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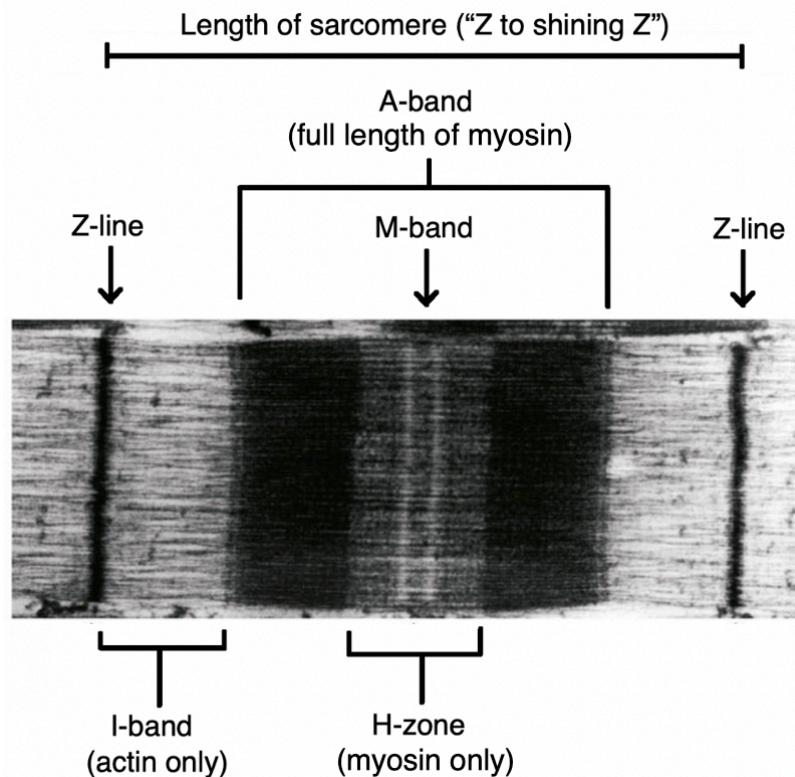
The purpose of this document is to focus on the highest yield anatomy/MSK and rheumatology for USMLE without all of the superfluous nonsense.

Some students romanticize the discussion of every muscle insertion/origin and physical examination maneuver, as well as go through loads of CT scans and MRIs of muscles, etc. Waste of time. The focus here is not to prep you for some ultra-pedantic school of medicine anatomy exam. The purpose is to drive your performance up on the USMLE. Especially now that Step 1 is pass/fail, it's an absolute waste of time for you to be off studying/memorizing nitpicky anatomy.

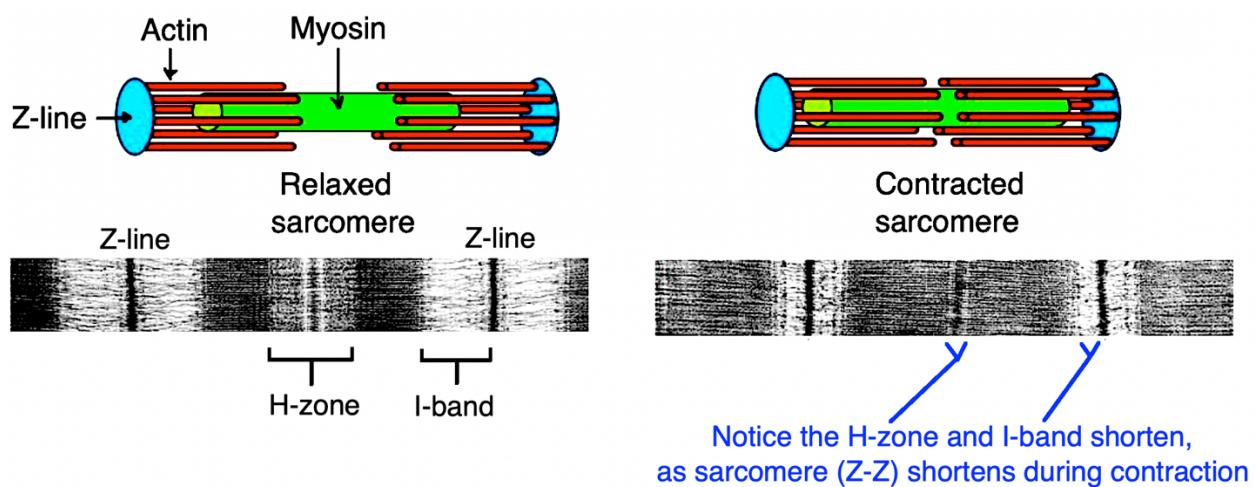
If you are studying for 2CK, you can ignore the overly anatomy-oriented points in this doc and focus on the HY presentations. Much of this document absolutely helps with 2CK as well.

HY Anatomy/MSK/Rheum

- Student Q showed electron micrograph (EM) pic of sarcomere + they asked what does not change length during muscle contraction + had letters at different locations. Answer = A-band.

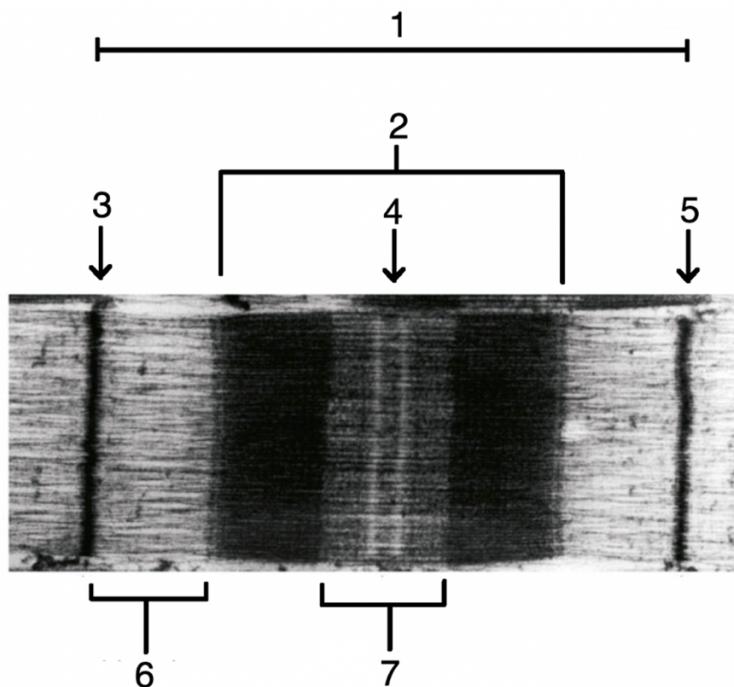


- Before you instantly freak out, relax. First look at above EM of sarcomere. Then compare with bottom images here:



- All you need to know is: as the myosin and actin overlap during muscle contraction, the H-zone, I-band, and sarcomere (Z-Z) shorten. The A-band (myosin; neon-green bar above) does not change in length.

