



NBME EXPLANATIONS

NBME 22 Block 3

from CrackNBME

22-Block 3

Q1

A 54-year-old woman with hypertension and bilateral renal artery stenosis starts taking a nonsteroidal anti-inflammatory drug for back pain. Over the next week, her serum creatinine concentration increases from 1.0 to 5.0 mg/dL. The most likely cause of this finding is the drug's ability to inhibit which of the following?

- A. Inflammation in the glomerular capillaries
- B. Inflammation in the renal interstitium
- C. Vasoconstricting prostaglandins at the afferent arteriole
- D. Vasoconstricting prostaglandins at the efferent arteriole
- E. Vasodilating prostaglandins at the afferent arteriole
- F. Vasodilating prostaglandins at the efferent arteriole

▼ Explanation

- Answer is E (Vasodilating prostaglandins at the afferent arteriole)
 - IMP Clues
 - Hypertension + Bilateral Renal Artery Stenosis (Post-menopausal female, so the etiology is likely to be atherosclerosis, not FMD found in young women)
 - Starts taking NSAIDs & Serum Creatinine concentration increases (makes sense as NSAIDs decrease blood flow to the glomeruli, which in addition to the pre-existing stenosis, causes worsening of renal function)

• HY to know that Renal Flow is affected by 2 mechanisms:

1. Prostaglandins

- PGs effect on renal flow is **VASODILATION** of **afferent** arterioles

HY to know that PGs **increase** GFR & RPF → maintains FF (No Net Change)

- NSAIDs decrease PGs → **DECREASE VASODILATION**

- So NSAIDs → **decrease** GFR & RPF → maintains FF (No Net Change)



Can worsen renal failure due to **decrease of GFR** so avoided in patients with renal insufficiency!

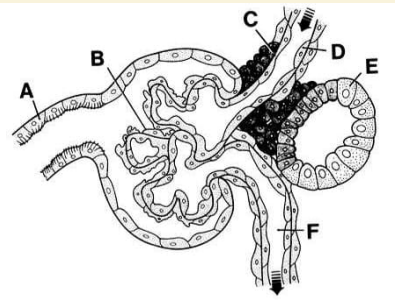
2. Angiotensin-2

- AT-II effect on renal flow is **VASOCONSTRICTION** of **efferent** arterioles

HY to know that ACE **increases** GFR but **doesn't affect** RPF → **increases** FF

- ARBs inhibit AT-II receptors → **DECREASE VASOCONSTRICTION**
- ACE inhibitors inhibit ACE, which decreased conversion of AT-I to AT-II → **DECREASE VASOCONSTRICTION**

“USMLE will give you a picture like the above pic & asks you to where NSAIDs/PGs and ACEi/AT-II act on the nephron. So, get comfortable with it.”



- ▼ NSAIDs/PGs act on afferent arterioles (D)
- ▼ AT-II act on efferent arterioles (F)

Where does ACE inhibitors act?

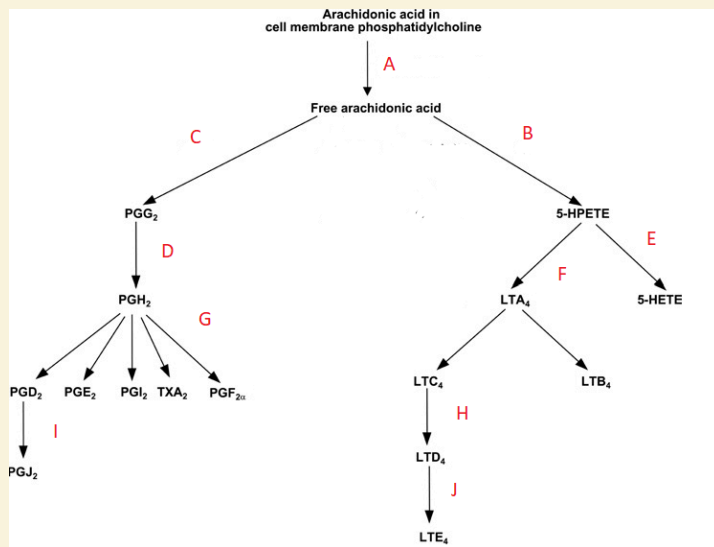
- **IN THE LUNGS**
 - ACE is produced in the lungs

? How does PGs vs AT-2 affect RPF, GFR, and FF

▼ Answer

Prostaglandins	Angiotensin II
Increase RPF	Decrease RPF
Increase GFR	Increase GFR
Same FF	Increase FF

? Choose the letter inhibited by Aspirin.



▼ Answer

Choice C (COX1/2) - Aspirin is an irreversible nonselective COX inhibitor

Q2

A 12-year-old girl who recently immigrated to the USA from Central Africa is brought to the physician because of a 5-week history of increasingly severe abdominal pain and vomiting blood. Her temperature is 37.8°C (100°F), pulse is 110/min, respirations are 27/min, and blood pressure is 112/65 mm Hg. Physical examination shows hepatosplenomegaly and abdominal ascites. Laboratory studies show: A photomicrograph of a stool specimen is shown:

Leukocyte count	13,400/mm ³ (N=4500-13,500)
Segmented neutrophils	42%
Eosinophils	15%
Lymphocytes	37%
Monocytes	6%



Which of the following is the most appropriate pharmacotherapy for this patient?

- A. Fluconazole
- B. Levofloxacin
- C. Metronidazole
- D. Praziquantel
- E. Trimethoprim-sulfamethoxazole

▼ Explanation

- Answer is D (Praziquantel)
 - IMP Clues
 - Severe abdominal pain & vomiting of blood (could be a PU or Varices)
 - Hepatosplenomegaly & Abdominal ascites (most likely varices due to portal hypertension)
 - Eosinophils high (most likely a parasite cause) + pic shows egg with lateral spine (so confirmed parasite, Schistosoma Mansoni)

- Q asks what is appropriate ttt?
 - Patient has **Portal Hypertension** suggested by the **hepatosplenomegaly, ascites, and hematemesis** (most likely due to bleeding varices)
 - **Eosinophilia + Egg with Lateral spine** ⇒ **Schistosoma Mansoni**
 - **Treatment is Praziquantel**
 - What is the mechanism of action?
 - **Massive Influx of calcium into the parasite's body, causing paralysis and detachment**



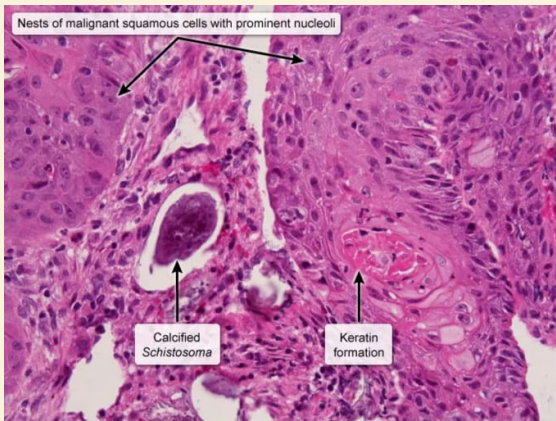
▼ Other Choices

- **Choice A** → Fluconazole is an “-azole” that **inhibits 14-demethylase** used as an antifungal.
 - **HY Side Effect is** ⇒ **Hepatotoxicity**
- **Choice B** → Levofloxacin is a fluoroquinolone that **inhibits DNA Gyrase (prokaryotic topoisomerase 2 & 4)**.
 - **HY Side Effect is** ⇒ **Cartilage Damage (Tendinopathy)**
- **Choice C** → Metronidazole is metabolized into a **metabolite that causes DNA breaks**
 - **HY Side Effect is** ⇒ **Disulfiram-like reaction** if taken with alcohol
- **Choice E** → Used as **prophylaxis & treatment of PJP**, and as **prophylaxis of Toxoplasmosis**

? What is a HY cause (hint: a parasite) of SCC of the bladder?

▼ Answer
Schistosoma Haematobium

- **Egg with large terminal spine**



? What drugs inhibit eukaryotic Topoisomerase?

▼ Answer

- **Irinotecan & Topotecan** → Inhibits **eukaryotic Topoisomerase 1**
- **Etoposide & Teniposide** → Inhibits **eukaryotic Topoisomerase 2**

Q3

A 38-year-old man who lives at sea level flies to a mountain resort in Colorado for a skiing vacation. He takes a carbonic anhydrase inhibitor tablet after arriving at the resort to help adjust to the altitude. Two hours after drug ingestion, which of the following changes in urinary pH, bicarbonate, and volume are most likely in this patient?

Choice	pH	HCO ₃ ⁻ (mEq/L)	Volume
A	↑	↑	↑
B	↑	↑	↓
C	↑	↓	↑
D	↑	↓	↓
E	↓	↑	↑
F	↓	↑	↓
G	↓	↓	↑
H	↓	↓	↓

▼ Explanation

- **Answer is A**
 - **IMP Clues**

- Patient who lives at sea level flies to a mountain resort (the higher you are, the less O₂ there is, so you get a little hypoxic & start to hyperventilate → respiratory alkalosis)
- He takes a Carbonic Anhydrase inhibitor (Acetazolamide causes metabolic acidosis, so neutralizes the respiratory alkalosis)
- Q asks what is expected changes in urinary pH, bicarb, and volume?
 - **Acetazolamide is a diuretic** (Diuretics cause diuresis “increased urine volume”)
 - It acts as a **CA inhibitor in the PCT**
 - **H₂O + CO₂ (mediated by CA) → H₂CO₃ → H + HCO₃**
 - The *H* is secreted into urine (hence the urine is a little acidic normally)
 - The *HCO₃* is reabsorbed into the blood (to neutralize the metabolic activity of the cells)
 - **If CA is inhibited, the opposite happens:**
 - **HCO₃ is lost in urine → Alkaline urine (high pH & high HCO₃)**
 - **H is reabsorbed into blood → Metabolic Acidosis**
 - **End Result would be:**
 - **Metabolic Acidosis** (more H in blood)
 - **Alkaline urine** (higher pH & HCO₃)
 - **Higher urine output** (diuresis)
- These match the arrows of **Choice A**

? What are 2 other HY uses of acetazolamide assessed on the USMLE?

▼ Answer

1. **Decreases Intraocular Pressure** by inhibition Aqueous Fluid Formation (inhibits CA enzyme)
2. **Decreases Intracranial Pressure** by inhibition of Cerebrospinal Fluid Formation (inhibits CA enzyme)

Q4

A 45-year-old man with poorly controlled type 2 diabetes mellitus comes to the physician because of a 1-month history of low-grade fever. He is receiving hemodialysis for end-stage renal disease. His temperature is 37°C (98.6°F), pulse is 72/min, and blood pressure is 144/92 mm Hg. Physical examination shows a subclavian catheter inserted below the right clavicle. The lungs are clear to percussion and auscultation. Cardiac examination shows no murmurs. Two of two blood cultures grow nonhemolytic, catalase-negative, gram-positive cocci in pairs and chains. Which of the following is the most likely causal organism?

- A. Enterococcus faecalis
- B. Listeria monocytogenes
- C. Staphylococcus aureus
- D. Staphylococcus epidermidis
- E. Streptococcus pneumoniae

▼ Explanation

- Answer is A (Enterococcus faecalis)
 - IMP Clues:
 - Non-hemolytic, Catalase negative, gram positive cocci in pairs & chains.
 - Okay, let's go through the answer choices
 - **Choice A → Enterococcus faecalis**
 - Perfectly matches the culture findings ⇒ **CORRECT**



- **Choice B** → Gram positive bacilli NOT cocci & beta hemolytic



- **Choice C** → Catalase positive & Beta hemolytic & in Clusters



- **Choice D** → Catalase positive



- **Choice E** → Alpha hemolytic



Q5

A 2-year-old boy is brought to the physician because of fever and cough for 2 days. He has had two episodes of *Streptococcus pneumoniae* bacteremia and multiple ear and sinus infections since birth. His temperature is 38.4°C (101.1°F). Physical examination shows no tonsillar tissue. Crackles are heard in the right lower lobe of the lung. Which of the following is the most likely immunodeficiency syndrome in this patient?

- A. Bruton agammaglobulinemia
- B. Chédiak-Higashi syndrome
- C. Chronic granulomatous disease
- D. DiGeorge syndrome
- E. IgG2 deficiency
- F. Isolated IgA deficiency

▼ **Explanation**

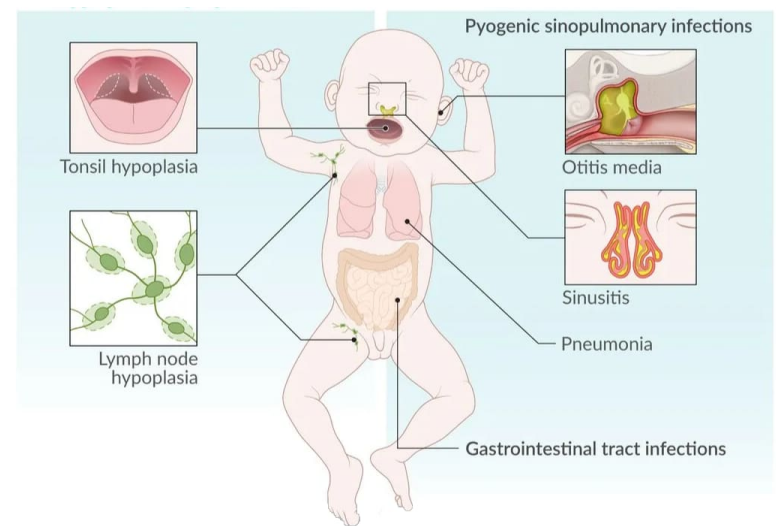
- **Answer is A (Bruton Agammaglobulinemia)**

- **IMP Clues**

- 2 episodes of streptococcus pneumoniae bacteria & multiple ear & sinus infections since birth (seems like something congenital affection humoral immunity)
- No tonsillar tissue (seals the deal for us, this means no B-cells are present)

- **Dx → Bruton Agammaglobulinemia**

- **X-Linked Recessive** disorder, characterized by **isolated Mature B-cell deficiency**
 - **Bruton Tyrosine Kinase** is needed to progress the maturation of **Pro-B cells → Pre-B cells**
 - **Defective BTK means that B cells are stuck at the "Pro-B cell" stage in bone marrow ⇒ NO Mature B-cells in blood**
 - **No B-cells = No plasma cells = No immunoglobulins/antibodies = No humoral Immunity**
 - This reflects the expected lab results: [asked on NBME]
 - **LOW/NO** Immunoglobulins of all classes
 - **LOW/NO** B-cells (**Low** CD19)
 - **NORMAL** T-cells (**Normal** CD3)
- Presents as **recurrent BACTERIAL** infections starting for **3-6 months of age**
 - **Why?**
 - **Maternal IgGs are present in the first 6 months [asked on NBME]**
- Physical Examination shows **ABSENT/SCANTY** tonsils & lymph nodes



HY PHRASES YOU MUST KNOW

"ABSENT/SCANTY tonsils," "ABSENT/SCANTY lymph nodes," or "ABSENT Germinal Centers in lymph nodes"

- **B-cells are absent** ⇒ think **Bruton XLA**
- Presents with **ONLY BACTERIAL INFECTIONS**

"ABSENT Thymic Shadow," or "Candida Skin Test/PDD shows no induration or erythema"

- **T-Cells are absent** ⇒ think **Thymic aplasia as in DiGeorge Syndrome**
- Presents as **ONLY FUNGAL / VIRAL / PROTOZOA INFECTIONS**

If Both

- **B-cells & T-cells are absent** ⇒ think **Severe Combined Immunodeficiency**
- Presents as **BACTERIAL INFECTIONS + FUNGAL / VIRAL / PROTOZOA INFECTIONS**

▼ Other Choices

- **Choice B → Chediak-Higashi Syndrome**

- Presents as **partial albinism (fair skin & light-colored hair) + Immunodeficiency**
- Due to **microtubule dysfunction**
 - **Impaired phagolysosome function → Giant Granules in phagosomes** (Immunodeficiency)
 - **Impaired melanosome function** → Albinism

- **Choice C → Chronic Granulomatous Disease**

- Deficiency of **NADPH Oxidase** (enzyme that converts O₂ into H₂O₂ to kill organisms after phagocytosis)
- **X-Linked Recessive**
- Presents as **recurrent infection with catalase positive microorganisms:**

Mnemonic: "LC SHAPES"

- L = Listeria
- C = Candida
- S = **Staph aureus** (most commonly tested ~50% of the time)
- H = *H.pylori*
- A = Aspergillus & Actinomyces
- P = *Pseudomonas*
- E = *E.coli*
- S = *Serratia*

- Diagnosis → **Dihydrorhodamine test**

- **Choice D → DiGeorge Syndrome**

- **22q11 deletion** - this causes failure of **3rd & 4th pharyngeal pouches** to develop
 - 3rd pouch → inferior parathyroid glands & Thymus gland
 - 4th pouch → superior parathyroid glands
- **Features of DiGeorge Syndrome**

[📌] "CATCH22"

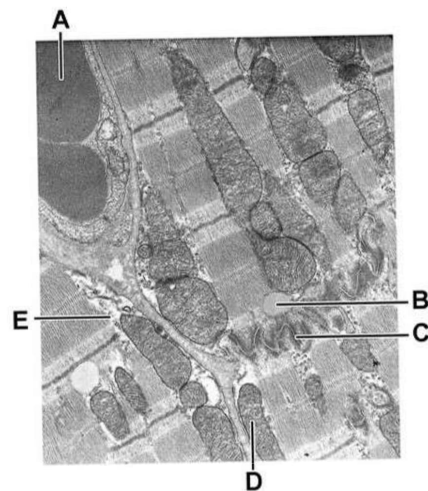
 - **C** → **C**ongenital Heart Anomalies (TOF, usually on the USMLE)
 - **A** → **A**bnormal Facies
 - **T** → **T**hymic aplasia (Immunodeficiency of T-cells) ⇒ **Presents as absent thymic shadow**
 - **C** → **C**left Palate
 - **H** → **H**ypocalcemia

- **Choice E** → Garbage & you won't be assessed on it

- **Choice F** → **IgA deficiency**
 - **Recurrent infections** (usually Respiratory) + **giardia infection** + **atopy** (**KNOW THIS TRIAD**)
 - MOA → **patients lack IgA**
 - Blood transfusions in these patients may cause **anaphylaxis**: they lack IgA, donor's plasma have IgA → **Anaphylaxis**
 - Patients with **IgA deficiency** + **Celiac disease** will have **NEGATIVE** test results
 - Celiac is tested for by **IgA tissue transglutaminase (no IgA so negative test)**
 - This association is common because autoimmune diseases go together

Q6

Microelectrode injection of antibodies to α -actinin results in the detachment of the myofibril from the plasma membrane in cardiac myocytes. On the basis of these data, α -actinin is most likely located at which of the following labeled sites in the electron micrograph of a normal cardiac myocyte shown?



