Cardiac Intensive Care Unit. J Am Coll Cardiol 2018;72:1532-1553.

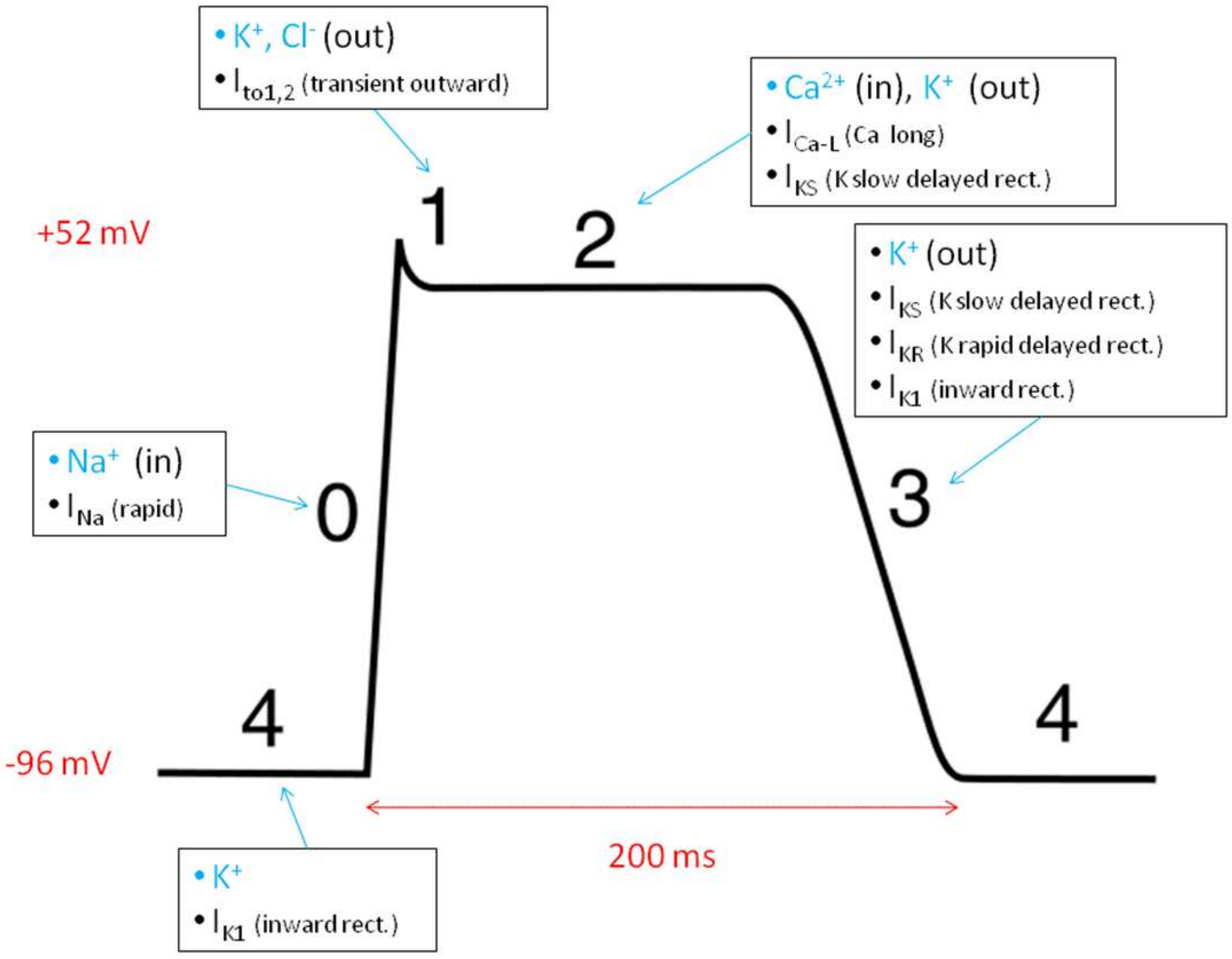
Pressure Volume Loops for the USMLE

USMLE Vignettes relevant to this change:

- Afterload is largely dependent upon aortic pressure.
- ⬆ blood pressure (essential hypertension)
- "A 50-year-old male who presents with passing out. He has CP non-tender to palpation. Walk test notes dyspnea. A murmur at the R-second intercostal space is noted.
  What is the likely mechanism?
  - Age related calcific stenosis →
    - A-V fistula = ⬆ preload



Compare and Contrast Two Action Potentials



Cardiac Action Potential

In ventricular muscle, what ion determines the phase 4 of the cardiac action potential?

- Potassium permeability
  - K equilibrium potential is -84 mV

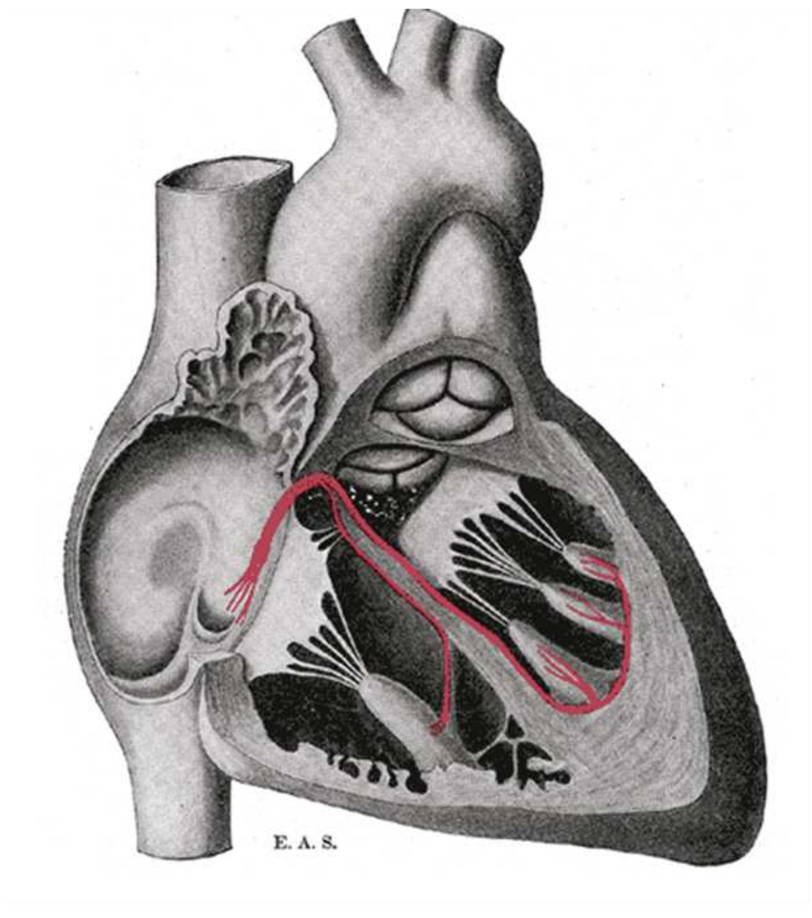
What ion determines phase 0 of the ventricular action potential?