- Tropomyosin is a protein on actin that covers up myosin binding sites. During contraction, calcium is released from the sarcoplasmic reticulum and binds to troponin, causing a conformational change that releases tropomyosin from actin, thereby allowing myosin to bind.
- ATP is required to *relax* muscle (i.e., rigor mortis in the deceased due to ↓ ATP).
- 24M + partakes in research study of muscle contraction; Q asks, on the following electron micrograph of a sarcomere, which segment will not change length? (choose the number):

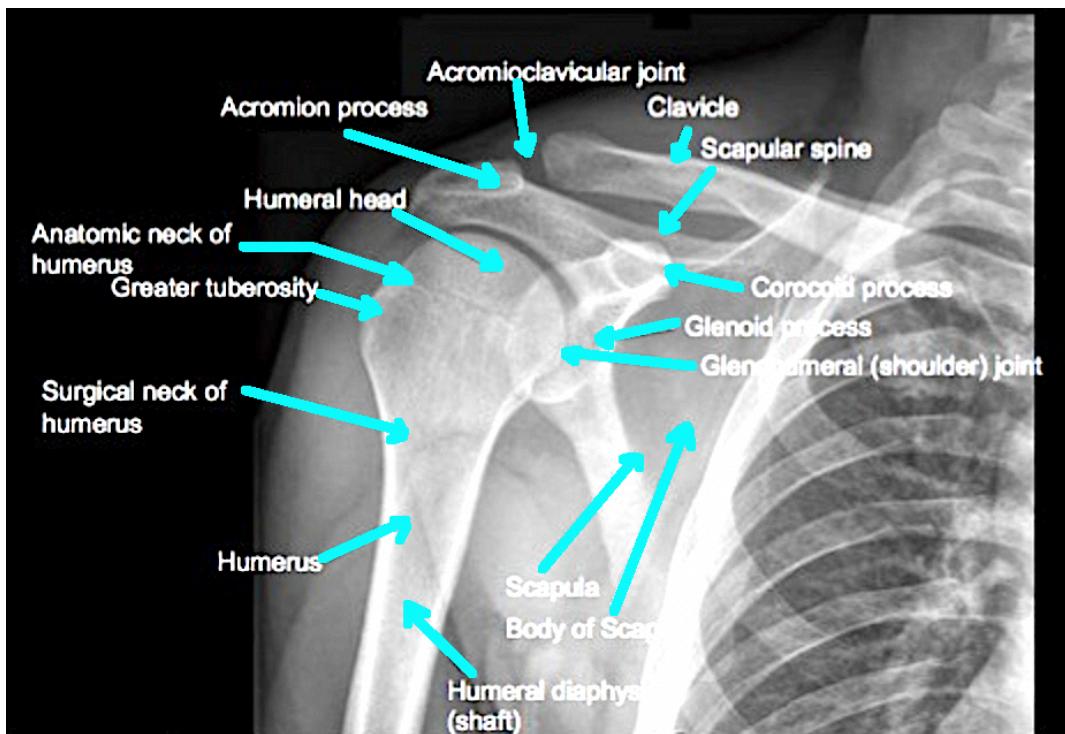


- Answer = #2 (A-band). In contrast, the I-band (#6), H-zone (#7), and length of sarcomere (#1; Z-Z) all shorten during contraction.

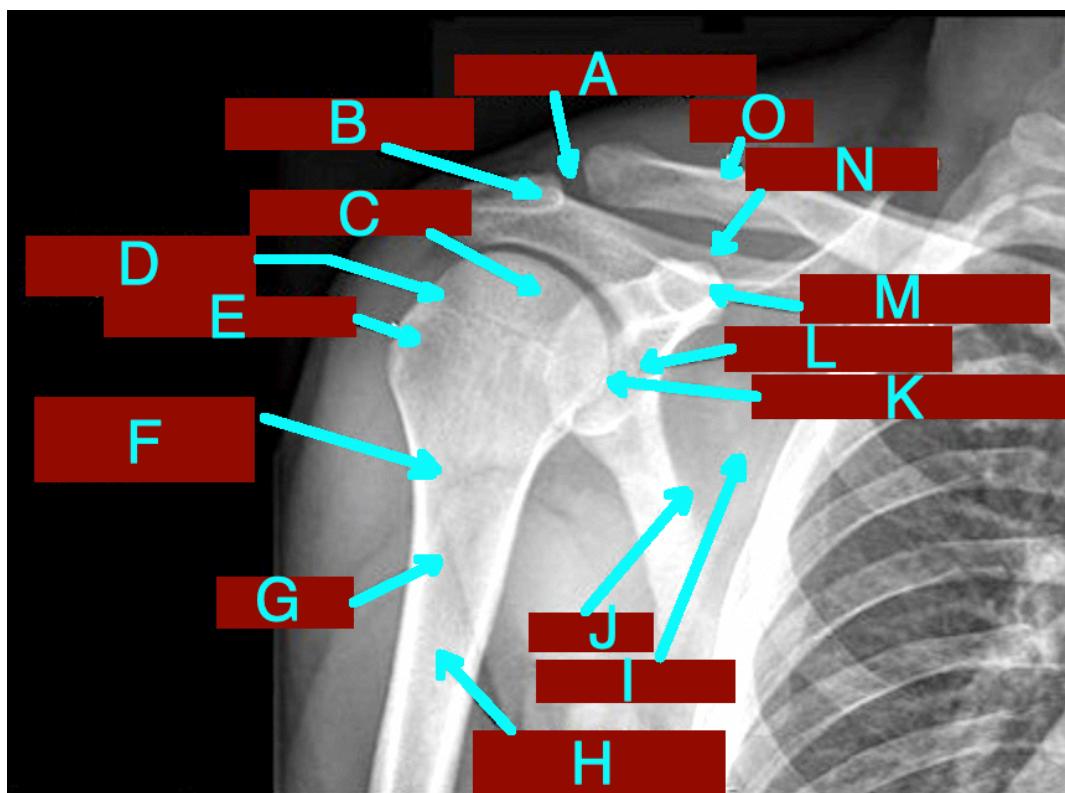
Muscle fiber type	Slow-twitch (type I)	Fast-twitch (type II)
Predominance in whom	Long-distance runners	Powerlifters; sprinters
Oxygen usage	Aerobic	Anaerobic
Glycogen content	Low	High
Fatiguability	Slow to fatigue	Quick to fatigue
Mitochondria	Many	Few
Myoglobin content (red in color)	High (more red)	Low (more white)

- 28M + femoral nerve injury resulting in denervation of rectus femoris; Q asks what is most likely to be seen during nerve recovery; answer = “fiber type grouping of type I and II muscle cells”; you need to know that reinnervation of muscle results in aberrant reorganization of type I and II muscle units. This aberrant reorganization is called fiber type grouping. This is answer on an NBME.