- A. A
- B. B
- C. C
- D. D
- E. E

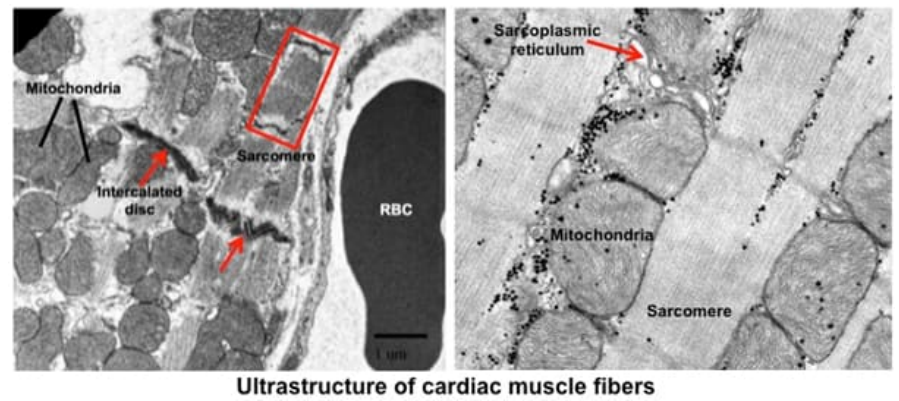
▼ Explanation

- **Answer is C**
 - Q says that antibodies to α -actinin causes detachment of the myofibril (muscle fibers) from the plasma membrane.
 - Q asks where is the α -actinin most likely located in a cardiac myocyte EM picture.
 - I know you have no idea of what you're looking at. Relax.
 - Basically, what happened is **when the injected antibodies bind to α -actinin, it caused detachment of the fibers from the plasma membrane.**
 - This means that most probably **the α -actinin are proteins that bind the fibers to the plasma membrane.**
 - So, what should we find in the picture?
 - **The plasma membrane**

- Out of all of this garbage, you see something very characteristic (**Choice C**), those zigzagging sharp lines. These are the **Gap Junctions** that connect myocytes. The *connect the myocytes at the plasma membrane*. So, yah **Choice C** is the Correct Answer

▼ Other Choices

- **Choice A** → RBCs. Yes, Red Blood Corpuscles.
- **Choice B** → No idea, I am no histopathologist.
- **Choice D** → Mitochondria
- **Choice E** → Sarcoplasmic Reticulum



Q7

An 82-year-old woman has been bedridden since surgical repair of a hip fracture 6 months ago. Healing has proceeded slowly, and her physician is concerned that deep venous thrombosis may develop. A drug that suppresses the action of which of the following factors is most likely to decrease this patient's risk for thrombosis?

- Carboxylation of precursor proteins
- Nitrous oxide
- Prostacyclin (PGI₂)
- Protein C
- Protein S
- Thrombomodulin

▼ Explanation

- **Answer is A (Carboxylation of precursor proteins)**
 - **IMP Clues**
 - Bedridden since surgical repair of a hip fracture 6 months ago (hypercoagulable state, due to stasis)
 - Concerned that a DVT may develop (yah, stasis = hypercoagulability = DVT risk)

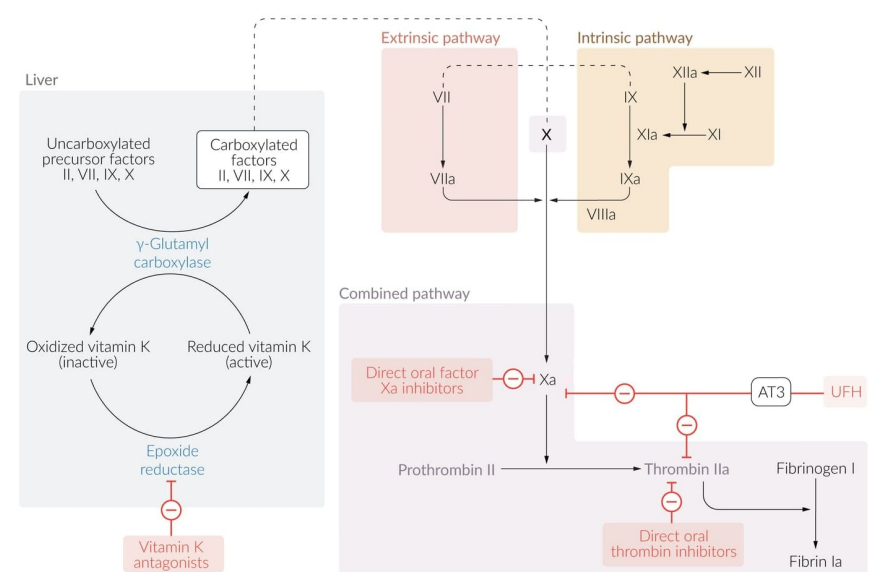
- Q asks what is most likely to decrease risk of thrombosis
 - Well, anticoagulants would decrease risk thrombosis. The most common anticoagulants we have are:

1. Heparin

- Upregulates **anti-thrombin 3**
- **Inactivates factors X & II**

2. Warfarin (Vitamin K antagonist)

- **Inhibits Vitamin K Epoxide Reductase**, which recycles inactive (Oxidized) Vitamin K into active (Reduced) Vitamin K
 - **Reduced/Active Vitamin K acts as a co-factor for γ -glutamyl-carboxylase** which adds a carboxyl group to clotting factors, causing their activation [**Factors X, IX, VII, II**]



▼ Other Choices

- **Choice B** → inhibition of NO would cause VC, which would increase risk of thrombosis
- **Choice C** → Inhibition of PGI₂ would cause VC, which would increase risk of thrombosis

- **Choices D & E** → Protein C & Protein S are Vitamin K dependent factors that actually induce thrombosis
- **Choice F** → It acts as a cofactor for thrombin, converting it from a procoagulant to an anticoagulant enzyme → inhibiting blood clotting.
 - Suppression of Thrombomodulin → Blood Clotting → Thrombosis

Q8

A 42-year-old man comes to the physician because of numbness and tingling in both legs for 2 weeks. Sensation to vibration is decreased in the lower extremities and feet. Deep tendon reflexes are decreased in the knees and ankles. A Romberg sign is positive. Which of the following is the most likely cause of these findings?

- A. Damage to the corticospinal tracts
- B. Damage to the spinothalamic tracts
- C. Entrapment neuropathy
- D. Radicular neuropathy affecting the anterior lumbar roots
- E. Sensory neuropathy

▼ Explanation

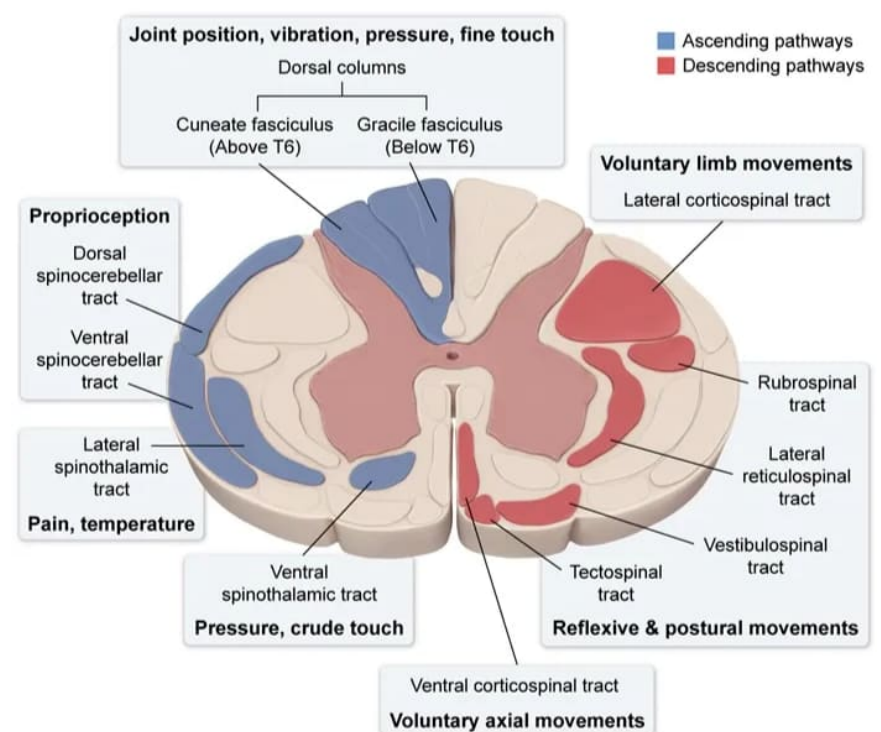
• Answer is E (Sensory Neuropathy)

◦ IMP Clues

- Numbness & tingling in both legs for 2 weeks (could be UMNL or LMNL)
- Sensation to vibration & Deep tendon reflexes are decreased (LMNL)
- Romberg sign positive (Excludes Cerebellar, and hints to affection of Dorsal Column)

- Q asks what is cause of these findings, so let's go through the answer choices:

- **Choice A** → Damage to **corticospinal tract** would cause **motor manifestations**. No mention of that.
- **Choice B** → Damage to **spinothalamic tract** would cause **loss of pain & temperature sensation**. No mention of that here.
- **Choice C** → Entrapment would most likely cause **radicular pain**, which is not present here + most likely a specific nerve entrapped, but the pain here is bilateral.
- **Choice D** → **Radicular neuropathy of anterior lumbar roots** would cause **motor dysfunction/symptoms** of the segment controlled by that lumbar root
- **Choice E** → **Loss of Peripheral Nerve function (Sensory Neuropathy)** could mean loss of sensation (which would cause tingling & numbness) and loss of proprioception (which would cause positive Romberg sign)
 - Basically, the Peripheral sensory nerve is affected.
 - That sensory nerve carries axons from multiple receptors (touch, pain, vibration, proprioception) and enters the spinal cord through the dorsal root.
 - Once inside the Spinal cord, different axons of different tracts go on their own ways.
 - So, if the peripheral nerve gets damaged, all these axons get affected & can cause these symptoms in the vignette.



Q9

An obese 45-year-old woman with type 2 diabetes mellitus, hypertension, dyslipidemia, and osteoarthritis of the hips and knees begins taking orlistat and starts to follow an appropriate diet and exercise program. During the first month of therapy, this woman is at increased risk for developing which of the following conditions?

- A. Anaphylaxis
- B. Diarrhea
- C. Increased blood pressure
- D. Tachycardia
- E. Tricuspid valvular insufficiency

▼ Explanation

- Answer is B (**Diarrhea**)
 - Q says patient begins taking Orlistat & asks for increased risk of developing?
 - Orlistat is a **pancreatic Lipase inhibitor**
 - It is used in **treatment of dyslipidemia**
 - **No Lipase = No fat absorption = Steatorrhea (Bulky Greasy Stools that float) ⇒ Diarrhea**

Q10

An 84-year-old woman comes to the physician because of a 2-month history of a sore on her left hand. Physical examination shows a red, scaly, raised plaque on the dorsum of the left middle finger. The diagnosis of squamous cell carcinoma is made. The ability of this tumor to invade the basement membrane is most likely facilitated by which of the following?

- A. Decreased apoptosis by tumor cells
- B. Decreased concentration of laminin receptors
- C. Decreased production of collagenase
- D. Downregulation of E-cadherin
- E. HER2/neu overexpression

▼ Explanation

- Answer is D (**Downregulation of E-cadherin**)
 - Patient has SCC & Q asks what facilitates the ability of the tumor to invade the basement membrane?
 - **Epithelial Cells are connected by adhesion molecules (E-cadherin is one of them)**
 - **Downregulation of E-cadherin → Less tight adhesions between cells → Tumor invasion**

▼ Other Choices

- **Choice A** → Decreased apoptosis by tumor cell would cause the tumor to enlarge **but not to invade**.
- **Choice B & C** → When tumor cells attach to **laminin, its enhanced adhesion, migration, and metastasis**. So, the more concentration of laminin receptors, the more likely it is for a cancer to bind & metastasize.
 - **Laminin induced the cancer cell to produce protease enzymes (e.g. collagenase)** which further facilitates destruction of collagen in basement membrane → **Invasion & Metastasis**.
- **Choice E** → HER2/neu are overexpressed in breast cancers. Overexpression causes larger & faster multiplying tumors; however, they don't directly affect the invasion/metastasis of the tumor.

Q11

A 56-year-old man with a palpable hard nodule on the prostate has an increased serum prostate-specific antigen concentration. A fine-needle biopsy specimen shows adenocarcinoma. The patient undergoes radical prostatectomy. Which of the following structures is at greatest risk for injury during removal

of the prostate?

- A. Dome of the bladder
- B. Obturator nerves
- C. Pelvic parasympathetic nerves
- D. Penile urethra
- E. Uterovesical junction

▼ Explanation

- Answer is C (Pelvic Parasympathetic nerves)

- Easy straight to the point anatomy Q

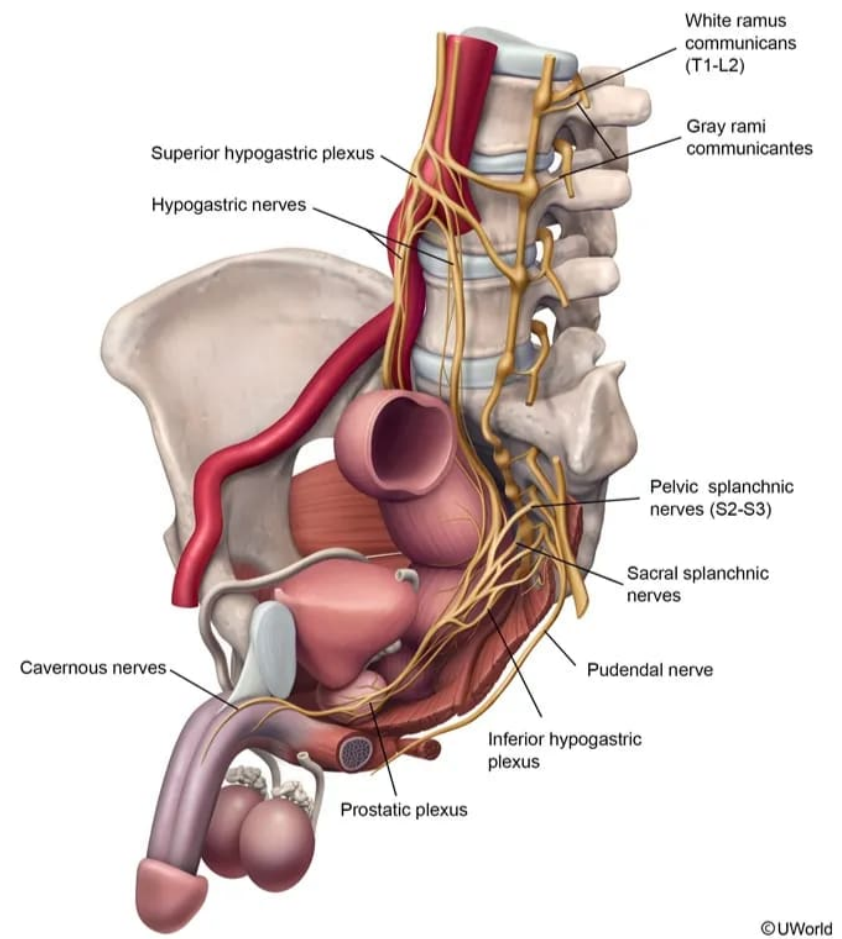
- The pelvic parasympathetic nerves are related to the **posterior surface of the prostate**.

- **Radical Prostatectomy carries the risk of injury of:**

- Pelvic Splanchnic Nerves ⇒ **Urine Incontinence**
- Cavernous Nerves ⇒ **Erectile Dysfunction**

- If followed by radiation, can cause radiation-associated effects:

- **Fibrosis & Stricture ⇒ Obstructive Uropathy**
- **Radiational Prostatitis** (STEP 2 shit)



▼ Other Choices

- **Choice A** → Dome of the bladder is far away superiorly. Unlikely to be injured.
- **Choice B** → Not even close dude.
- **Choice D** → Penile urethra is far away inferiorly. The Prostatic Urethra is what is at risk of getting injuries
- **Choice E** → Super far away & unrelated to the prostate.

Q12

A 60-year-old man is brought to the emergency department because of the sudden onset of pain on the right side of his chest following a deep cough. An x-ray of the chest shows a fractured rib, and a bone scan shows multiple osteoblastic lesions distributed primarily in the lumbar spine, pelvis, and ribs. A complete blood count and results of a chemistry profiling, urinalysis, and protein electrophoresis are within the reference ranges. Which of the following is the most likely diagnosis?