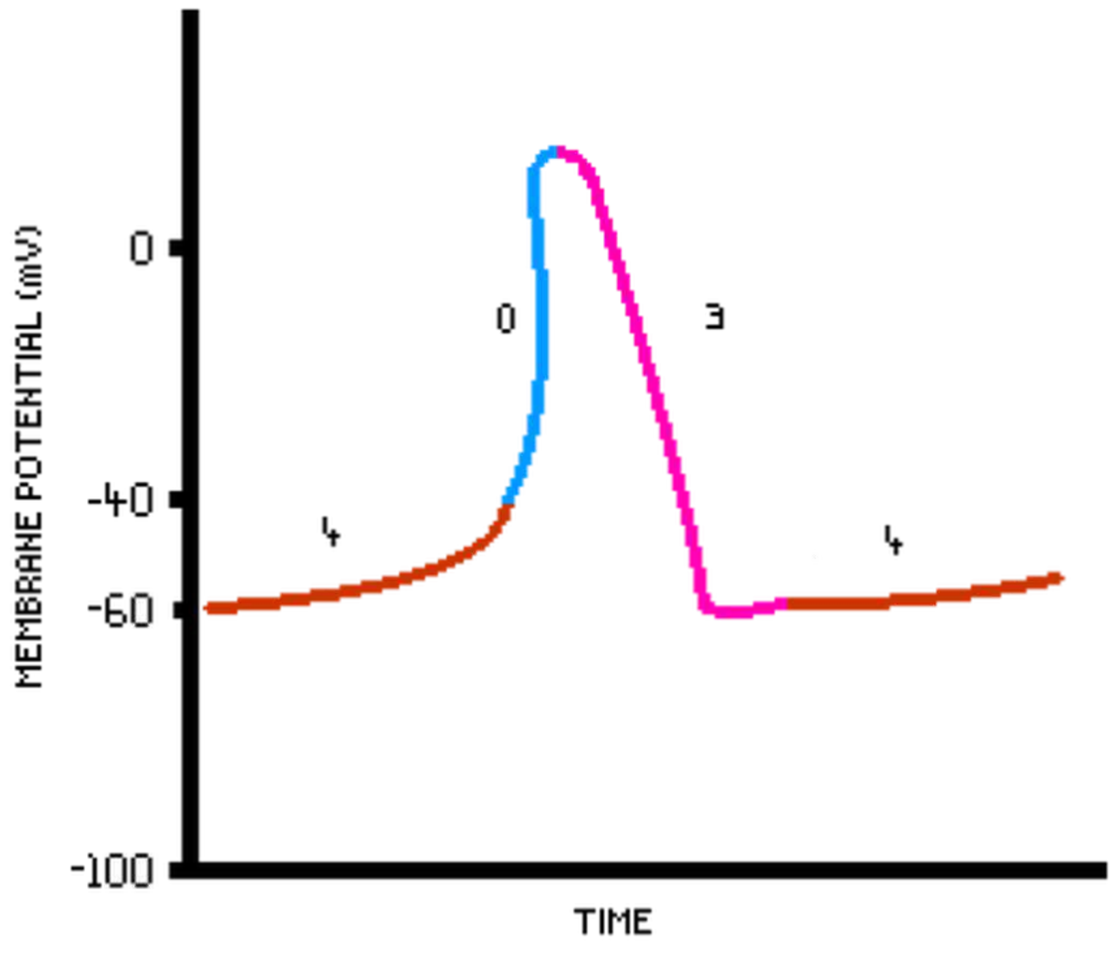
- Na influx

What phase of the ventricular action potential defines the difference between skeletal action potential vs. ventricular action potential?

- Phase 2 → Cardiac action potential has a plateau phase which is due to Ca influx and K efflux.
- Other differences: Ca induced Ca release, and gap-junctions

Compare and Contrast Two Action Potentials





Cardiac Action Potential

A farmer is working in the field and suddenly experiences lacrimation, rhinorrhea, and diarrhea. He begins to have sweating and bronchospasm. In the ED, his HR is found to be 45.

- An increase in which NT defines his symptoms?
  - Ach (due to inhibition of AchE).
- What phase of the nodal action potential does his bradycardia affect?
  - Phase 4

Regional Circulation for the USMLE

Circulation	What factors increase blood flow to these areas?	USMLE Vignettes
Coronary	• Hypoxia • Adenosine	• A patient who presents with myocardial infarction. He goes to cath lab and gets a stent place. What local metabolite mediated flow prior to stent?
Cerebral	• CO_2 • H^+	• A patient who has a history of asthma, has a respiratory acidosis and is somnolent. What is the mechanism? • A patient with impending herniation, what is the mechanism behind hyperventilation?
Skeletal Muscle	• Lactate • CO_2 • Adenosine	• An athlete who feels sore the next day. What mediator contributes to his soreness?
Pulmonary	• Hypoxia	• An obese male with daytime sleepiness. Found to have increased RV pressures on echocardiogram. What physiologic principle drives the changes in pulmonary vasculature?
Renal	• PGE-2	• A female with osteoarthritis who has taken Ibuprofen for 5 months, now has elevated creatinine. The medication inhibits what physiologic mechanism?

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Questions?
rahul@hyguru.com

Ventricular Filling

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CHAPTER 2

NBME Top Concepts: Cardiology

NBME Style Question

A 2-months-old female presents with seizures. She is lethargic and hypertonic. The patient is also found to have respiratory distress. The exam is notable for a cleft palate, and a murmur is heard on the clinical exam. What is the likely embryological mechanism?

A. Defective neural crest migration.
B. Neural crest defect.
C. Failure of the 3rd and 4th arch to develop.
D. Failure of 3rd and 4th pouch to develop.
E. Failure of 3rd and 4th cleft to develop.