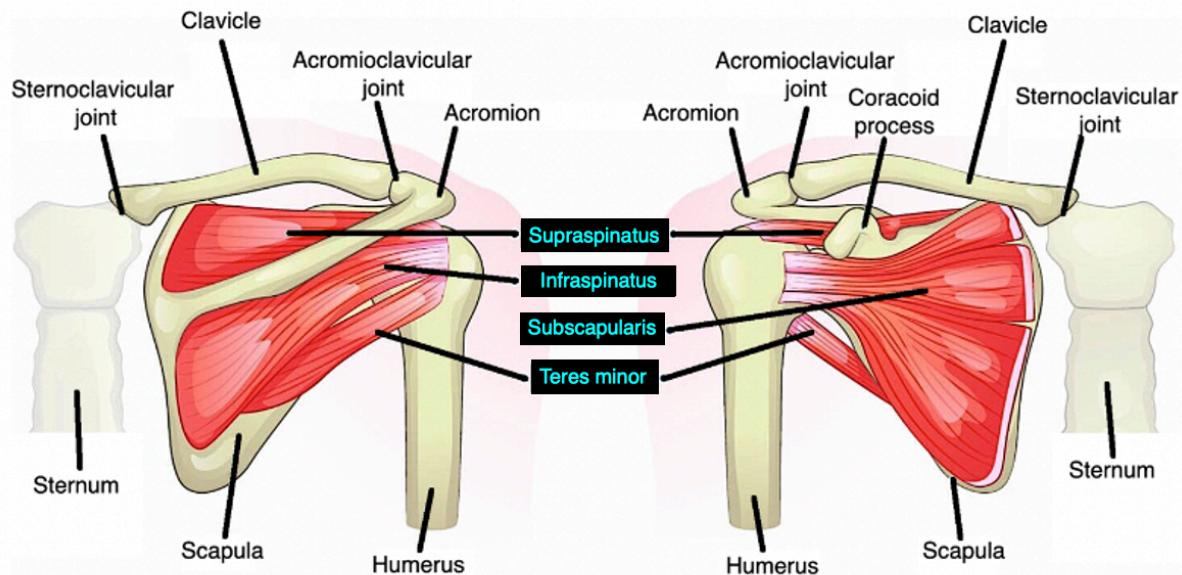
- 24M + partakes in powerlifting routine; Q asks ↑ or ↔ for changes in muscle cell number, muscle cell size, and mitochondria; answer = ↔ muscle cell number, ↑ muscle cell size, and ↔ mitochondria.
Skeletal muscle response to activity is hypertrophy, not hyperplasia. Powerlifting is anaerobic and does not increase mitochondria.
- 20F + paraplegic following accident; Q asks what is most likely to be seen in this patient; answer = “polyubiquitination”; proteins are tagged with ubiquitin in order to be sent to the proteasome for breakdown; atrophy in the setting of inactivity = ↑ ubiquitination.
- 31M + in wilderness for 3 weeks without food; Q asks what allows him to maintain normal serum glucose levels during this time; answer = “skeletal muscle protein” → you must know that skeletal muscle does **not** contain glucose-6-phosphatase and therefore does not directly carry out gluconeogenesis; glucogenic amino acids can be liberated in the fasting state from skeletal muscle, with the liver carrying out the gluconeogenesis. The **kidney** can also carry out gluconeogenesis.
- 16F + receives insulin injection + serum glucose lowers; Q asks why; answer = “increased glucose uptake by skeletal muscle”; both skeletal muscle and adipose tissue take up glucose via GLUT4 in response to insulin.
- Q on offline Step 1 NBME form asks why ATP does not fall appreciably during a series of muscle twitches → answer = “ATP is quickly regenerating from creatine phosphate.”
- “What do I need to know about shoulder anatomy for USMLE?” → USMLE is known to occasionally give images of shoulder, clavicular, and humeral fractures. Spending a few moments to gain an idea of normal shoulder anatomy is not “nitpicky.”



- Now identify:



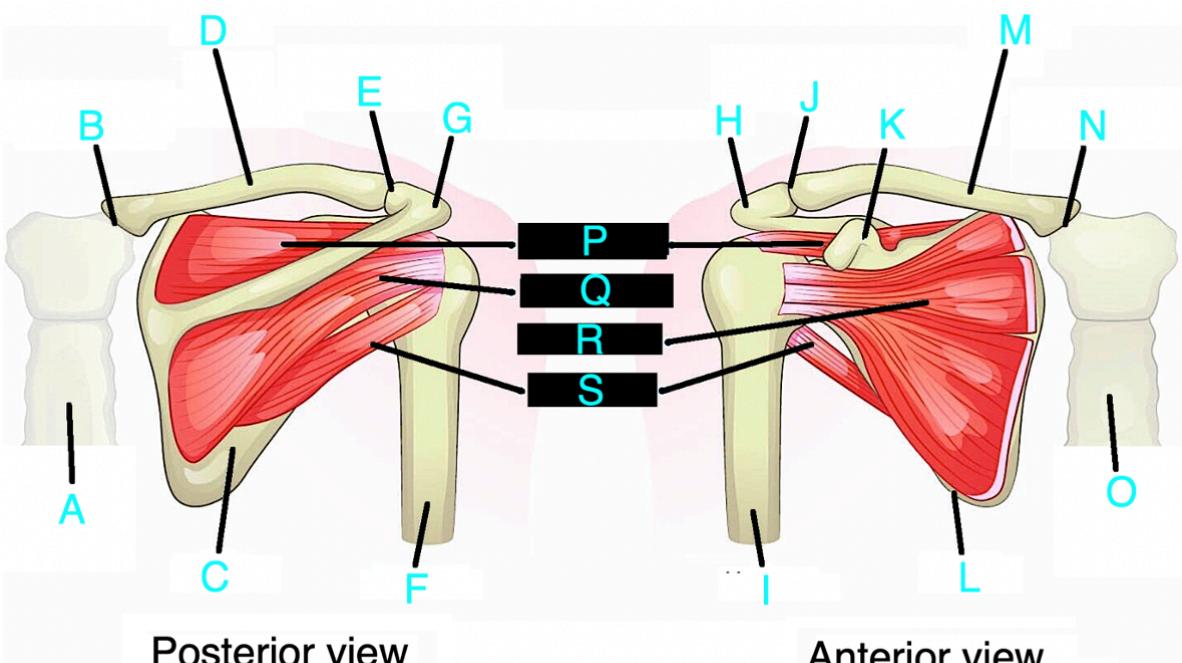
- "What do I need to know about the rotator cuff? It's high-yield right?" → Yes. Same as with the above x-rays, you need to know the rotator cuff muscles. Just deal with it.



Posterior view

Anterior view

- Now identify:



Posterior view

Anterior view

Rotator cuff muscles (SITS)	Function	Innervation (mostly C5-6)	HY Points
Supraspinatus	Abduction of arm (first 15 degrees)	Suprascapular nerve	<ul style="list-style-type: none"> - Answer if patient has difficulty abducting arm first 15 degrees. - Empty-can (thumb-down) / full-can (thumb-up) tests for diagnosis → patient abducts arm to 90 degrees with thumb up or down → downward pressure applied to arm → if elicits pain, answer = supraspinatus injury.

			- There is Q on new 2CK CMS IM form 7 where answer is supraspinatus tendonitis, and they say patient has reduced ability to abduct the first 60 degrees.
Infraspinatus	Lateral (external) rotation	Suprascapular nerve	<ul style="list-style-type: none"> - Notion of "pitcher injury" = infraspinatus does more harm than good for USMLE; vignette can by all means give a pitcher with (+) full-can test above and answer is supra-, not infra-, spinatus injury. - Q might say patient simply cannot externally rotate arm, nothing more, where teres minor isn't listed as another answer, so infraspinatus is only one that could be right.
Teres minor	Adduction; lateral rotation	Axillary nerve	<ul style="list-style-type: none"> - Same as infraspinatus, just know it externally rotates the arm. - Also adducts arm, so if patient has issues with both lateral rotation and adduction, answer is teres minor over infraspinatus. - I've never seen NBME material assess the diagnostic tests for infraspinatus or teres minor.
Subscapularis	Adduction; medial (internal) rotation	Subscapular nerves (upper and lower)	<ul style="list-style-type: none"> - Can medially rotate and adduct the arm. - I've had students get asked Gerber lift-off test on both Step 1 as well as 2CK Family Med shelf, where answer = subscapularis. - Gerber lift-off test = patient places dorsal aspect of hand on lower back, with palm facing posteriorly → examiner applies pressure into the patient's palm against his/her lower back → patient is then asked to move hand away under the pressure → if elicits pain / difficult to do, answer = subscapularis injury.