- A. Ewing sarcoma
- B. Fibrosarcoma
- C. Multiple myeloma
- D. Neurofibrosarcoma
- E. Osteoid osteoma
- F. Osteosarcoma
- G. Prostate adenocarcinoma
- H. Renal adenocarcinoma
- I. Tuberculosis of the spine

▼ Explanation

• Answer is G (Prostate Adenocarcinoma)

◦ IMP Clues

- 60-year-old man (classic epidemiology of prostate cancer)
- Fractured rib + sudden onset pain in chest after a deep cough (Pathological stress fracture)
- Bone scan shows multiple osteoblastic lesions in the lumbar spine, pelvis, and ribs (classic findings in prostate cancer, on the USMLE OLD MAN + OSTEOLASTIC LESIONS ⇒ PROSTATE CANCER)
- Protein electrophoresis is normal (excludes MM)

• Dx → Prostatic Adenocarcinoma

- Most common cancer in men.
- Prostate cancer **LOVES to metastasize to the vertebra**. USMLE will test this concept by the following presentations:
 1. Patient with prostate cancer + develops **acute back pain (stress fracture of vertebra)**
 2. Patient with prostate cancer + develops **pain of palpation of vertebra (metastasis)**
 3. Patient with prostate cancer + develops **acute neurological lower limb symptoms (metastasis + invasion of spinal cord / cauda equina)**
- Questions could be tricky and give you an **old man with the above presentations & NO mention of prostate cancer**.
 1. If the question is somewhat easy, they will give you "spine shows osteoblastic lesions" → prostate cancer
 2. If the question is hard, they will give you nothing and you will have to infer that the old man most likely has prostate cancer

? Why does prostate cancer LOVE to metastasize to the vertebrae & pelvic bones?

▼ Answer

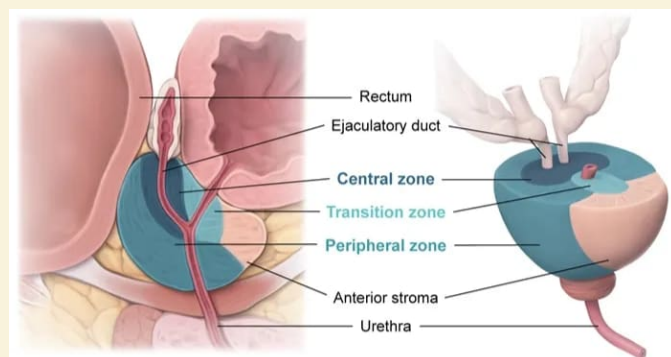
Prostate is drained by the prostatic venous plexus → connected to the vertebral venous plexus, which is valveless & drains the spine, pelvis, and connects to the brain.

Bidirectional Flow allows prostate cancer to flow **either to the spine, or down the spine to the pelvis, or up the spine to the brain.**



Site of Prostate Adenocarcinoma vs Site of Benign Prostatic Hyperplasia:

- BPH ⇒ **Transitional Zone**
- Prostate Adenocarcinoma ⇒ **~80% Peripheral Zone & 20% Transitional Zone**



? Patient with prostate cancer will undergo orchiectomy as a part of treatment, what change is expected from this step?

▼ Answer

Decreased Dihydrotestosterone - Testosterone is converted to DHT via 5-alpha reductase. DHT drives hyperplasia and multiplication of prostate tissue → BPH & Prostate Cancer.

- Orchiectomy is done to **decreased testosterone levels** & hence **decrease DHT levels**, which will **increase apoptosis** (can be referred to on the USMLE as "controlled DNA Fragmentation")
- Other steps of ttt include:
 - Surgery → **Risk of injury to pelvic parasympathetic nerves** which lay on the *posterior* aspect of the prostate ⇒ **Urine Retention & Impotence [asked on NBMEs]**
 - GnRH suppression → **Leuprolide** is a GnRH agonist given **continuously**, which *increases FSH & LH levels* in first few days then *FSH & LH levels decrease* due to **receptor desensitization (tachyphylaxis)** ⇒ *decreased testosterone production*
 - **Androgen Receptor Blockers** → **Flutamide** administered **BEFORE** Leuprolide so that initial increase in FSH & LH doesn't increase testosterone production
 - In actual practice, they are given together, however, for **USMLE purposes** → **flutamide then leuprolide**.

USMLE gives you a CT Pelvis and asks you to pinpoint the prostate:



Answer is D ⇒ Prostate Gland

Other Choices:

- C ⇒ Urinary Bladder (Most anterior pelvic organ)
- E ⇒ Rectum
- B ⇒ Obturator Internus
- A ⇒ Head of Femur

▼ Other Choices

- **Choice A** → A **pediatric** tumor that affects the **diaphysis of long bones**. Causes **Osteolytic lesions** with **concentric (onion skin) periosteal reaction** & associated with **t(11:22) EWS:FLI1**.
- **Choice B** → Fibrosarcoma are **painless enlarging masses** found **around muscles or tendons**. They are composed of **fibroblasts** that form a **round well-demarcated fibrous lesion**. It can **compress nerves causing pain, paresthesia, and motor deficits**.
- **Choice C** → Multiple Myeloma causes **osteolytic lesions**; however, they most commonly affect the **skull**. They are also diagnosed by **high protein electrophoresis content**.
- **Choice D** → Part of NF1. Usually found on extremities. These tumors grow from the peripheral nerve sheath tissue.
- **Choice E** → Osteoid Osteoma affects diaphysis of long bones and biopsy shows **nidus**. This nidus **produces PGs that respond to NSAIDs**. So, **pain decreases with NSAIDs**.
- **Choice F** → Osteosarcoma affect the **metaphysis of long bones** usually. Xray shows **Codman triangle & sub-burst** periosteal reaction
- **Choice H** → Causes **Osteolytic lesions** & patient would most probably have hematuria.
- **Choice I** → History of Night sweats, Night fever, and Weight loss. Patient would also have **Destructive caseating lesion of spine & intervertebral discs** as well (**Pott's disease**)

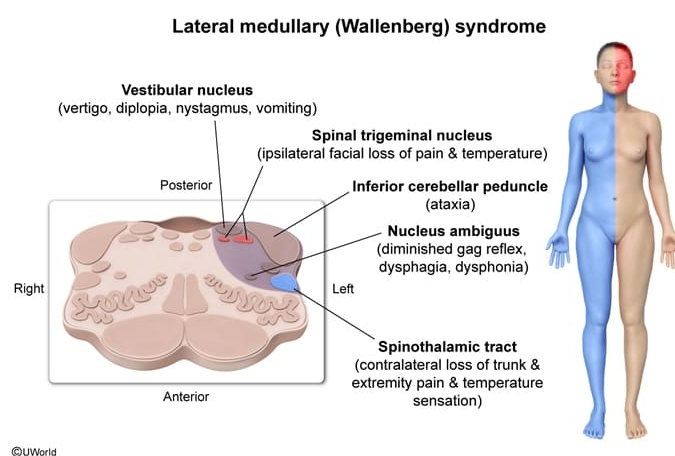
Q13

Following a stroke, a patient is hoarse and cannot detect pinprick or cold on the left side of the face or the right side of the body. Damage is most likely to have occurred in which of the following areas of the brain on the left?

- A. Base of the pons
- B. Dorsal midbrain
- C. Internal capsule
- D. Lateral medulla
- E. Postcentral gyrus

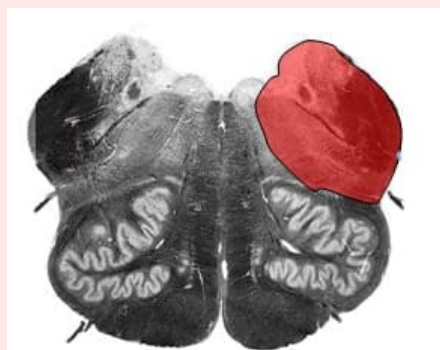
▼ Explanation

- **Answer is D (Lateral Medulla)**
 - **IMP Clues**
 - Hoarseness (Vagus nerve affection)
 - Cannot detect pinprick or cold on the left side of the face (Left trigeminal nucleus affection)
 - Or the right side of her body (Left spinothalamic tract affection)
- **Dx → Lateral Medullary Syndrome**
 - **Occlusion of Posterior Inferior Cerebellar Artery (PICA)**
 - **Affection of:**
 - **Sympathetic Chain** → **IPSILATERAL Horner Syndrome**
 - **Cerebellum** → **IPSILATERAL Ataxia**
 - **CN X** → **Hoarseness & Uvula deviation to opposite side [This here is the buzzy finding in Wallenberg Syndrome]**
 - **Trigeminal nucleus** → **IPSILATERAL facial loss of pain & temperature sensation**
 - **Spinothalamic tract** → **CONTRALATERAL bodily loss of pain & temperature sensation**



USMLE will give you a similar picture to the one below in a patient with feature of stroke AND HOARSENESS/DYSPHAGIA.

- Q then asks for site of lesion; Choose **Lateral Medulla**, and we know that it is supplied by **Posterior ICA**; so posterior.



Q14

A previously healthy 60-year-old woman is admitted to the hospital following a myocardial infarction of the right ventricle. Examination shows hepatomegaly and an accumulation of free fluid in the peritoneal space. Which of the following mechanisms is the most likely cause of the ascites and hepatomegaly?

- A. Decreased capillary colloid osmotic (oncotic) pressure
- B. Increased central venous pressure
- C. Increased interstitial fluid colloid osmotic (oncotic) pressure
- D. Increased pulmonary capillary hydrostatic pressure
- E. Increased pulmonary capillary permeability
- F. Lymphatic blockage

▼ Explanation

- **Answer is B (Increased Central Venous pressure)**

◦ IMP Clues

- MI of the right ventricle (RV dysfunction would cause systemic venous congestion as blood is accumulated in the RV & cannot be pumped into the lungs & Left side of the heart)
- Hepatomegaly & accumulation of free fluid in peritoneal space (These are examples of systemic venous congestion)

◦ Q asks what the mechanism of ascites & hepatomegaly is?

- Basically, MI of the Right Coronary Artery → **RV dysfunction**

• What is the function of the RV?

- Pump the blood that was returned by the SVC & IVC into the lungs and then into the Left Side of the heart.

• What would happen in RV dysfunction (RV MI)?

- Blood is accumulated into the RV & cannot be pumped into the lungs & Left side of the Heart.
- Blood then **starts backing up into the RA (causes increased CVP)**, then the blood further **backs up into the SVC (causes JVD) and IVC (causes systemic congestion)**, for example, **congested liver 'hepatomegaly', edema either LL or Ascites**

- So basically, **increased hydrostatic pressure due to accumulation of blood causes increased Central venous pressure (Pressure of RA) & congestion of organs /extravasation of blood into body cavities.**

▼ Other Choices

- **Choices A & C** → Osmotic pressure is determined by albumin. Albumin levels are not affected, so oncotic pressure is the same & not increased nor decreased
- **Choice D** → Increased Pulmonary Capillary pressure is found in LV MI/dysfunction. LV not pumping blood to the body, blood backs up into LA then into lungs (increasing the hydrostatic pressure & causing transudation "pulmonary edema")
- **Choice E** → Inflammatory reactions that cause ARDS increase the capillary permeability of pulmonary capillaries. **Very HY causes on the USMLE are Pancreatitis, Gastric content aspiration, sepsis, and drowning.** They cause Exudate (not transudate), while Heart Failure causes transudate.

- **Choice F** → Lymphatic Blockage is usually caused by either tumors or trauma. None of these are mentioned here + they cause exudation too. HF causes what? Yes, Transudate.

Q15

A 37-year-old woman undergoes excision of a 1-cm, painless, benign lump from the back of her neck. Seven days later, the sutured incision is erythematous and slightly warm. There is no pain or drainage. Which of the following processes best characterizes the predominant histologic appearance of the incision at this time?

- A. Angiogenesis
- B. Eosinophil infiltration
- C. Fibrosis
- D. Lymphocyte infiltration
- E. Neutrophil infiltration

▼ **Explanation**

- **Answer is A (Angiogenesis)**

- **IMP Clues**

- 7 days later (timing is very important, so that we know at what stage of wound healing are we in)
 - Erythematous & slightly warm (signals increase blood flow)
 - No pain or drainage (exclude infection & wound healing complications in general)

- Q asks what is the predominant histological finding expected to be seen at this time?

- **7 Days is the proliferative phase**, and only **Angiogenesis** is part of the proliferative phase. You should've mastered it by now.

- Let's go through the stages of Wound healing:

- 1. **3 mins - 3 hours**

- **Homeostasis** (Vasoconstriction & Fibrin clot formation)

- 2. **3 hours - 3 days**

- **Inflammation** (Vasodilation, increased vascular permeability, neutrophils chemotaxis, macrophages influx)

- 3. **3 days - 3 weeks**

- **Proliferation** (**Angiogenesis**, Formation of Type 3 collagen granulation tissue, Re-epithelization)

- 4. **3 weeks - 3 months**

- **Remodeling** (Type 3 collagen is converted to Type 1 collagen which increases tensile strength of wound)

▼ **Other Choices**

- **Choice B** → Eosinophils is seen in atopy or parasites.
- **Choice C** → Fibrosis is seen if there is a faulty healing
- Choice D → Usually seen if there is a Type 4 HS due to some sort of items that injured the skin or a fungal infection (which is excluded by the absence of pain & drainage)
- **Choice E** → Seen in the Inflammation phase

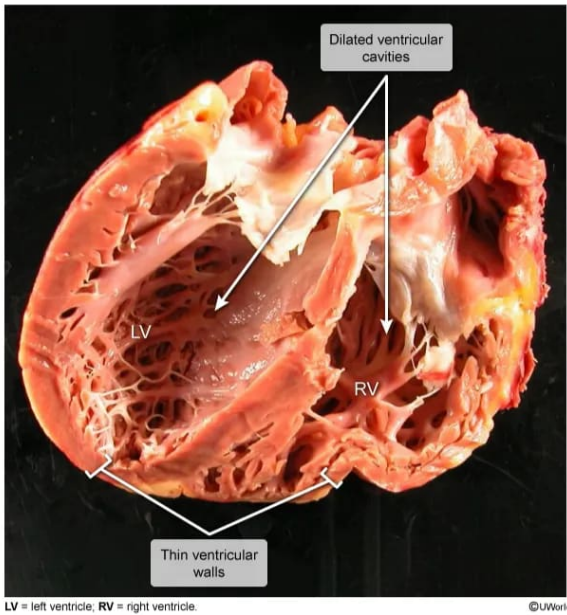
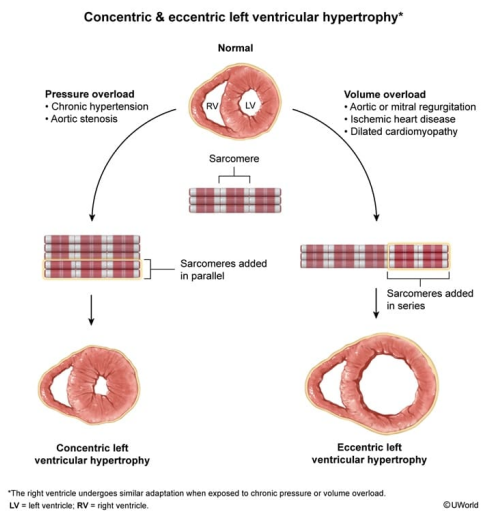
Q16

A 22-year-old woman comes to the office because of a 3-day history of nonproductive cough. She also has a 1-week history of fatigue, progressive shortness of breath with exertion and while lying down, and swelling of her legs and feet. She delivered a male newborn via uncomplicated vaginal delivery 1 month ago. She has no history of major medical illness and takes no medications. Her temperature is 37.7°C (99.8°F), pulse is 104/min, respirations are 20/min, and blood pressure is 126/80 mm Hg. Bilateral basilar crackles are heard. There is 1+ edema of the lower extremities bilaterally. Which of the following is the most likely diagnosis?

- A. Amniotic fluid embolism
- B. Cardiomyopathy
- C. Major depressive disorder
- D. Pneumonia
- E. Pulmonary embolism
- F. Pulmonary fibrosis

▼ Explanation

- Answer is B (Cardiomyopathy)
 - IMP Clues
 - Nonproductive cough (non-infectious etiology)
 - SOB with exertion & while lying down + Bilateral basilar crackles (Fluid in lung, Right-sided HF)
 - Swelling of her legs & feet + edema of lower extremities bilaterally (Systemic venous congestion, Left-Sided HF)
 - No history of major medical illness & takes no medications (excludes etiologies)
 - She delivered a male newborn 1 month ago (OUR KEYWORD & etiology)
 - Dx → Peripartum Cardiomyopathy
 - Form of **Dilated Cardiomyopathy**, which is characterized by **systolic dysfunction secondary to eccentric hypertrophy of the heart**
 - Sarcomeres are added in **series** [asked on NBME] ⇒ Dilated Chambers (Four Chamber Dilation, choice C) with relatively thinner walls ⇒ Systolic Dysfunction
 - Right-side HF ⇒ Jugular venous distension, Mild Hepatomegaly, Mild Pitting Edema in lower extremities
 - Left-side HF ⇒ Edema in lung bases
 - Basically ⇒ Four Chamber Dilation [asked on NBME]
 - Peripartum cardiomyopathy affects young women in their last months of pregnancy until a few months after.



HY Findings:

- S3 Sound (Rapid Ventricular filling due to dilated ventricles)
- ECHO shows dilated heart (Grossly Enlarged)
- CXR shows Balloon Appearance



Most common cause of DCM is familial due to **TTN gene mutation** that encodes for the **titin sarcomere protein**

? What are other HY causes of DCM?