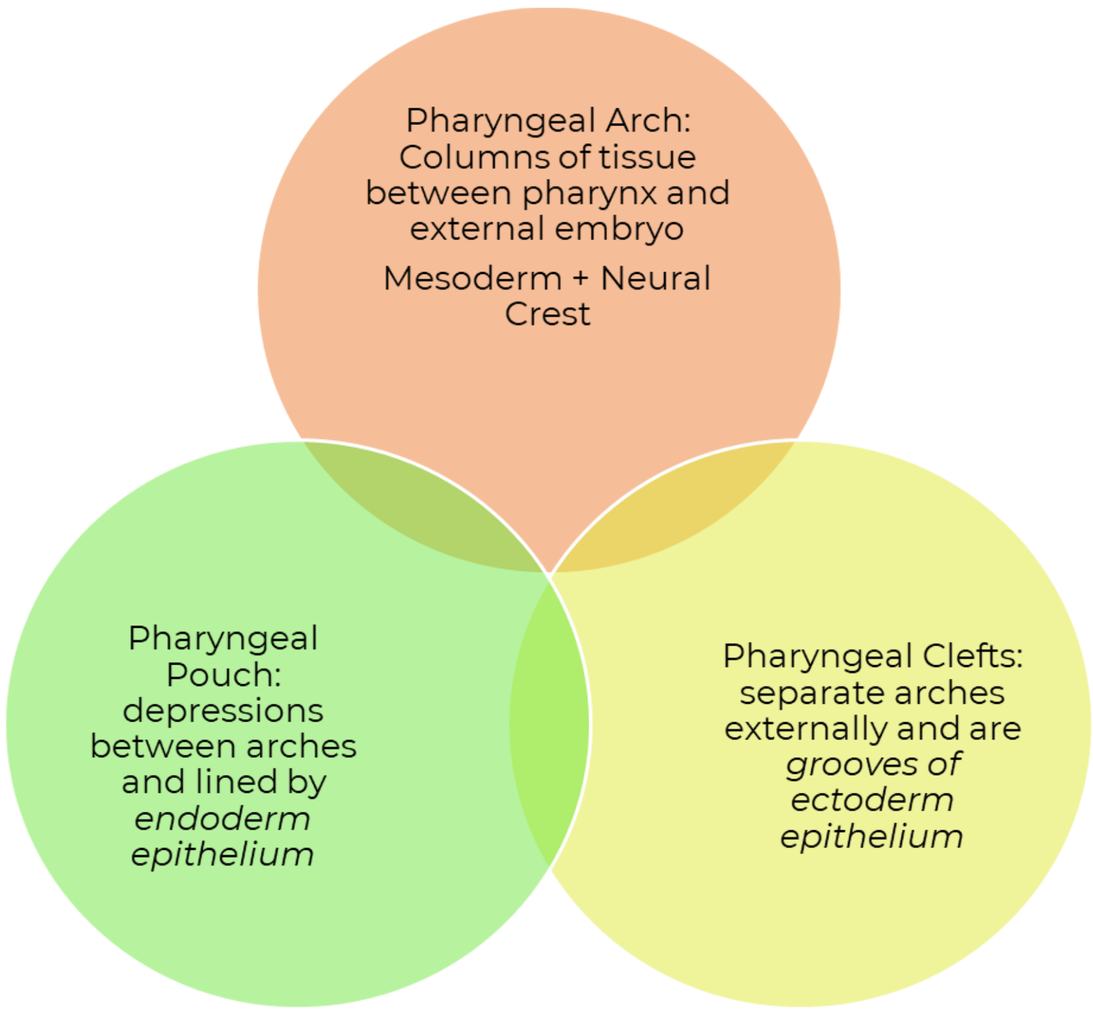
HyGuru Test-Taking Tip

RECOGNIZING MULTI-SYSTEM INVOLVEMENT

Whenever you see multiple organ systems involved in exam questions, think about a:
- Syndrome
- Systemic Condition

DiGeorge Syndrome:
- Recurrent infections ➡ Infectious Disease
- Hypocalcemia ➡Endocrine.

Embryology of the Pharyngeal System



Pharyngeal Pouches

Pouch	Derivation	USMLE points
1st pouch	Middle ear cavity Eustachian tube	"Ear"
2nd pouch	Palatine tonsils	"2 tonsils"
3rd pouch	Inferior Parathyroids Thymus	"3 is an inferior number"
4th pouch	Superior parathyroids Para-follicular C-cells of the thyroid	"4 is a superior number" Calcitonin

NBME Style Question

A 40-year-old female with a history of Grave's disease is noted to have intermittent chest pain with activity. She has a history of elevated LDL. She takes PTU for hyperthyroidism. She is started on a medication to control her dyslipidemia. Which of the following best explains the mechanism of action of this medication?

A. Activation of HMG-CoA Synthase.
B. Upregulation of hepatocyte LDL-receptor.
C. Downregulation of bile-acid synthesis.
D. In-activation of reverse transport in cholesterol metabolism.
E. Upregulation of bile-acid metabolism.

Relevant Drugs

Drug	Mechanism	USMLE Vignettes
Statin	• HMG-CoA Reductase inhibitor • Upregulates LDL-R on hepatocytes	• Decreases LDL • Increased LFTs • Increased CK levels
Ezetimibe	• Inhibits cholesterol absorption	• Decreases NPC1L1 in enterocyte • Increased LFTs
Bile Acid Sequest (Cholestyramine)	• Prevents reabsorption of bile-acids in terminal ileum • Up-regulates cholesterol synthesis, thus decreasing total cholesterol	• Nausea and fat-soluble vitamin malabsorption (fatty stools)
Niacin	• Decreases fatty acid release • Vitamin B_3	• Increases HDL • Gout • Flushing/pruritis
Fibrates	• PPAR-alpha activation → increases fat metabolism	• Reduces TAG levels • Increased CK levels

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PPAR integration

PPAR-alpha:
- Upregulates LPL
  - Increases TG clearance
  - Upregulates HDL synthesis

Pharm correlate: fibrates
- PPAR gamma:
  - Increases insulin sensitivity
  - Increases adiponectin levels
  - Pharm correlate: pioglitazone, rosiglitazone

Hepatotoxicity

Which of the anti-hyperlipidemics can be hepatotoxic?

- Statins
- Ezetimibe
- Niacin

What are ways the test maker may as this on the exam?

- Increases in AST and ALT.

Muscle Myopathy

Which of the anti-hyperlipidemics can cause myopathy?

- Statins
- Fibrates

What are ways the test maker may as this on the exam?

- Increases in CPK.