- "Are there other shoulder conditions sometimes confused with rotator cuff injury?" → Yes. USMLE likes subacromial bursitis and biceps tendonitis as well.

Frequently confused shoulder conditions for USMLE	
Subacromial bursitis vs rotator cuff tendonitis	<ul style="list-style-type: none"> - In NBME vignettes, I've seen both can give Hx of patient doing frequent overhead movement (i.e., painting a fence) + pain with palpation + pain that's worse when lying on one's shoulder in bed at night, making differentiating these difficult. - Subacromial bursitis will only present with above findings, which collectively are known as impingement syndrome. - Rotator cuff tendonitis will present with weakness when performing exam maneuvers (as described in prior table).
Biceps tendonitis	<ul style="list-style-type: none"> - Presents as anterior shoulder pain with focal tenderness over the biceps tendon (i.e., when pressing on anterior shoulder).
Adhesive capsulitis	<ul style="list-style-type: none"> - Aka "frozen shoulder," or arthrofibrosis. - Decreased passive and active motion of shoulder in all directions. - Idiopathic, but increased risk in diabetes. - Tx = range of motion exercises / physiotherapy. - This is a Dx that is LY on Step 1, but for whatever reason, becomes HY on 2CK.

- “I know upper limb nerves are HY. What do I need to know for USMLE without all of the bullshit.” →

You need to know the **injuries** associated with the nerves, and then just basic motor/sensory issues.

Upper limb nerve HY Points for USMLE	
Axillary	<ul style="list-style-type: none"> - Main innervation of the deltoid, allowing for abduction of arm 15-90 degrees. USMLE wants you to know deltoid has an origin on the lateral clavicle and axillary nerve innervating it is at C5/C6. - Palsy caused by surgical neck of humerus fracture. - USMLE vignette will often say “flattened deltoid” or “loss of sensation over lateral upper arm / deltoid.”
Median	<ul style="list-style-type: none"> - Main innervation is lateral “3 and a half” fingers / thenar pad, and lateral forearm. - Does thumb abduction. (In contrast, ulnar nerve does thumb adduction) - NBME wants “palmar cutaneous branch of median nerve” as answer for sensation over thenar region. - Palsy caused by supracondylar fracture of humerus, or “distal shaft fracture.” Former is buzzy; latter sounds non-specific, but I’ve seen it this way on NBME. - Entrapment of median nerve causes carpal tunnel syndrome; will present as paresthesia/numbness of lateral hand / thenar region; can be caused by hypothyroidism (GAG deposition), acromegaly (growth of tendons), and pregnancy (edema); can occur bilaterally in construction workers using jackhammer. - Tx for carpal tunnel ultra-HY on 2CK FM forms. “Use of wrist pad when using computer” is answer on new 2CK NBME. If not listed, “wrist splint” is answer on FM form. If vignette says wrist splint fails, NSAIDs are wrong answer and not proven. USMLE wants “triamcinolone injection into carpal tunnel” (not IV steroids) as next answer. Surgery is always wrong answer for carpal tunnel on USMLE. - 2CK wants “electrophysiological testing” and “electromyography and nerve conduction studies” as next best step in diagnosis for carpal tunnel.
Ulnar	<ul style="list-style-type: none"> - Main innervation of medial “1 and a half” fingers, and medial forearm. - Ulnar nerve also does finger abduction and adduction (i.e., interosseous muscles). - USMLE loves Froment sign for ulnar nerve injury, which is inability to pinch a piece of paper between the thumb and index finger (ulnar nerve needed for thumb adduction against index finger, despite thumb being most lateral digit). - Distal compression (i.e., of wrist and hand only, not forearm) is aka Guyon canal syndrome and is caused by hook of hamate fracture; this can sometimes be seen in cyclists due to handlebar compression; presents as paresthesias / numbness of 4th and 5th fingers + hypothenar eminence. - Proximal compression (i.e., medial forearm + wrist/hand) is aka cubital tunnel syndrome and is one of the most underrated diagnoses on USMLE, since its yieldness, especially on 2CK, is comparable to carpal tunnel syndrome, but students often haven’t heard of it. Essentially, patient will get paresthesias of medial forearm + hand, where it “sounds like carpal tunnel but on the ulnar side instead” → answer = cubital tunnel syndrome. - Tx for cubital tunnel syndrome is “overnight elbow splint.” Surgery is wrong answer on USMLE.
Radial	<ul style="list-style-type: none"> - Main innervation for finger, wrist, and elbow extension. - Innervates BEST → Brachioradialis, Extensors, Supinator, Triceps. - Palsy occurs as a result of midshaft fracture of the humerus, or as a result of fracture at the radial groove (latter is obvious). - Retired Step 1 NBME Q says construction worker sustains “comminuted spiral fracture of humerus” (unusual, since spiral fracture classically = child abuse), and they ask for the resulting defect → answer = “loss of radial nerve function.” - Highest yield point is that injury results in pronated forearm + wrist drop.
Musculocutaneous	<ul style="list-style-type: none"> - Main innervation of the biceps. - Just need to know injury results in loss of sensation over lateral forearm + decreased biceps function.

	- USMLE doesn't give a fuck about what kind of injury causes palsy.
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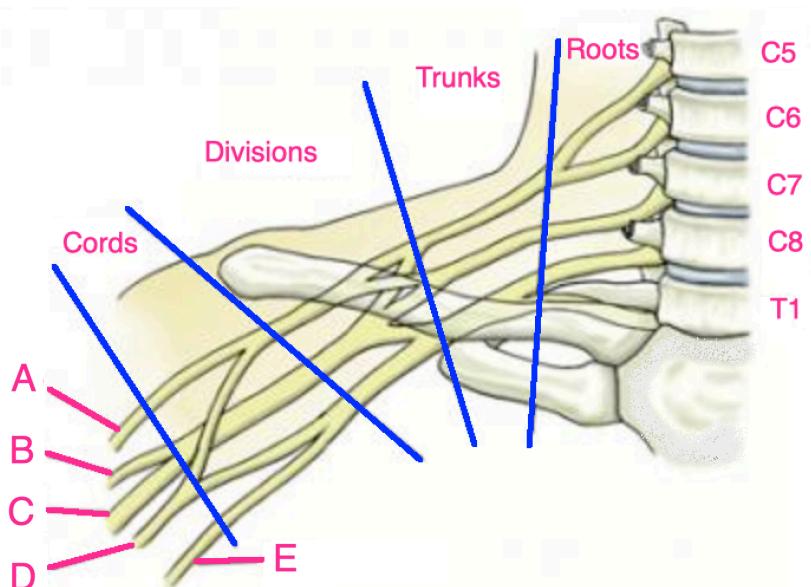
- 45M + construction worker + sensation to pinprick is reduced on the thumb and a portion of the forearm; physician suspects compression of C5/C6; Q asks, which movement is most likely fucked up in this patient → answer = “abduction of upper extremity”; deltoid is innervated by axillary nerve from C5/C6.
- 32F + office worker + paresthesias of lateral three fingers; wrist pad when using computer and wrist splint have not worked; next best step? → answer = triamcinolone injection into carpal tunnel; NSAIDs are wrong answer.
- 28M + lifts weights + paresthesias down medial forearm and 4th/5th fingers past week; Q asks next best step in management → answer = overnight elbow splint; diagnosis is cubital tunnel syndrome.
- 42M + avid cyclist + difficulty keeping piece of paper between thumb and index finger on physical exam; Q asks location of injury; answer = ulnar nerve; patient has (+) Froment sign; ulnar nerve needed for thumb adduction, even though it's lateral digit.
- 49F + skiing accident + decreased sensation over lateral forearm + weakened flexion at elbow; Q asks nerve that's fucked up → answer = musculocutaneous.
- 35M + in car accident and wasn't wearing seatbelt + x-ray of arm is shown below; Q wants to know the most likely deficit in this patient:



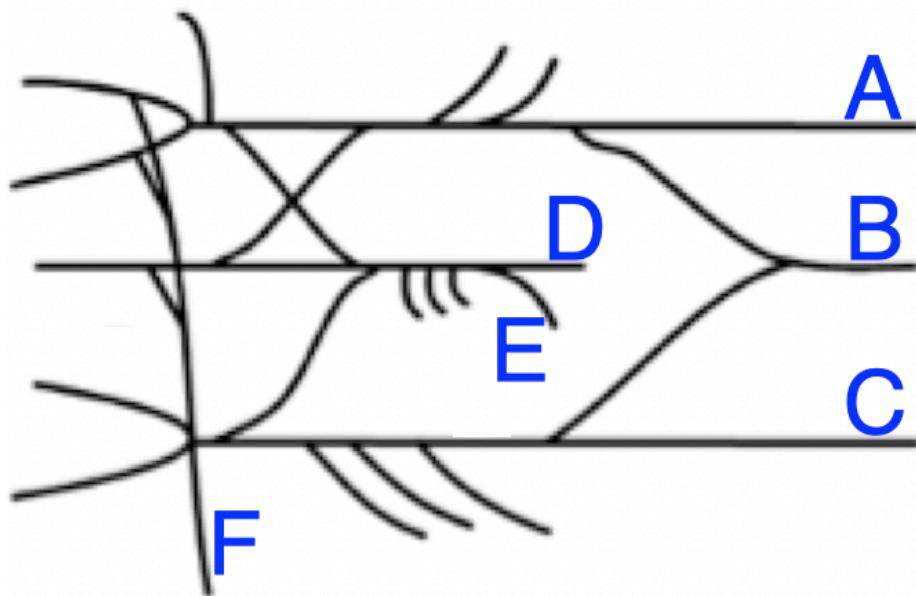
- Answer = inability to extend the wrist; answer can also be inability to supinate the forearm; x-ray shows midshaft fracture of humerus → radial nerve injury resulting in pronated arm with wrist drop.
- 29F + motorcycle accident + has x-ray of arm shown below; Q asks most likely deficit to be seen in this patient:



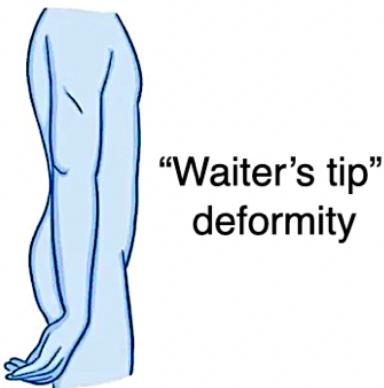
- Answer = impaired abduction of arm, or loss of sensation over deltoid; x-ray shows surgical neck of humerus fracture → axillary nerve injury.
- 45M + has arm slashed in street fight + now is unable to supinate and extend wrist; which letter on the following brachial plexus image corresponds to this patient's deficit?



- Answer = radial nerve (choice C). A = musculocutaneous nerve; B = axillary nerve; D = median nerve; E = ulnar nerve.
- USMLE will ask you relatively easy presentation for a neurologic deficit but require you to identify where on the brachial plexus is affected.
- 24M + in motorcycle accident + has loss of sensation over deltoid + diminished ability to abduct shoulder; question asked which nerve on the following diagram is fucked up.



- Answer = E (axillary nerve); A = musculocutaneous nerve; B = median nerve; C = ulnar nerve; D = radial nerve; F = long thoracic nerve; the black lines on the left side of the above image, from top to bottom, are the C5-T1 nerve roots.
- “Does USMLE care about upper limb reflexes?” → Not really. But you could be aware that if biceps reflex is weakened, they want C5 as the nerve root that’s fucked up. And if triceps reflex is weakened, it’s C7 that’s fucked up.
- 14-month-old boy + arm has been adducted, pronated, and wrist flexed since birth but has gradually been improving with physiotherapy; Q asks location of injury → answer = upper brachial plexus (C5-C6); Erb-Duchenne palsy presents with “waiter’s tip” deformity; most commonly seen in neonates during traumatic birth, but can also occur in older patients due to trauma.



- 22M + grabbed onto tree branch while falling from tree + presents with claw-like appearance of hand; Q wants to know location of injury → answer = lower brachial plexus (C8-T1); you just need to know Klumpke palsy = lower brachial plexus injury and presents with claw-hand.



- 49F + underwent mastectomy one year ago + physical examination demonstrates winged scapula; Q asks nerve injury; answer = long thoracic nerve → innervates serratus anterior; nerve can be damaged during mastectomy.