▼ Answer

- **Doxorubicin**
 - Anti-Cancer drug that causes increased ROS
 - *ttt* → *Dexrazoxane*
- **Coxsackievirus B**
- **Chagas Disease** (Trypanosoma Cruzi)
- **Peripartum Cardiomyopathy**
- **Wet Beri Beri** (Thiamine Deficiency)
- **Stress Cardiomyopathy** ("Broken Heart Syndrome" or "Takotsubo Cardiomyopathy")
 - *ECHO* shows *ventricular apical ballooning*
 - *Caused by "Catecholamine Excess" or "Increased Sympathetic Stimulation"*

▼ Other Choices

- **Choice A** → Presents immediately after delivery
- **Choice C** → No symptoms/signs of depression
- **Choice D** → presents as productive cough + fever + NO signs of heart failure
- **Choice E** → Tachypnea, Tachycardia, hypotension, and severe chest pain. Also develops within few days after pregnancy
- **Choice F** → Caused by previous infection (which was excluded here) or Drugs (which was also excluded)

Q17

A 75-year-old woman has taken 12 over-the-counter nonsteroidal anti-inflammatory tablets daily for the past 2 weeks for mild osteoarthritis of the neck. Which of the following is most likely to be increased in this patient?

- A. Glomerular filtration rate
- B. Renal blood flow
- C. Plasma renin activity
- D. Urine prostaglandin E₂ excretion
- E. Urine thromboxane A₂ excretion

▼ Explanation

- **Answer is C (Plasma renin activity)**
 - Patient taking NSAIDs and asks what would most likely increase.
 - Let's go through the choices
 - **Choices A & B** → NSAIDs inhibit PGs, and PGs causes VD of afferent renal arterioles
 - **NSAIDs = decreased vasodilation = decreased RBF & GFR**

- **Choice C** → Decreased renal blood flow by intake of NSAIDs, causes the **JG cells** to think that there is hypovolemia, and as a result **increase the production of renin, to activate RAAS**.
 - **AT-2** → Causes VC of efferent arterioles → **increases GFR**
 - **Aldosterone** → causes salt-water retention → **increases blood volume & RBF**
- **Choices D & E** → NSAIDs **inhibits COX1 & COX2** (which go on and produce PGs & TXA2)
- **So, correct answer choice is C (Plasma Renin Activity)**

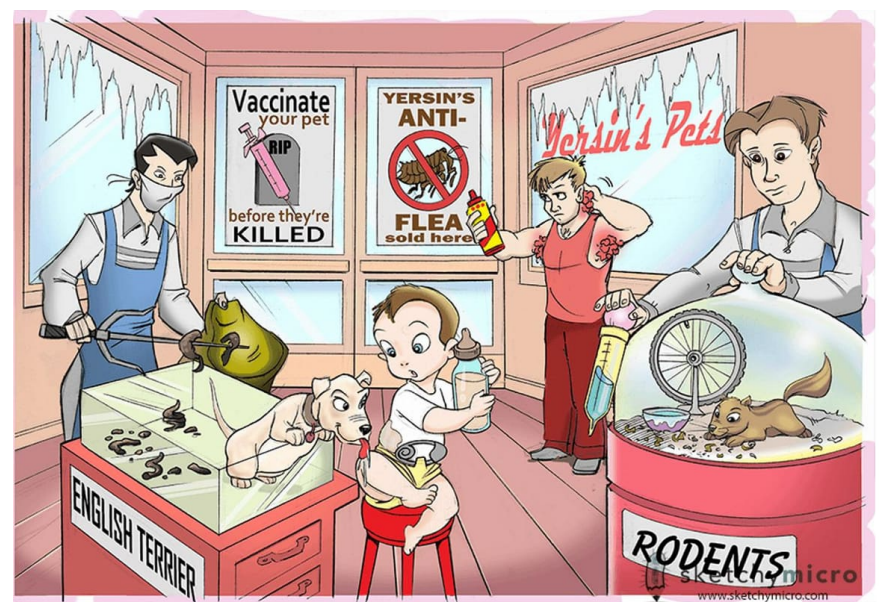
Q18

A 5-year-old boy who lives on a farm has had diarrhea, cramping, abdominal pain, and fever for 2 days. He drinks unpasteurized milk. An organism is isolated from the stool and grows at 4°C. Which of the following is the most likely causal organism?

- A. Bacteroides fragilis
- B. Campylobacter jejuni
- C. Escherichia coli
- D. Helicobacter pylori
- E. Salmonella typhi
- F. Vibrio cholerae
- G. Yersinia enterocolitica

▼ **Explanation**

- **Answer is G (Yersinia Enterocolitica)**
 - **IMP Clues**
 - Lives on a farm (could be an animal-borne infection)
 - Diarrhea, cramping, abdominal pain, and fever (infection that causes GI symptoms)
 - Drinks unpasteurized milk (now we know the mode of transmission)
 - Grows at 4 degrees C (MAIN KEYWORD, 2 HY bacteria LOVE the cold)
- Q asks what the organism is?
 - **Yersinia Enterocolitica**
 - Transmission: **Contaminated Milk Products or Pet feces**
 - Morphology: **Pleomorphic bacteria** that can be classified as **coccobacillus** or **rod** with **Bipolar Staining [Buzzy]**
 - HY Diseases:
 - **Yersiniosis** ⇒ Presents as abdominal pain, diarrhea (+/- bloody), and pseudoappendicitis
 - **Reactive Arthritis**
 - **Acute Diarrhea (Bacterial Gastroenteritis)**



? What is the other bacterium that is cold resistant?

▼ Answer
Listeria.



Q19

A 45-year-old man with Li-Fraumeni syndrome agrees to participate in an investigational study of tumor suppressor gene disorders. A mutation is found in his p53 tumor suppressor gene that converts an arginine to a proline at amino acid position 248 (R248P). This change alters hydrogen bonding between the mutant p53 tumor suppressor gene protein and the thymidine oxygen and adenine ring nitrogen of DNA. Which of the following is the most likely result of this mutation on the transcription of genes that inhibit cell division and contain the consensus sequence TATA (A/T) (A/T) at -30 bp 5' to the transcription start site?

- A. Decreased binding of DNA polymerase
- B. Decreased binding of RNA polymerase
- C. Increased binding of DNA polymerase
- D. Increased binding of RNA polymerase
- E. Increased binding of trans factors

▼ Explanation

- Answer is B (Decreased binding of RNA polymerase)
 - IMP Clues
 - Patient has Li-Fraumeni Syndrome (caused by p53 mutation)
 - Mutation is found in his p53 tumor suppressor gene (yep)
 - Q asks how this mutation will affect the transcription of genes (that inhibit cell division & contains the TATA promotor)?
 - I know that you probably don't understand shit rn. So let's go through it together.
 1. From the Q, we know that this mutation will affect transcription of genes
 - What is transcription?
 - **DNA → RNA.**
 - This is **transcription**
 - **Translation** is RNA → Protein
 - What enzyme causes transcription?
 - **RNA Polymerase. (Forms RNA from DNA sequence)**
 - What is the function of **DNA polymerase?**
 - **Synthesizes new DNA strands using a template strand.**
 2. Okay, so we know that this Question is talking about Transcription/ RNA polymerase.
 3. P53 is a **tumor suppressor gene**, which **synthesizes inhibitory proteins** that *inhibit* the cell cycle.
 - a. **If P53 is mutated, decreased synthesis of proteins (inhibitory) ⇒ decreased RNA polymerase activity.**
 - Question asks, **what would be the result of this p53 mutation** on the **transcription of genes** that **inhibit cell division**?
 - Well, **healthy P53 produces proteins** that **inhibit cell cycle (by RNA polymerase)**

- If p53 is mutated, less proteins are produced (less RNA polymerase binding) = less cell cycle inhibition → MORE PROLIFERATION → TUMORS

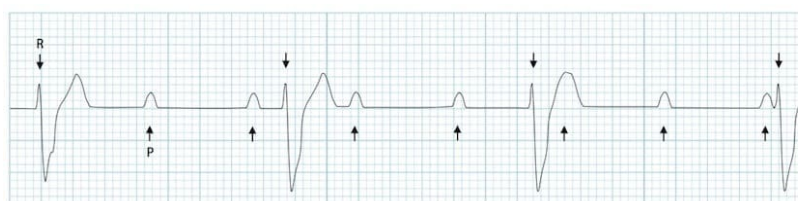
Q20

A 79-year-old man is brought to the emergency department by his wife 30 minutes after he lost consciousness for 30 seconds. On arrival, he is alert, but he says that he is dizzy. There is no urinary or fecal incontinence. His pulse is 40/min and regular, and blood pressure is 92/56 mm Hg. Physical examination shows no evidence of tongue biting. The lungs are clear to auscultation. Cardiac examination shows a variable intensity S₁. He is oriented to person, place, and time. An ECG shows a third-degree atrioventricular block. Which of the following is the most appropriate next step in management?

- A. Transesophageal echocardiography
- B. Transthoracic echocardiography
- C. Insertion of pulmonary artery catheter
- D. Insertion of transvenous pacemaker
- E. Cardiac catheterization with angioplasty
- F. Cardiac catheterization with stent placement

▼ Explanation

- Answer is D (Insertion of transvenous pacemaker)
 - ECG shows Third-degree AV block (Heart Block)
 - Treatment of 3rd degree AV block is pacemaker
- What's a 3rd degree AV block?
 - It is when the Atria & Ventricles beat independently of one another



[For Nerds] Let's Try & Understand the ECG

- Atria depolarization = p-waves
- Ventricle depolarization= QRS complex
- Normally, we have a p-wave followed by a narrow (<3 small boxes) QRS
 - Each atrial depolarization causes a ventricular depolarization
- What does the ECG show?
 1. It shows p-waves **NOT** followed by QRS complexes
 2. The QRS complexes are **wide** (>3 small boxes), which means the source ventricular depolarization is **NOT the atria**

Q21

A 12-year-old boy is swimming in a mountain stream. He is immersed up to his neck in 60°F water for 20 minutes. Which of the following sets of physiologic changes is most likely to occur in this boy?

Choices	Central Blood Volume	ADH (Vasopressin)	Atrial Natriuretic Peptide
A	↑	↑	↑
B	↑	↑	↓
C	↑	↓	↑
D	↑	↓	↓
E	↓	↑	↑
F	↓	↑	↓
G	↓	↓	↑
H	↓	↓	↓

▼ Explanation

- Answer is C
 - IMP Clues
 - Immersed up to his neck in 60F water for 20 mins (60F is cold water, so we expect vasoconstriction to happen)

- Q asks expected values for Central Blood Volume, ADH, and ANP?
 - **Hypothermia & Sympathetic System Activation** → **Vasoconstriction of peripheral arterioles in your extremities**
 - This results in **less blood** in **extremities** & **more blood centrally** (**Increased Central Blood Volume**)
 - Increased Blood Centrally → **Increased VR** to the heart, which **increases Preload & Effective plasma volume**
 - **Increased Effective Plasma Volume** → **Inhibition of ADH secretion** (why would you need antidiuretic hormones when you have 'high' blood volume?)
 - **Increased Preload** → Increased Stretch of ventricles (by **Starling's Law**)
 - **Increased Stretch of ventricles causes secretion of ANP/BNP**
- So, results of hypothermia are:
 - **Increased Central Blood Volume - Decreased Serum ADH - Increased Serum ANP (Choice C)**

Q22

Ten healthy human subjects are given a new oral drug and monitored for drug effect and toxicity. Blood samples are periodically taken and analyzed to define the human pharmacokinetics of the drug for the first time. Which of the following best describes this trial?

- A. Preclinical testing
- B. Phase 1
- C. Phase 2
- D. Phase 3
- E. Phase 4

▼ Explanation

- **Answer is B (Phase 1)**
 - **IMP Clues**
 - Ten (remember the rule we established, Phase 1 = 10^1 , Phase 2 = 10^2 ,...)
 - Healthy (Phase 1 = healthy/diseased, Phase 2 = diseases,...)
 - New drug & monitored for effect & toxicity (Not comparing between an old & new drug, so NOT phase 3, also assessing safety & effectiveness)
 - **Phase 1 Clinical Trial**
 - Number of participants = 10^1
 - Participant status = **Healthy or Diseased**
 - Aim = Mainly tests for **safety**

▼ Other Choices

- **Choice A** → Preclinical trials are usually done on lab animals
- **Choice C** → **Phase 2** mainly tests **Efficacy & Safety**, which is tested on **< 100 (10^2) of diseases patients**.
- **Choice D** → **Phase 3** *compares* **between the new drug & existing treatments** on **100s-1000** of diseased patients (10^3)
- **Choice E** → **Phase 4** If a drug is **on the market, this means it already had the FDA approval and is now in stage 4**.
 - USMLE always does this trick. They may give you a 5-line vignette and flood you with unnecessary garbage, while all you need is that "marketed drug". **Boom phase 4.**

Q23

A 32-year-old woman comes to the physician because of a 1-day history of chest pain that radiates to her left arm. She also has a 1-week history of swelling of the left eye and a 4-day history of recurrent episodes of fever followed by shortness of breath, muscle aches, and joint pain. Two weeks ago, she returned from a trip to the Amazon rain forest. Her temperature is 39.1°C (102.4°F), pulse is 110/min, respirations are 17/min, and blood pressure is 90/65 mm Hg. Bilateral

basilar crackles are heard over the lung fields. There is 3+ edema of the lower extremities. A photomicrograph of a peripheral blood smear is shown. Which of the following is the most likely vector for the causal organism in this patient?



- A. Anopheles mosquito
- B. Black fly
- C. Flea
- D. Ixodes tick
- E. Reduviid bug
- F. Sand fly
- G. Tsetse fly

▼ Explanation

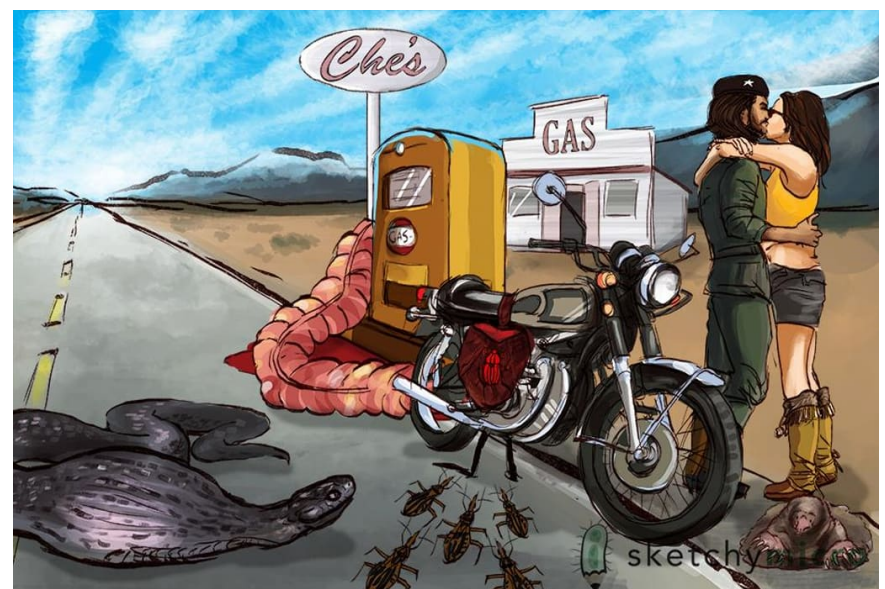
- **Answer is E (Reduviid bug)**

- **IMP Clues**

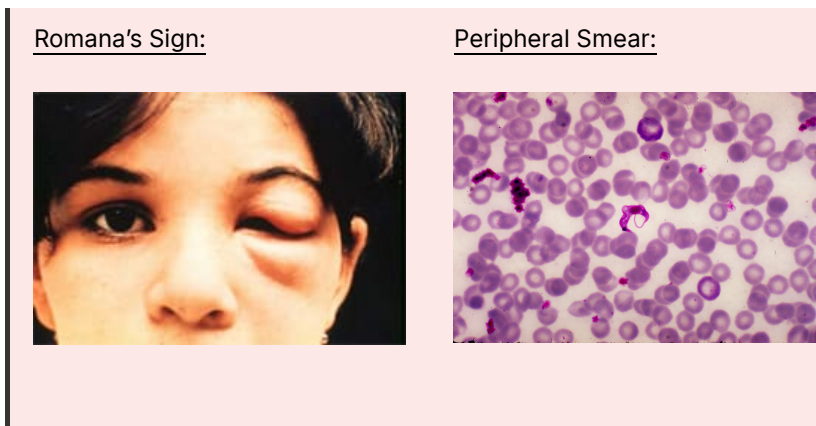
- 32y old woman + Chest pain that radiates to her left arm (MI in a 3rd decade woman is very unusual, not your normal MI epidemiology)
- Swelling of left eye (you might think it is edema, but it is unilateral which is weird, so something else?)
- Recurrent episodes of fever followed by SOB, muscle aches, and joint pain (sounds like recurrent activation of the immune system like what is seen in malaria, due to transient presence of something in the blood)
- She returned from a trip of the Amazon rain forest (definitely a parasite then)
- Temperature is 39.1C + pulse is 110/min + BP is 90/65mmHg (hemodynamically unstable)
- Bilateral basilar crackles are heard over lung fields (MI causing Left side HF?)
- 3+ edema in the lower extremities (Right side HF, too)
- Peripheral blood smear shows Trypomastigote.

- **Dx → Chagas Disease**

- **Caused by *Trypanosoma Cruzi***
- **Transmission:** Mainly by **Reduviid bug (kissing bug)**, which shed its feces that is then rubbed into bite site while scratching.
- **Features:**
 - **Early Features:**
 - **Chagoma:** Edema at bite site (usually in the face)
 - **Romana Sign:** **Unilateral painless** edema of the eyelid and periocular tissue
 - Eyelid "swelling" is **Romana's Sign**
 - **Late Features:**
 - **Cardiomyopathy (Dilated Cardiomyopathy + RBBB + Heart Failure)**
 - **Achalasia**
 - **Megaesophagus**
 - **Megacolon**
- Basically, the patient got bitten by the bug on her eyelids, which caused the swelling. The **trypomastigote then moves in blood which causes activation of immune system & production of cytokines**, causing the *fever, muscle aches, and joint pain*.
 - The parasite then burrows into the heart & caused **dilated cardiomyopathy, MI, and HF**.