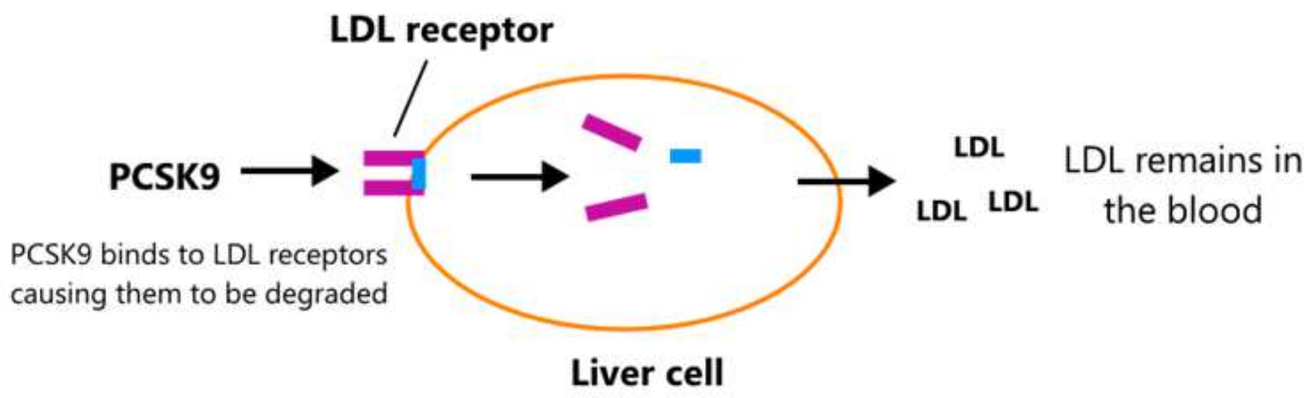
Anti-Hyperlipidemics

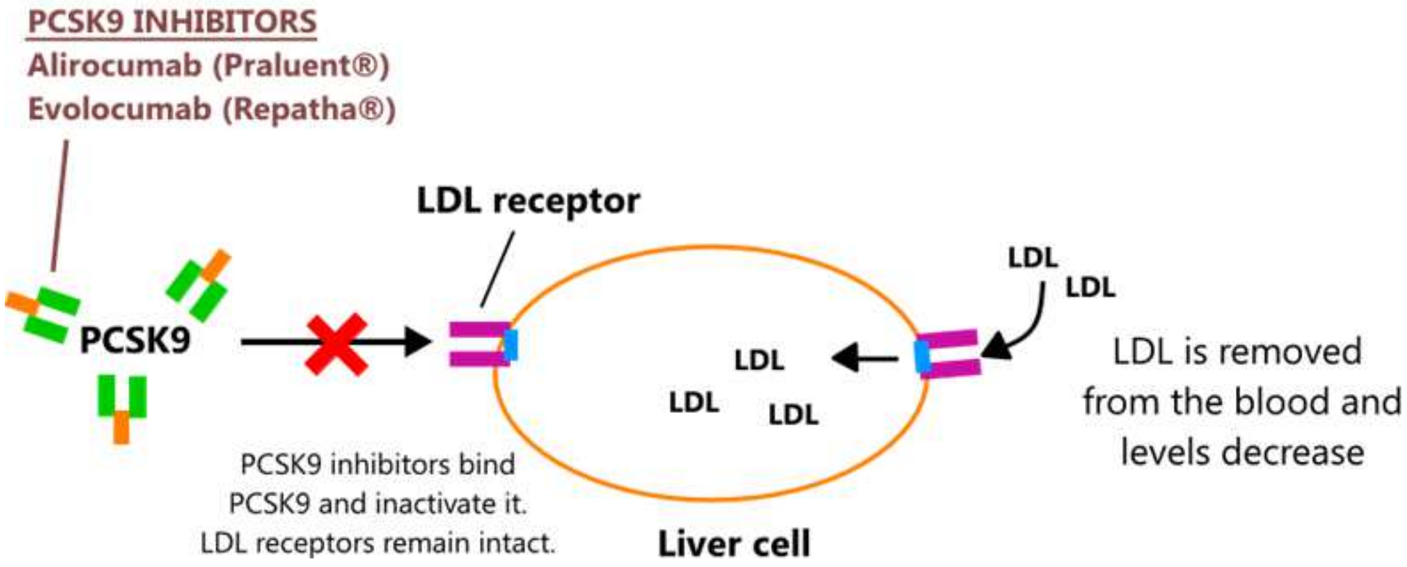
An experimental trial is studying the modulation of receptor mediated endocytosis via clathrin coated pits as it relates to lipid metabolism. Inhibition of receptor degradation via inactivation of the endo-lysosomal construct is noted to decrease LDL receptors. What is the likely agent studied?

PCSK9 Inhibitors:

- Alirocumab, Evolocumab.

PCSK9





USMLE Test Taking Strategy Experimental Questions

Think like the test-maker:

- Test makers want a student to:
  - Organize elements of an experiment.
  - Interpret relevant data.
  - Relate the experiment to the content you have studied.

Strategy:

1. Don't panic
2. Organize cohorts, groups, or data sets:
   Ex: Treatment group vs. control
   Ex: Filling out 'givens'
3. Relate to content studied.

NBME Style Question

A 50-year-old male presents with severe chest pain while mowing his lawn. His vital signs: 110/min, 20 breaths/min, 105/70. He is cool and clammy. He is noted to have an elevated PCWP and left-atrial pressure of 20. What are the most likely pressure changes in the pulmonary vasculature seen?

	Pulmonary Capillary Hydrostatic Pressure	Alveolar Interstitial Hydrostatic Pressure	Alveolar Interstitial Oncotic Pressure
A	High	High	High
B	High	High	Low
C	High	Low	High
D	Low	High	High
E	Low	High	Low

Mastering Shock for the USMLE

Isolate the primary etiology of each shock.

Parameters to watch out for:

- Cardiac Output:
  Blood coming out of the heart.
- TPR:
  Usually at the level of the pre-capillary arteriole.
- PCWP:
  Pressure in the pulmonary artery ➡ surrogate for LAP
- SVO2:
  Related to oxygen extraction
    - If tissues are extracting a lot of O2 ➡ MVO2 will be low
    - If tissues are extracting less O2 ➡ MVO2 will be high.

Understand the monitoring parameters:

CO: blood pumping out of the heart

SV x HR

TPR: resistance of the vessels

Usually at the level of the pre-capillary arteriole

PCWP: pressure in the pulmonary artery

Can be a surrogate for left atrial pressure

LVEDV: blood remaining in LV after filling/diastole

MVO2: how well are tissues extracting oxygen

Measured at the right atrium:

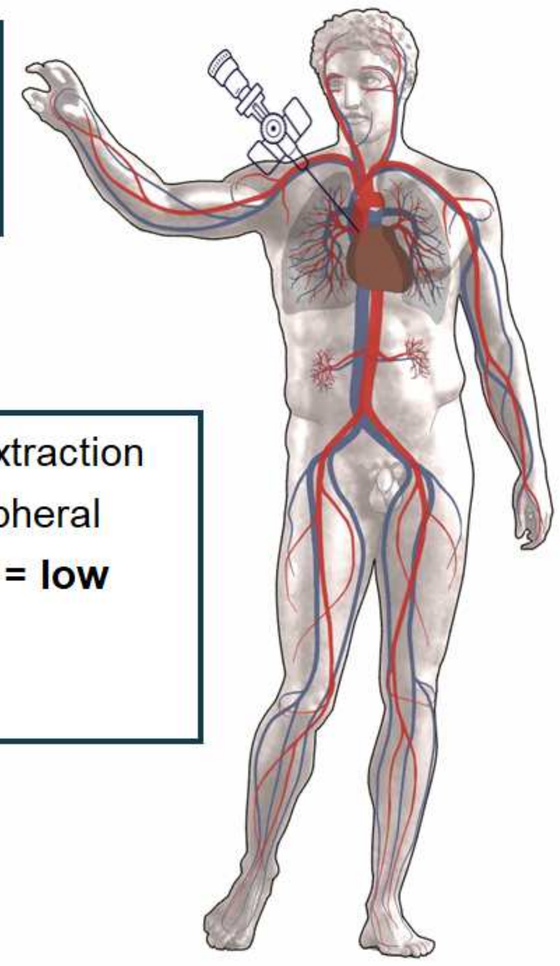
If tissues are extracting a lot of O2 -> MVO2 will be low