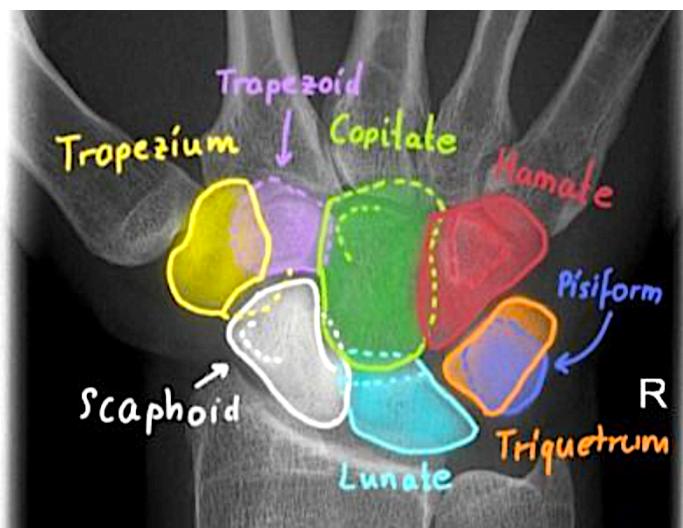


Winged scapula

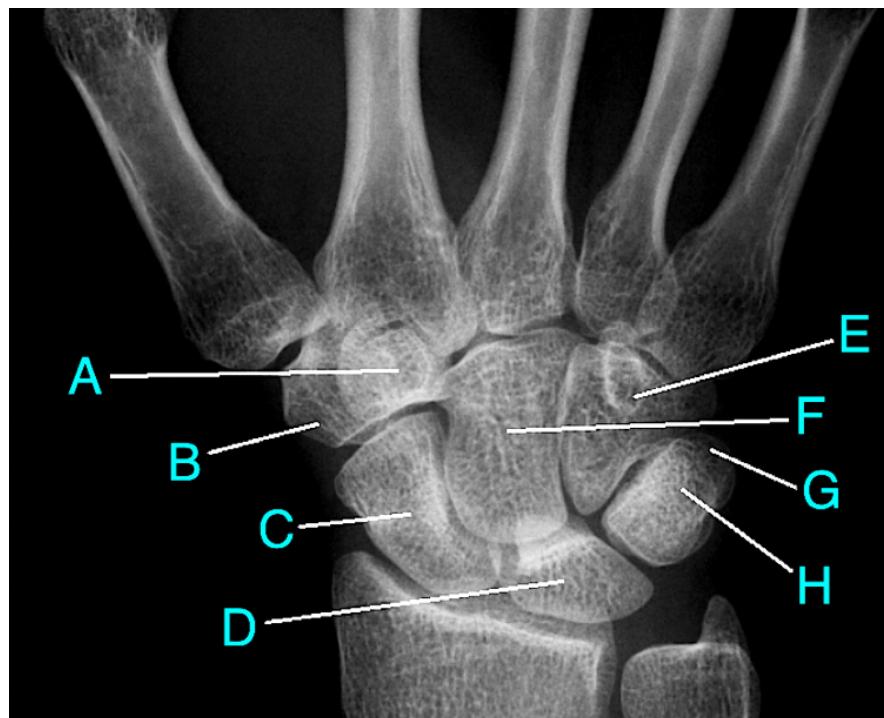
- 21F + paresthesias of the hand and forearm + sometimes exacerbated by wearing backpack for long periods; Q wants diagnosis → answer = thoracic outlet syndrome; common cause is "first cervical rib." USMLE just wants you to know there's some strange anatomic variant of the cervical ribs where

a “first cervical rib” can cause miscellaneous paresthesias and/or muscle wasting of upper limb. This is called thoracic outlet syndrome. Nothing else you need to know.

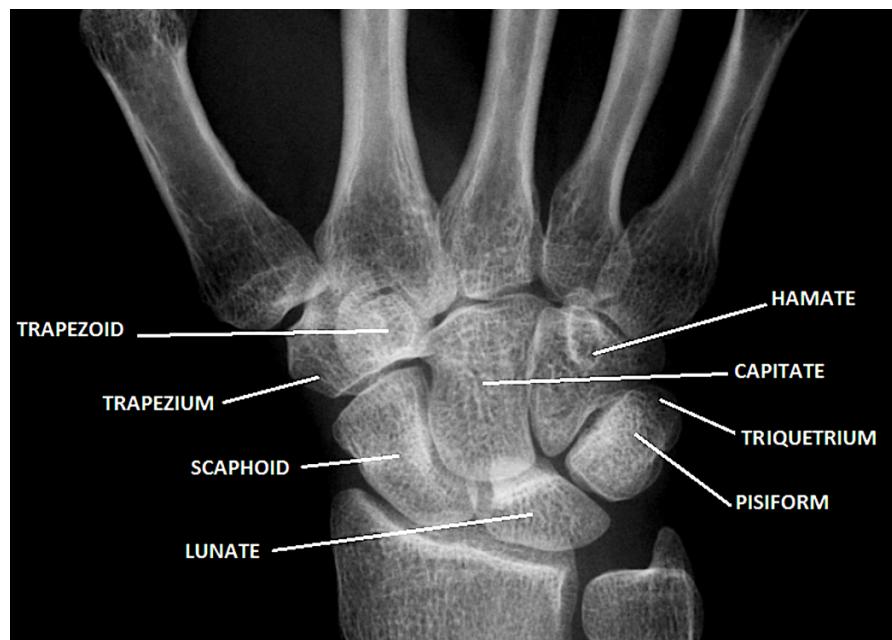
- 46M + diabetic + difficulty moving shoulder passively and actively in all directions; Q just simply wants the diagnosis? → answer = adhesive capsulitis (aka arthrofibrosis, or “frozen shoulder”); idiopathic condition with decreased movement of shoulder in all directions +/- pain; increased risk in diabetics; Tx = range of motion exercises. This condition is HY on 2CK in particular.
- 31F + was painting fence + pain in anterior/lateral shoulder that is worse when lying on side in bed + no weakness in shoulder; Q asks diagnosis → answer = subacromial bursitis (impingement syndrome).
- 31F + was painting fence + pain in anterior/lateral shoulder that is worse when lying on side in bed + weakness on external rotation of shoulder; Q asks diagnosis → answer = rotator cuff tendonitis.
- 26M + pain in anterior shoulder + palpation of anterior shoulder elicits pain; Q wants diagnosis → answer = biceps tendonitis.
- “What do I need to know about bones of hand / wrist?” → USMLE likes carpal bones.
 - o The two rows of carpal bones (i.e., proximal and distal), from lateral to medial, are: “She Looks Too Pretty. Try To Catch Her.”
 - First row: Scaphoid, Lunate, Triquetrum, Pisiform;
 - Second row: Trapezium, Trapezoid, Capitate, Hamate.



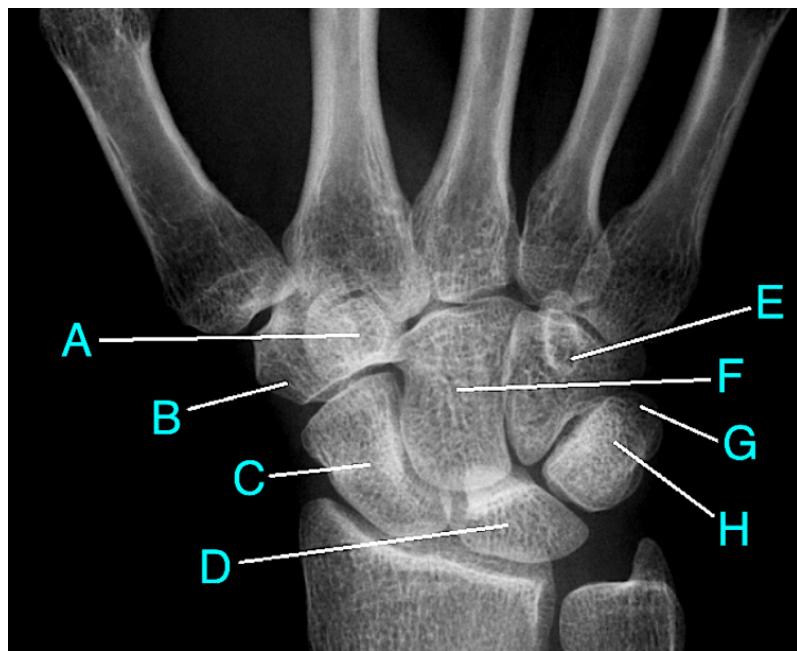
- 16M + skateboarding + falls on outstretched hand + no pain over anatomic snuffbox + pain in central palm; Q asks which bone is fractured (choose a letter):