Related Pictures to Chaga's Disease:



▼ Other Choices

- Choice A → Malaria
- Choice B → Microfilaria of **Onchocerca Volvulus**
- Choice C → **Yersinia Pestis**
- Choice D → Babesiosis or Lyme disease (**Borrelia Burgdorferi**)
- Choice F → Leishmaniasis
- Choice G → **Trypanosoma Brucei** (African Sleeping Sickness)

Q24

A 2-day-old full-term female newborn suddenly develops bilious emesis, abdominal tenderness, and hemodynamic deterioration. An upper gastrointestinal barium x-ray shows the ligament of Treitz on the right side of the abdomen and duodenal obstruction. This patient is at greatest risk for occlusion of which of the following arteries?

- A. Celiac
- B. Left colic
- C. Right colic
- D. Superior mesenteric
- E. Umbilical

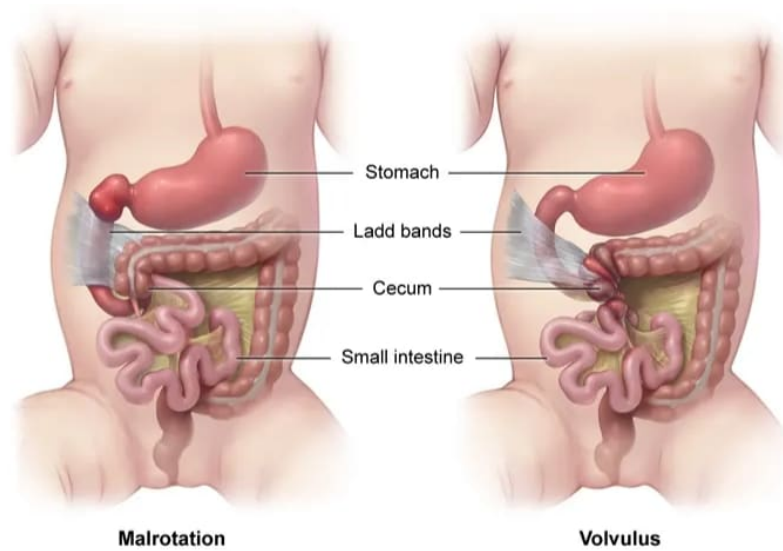
▼ Explanation

- Answer is D (Superior Mesenteric)
 - IMP Clues
 - 2-day-old newborn (pediatric case)
 - Bilious Emesis (Obstruction is distal to 2nd part of duodenum)
 - Upper GI barium shows ligament of Treitz on the right side & duodenal obstruction (this is midgut malrotation)

- **What happens in Midgut Malrotation?**

- Then normal rotation of the Midgut doesn't happen + the presence of abnormal fibrous peritoneal bands (**Ladd's Bands**) compresses the duodenum & SMA, causing **Midgut Volvulus**

- **Duodenum compression** → **Bilious Vomiting**
- **SMA compression** → **SMA Syndrome (Choice D)**

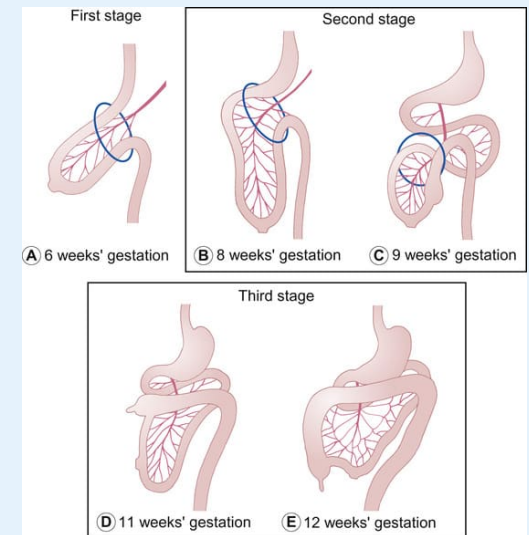


- How do we know that it is Midgut Malrotation?

- The **Duodenojejunal Flexure** is normally on the **left**.
 - In **Midgut Malrotation**, the barium shows that the **duodenojejunal junction** is on the **Right**
- **Duodenal Obstruction**
 - This is caused by **Ladd's Bands**

[For Nerds] First, how does the GI content position?

- In early embryological stages, we know that the abdominal contents herniate outside the cavity into the umbilical cord because of its small size.
- It then **rotates counterclockwise** around the **SMA** while retracting into the abdominal cavity.
- **This results in:**
 - **Jejunum on the Left Upper Quadrant** (Site is marked by the presence of Ligament of Treitz there)
 - **Cecum on the Right Lower Quadrant**



Q25

A 56-year-old woman comes to the physician for a follow-up examination 8 weeks after recovering from pneumococcal pneumonia. X-rays of the chest show no abnormalities. Which of the following most likely allowed this resolution to occur?

- Formation of granulation tissue
- Increased angiogenesis
- Maintenance of basement membrane integrity
- Metaplasia of mesenchymal cells to pneumocytes
- Proliferation of fibroblasts

▼ **Explanation**

- **Answer is C (Maintenance of Basement Membrane Integrity)**
 - Simple concept.
 - **Intact basement membrane** allows the **Type 2 pneumocytes** to regenerate the **alveolar epithelium**, and **everything returns to normal**.
 - **If the basement membrane is destroyed**, the repair process will be **via fibrosis**, which will **leave permanent residue on CXR**.

Q26

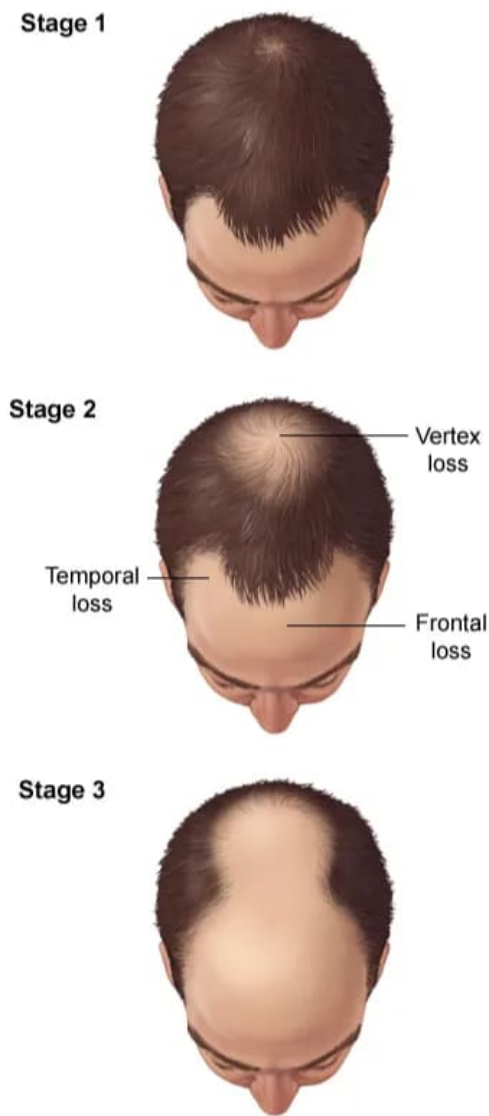
A 31-year-old man comes to the physician because of concerns about hair loss. He has a family history of androgenetic alopecia. Examination shows some hair thinning over the vertex with normal scalp skin. If pharmacologic treatment is elected, use of a drug to block the synthesis of which of the following steroids is most appropriate?

- Androstenedione
- Dihydrotestosterone
- Estradiol

- D. Estriol
- E. Testosterone

▼ Explanation

- Answer is B (Dihydrotestosterone)
 - Family History of androgenetic alopecia (like all of us 😊)
 - Hair thinning over the vertex (classic alopecia pattern)
 - With normal scalp skin (exclude other causes like tinea capitis, where the skin is abnormal)
- Q wants to know the drug that will be given inhibits what?
 - **DHT is what causes Androgenic Alopecia**
 - **DHT causes the hair follicle to shrink**, which overtime causes the hair to thin & fall.
 - This is called **miniaturization** of hair follicles
 - The drug given is **Finasteride (5-alpha reductase inhibitor)**
 - **Testosterone → DHT via 5-alpha reductase**



Differences between Androgenetic Alopecia in Males vs Females:

Males:

- **Recession of Hairline** + gradual/asymptomatic hairloss involving the vertex, temporal scalp, or midgrontal regions.
- Commonly starts during **Adolescence**



Females:

- **NO** Recession of hairline, but there is hair loss at the vertex and frontal scalp
- Usually starts after **Menopause**



Q27

A 44-year-old man comes to the physician because of fever and mild abdominal discomfort for the past 3 days. He has a 10-year history of intravenous drug abuse. Temperature is 39.0°C (102.2°F), pulse is 108/min, and blood pressure is 150/94 mm Hg. The liver edge is percussed to 12 cm (4.8 in), and there is a prominent systolic pulsation of the liver. Which of the following is the most likely diagnosis?

- A. Dissecting aortic aneurysm
- B. Hepatocellular carcinoma
- C. Portosystemic shunt
- D. Renal artery hypertension
- E. Tricuspid insufficiency

▼ **Explanation**

• **Answer is E (Tricuspid Insufficiency)**

◦ **IMP Clues**

- 10-year history of IV drug abuse (MAJOR KEYWORD, highly indicative of Infective Endocarditis)
- Liver edge is percussed to 12 cm (hepatomegaly)
- There is prominent systolic pulsation of the liver (Pulsatile Liver, buzzy for Tricuspid Regurgitation)

◦ **Dx → Tricuspid Insufficiency**

- Patient on **IV drugs** causes seeding of **Right Sided heart valves (usually tricuspid)** & predisposes to **infective Endocarditis**
 - **Why Right Sided valves?**
 - You inject drugs into **veins & blood in the veins returns to RA → Tricuspid valve**
- **Infective endocarditis causes destruction of the valve → *tricuspid regurgitation***
 - When heart pumps the blood, the insufficient tricuspid valve causes backflow of the blood into the RA & into the IVC into the hepatic veins → **Pulsating Liver with each systole.**

▼ **Other Choices**

- **Choice A** → History of smoking, atherosclerosis, connective tissue disease + presentation of severe hypovolemia & chest/abdominal pain radiating to the back + examination shows different blood pressure on both arms + AR murmur
- **Choice B** → History of HBV, HCV, Aflatoxin, Wilson's disease, hemochromatosis + weight loss, low grade fever, abdominal pain + jaundice
- **Choice C** → usually seen in patients with Portal HTN
- **Choice D** → usually an old atherosclerotic male with bruit on flanks

Q28

A 17-year-old boy comes to the physician because of a 1-week history of fever, fatigue, and sore throat. His temperature is 38.3°C (101°F). Physical examination shows an erythematous oropharynx, bilateral cervical lymphadenopathy, and splenomegaly. Laboratory studies show a leukocyte count of 15,000/mm³ (50% typical lymphocytes and 10% atypical lymphocytes). A test result for heterophil antibody is positive. Twelve months after his complete recovery, which of the following is still likely to contain the virus that caused his sore throat?

- A. B lymphocyte
- B. Hepatocyte
- C. Macrophage
- D. Renal epithelial cell
- E. Segmented neutrophil
- F. Sensory neuron

▼ **Explanation**

• **Answer is A (B lymphocytes)**

◦ **IMP Clues**

- Fever, sore throat, erythematous oropharynx, bilateral cervical lymphadenopathy, and splenomegaly (sounds like infectious mononucleosis)
- Leukocyte count of 15,000 + 10% atypical lymphocytes (Atypical lymphocytes are T-cells in response to the infected B-cells)
- Heterophil antibody test is positive (confirmation of EBV)

• **Dx → Infectious Mononucleosis**

- Caused by **Epstein-Barr Virus (EBV)**; which is a **dsDNA virus**
- **EBV binds to CD21 on B-cells → Infects them & causes B-cell proliferation (what is referred to by "monomorphous population of B lymphocytes")**
 - This **B-cell proliferation** is the cause of **hepatosplenomegaly & lymphadenopathy** (*Posterior Cervical Lymphadenopathy* is buzzy & HY for EBV infection)
- USMLE can give you a patient who had a graft rejection for a cadaveric kidney she got → doctors gave her maximal immunosuppression drugs → caused **reactivation of EBV** in the

? 21M with pharyngitis was given ampicillin & developed a maculopapular rash. What is the causative organism?

▼ **Answer**

EBV - patients with Infectious Mononucleosis develop a maculopapular rash when given **ampicillin or amoxicillin**.

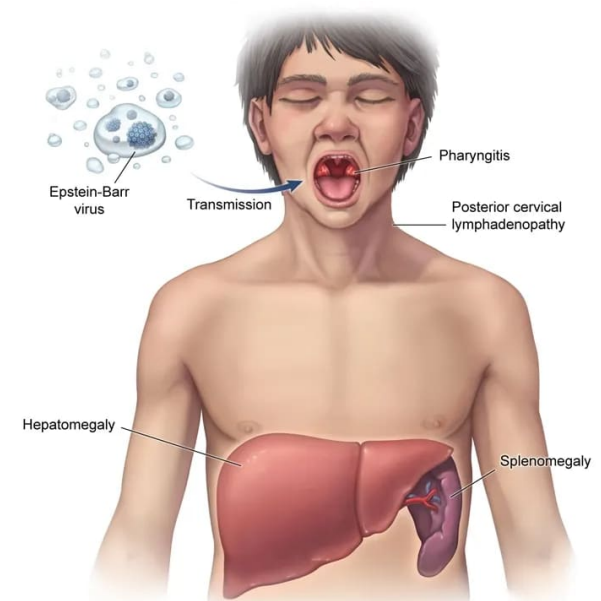
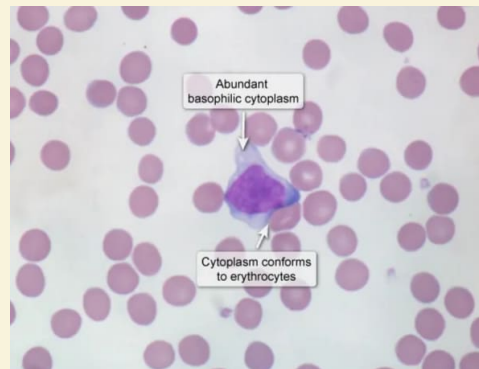
host → **EBV enters the B-cells via CD21** [asked on NBMEs] → causes B-cells to proliferate → HSM & lymphadenopathy.

? What would be expected to be seen on peripheral smear of this patient?

▼ Answer

Reactive/Downy/Atypical T-cells

- EBV infects B-cells & causes their proliferation in lymph nodes & spleen
- T-cells "react" to EBV by transforming their shape, named Reactive/Atypical T-cells in plasma



? What test is used to diagnose Infectious Mononucleosis?

▼ Answer

Heterophil (or Monospot) test - If Q says these tests are negative, **IT IS NOT EBV**

Q29

A 27-year-old man comes to the physician for a routine examination. He has smoked 1 pack of cigarettes daily for 14 years. When the physician initiates a discussion on smoking cessation, the patient says, 'I'd like to quit because I know it can hurt me in the long run. However, I don't think I'm ready to make such a big change now.' Which of the following is the most appropriate next step for the physician?

- Ask the patient to identify the pros and cons of smoking cessation
- Detail the long-term health effects of smoking
- Initiate pulmonary function tests
- Prescribe bupropion
- Recommend nicotine replacement therapy

▼ Explanation

• Answer is A

- You need to know the **Stages of Change**
- I'll explain it in simple examples for you to understand:

1. **Pre-contemplation**

- Patient sees that there is nothing wrong with smoking and he doesn't want to stop

2. **Contemplation**

- Patient knows that smoking is wrong but he's hesitant to make the decision to stop

3. **Preparation**

- Patient starts reading about pros and cons & maybe goes to therapy to learn about quitting (**BUT HE HASN'T QUIT YET**)

4. **Action**

- Patient actually stops smoking

5. **Maintenance**

- Patient maintains cessation of smoking

- The patient **here is contemplation**, he knows it's bad on the long run but he's not ready to make the change now.
 - So, the **next step** is to make the patient **realize the pros and cons** (i.e. prepare him to quit → **Preparation phase**)

▼ **Other Choices**

- **Choice B** → He knows them. He said "I know it can hurt me in the long run"
- **Choice C** → Why?
- **Choice D & E** → Would be helpful in the maintenance phase

Q30

A 39-year-old woman comes to the physician because of increasing hair growth on her face for the past year. She has not had a menstrual period during this time. A CT scan of the pelvis shows an ovarian tumor on the left. Serum testosterone concentration is 450 ng/dL (N=20-60 ng/dL). Which of the following laboratory values is most likely increased due to the increased serum testosterone concentration?

- A. Alkaline phosphatase
- B. Follicle-stimulating hormone
- C. Hemoglobin
- D. High-density lipoprotein
- E. Prostate-specific antigen

▼ **Explanation**

- **Answer is C (Hemoglobin)**
 - **IMP Clues**
 - Increasing hair growth on her face (hirsutism)
 - No menstrual period (hormones all over the place)
 - CT shows ovarian tumor (likely to be an androgen secreting tumor, most commonly Sertoli-Leydig Cell tumor)
 - Serum testosterone concentration is 450 (high, so supports the diagnosis)
 - Q asks what's most likely to increase as a result of the increased testosterone?
 - Increased testosterone stimulates the **EPO production**, which acts on **bone marrow to increase erythropoiesis**
 - This is why men on average have higher hemoglobin levels in comparison to women

▼ **Other Choices**

- **Choice A** → ALP reflects bone turnover.
 - Bone turnover increases as testosterone level decreases.
 - When men get older, testosterone levels decrease, bone turnover increases → more liable to osteoporosis
- **Choice B** → Higher testosterone levels cause negative feedback on FSH & LH levels.
 - So FSH decreases.
- **Choice D** → Testosterone levels increase LDL levels not HDL levels.
- **Choice E** → PROSTATE? In a woman? Personally, the women I know have no prostate.