If tissues are extracting less O2 -> MVO2 will be high

What is the primary etiology of each shock and extrapolate

Mixed Venous Oxygen Saturation

- Measured at internal jugular or subclavian vein

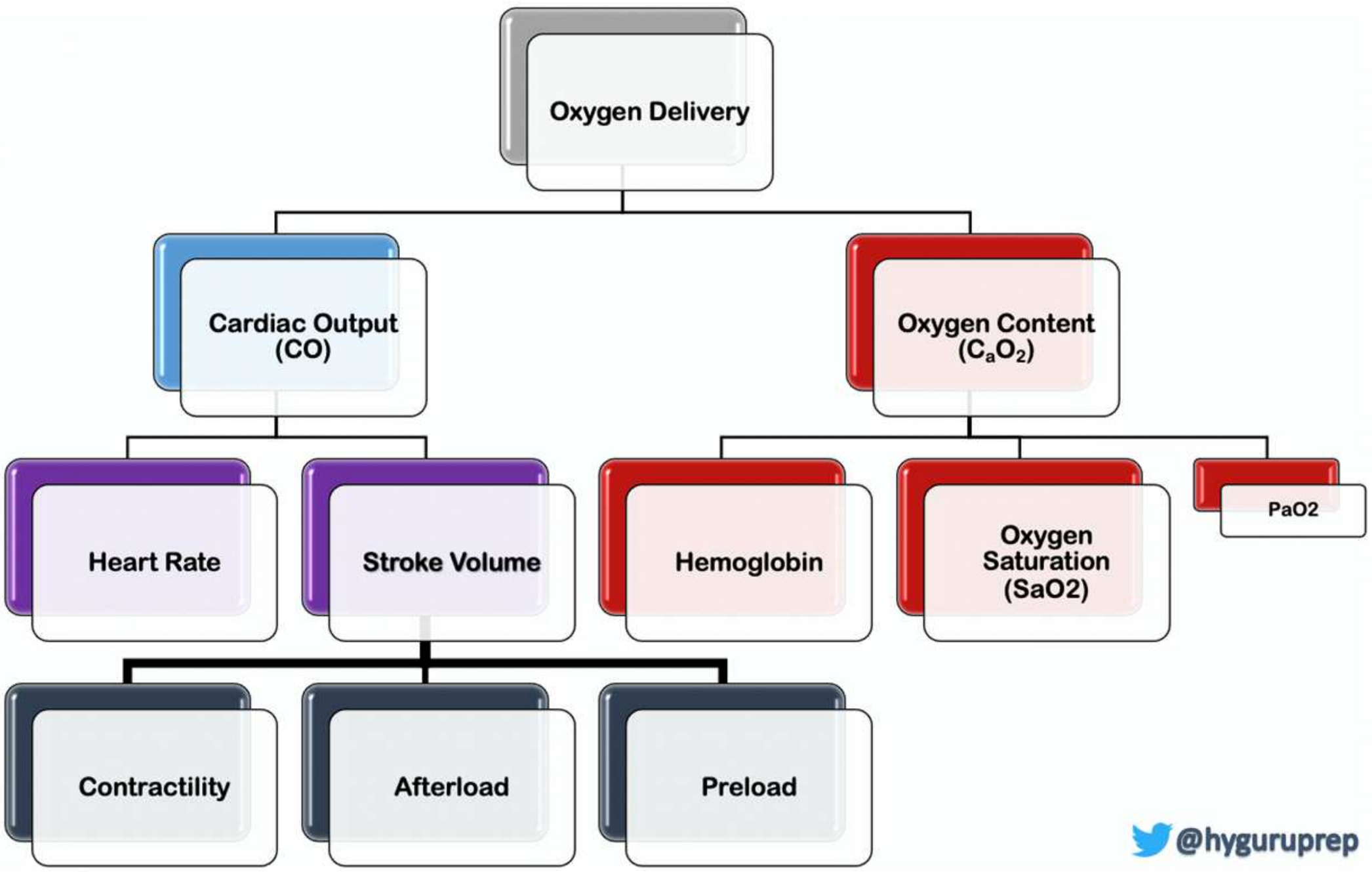


- High O2 extraction in the peripheral circulation = **low** SVO2

Shock for the USMLE

Shock	CO	SVR	PCWP/LVEDV	SVO_2
Cardiogenic 'pump failure'	Low	High	High	Low
Hypovolemic 'bleeding/losses'	Low	High	Low	Low
Septic 'Cytokine vasodilation'	High	Low	No change	High
Anaphylactic 'swelling + vasodilation'	High	Low	No change	High Due to vasodilation & edema
Dissociative 'cannot dissociate O2 from Hb' CO poisoning	High	High	No change	High

Cardiac Output for the USMLE



Shivering

Response to Shivering

An athlete is submerged in an ice-bath ➡

- What is the likely physiologic response?
  - Shivering ➡ posterior hypothalamus regulates this.
    - α-motor neurons & gamma-motor are activated ➡ skeleton muscle contraction and heat production.
    - Thyroid hormone ➡ increases metabolic rate by increasing Na/K-ATPase
    - Brown fat ➡ via beta-3 (Gs) mediated activity.

Heat Stroke

A football player presents in summer after fainting. He is noted to have temp 104F, tachypnea, and rigid muscles. CPK is elevated. The patient is also noted to have increased Cr. What is the likely mechanism?

- Abnormal hypothalamic thermoregulatory response.

Heat Dissipation

- Vasodilation. Mechanism?
  - Hypothalamus mediated peripheral vasodilation
    - Exposes blood to cooler air

- Sweating. Mechanism?
  - Dissipation of heat ➡ usually patients in exam questions will have an absence of sweating

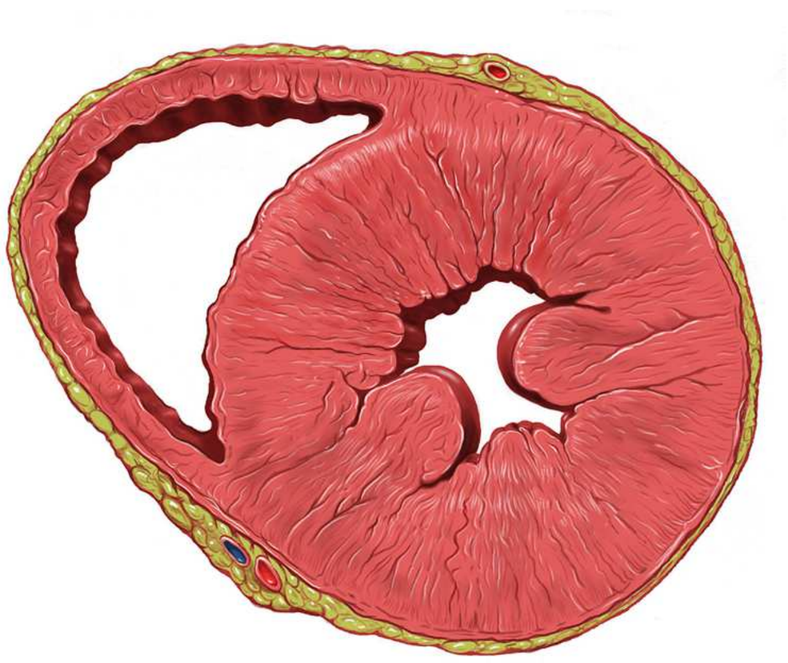
- Pathophysiology:
  - High body temp ➡ proteins denature ➡ cell membranes damage ➡ multi-organ failure.

NBME Style Question

A 62-year-old man dies while playing tennis. At autopsy, examination shows cardiac valve defect and concentric left ventricular hypertrophy. Which of the following valve abnormalities is involved in his sudden death?

A.Aortic Insufficiency
B.Aortic Stenosis
C.Mitral insufficiency
D.Mitral stenosis
E.Pulmonic insufficiency
F.Pulmonic stenosis