Q31

During a study of symptomatic proximal deep venous thrombosis, patients with this condition are randomly assigned to receive either dalteparin subcutaneously for 5 to 7 days and then oral warfarin for 6 months, or dalteparin alone subcutaneously for 6 months. No placebo controls are used. The probability of recurrent thromboembolism at 6 months is 10% in the dalteparin group and 19% in the warfarin group. Which of the following best describes this study design?

- A. Case-control study
- B. Case series

- C. Observational cohort study
- D. Open-label clinical trial
- E. Open-label crossover study

▼ **Explanation**

- **Answer is D (Open-label clinical trial)**

- Patients are assigned to receive either dalteparin then oral warfarin or dalteparin alone
 - So, this is not an observational study. We assigned patients to things. (Excludes choices A, B, and C)
 - Also, patients either take dalteparin alone or dalteparin then warfarin. No switching between groups happens (Excludes choice E)
- No placebo controls are used (okay, so the patients know what they are taking)
 - So, no patients & no controls (Also excludes choice A)
- Patients know what they are taking & so does the doctors, basically an "open-label" clinical trial.

▼ **Other Choices**

- **Choice A** → we observe 2 groups: a group with disease (case) and a group with no disease (control) and we look for risk factors that could've caused the disease
- **Choice B** → Case series are when we get information about X number of cases with a specific disease & we observe them to see details about the disease, risk factors, outcomes. You get it.
- **Choice C** → Cohort Study
 - we observe 2 groups: a group with a specific risk factor & a group with no risk factor. We then see if the risk factor causes a specific disease/outcome
- **Choice E** → Open Label Cross-over Study
 - We have 2 groups, we give group 1 Drug A & group 2 Drug B.
 - After a few weeks, we switch. We give group 1 Drug B & group 2 Drug A.

Q32

A 5-year-old boy is brought to the physician because of pain in the right eye at night for the past week. There is no family history of neoplasia. Examination shows strabismus and tenderness in the eye. The left eye is normal. Examination of the retina shows the presence of a mass. The physician explains to the parents that the boy is unlikely to develop any other neoplasms. The first mutation leading to this neoplasm most likely occurred in which of the following?

- A. Germ cells
- B. Retinal cells
- C. Somatic cells of the child
- D. Somatic cells of the parents
- E. Zygote

▼ **Explanation**

- **Answer is B (Retinal Cells)**

- **IMP Clues**
 - No family history of neoplasia (excludes familial neoplasia)
 - Examination shows strabismus + presence of mass (In a child with that age, must be a retinoblastoma)
 - Physician explains to the parents that the boy is unlikely to develop any other neoplasms (Hinting to osteosarcoma, as mutation in RB1 gene predisposes to both Retinoblastoma & Osteosarcoma.)
- Okay, Let's review what we have:
 1. No family history → so probably **NOT** a familial / genetic cause / hereditary syndrome
 2. No risk of developing osteosarcoma → **NOT** caused by RB1 gene mutation
 - So basically, this is just **sporadic mutation in the child's retinal cells**

Q33

A 78-year-old man comes to the physician because of a 3-month history of increasingly severe back pain that is worse at night and persists regardless of his activity level. Physical examination shows no abnormalities. His serum alkaline phosphatase activity is increased. An x-ray of the spine shows numerous lytic lesions along the vertebral column. Which of the following is the most likely diagnosis?

- A. Chondrosarcoma
- B. Ewing sarcoma
- C. Metastatic carcinoma
- D. Osteitis deformans (Paget disease)
- E. Osteosarcoma

▼ **Explanation**

- **Answer is C (Metastatic carcinoma)**

- **IMP Clues**

- Severe back pain that is worse at night & persists regardless with activity level (RED FLAG, severe back pain is probably stress fracture. Worse at night hints to metastasis)
 - Physical examination shows no abnormalities (excludes Paget as it causes enlargement of skull, and hyperdynamic circulation due to AV fistulas)
 - Increased ALP activity (Increased bone turnover)
 - XRAY of spine shows numerous lytic lesions along vertebral column (okay so probably a metastasis, numerous + lytic hints to metastasis. Of what? no information, but we know it is NOT prostate as it causes blastic lesions)

- **Dx → Metastatic Carcinoma**

- What happened is this man most likely has a tumor somewhere which metastasized to the spine. This caused the spine to be weak & caused a stress fracture → **SEVERE BACK PAIN.**
 - **ALP levels hinted that there is bone turnover, so we did an XRAY which revealed lytic lesions.**
 - All of this hints to a **metastatic cancer.**

▼ **Other Choices**

- **Choice A** → Most common site is metaphysis of long bones not spine + Xray shows cartilaginous cap
- **Choice B** → Pediatric tumor that has onion skin periosteal reaction
- **Choice D** → Paget disease yes had isolated ALP increase. But also, physical finding is positive for skull enlargement (which can cause tinnitus) and high-output HF (due to AV Fistulas)
- **Choice E** → Osteosarcoma usual site is at diaphysis of long bones not spine. Xray would have shown Codman triangle & sunburst periosteal reaction

Q34

A 48-year-old man comes to the emergency department because he is vomiting blood. Six months ago, he had a 3-month hospital stay for severe alcohol-induced pancreatitis. His recovery was complicated by a pseudocyst of the pancreatic tail that required surgical drainage. Examination shows splenomegaly. Hemoglobin concentration is 8.5 g/dL; platelet count is 56,000/mm³. Which of the following vessels is most likely thrombosed?

- A. Gastroduodenal artery
- B. Gastroduodenal vein
- C. Inferior pancreaticoduodenal artery
- D. Inferior pancreaticoduodenal vein
- E. Left gastric artery
- F. Left gastric vein
- G. Splenic artery
- H. Splenic vein

▼ **Explanation**

- **Answer is H (Splenic Vein)**

- **IMP Clues**

- Vomiting blood
- history of severe alcohol-induced pancreatitis (IMP Keyword)
- Splenomegaly + Hb 8.5 + PLTs 56,000 (Hypersplenism?)

- Q asks which vessel is most likely thrombosed?

- 2 ways to answer this

1. You straight up know that a **common complication of pancreatitis is Splenic Vein thrombosis** due to its close proximity. So, inflammation of pancreas induced activation of endothelium in splenic vein → **Thrombosis**

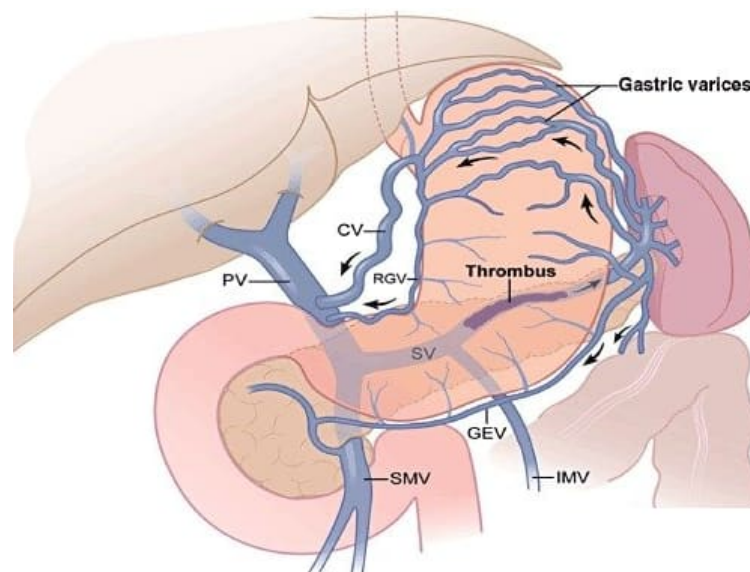
2. You don't know the fact, so you think about what would affect the spleen, so either splenic artery or vein.

a. Thrombosis of Splenic Artery → Infarction

b. **Thrombosis of Splenic Vein → Congested Spleen (Enlarged)**

- Either way, the thrombosed vein is the Splenic Vein

- Causes Congested spleen, Blood pool longer inside the spleen → more filtration of RBCs & PLTs → **Anemia & Thrombocytopenia**
- Thrombosis of Splenic vein causes increased pressure in portal circulation → **Short Gastric Veins Congestion** → **Varices** (which is the probable cause of blood vomiting)



Q35

A 28-year-old man has recurrent pancreatitis associated with familial hypertriglyceridemia. Administration of a drug with which of the following effects is most appropriate?

- A. Decreasing bile acid production
- B. Decreasing VLDL
- C. Increasing chylomicrons
- D. Increasing HDL
- E. Increasing phospholipids

▼ **Explanation**

- **Answer is B (Decreasing VLDL)**

- **IMP Clues**

- Recurrent pancreatitis associated with familial hypertriglyceridemia (Types 1 "hyperchylomicronemia" & Type 4 "Hypertriglyceridemia" both causes pancreatitis)

- Q wants to know the drug to be given should cause what?

- We know that **Type 4 (Hypertriglyceridemia)** is caused by **increased VLDL production**
- The increased VLDL then gives out TAGs, which if they **>1000 mg/dl, they cause pancreatitis (increased fats in pancreas → inflammation)**
- So, if we were to give a drug for hypertriglyceridemia, it would act to **decrease VLDL**



Familial Dyslipidemias Rapid Review:

📖 "1LP, 2LD, B adds V, 3 is E, 4 gets More"

1. Type 1 (Hyperchylomicronemia)

📖 "1LP"

- Deficiency: **LPL** or **Apo-C2**
- *high* Chylomicrons, *high* TAGs, *high* cholesterol
- **Turbid Creamy Plasma → Pancreatitis**

2. Type 2 (Hypercholesterolemia)

a. 📖 "2LD" (Type 2A)

- Deficiency: **LDL receptor** or **Apo-B100**
- *high* Cholesterol
- **Xanthelasma & Achilles Tendon Xanthomas**

b. 📖 "B adds V" (Type 2B)

- *high* Cholesterol + **VLDL**

3. Type 3 (Dysbetalipoproteinemia)

📖 "3 is E"

- Deficiency: **Apo-E**
- *Decreased* reuptake of remnants → *Increased* chylomicrons & VLDL
- **Palmer Xanthoma**

4. Type 4 (Hypertriglyceridemia)

📖 "4 gets More"

- **VLDL overproduction**
- *high* VLDL, *high* TAGs
- **Pancreatitis**

Q36

A newborn born at 26 weeks' gestation has respiratory distress and requires intubation and maximal oxygen support. A chest x-ray shows a ground-glass appearance in both lungs. Deficient synthesis of which of the following is the most likely cause of the respiratory difficulty in this newborn?

- A. Angiotensin II
- B. Dipalmitoyl lecithin
- C. Phosphatidylinositol 4,5-bisphosphate
- D. Phosphatidylserine
- E. Sphingomyelin

▼ Explanation

• Answer is B (Lecithin)

◦ IMP Clues

- Newborn at 26 weeks gestation (Premature babies' complications are super HY)
- Respiratory distress (most likely NRDS)
- CXR shows ground-glass appearance in both lungs (consistent with our judgement)

◦ Q asks deficiency of what is causing this respiratory distress?

▪ NRDS is caused by **decreased surfactant synthesis**

- Surfactant is made up of lipids, most HY to know is **"Phosphatidylcholine/Lecithin"** (Choice B) and the other LY one is phosphatidylglycerol.

- Alveoli are made up of *elastic tissue* that wants to *recoil & collapse*

- Surfactant **decrease** surface tension, **prevent** alveolar collapse, and **increase** compliance of alveoli, making the alveoli open & facilitates O₂ exchange

◦ In NRDS → No surfactant → Collapsed alveoli, causing:

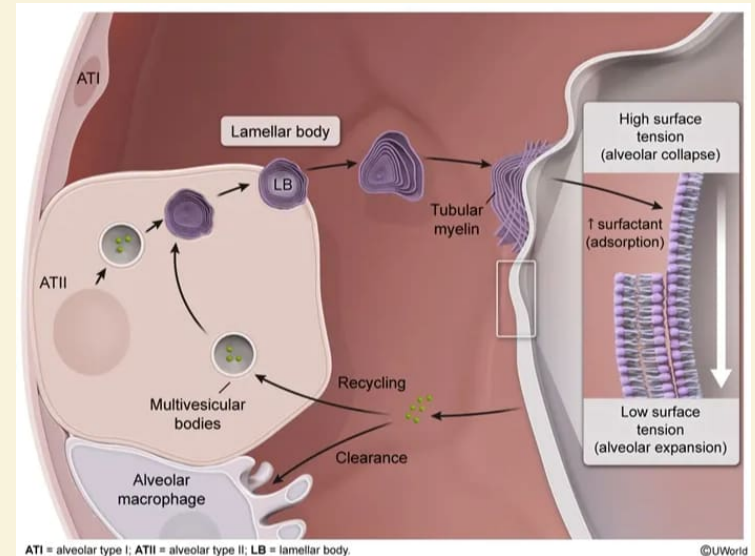
1. **Ground Glass appearance on CXR**
2. Dysfunctional Gas exchange → **Hypoxia & Distress**

? What secretes surfactant?

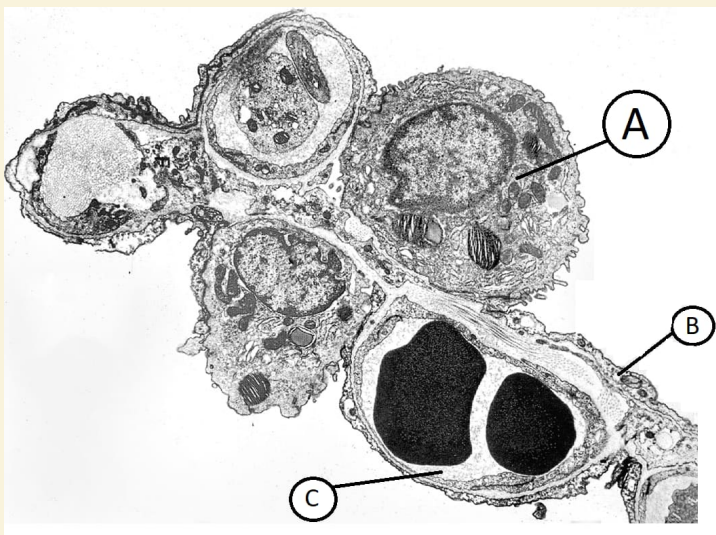
▼ Answer

Type II pneumocytes

- Has 2 Functions ⇒ **Surfactant Synthesis** (via Lamellar Bodies) & **Regeneration of Alveolar Epithelium**
 - NRDS = Decreased Surfactant Synthesis
 - Post-Inflammatory Fibrosis (In case of intact BM) ⇒ Increased Type II pneumocytes & Fibroblasts, but decreased Type I pneumocytes



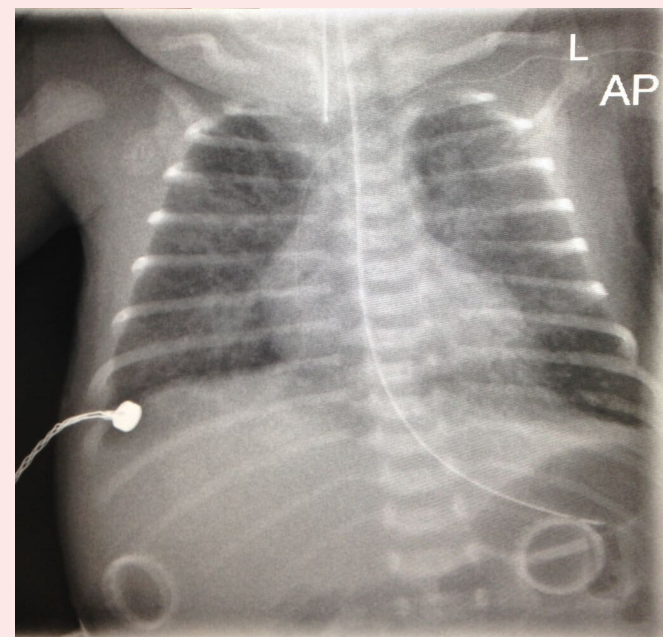
? Label the following EM Picture.



▼ Answer

- A ⇒ Type II pneumocytes
- B ⇒ Type I pneumocytes
- C ⇒ Capillary

Picture below shows the "Ground-Glass Appearance" on a CXR:



Q37

A 27-year-old man is brought to the emergency department 2 hours after injuring his left ankle while rock climbing. His pulse is 80/min, respirations are 25/min, and blood pressure is 135/90 mm Hg. Physical examination shows swelling on the medial and lateral aspects of the left ankle and severe pain on palpation. An x-ray of the left ankle is shown. This patient's injury most likely occurred when his left foot was forcibly moved into the extreme of which of the following positions?



- A. Dorsiflexion
- B. Eversion
- C. Inversion
- D. Plantar flexion

▼ Explanation

- **Answer is B (Eversion)**

- **IMP Clues**

- Swelling on medial & lateral aspect of the left ankle (Okay, so mostly a medial + lateral injury)
- XRAY shows fracture of both fibula & tibia

- Q wants to know what caused these fractures?

- Okay so the lateral aspects of the ankle are injured, so it must be either an inversion or an eversion injury.
 - First, let's get comfortable with some general rules:
 1. If the leg **everts** → **stretch of medial ligaments** (*deltoid ligament is the most important & the strongest*)
 2. If the leg **inverts** → **stretch of lateral ligaments**
 3. The **Tibia** is the **medial** bone
 4. The **Fibula** is the **lateral** bone
 5. The **Deltoid ligament (medial ligament)** is so **strong** that if it stretches, it causes an **avulsion fracture to medial malleolus of the tibia**

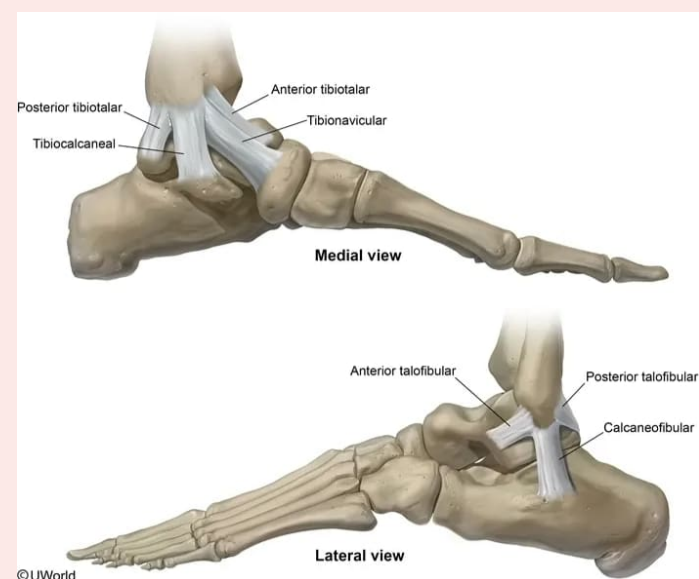
- The XRAY shows **bimalleolar fracture** (The lateral malleolus + medial malleolus are injured), this is called **Pott's Fracture**

- Caused by **Eversion Injury**
 - Basically, the **forceful eversion of the foot stretches the medial deltoid ligament.**
 - Medial Deltoid is strong that it causes **avulsion fracture of medial malleolus of tibia.**
 - The forceful eversion continues that it **pushes the talus bone laterally** → pushes the **lateral malleolus of the fibula** → **Fractures.**



Picture below shows Ankle Ligaments:

- The medial view shows the Deltoid Ligament (made up of Anterior Tibiotalar, Posterior Tibiotalar, Tibionavicular, Tibiocalcaneal)



Q38

Two patients, a 54-year-old man (Patient X) and a 76-year-old woman (Patient Y), are about to receive intravenous vancomycin for severe gram-positive bacterial infections. Both patients weigh 70 kg (154 lb). Patient X has an estimated glomerular filtration rate (GFR) of 60 mL/min, and Patient Y has a GFR of 20 mL/min. Which of the following parameters of their drug therapy is most likely to be the same in both Patient X and Patient Y?

- A. Elimination half-life
- B. Loading dose
- C. Serum drug concentration at 12 hours
- D. Time to steady-state concentration

▼ Explanation

- **Answer is B (Loading dose)**
 - Q says that we have 2 patients with 2 different ages and 2 different GFRs & asks which of the following would be the same in those 2 patients?
 - **Choice A** → Elimination half-life depends on the GFR of the patient. They're different here so NOT the same.
 - **Choice B** → **Loading dose = (Target concentration x Vd) / bioavailability**
 - All of these are characteristics *intrinsic to the drug, NOT the patient*
 - **Choice C & D** → Serum concentration after 12 hours & Time-to steady state depends on elimination half-life which depends on GFR (clearance)

Q39

A previously healthy 6-year-old boy is brought to the physician by his mother because of a 1-week history of an itchy rash in his armpits, both hands and feet, and groin. The itching is most intense at night and keeps him awake. His vital signs are within normal limits. Examination of the skin shows multiple erythematous papules, some with burrows and many of which are excoriated, similar to the ones shown in the photograph. Which of the following questions to the mother will be most helpful in establishing the diagnosis?



- A. 'Do you have any pets at home?'
- B. 'Does anyone else in the family have an itchy rash like this?'
- C. 'Does your child take any medications?'
- D. 'Has there been any recent travel?'
- E. 'Have you changed soaps or detergents lately?'

▼ Explanation

- **Answer is B**
 - **IMP Clues**
 - Itchy rash in his armpits, both hands and feet, and groin + examination show multiple erythematous papules with burrows + excoriations (classical scabies rash & sites)
 - Q asks what should the doctor ask the mother to confirm that this is scabies?
 - **Scabies** is transmitted **person-to-person**, so if he has it then someone in the family most likely has it (**Choice B**)

- Let's go through the other answer choices
 - **Choice A** → It's not a zoonotic parasite, so this Q will not confirm/deny my diagnosis
 - **Choice C** → This is not drug-induced/side effect.
 - **Choice D** → One of the most common causes actually of contracting scabies is by sleeping in sketchy unclean hotels. So technically *can be a correct choice*. However, MOST helpful is knowing if it transmitted from person-to-person or not. It can be contracted from other sites, not just hotels
 - **Choice E** → A question to ask if we have like an allergic reaction not a scabies infection

Q40

A patient in the early stages of hemorrhagic shock is most likely to have which of the following?

- A. Decreased ventilatory rate due to inhibition of the respiratory center
- B. Flushing due to cutaneous vasodilation that occurs secondary to sweating
- C. Increased renal blood flow due to sympathetic activation
- D. Sweating due to parasympathetic stimulation of sweat glands
- E. A weak pulse due to decreased stroke volume

▼ **Explanation**

- **Answer is E (A weak pulse due to decreased SV)**
 - Patient in early hemorrhagic shock would have **decreased preload = decreased SV = decreased CO = Weak thready pulse (Choice E)**

▼ **Other Choices**

- **Choice A** → The hypovolemia would cause decreased carotid sinus pressure which would cause decreased parasympathetic stimulation & increased sympathetic stimulation.
 - This causes increased RR due to stimulation of Respiratory center + the reflex Tachycardia also causes an increase in RR to accommodate for the faster circulation
- **Choice B** → Sympathetic stimulation causes VC of peripheral arterioles & redirects blood to the most important organs (Brain & Heart)
- **Choice C** → The body doesn't "see" the kidney as an important organ, so sympathetic stimulation decreases renal flow
- **Choice D** → Sweating is sympathetic stimulation NOT parasympathetic

Q41

A 45-year-old man with chronic pancreatitis caused by alcohol use disorder comes to the office because of a 3-month history of diarrhea. Physical examination shows no abnormalities. Examination of a stool specimen shows a markedly decreased amount of fecal elastase. Which of the following medications is most appropriate for this patient's diarrhea?

- A. Ciprofloxacin
- B. Lactobacillus
- C. Loperamide
- D. Pancrelipase
- E. Somatostatin

▼ **Explanation**

- **Answer is D (Pancrelipase)**
 - **IMP Clues**
 - Chronic pancreatitis (pancreas not working effectively, causing hyperglycemia & malabsorption)

- 3 months history of diarrhea (probably due to malabsorption)
- Decreased amount of fecal elastase (Elastase is produced by the pancreas to digest macronutrients, if it is low then this means there is pancreatic insufficiency, not working)
- Q asks what med should be given for this patient's diarrhea?
 - We know that his diarrhea is **malabsorptive diarrhea** (most likely **steatorrhea**, the bulky greasy diarrhea with a lot of fat content due to absence of pancreatic enzymes)
 - What does he need?
 - **Pancreatic enzymes (pancreatic lipase) to digest the fat.**

▼ Other Choices

- **Choice A** → Antibiotic, why?
- **Choice B** → The bacteria that maintains the vaginal environment? Yes, that same bacteria.
 - Can be used as “probiotics” or “healthy GI biogut” that decreases other bad bacteria and prevent diarrhea.
 - The etiology of that diarrhea is bacterial overgrowth not malabsorptive
- **Choice C** → Weak opioid agonist used for diarrhea
 - Slows down motility of GI, and causes constipation
 - The problem here is not the motility. It is the absorption.
- **Choice E** → Somatostatin decreases all secretions, which would further decrease the pancreatic secretions

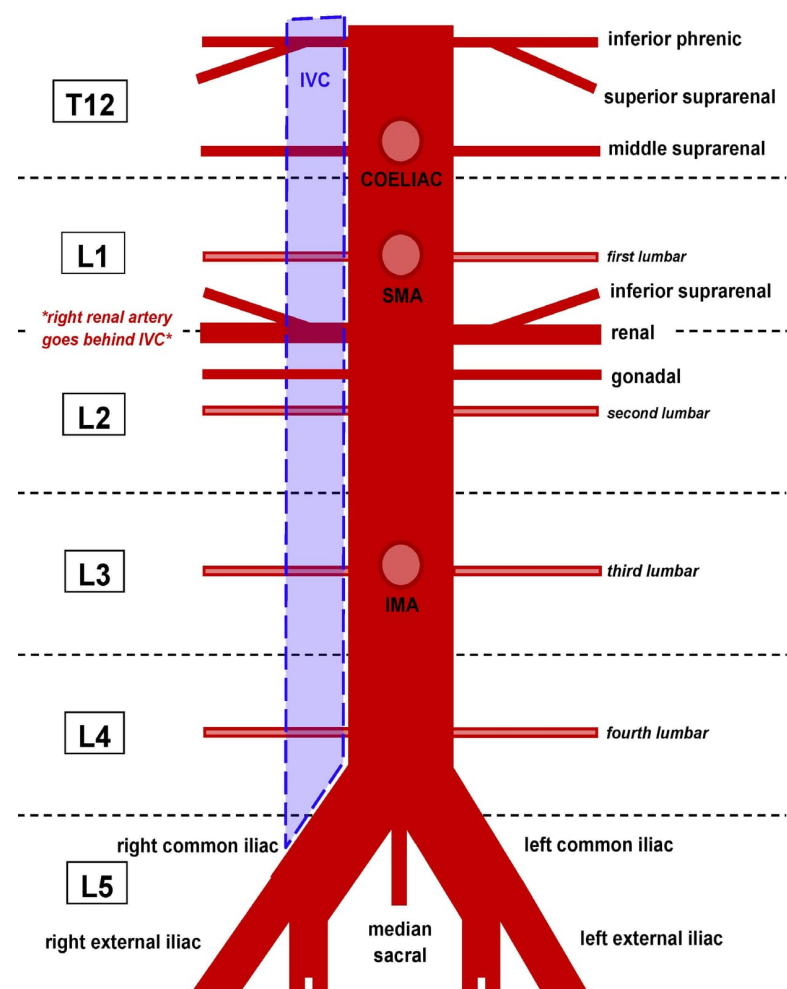
Q42

A 48-year-old man with renal artery stenosis undergoes stent placement. Femoral access is used to place the stent. After entrance into the aorta, the guide wire should be advanced superiorly just beyond which of the following structures to approach the right renal artery in this patient?

- A. Celiac trunk
- B. Internal iliac artery
- C. Superior mesenteric artery
- D. Testicular artery

▼ Explanation

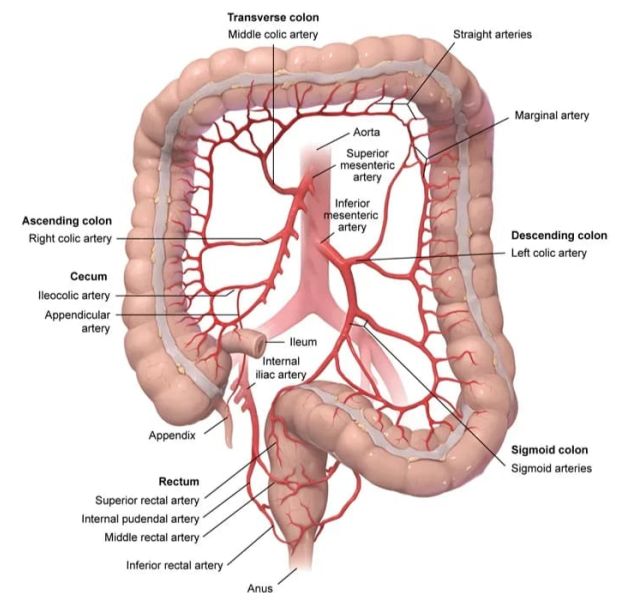
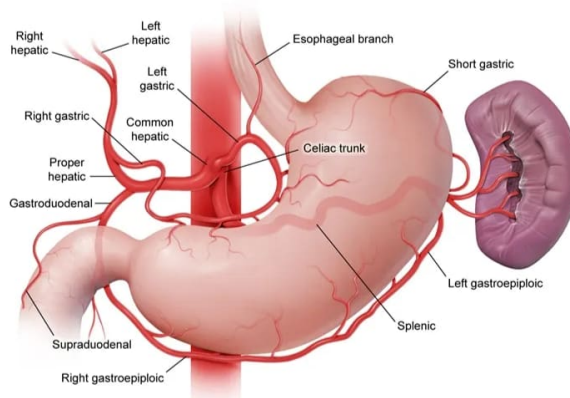
- **Answer is D (Testicular artery)**
 - Q asks above which artery will they find the renal artery?
 - Let's try and imagine the course:
 1. Femoral Artery access (below inguinal ligament)
 2. External Iliac (above inguinal Ligament)
 3. Common Iliac (L4)
 4. Aorta
 5. IMA (L3)
 6. **Testicular/Ovarian artery (L2)**
 7. **Renal Artery (between L2 & L1)**
 8. SMA (L1)
 9. Celiac trunk (Between T12 & L1)



Let's Review Some HY Factoids about these arteries:

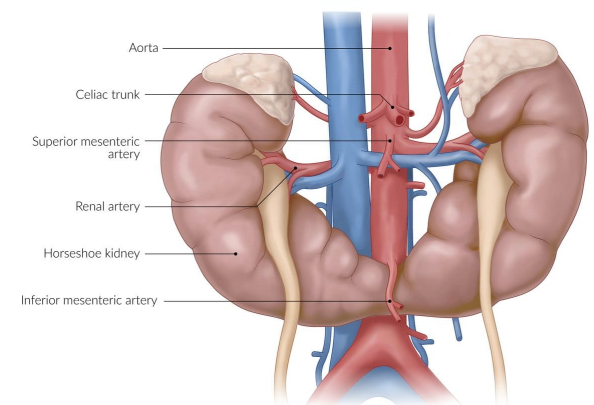
1. Celiac Trunk

- Branches: Left Gastric artery, Splenic artery, and Common Hepatic artery
 - Splenic Artery → Short Gastric arteries → Fundus of the Stomach **[asked on NBME]**
 - Left Gastric Artery → Esophageal branch → Lower Esophagus **[asked on NBME]**
 - Common Hepatic → Proper Hepatic → Right Hepatic → Cystic Artery **[asked on NBME]**



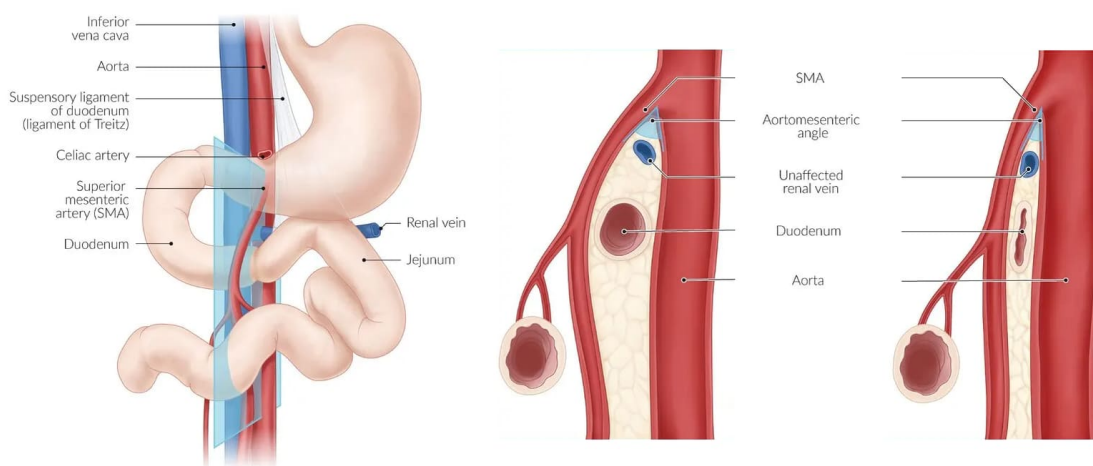
2. Inferior Mesenteric Artery

- Branches: (look at picture)
- HY Fact: **Horseshoe Kidney (abnormal connection of metanephros) ascend to position is prevented by IMA artery [asked on NBME]**



3. Superior Mesenteric Artery

- Branches: (look at picture)
- HY Facts:
 - **Midgut Malrotation predisposes to Midgut Volvulus (Compression of duodenum & SMA) [asked on NBME]**
 - **In Malnutrition (Anorexia Nervosa usually), loss of fat around the duodenum causes its obstruction between the SMA & Aorta (SMA Syndrome) [asked on NBME]**



Q43

A 13-year-old boy is brought to the physician for a well-child examination. He says that he is teased by his peers for 'having breasts like a girl.' He has no history of medical illness. He takes no medications. He is at the 50th percentile for height, 60th percentile for weight, and 60th percentile for BMI. Physical examination shows a small, soft mound of tissue bilaterally beneath the areola. His genital development is Tanner stage 3. Which of the following is the most appropriate next step in management?

- Reassurance
- Measurement of serum growth hormone concentration
- Measurement of serum luteinizing hormone concentration
- Measurement of serum testosterone concentration

E. Mammography

▼ Explanation

- **Answer is A (Reassurance)**
 - 13-year-old boy (hormones all over the place)
 - Teased by his peers for “having breasts like a girl” (we know where this Q is going)
 - No history of medical illness (Liver failure or hormone-producing testicular tumor)
 - He takes no medications (Spironolactone & Ketoconazole)
 - Small, soft mound of tissue bilaterally beneath the areola (yep, gynecomastia)
 - Tanner stage 3 (developing normally)
- Q wants to know the next-step management?
 - **THE PATIENT IS NORMAL. Reassure him.**
 - During puberty, the **surge in testosterone** can cause **increased aromatization** into **estrogen** → **gynecomastia**
 - It **resolves spontaneously** most of the time after puberty.
 - **If not → surgical removal.**

Q44

A 62-year-old man comes to the physician's office for excision of an invasive squamous cell carcinoma on the lower lip. The physician has explained the reasons for the procedure, the technique to be used, the possible complications of the procedure, and the identity of the physician who will be performing the procedure. Which of the following additional information is required for informed consent?