Concentric Hypertrophy



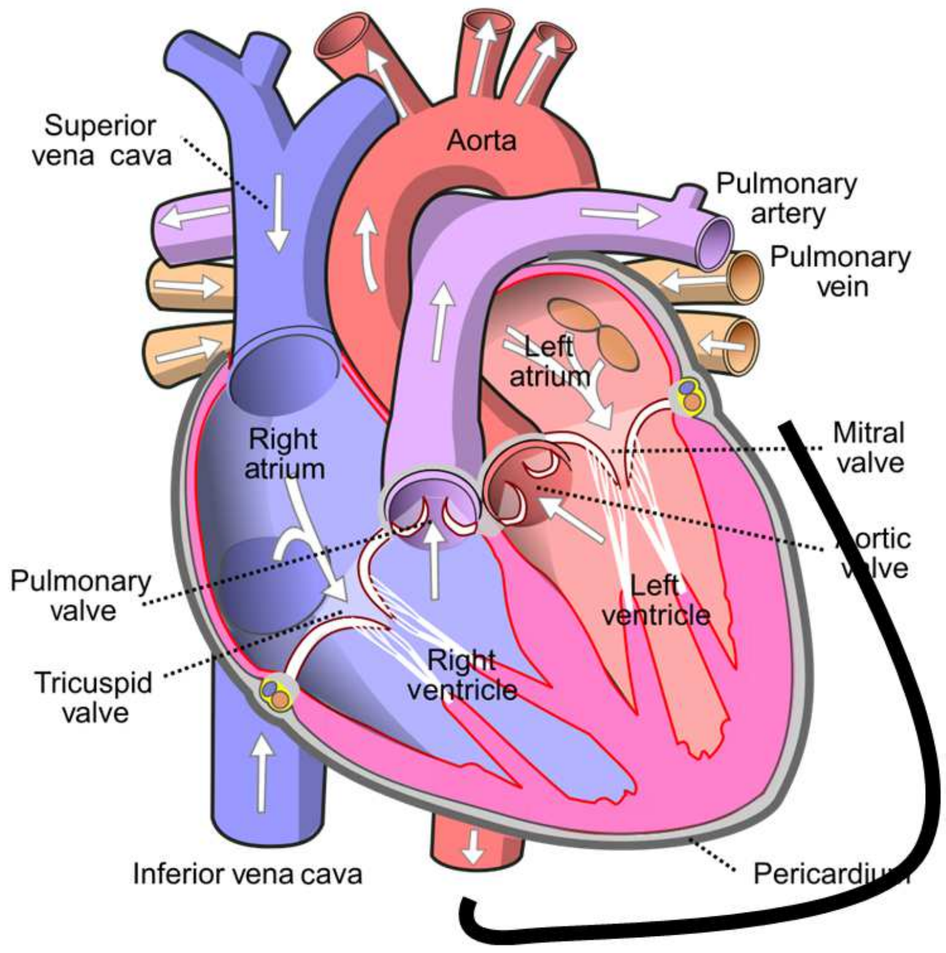
S3-Gallop

- During what phase of the cardiac cycle will you hear this sound?
  - Early diastolic sound ➡ rapid filling of the left ventricle

- On USMLE multi-media questions where will be the most likely position to hear this sound?
  - Apex especially in the left-lateral

- USMLE Vignettes:
  - Mitral regurgitation (the best indicator of MR severity)
  - Dilated Cardiomyopathy.

Atria rapidly filling into a dilated left-ventricle.



S4

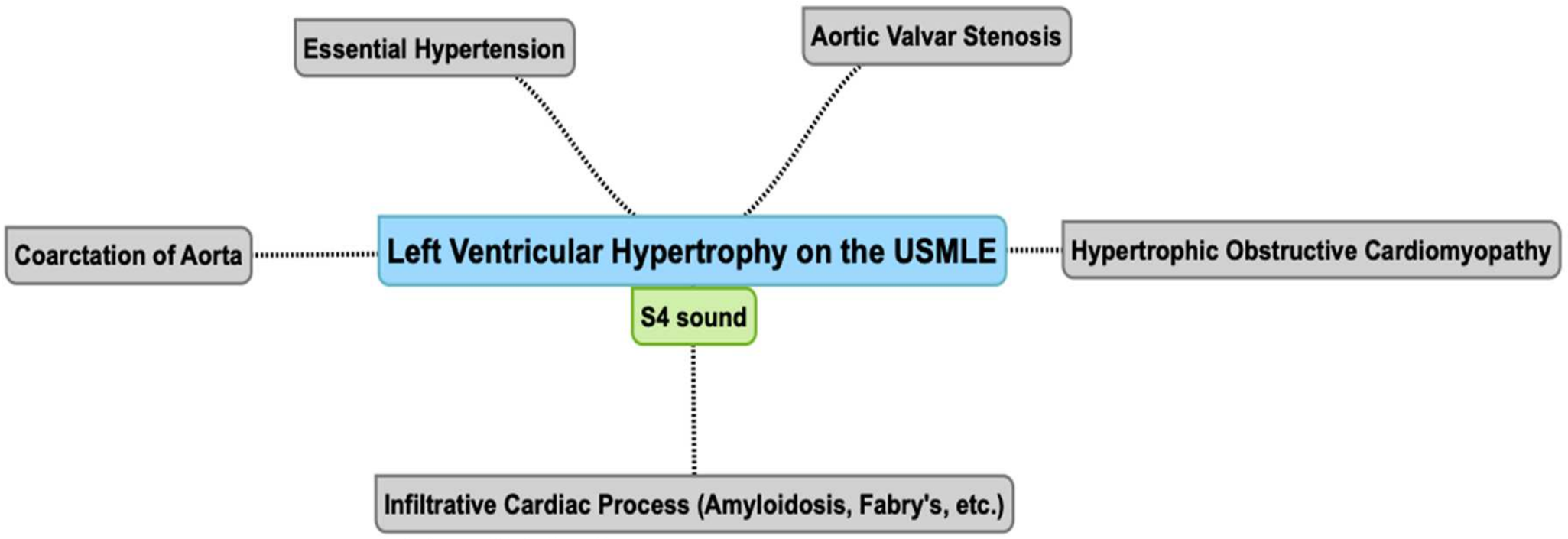
During what phase of the cardiac cycle will you hear this sound?

- late diastolic sound ➡ atrial contraction

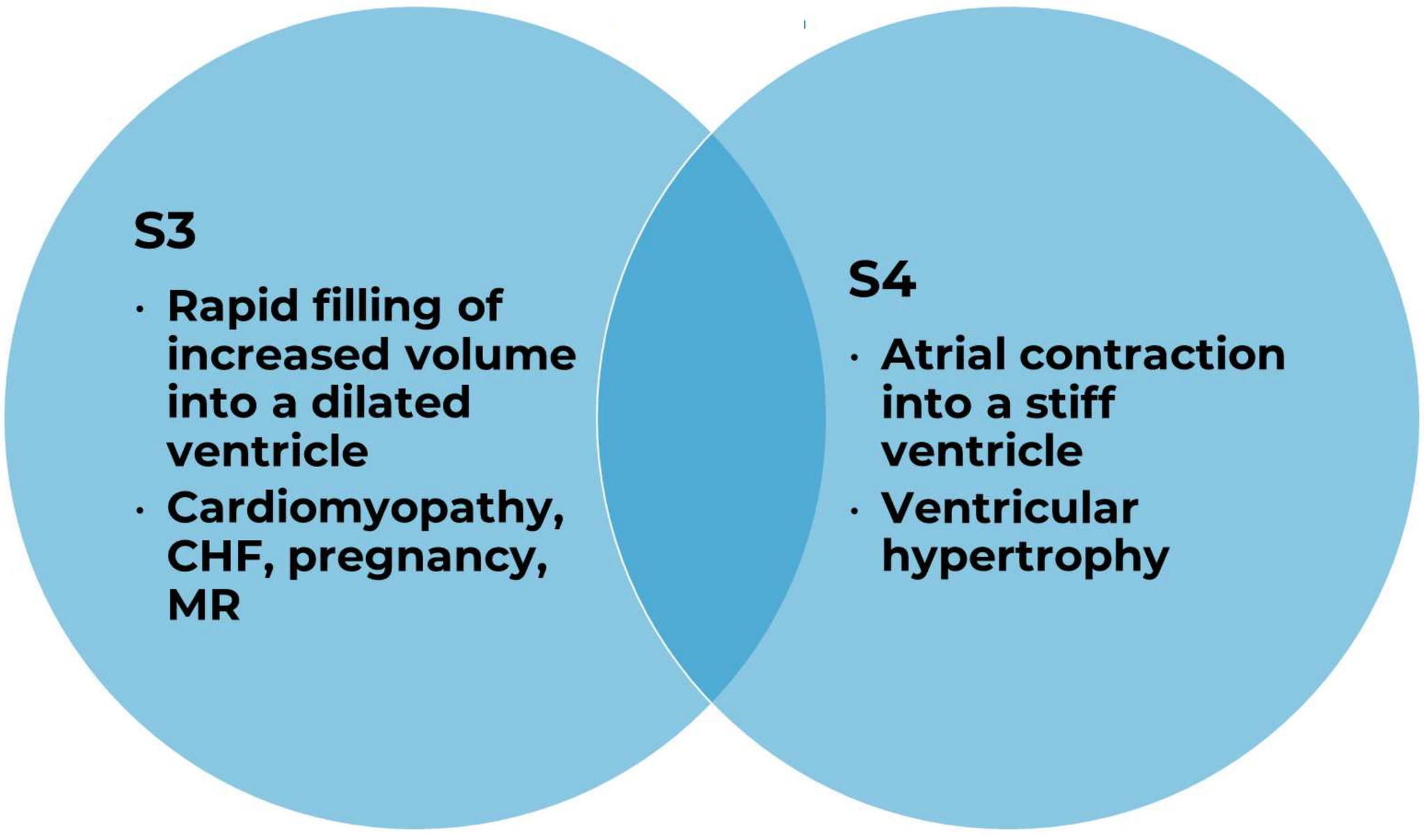
USMLE Vignettes:

- “Reduced ventricular compliance”
- Hypertrophy.

Left Ventricular Hypertrophy Questions on the USMLE



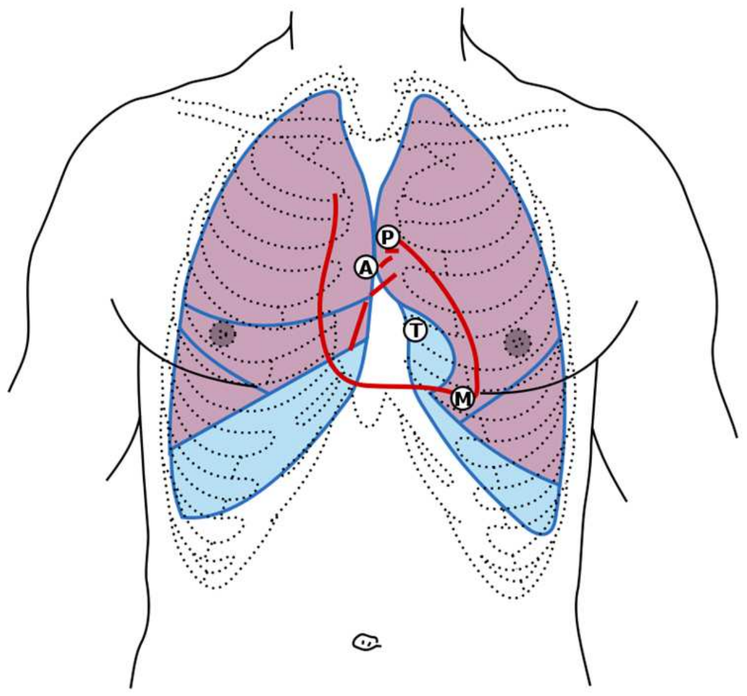
S3 vs. S4


S3
· Rapid filling of increased volume into a dilated ventricle
· Cardiomyopathy, CHF, pregnancy, MR
S4
· Atrial contraction into a stiff ventricle
· Ventricular hypertrophy

Murmurs

A 15-year-old female has a grade 2/6 holosystolic murmur is heard best over the left fifth intercoastal space adjacent to the sternum. It increases with inspiration, this murmur is most consistent with an abnormality of which of following valves?

A.Aortic
B.Mitral
C.Pulmonary
D.Tricuspid



Murmurs for the USMLE

- Locate the Area of Auscultation
- Characterize Systolic VS. Diastolic
    - Systolic:
        - Aortic Stenosis
        - Mitral Regurgitation
        - VSD
        - HOCOM
        - MVP
    - Diastolic:
        - Mitral stenosis
        - Aortic Regurgitation

Summary of Maneuvers

- Less Blood in the Heart:
- MVP louder (click is earlier)
- HOCOM

- Afterload (high):
- Regurgitant murmurs louder

How to Recognize Vasculitis on the USMLE

Histology warm-up: what are the three normal layers of an arterial blood vessel?
- Intima
- Media
- Adventitia

USMLE presentations:
- Fever, fatigue, weight loss, and myalgias ➡ non-specific systems full of multi-system involvement.

Giant Cell Temporal Arteritis

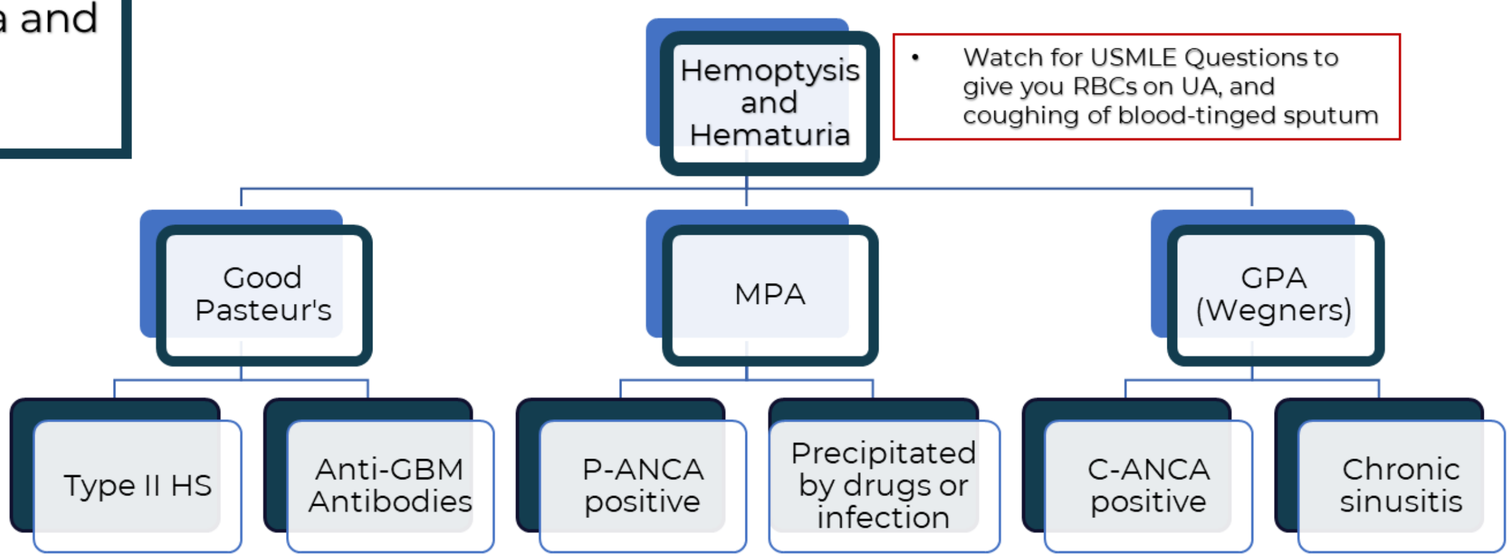
An elderly female presents with muscle pain and difficulty chewing. She states that she had a transient loss of vision during driving. Her ESR is elevated. What is the next best step in management?

- Corticosteroids ➡ Giant Cell Temporal Arteritis
  - Granulomas that affect the branches of the carotid (temporal, ophthalmic)

This vasculitis is associated with this USMLE vignette/disease:
A 70-year-old patient with joint pain. She has a fever and weight loss. Has difficulty climbing stairs and combing hair. Exam shows pain and stiffness in the shoulders and hip. ESR is elevated, and CK is normal. What is the most likely diagnosis?
- Polymyalgia rheumatica ➡ associate with Temporal Giant Cell arteritis.

Hemoptysis and Hematuria

- How do you tell MPA from eoGPA?
  - P-ANCA positive for both.
    - eoGPA has asthma and eosinophilia, and granuloma.



Myocardial Infarction

• A patient presents with substernal chest pain which he noticed after a hike with his grandchildren. He said that the pain stopped after he rested on a bench. He is a smoker, and his exam is normal. What is the likely diagnosis?
    • Stable angina:
    • Deep poorly localized pain that relieves with rest or nitroglycerin brought on by activity
    • Treatment: Vasodilate by increase NO in vascular smooth muscle

• What would you see on pathology:
        Atherosclerosis of the coronary artery lumen > 75% however less than 100%

• Plaques can rupture and then usually have super imposed thrombi. If after they rupture and almost occlude the whole lumen of the coronary vessel, what pathology does this refer to:
    • Unstable angina (negative troponins)
    • Subendocardial infarction (positive troponins) ➡ NSTEMI

• Plaques that occlude the whole lumen: transmural infarction.

• What is the most common cause of death after myocardial ischemia caused by coronary artery disease?
    • Arrhythmia ➡ VF

• A patient presents dead to the ER, autopsy shows complete occlusion of the LAD. What is the likely cause of death?
    • VF ➡ most common prehospital cause of death in MI patients

• What is the most common in-hospital death following MI?
    • Ventricular failure (LV failure/cardiogenic shock)
        • Remember it takes time (3-7 days) to get structural issues:
            • Ventricular rupture, mural thrombus, tamponade.

• A patient's heart is studied on autopsy after he myocardial suffered a myocardial infarction. He presented to the hospital within four hours of the acute attack. What would light-microscopy immediately after the event yield?
    • No visible changes.
        • First changes occur 4-12 hour range:
            • Wavy fibers with elongated myocytes

• Cell death ensues:
    • The nucleus shrivels and darkens until there is no more euchromatin (pyknosis) ➡ fragments (karyorrhexis) ➡ then vanishes (karyolysis)
    • Mitochondrial vacuolization is a sign of irreversible cell injury

Myocardial Infarction

- Inflammation ensues and what pathological change occurs one day?
    - Neutrophillic infilration and coagulation necrosis

- At one week macrophages become the prominent cell and at two weeks granulation tissue becomes neovascularized
    - Structural complications like free wall rupture, septum rupture, or pap muscle rupture occur approx. 1 week after MI

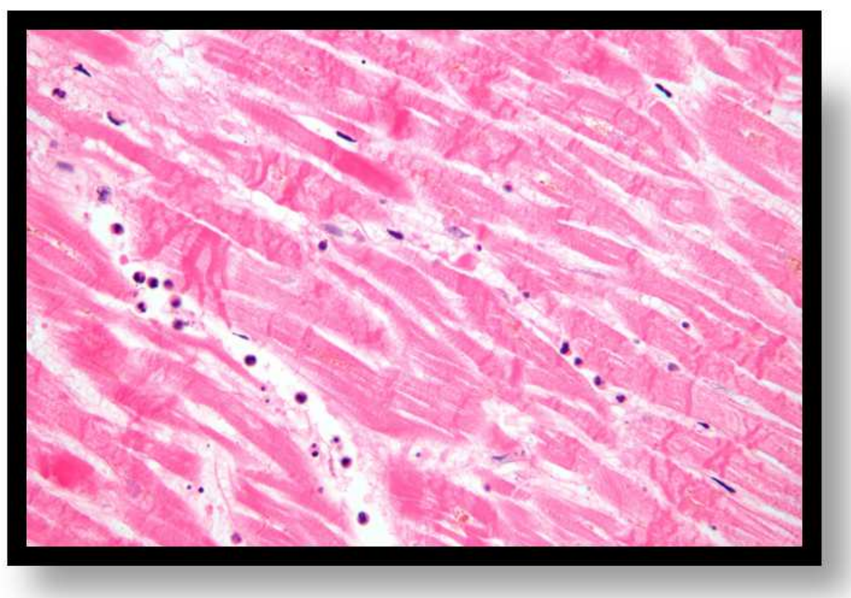
- At a month's time, a patient will have scar formation

- What antiarrhythmic is best after MI?
    - Lidocaine, MexileTine.
      "I'd Buy Liddy's Mexican Tacos."
    - Class IB Na channel blockers.

Timeline of Myocardial Infarction

- 0 to 4 hrs
    - Minimal Change
- 4 to 12 hrs
    - Early coagulation necrosis
    - Wavy fibers
- 12 to 24 hrs
    - Contraction bands
- 1 to 5 days
    - Neutrophil migration
- 5 to 10 days:
    - Macrophage phagocytosis
- 10 to 14 days:
    - Granulation tissue:
        - Fibroblasts
        - Capillaries
        - Myofibroblasts
- 2 weeks to 2 months:
    - Collagen deposition
    - Scar formation

Contraction Bands



Contraction Bands

- **A Calcium-Dependent mechanism** – activation of contractile cellular machinery
- **A Calcium Independent mechanism** – persistent activation of the contractile machinery in the setting of low ATP

DiGeorge Syndrome

A 2-months-old female presents with seizures. She is lethargic and hypertonic. The patient is also found to have respiratory distress. The exam is notable for a cleft palate, and a murmur is heard on the clinical exam. What is the likely embryological mechanism?

A. Defective neural crest migration.
B. Neural crest defect.
C. Failure of the 3rd and 4th arch to develop.
D. Failure of 3rd and 4th pouch to develop.
E. Failure of 3rd and 4th cleft to develop.

Lipid Lowering Drugs

A 40-year-old female with a history of Grave's disease is noted to have intermittent chest pain with activity. She has a history of elevated LDL. She takes PTU for hyperthyroidism. She is started on a medication to control her dyslipidemia. Which of the following best explains the mechanism of action of this medication?

A. Activation of HMG-CoA Synthase.
B. Upregulation of hepatocyte LDL-receptor.
C. Downregulation of bile-acid synthesis.
D. In-activation of reverse transport in cholesterol metabolism.
E. Upregulation of bile-acid metabolism.

Shock

A 50-year-old male presents with severe chest pain while mowing his lawn. His vital signs: 110/min, 20 breaths/min, 105/70. He is cool and clammy. He is noted to have an elevated PCWP and left-atrial pressure of 20. What are the most likely pressure changes in the pulmonary vasculature seen?

	Pulmonary Capillary Hydrostatic Pressure	Alveolar Interstitial Hydrostatic Pressure	Alveolar Interstitial Oncotic Pressure
A	High	High	High
B	High	High	Low
C	High	Low	High
D	Low	High	High
E	Low	High	Low

S3 vs. S4

A 62-year-old man dies while playing tennis. At autopsy, examination shows cardiac valve defect and concentric left ventricular hypertrophy. Which of the following valve abnormalities is involved in his sudden death?

A.Aortic Insufficiency
B.Aortic Stenosis
C.Mitral insufficiency
D.Mitral stenosis
E.Pulmonic insufficiency
F.Pulmonic stenosis