- A. Alternative treatments
- B. Availability of a second opinion
- C. Cost of the procedure
- D. Expected recovery time
- E. Medications used during the procedure

▼ Explanation

- **Answer is A (Alternative treatments)**
 - For a doctor to have the consent of a patient, the doctor is required to inform the patient of:
 1. The **doctor** who is doing the procedure/intervention
 2. The **nature of the procedure/intervention** (reason - techniques)
 3. The **risks & benefits of the procedure/intervention**
 4. **Any alternative treatment options**
 5. The **risks & benefits of the treatment options**
 - The patient should also be **checked for mental capacity status**.

Q45

A 35-year-old man comes to the physician because of an itchy rash on his hands, waist, and feet for 2 days. He says that his wife and three teenaged children are beginning to develop the same symptoms. He says, 'We live near a wooded area and love to hike in the woods.' Physical examination shows 2-mm erythematous papules in the finger webs, wrists, umbilicus, genital area, and toes. Scrapings of the lesions show mites and eggs. Which of the following is the most appropriate next step by the physician?

- A. Instruct the patient to hire an exterminator to treat his home
- B. Instruct the patient to use diethyltoluamide (DEET) bug spray while hiking
- C. Instruct the patient to wear a long-sleeved shirt and pants while hiking
- D. Prescribe penicillin for the patient and his family
- E. Prescribe permethrin for the patient and his family

▼ Explanation

- **Answer is E (Prescribe permethrin for the patient and his family)**
 - Patient has itchy rash + history of hiking + papules in sites characteristic of scabies + diagnosis confirmed by lesions showing mites & eggs
 - Q asks what is the most appropriate **next** step?
 - You diagnosed the patient, so the next step is *treating him*.
 - **Treatment of Scabies is Permethrin (Choice E) NOT penicillin (Choice D)**
 - **After** advising the patient to start the treatment, **you can add other prophylactic measures** to *prevent re-infection or infection of his family (Choices A, B, and C)*

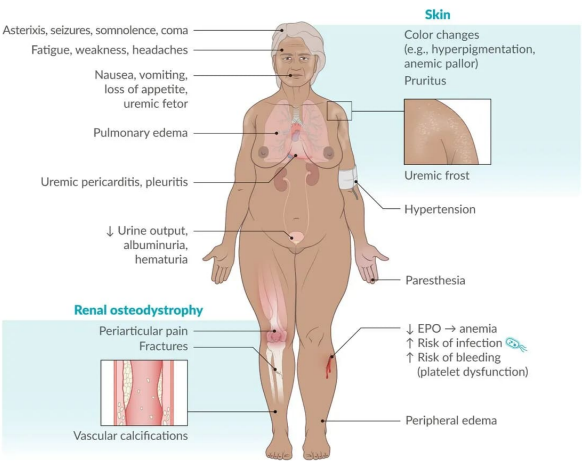
Q46

A 45-year-old man with end-stage renal failure is brought to the emergency department by his mother because of his feelings of depression and apathy for 2 weeks. He has been receiving dialysis three times weekly for 5 years, but he has missed the last three sessions because, 'I've been too depressed to do anything since my wife left me 3 weeks ago.' Bilateral crackles are heard on auscultation of the chest. Mental status examination shows confusion. Serum studies are most likely to show a decrease in which of the following concentrations?

- A. Bicarbonate
- B. Creatinine
- C. Magnesium
- D. Phosphate
- E. Potassium
- F. Urea nitrogen (BUN)

▼ Explanation

- **Answer is A (Bicarbonate)**
 - **IMP Clues**
 - End-stage Renal failure (IMP keyword to find out what electrolytes will be messed up)
 - Has been receiving dialysis 3 times weekly for 5 years but has missed his last three sessions (Dialysis does the kidney's job, no dialysis = renal failure)
 - Bilateral crackles are heard on auscultation (probably edema)
 - Mental status examination shows confusion (probably due to electrolyte imbalance)
 - Q wants to know which of the following would have a decreased serum concentration?
 - **How does Renal Failure affect serum electrolytes?**
 - **Hyperkalemia**
 - **Hypocalcemia & hypermagnesemia**
 - **Hyperphosphatemia**
 - **Increased Creatinine & BUN**
 - **Metabolic Acidosis (decreased HCO₃)**
 - Normocytic Anemia (**EPO failure**)
 - Na/Water Retention (HF - Edema - HTN)
 - Renal Osteodystrophy



Q47

A 50-year-old man comes to the physician for follow-up treatment of progressive, disabling osteoarthritis during the past 6 years. The physician has just learned of a promising experimental treatment for this condition. The company that produces the new drug is offering physicians \$100 for each case referred for treatment. The physician believes that the patient is a good candidate for this drug. Which of the following best describes whether the physician should tell this patient that she will receive \$100 for the referral?

- A. No; the arrangement is contractual between the physician and the company, not the patient

- B. No, because the patient may ask for the money
- C. No, especially if the protocol clearly spells out that the patient is not to know
- D. Yes, and offer to share the money with the patient
- E. Yes; the patient may wish to consider the money's influence on the physician's recommendation

▼ Explanation

- **Answer is E**
 - Patient has a disease
 - Experimental ttt is available + the owning company pays a referral to each physician that offers his patients this new drug
 - The physician believes that this patient would be a good candidate.
- Q asks what should the physician do now?
 - This is an ethics rule: **If you are getting a benefit from a referral, you must tell the patient.**
 - The referrals can lead to **conflict of interest and biased decision-making**. The patient must know so that she can make her own decision & think about it.

Q48

A study is conducted to assess the prevalence of hypertension in Caucasian people compared with African American people. A total of 500 Caucasian participants (Group X) and 500 African American participants (Group Y) between the ages of 25 and 40 years are enrolled. Blood pressure readings are taken from each participant three times over a period of 3 months. The prevalence of hypertension in Group X is 10%, and the prevalence in Group Y is 16%. Which of the following statistical tests is most appropriate to determine if this difference is statistically significant?

- A. Analysis of variance
- B. Chi-square test
- C. Independent t-test
- D. Multiple logistic regression
- E. Paired t-test
- F. Pearson correlation

▼ Explanation

- **Answer is B (Chi-square test)**
 - **IMP Clues**
 - 500 Caucasian participants 'Group X' & 500 African American participants 'Group Y' (1000 total patients in 2 groups)
 - Prevalence of HTN in group X is 10% while Group Y is 16% (tricky, but noted)
 - Q asks which test should be used?
 - I'm saying this is trick because this may seem like 2 groups so you think this must be t-test.
 - However, this is actually **Chi-square** because the results are hypertensive or normotensive.
 - Group X
 - Total = 500
 - Hypertensive patients = 10% = 50
 - Normotensive patients = 450
 - Group Y
 - Total = 500
 - Hypertensive patients = 16% = 80
 - Normotensive patients = 420
 - So, the patients are divided **categorically (as hypertensive or normotensive), NOT as numerical**.
 - So, this is either **Fisher's** (if small sample size) or **Chi square** (if large sample size)



Remember the Algorithm?

1. **Numerical?**
 - a. **2 groups** → **t-Test**
 - b. **3+ groups** → **ANOVA**
2. **Categorical?**
 - a. **Small sample size** → **Fisher's**
 - b. **Large sample size** → **Chi-square**

Mnemonic: "Tests Are Fucking Confusing"

Q49

A 30-year-old man is brought to the emergency department 30 minutes after being stabbed in the abdomen during a robbery. His pulse is 130/min, and respirations are 28/min. His mean arterial pressure is 50 mm Hg, and pulse pressure is 5 mm Hg to 10 mm Hg. A diagnosis of rupture of the aorta is made. Which of the following is expected to occur as a compensatory response to this rupture?

- A. Decreased serum ADH (vasopressin) concentration
- B. Decreased serum urea nitrogen:plasma creatinine ratio
- C. Decreased total peripheral resistance
- D. Increased capillary hydrostatic pressure
- E. Increased carotid sinus nerve firing rate
- F. Increased serum angiotensin II concentration

▼ Explanation

- Answer is F (Increased serum angiotensin II concentration)

◦ IMP Clues

- Stabbed in the abdomen (will probably be hypovolemic due to bleeding)
- Pulse is 130 (tachycardic)
- Mean arterial pressure is 50 mmHg (normal is 70-100, if you don't know then you'd think this guy is bleeding so he's hypotensive)
- Pulse pressure is 5-10 mmHg (normal is 40, again hypovolemic so probably low without knowing the normal value)

- Q wants to know what is expected compensatory mechanism to occur?

- Patient gets stabbed & losses blood → Hypovolemia → **decreased preload**

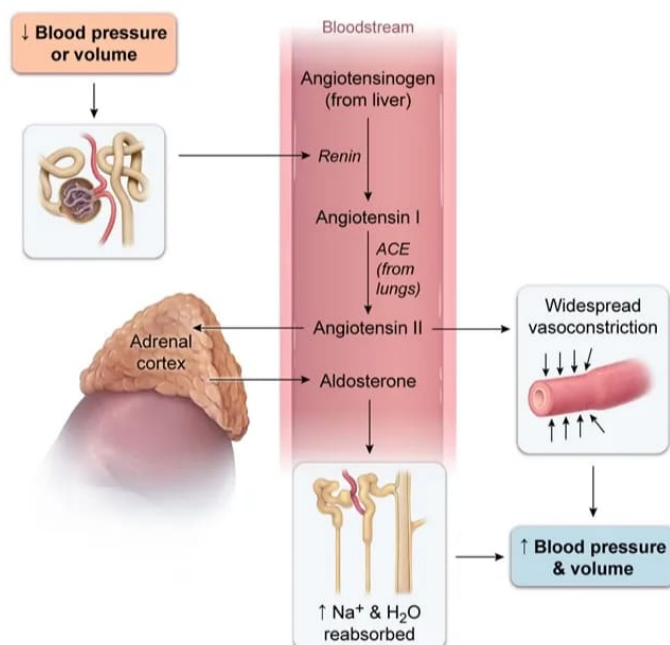
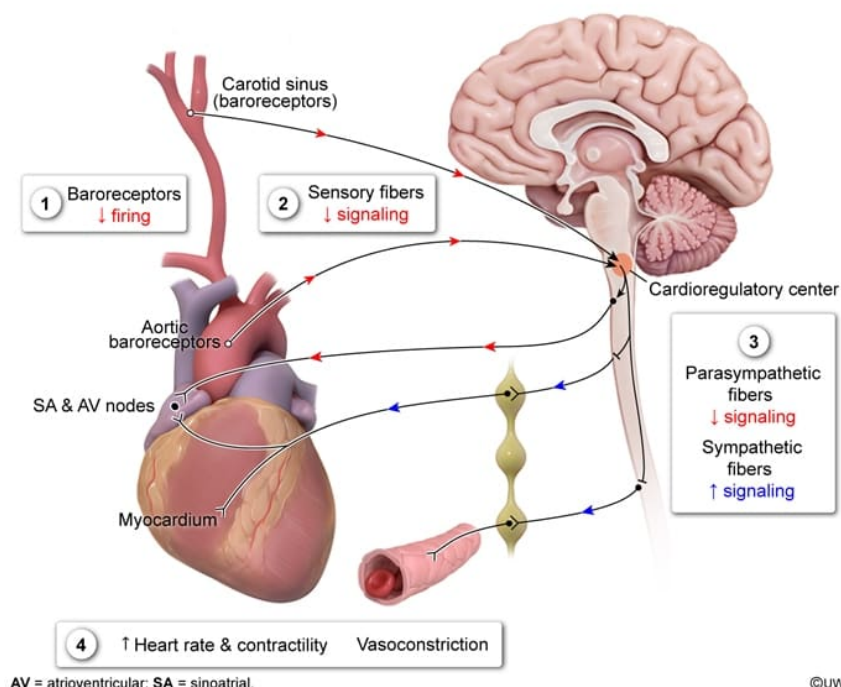
- **Decreased preload → decreased SV → decreased CO**

- Decreased CO → **decreased carotid sinus pressure (Choice E)** → decreased parasympathetic stimulation & increased sympathetic stimulation
 - Decreased CO → decreased effective plasma flow → **Increased ADH (Choice A)**
 - Increased Sympathetic Stimulation → Increased HR (to increase CO) & **increased peripheral arteriolar resistance [to increase blood pressure] (Choice C)**

- **Increased Peripheral arteriolar resistance (Vasoconstriction):**

- **Decreased Capillary hydrostatic pressure** (less blood in vessel, due to VC) **(Choice D)**
- Decreases Renal Blood Flow → **Increase AT-II (Choice F) & Increased Serum BUN/Creatinine ratio (Choice B)**

Baroreceptor reflex in response to decreased blood pressure



Q50

A 35-year-old man is admitted to the hospital because he has been vomiting blood. He has a 15-year history of alcohol dependence and biopsy-proven cirrhosis. Examination shows ascites, prominent periumbilical veins, and hemorrhoids. Over the next 7 days, his level of consciousness decreases and he develops a flapping tremor of the hands. The pathogenesis of the neurologic symptoms is most likely directly related to which of the following?

- A. Absorption of nitrogenous products from the gastrointestinal tract
- B. Hypoxia caused by decreased respiratory effort resulting from ascites
- C. Shunting of systemic blood into the portal system
- D. Systemic hypotension caused by blood loss
- E. Thrombosis of hepatic veins

▼ Explanation

- Answer is A (Absorption of nitrogenous products from the GI tract)

- IMP Clues

- Vomiting blood (again, usually either PU or varices)
- Alcohol dependence and biopsy proven cirrhosis (so most likely Portal HTN → Varices)
- Ascites, Prominent periumbilical veins & hemorrhoids (definitely Portal HTN)
- Decreased level of consciousness & develops flapping tremors (most likely hepatic encephalopathy)

- Q asks to which of the following is the pathogenesis of the flapping tremors & encephalopathy related to?

- One of the most common causes of **exacerbations of Hepatic Encephalopathy** is **Upper GI Bleeding**.

- Upper GI Bleeding → Some blood is swallowed
- Bacteria in the gut → breaks down hemoglobin (a protein) in the GI → **Increased ammonia**
- **Ammonia can't be filtered by the cirrhotic liver & diffuses into blood stream → passes BBB**

- **Neurotoxicity ⇒ Altered Mental Status & Flapping Tremors**

- **Why is ammonia neurotoxic?**

- **Ammonia is taken up by astrocytes, which convert it to glutamine** → increased in osmotic pressure, causing **cellular swelling** → **brain edema & increased intracranial pressure**

? What are some other HY causes of Hepatic Encephalopathy?

▼ Answer

1. Increased Nitrogenous production & Absorption

- **Upper GI Bleeding** - Muscle Catabolism - **Infections (SBP)** - Electrolyte Disturbances (Hypokalemia & Metabolic Alkalosis)

2. Decreased Ammonia Clearance:

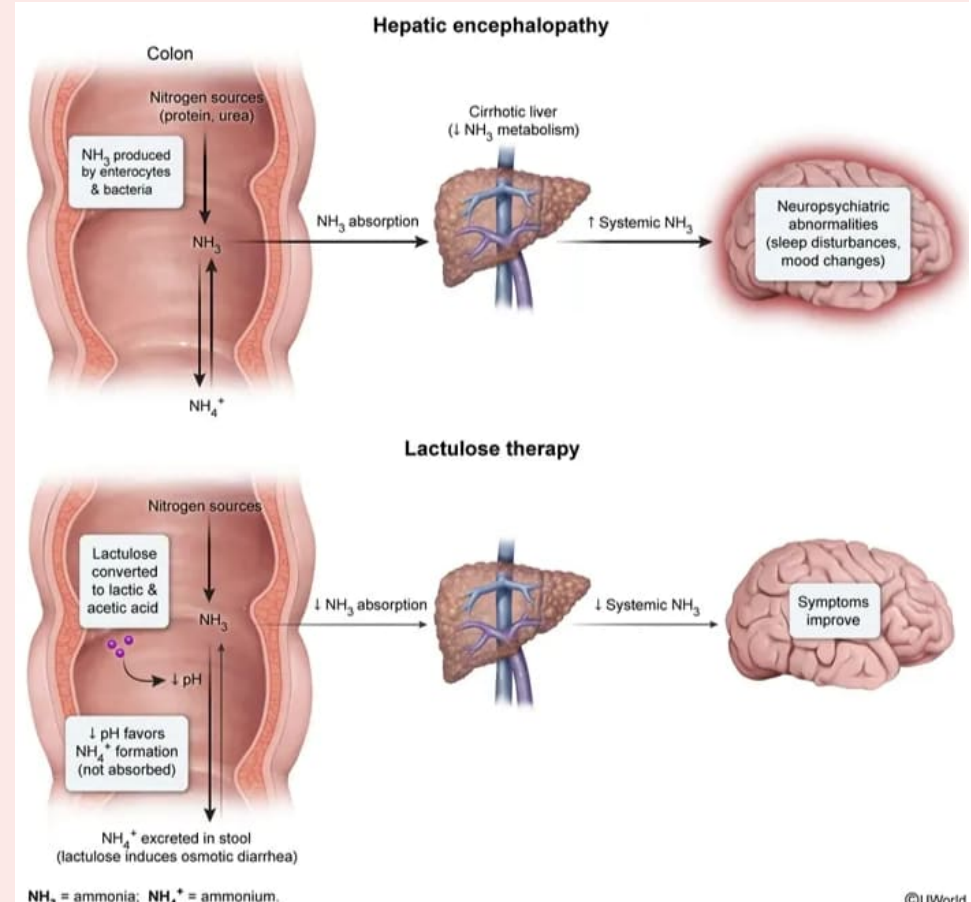
- Worsening of Hepatic Functions (Ischemia, Toxins, HCC) - **Constipation** - Renal Insufficiency

3. Portosystemic Shunting

- Spontaneous - **TIPS**

What is the treatment for hepatic encephalopathy?

1. Treatment of the cause
2. **Lactulose (binds to ammonia & forms ammonium, which is ionized ⇒ less absorption & can't pass BBB)**
3. **Rifaximin/Neomycin (kills the ammonia producing bacteria in the GI tract)**





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