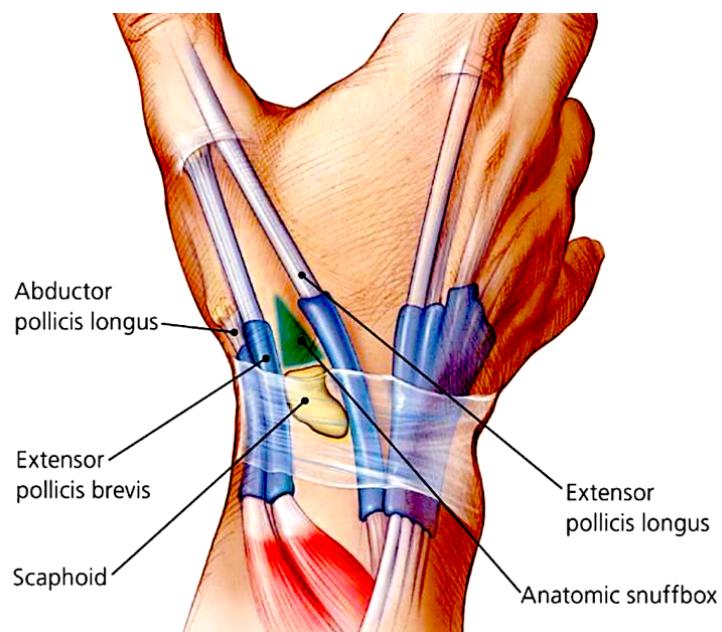
- Answer = D (lunate); this is on Step 1 NBME; as described, they'll give pain in central palm + *no* pain over anatomic snuffbox.



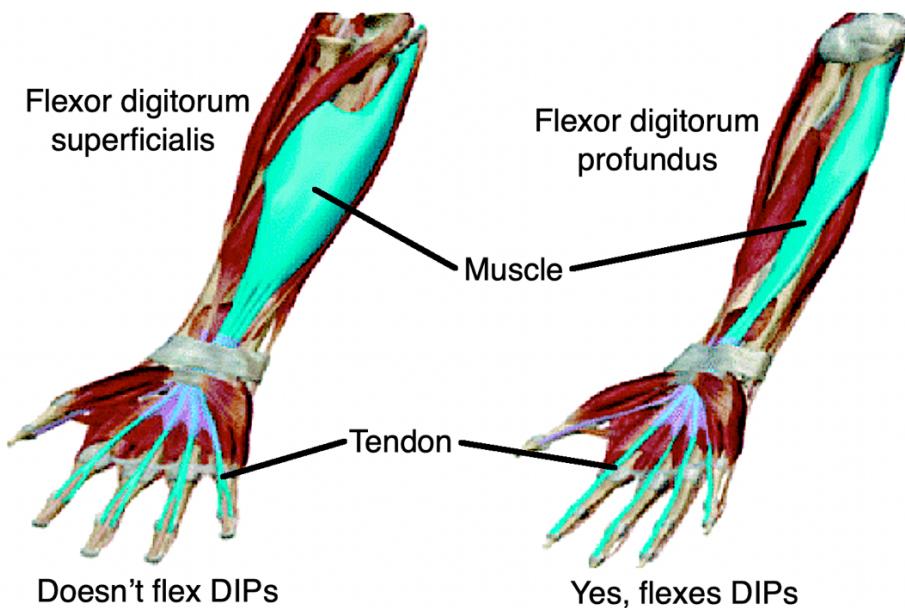
- 17M + skateboarding + falls on outstretched hand + pain over anatomic snuffbox + x-ray shows no abnormalities; Q asks which bone is fractured:



- Answer = C (scaphoid); next best step is thumb-spica cast; x-ray is often negative initially; patient needs thumb-spica cast to prevent avascular necrosis, followed by re-x-ray in 2-3 weeks.
- 14M + falls skateboarding + has pain over anatomic snuffbox; Q asks strain of which of the following tendons might also be seen in this patient: answer = extensor pollicis longus (only one listed that is one of the three that form the border); borders of anatomic snuffbox are: abductor pollicis longus, extensor pollicis brevis, extensor pollicis longus.



- 17F + injured index finger at softball game + can't flex distal interphalangeal joint of right index finger; Q wants to know which tendon is most likely damaged → answer = flexor digitorum profundus; USMLE wants you to know that flexor digitorum superficialis does not flex the DIPs, but flexor digitorum profundus does.



- "Wait, are you saying we need to know all about hand/forearm muscles and tendons, etc. then?" → No. USMLE really doesn't give a fuck about hyper-nitpicky details, but I've seen this one asked on an offline Step 1 NBME.
- 24M + hunting accident in which he sustains gunshot wound and severs flexor digitorum profundus tendon; Q asks which forearm tendon can be used as a graft to repair the damaged tendon → answer = palmaris longus; classically used as graft tendon; not present in about 1/7 people in the population.
- 59M + alcoholic + smoker + worked in construction + image of hand shown below; Q wants to know biggest risk factor in this patient:



- Answer = alcoholism; diagnosis is Dupuytren contracture, which is abnormal proliferation of palmar connective tissue and fascia; risk factors are Norwegian descent, alcoholism, diabetes, and epilepsy. Constellation of risk factors makes no sense, but just memorize it.
- 33F + breastfeeding + severe pain in lateral wrist; pain is worsened with maneuver shown below; Q asks for the next step in management



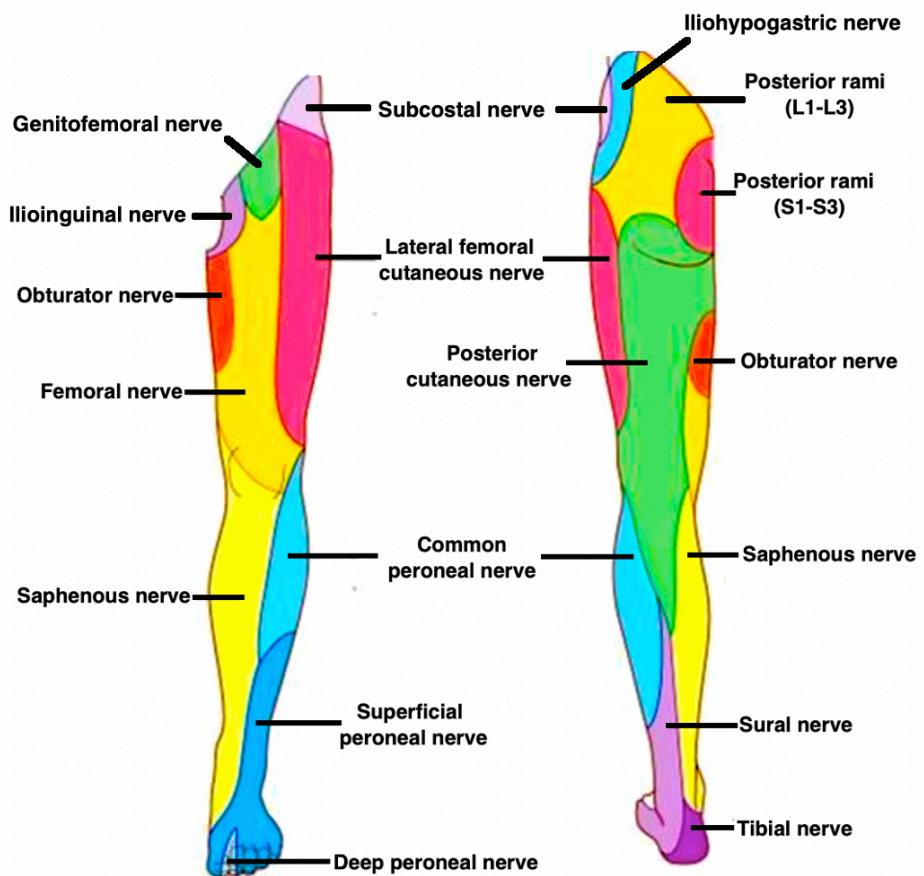
- Answer = steroid injection; diagnosis is deQuervain tenosynovitis; tenosynovitis means inflammation of tendon sheaths; deQuervain is classic in breastfeeding women and is worsened with Finkelstein test (shown above) → 1) thumb is placed in palm; 2) 2nd-5th fingers are wrapped over the palm; 3) patient ulnar deviates the wrist → this causes pain. Patient should avoid offending activity, but since this is often breastfeeding, steroid injection can provide immediate relief.
- 35F + painless 2-cm bump on dorsal aspect of hand/wrist + image shown below; Q wants diagnosis:



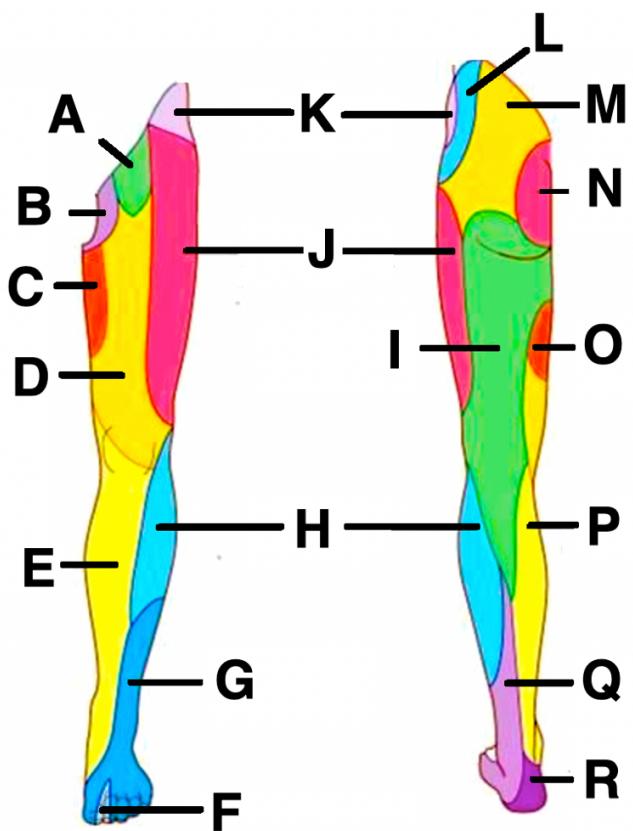
- Answer = ganglion cyst, which is gelatinous collection of joint fluid; Tx is needle drainage; recurrence common; can occur on ankles and flexor areas as well, but classic location is dorsum of hand/wrist.
- Offline NBME 23 has Q where they ask for most likely outcome of this pathology if untreated, and answer = “spontaneous regression.”
- 16F + history of easy bruising + hyperextensible skin + image shown below; Q wants to know mechanism:



- Answer = “defect in synthesis of fibrillar collagen”; diagnosis is Ehlers-Danlos syndrome (usually caused by collagen III defect); wrong answer = “abnormal synthesis of extracellular glycoprotein” (refers to fibrillin, which is a glycoprotein that forms a sheath around/stabilizes elastin); do not confuse fibrillar collagen (Ehlers-Danlos) with fibrillin (Marfan syndrome). Marfan syndrome has nothing to do with collagen.
- 54F + smoker past 40 years + bilateral hand pain with clubbing; Q wants next best step in diagnosis → answer = chest x-ray; Dx is hypertrophic osteoarthropathy (osteoarthropathia hypertrophicans); presents as arthritis + clubbing as a result of lung cancer.
- “What do I need to know for lower limb nerves for USMLE?”



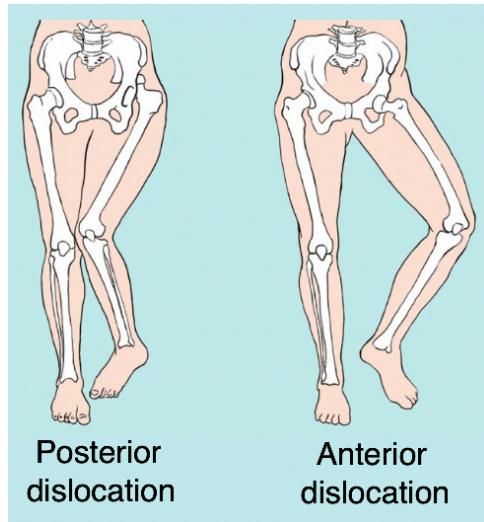
- Now identify:



Lower limb nerve HY Points for USMLE	
Common peroneal (fibular) nerve	<ul style="list-style-type: none"> - The answer on USMLE if patient loses both eversion and dorsiflexion of the foot. - Sensation to upper third of lateral leg (around and below lateral knee). - Splits into superficial and deep peroneal (fibular) nerves.
Superficial peroneal nerve	<ul style="list-style-type: none"> - The answer on USMLE if patient loses only eversion of the foot, but dorsiflexion stays intact. - Sensation to lower lateral leg and dorsum of foot.
Deep peroneal nerve	<ul style="list-style-type: none"> - The answer on USMLE if patient only loses dorsiflexion of the foot, but eversion stays intact. - Deep for Dorsiflexion, which means superficial is the one that does eversion instead. - Loss of dorsiflexion causes a high-steppage gait (patient has to lift foot high into the air with each step). - Also does sensation to webbing between 1st and 2nd toes. I've never seen NBME Qs ask or give a fuck about this sensation detail, but students get fanatical about it as if it's supposed to be high-yield.
Tibial nerve	<ul style="list-style-type: none"> - The answer on USMLE if patient loses plantarflexion of the foot (can't stand on tippytoes). - Sensation to bottom of foot / heel.
Sciatic nerve	<ul style="list-style-type: none"> - The answer on USMLE if patient has motor dysfunction of tibial and common peroneal nerves at the same time, or has sciatica (shooting pain down leg). - Splits into the common peroneal nerve and tibial nerve. - Does not supply sensation to thigh; sensation encompasses that supplied by the combination of the common peroneal nerve and tibial nerves. - Supplies some motor function to muscles of thigh but USMLE doesn't care. - Sciatica = shooting pain from the lower back down the leg usually as the result of disc herniation; 2CK Neuro forms simply want NSAIDs as treatment; straight-leg test is classically used in part to diagnose, but I've seen this test show up on NBME material for simple lumbosacral strain (i.e., the test is non-specific and not reliable).
Obturator nerve	<ul style="list-style-type: none"> - The answer on USMLE if patient has inability to adduct the hip with loss of sensation to medial thigh.
Femoral nerve	<ul style="list-style-type: none"> - The answer on USMLE if patient cannot extend knee and/or has buckling at the knee. - Also does sensation to anterior thigh + medial leg (not thigh), although I haven't seen sensation specifically asked for femoral nerve.
Saphenous nerve	<ul style="list-style-type: none"> - The answer on USMLE if patient loses sensation to medial leg. - Pure sensory branch of the femoral nerve.
Sural nerve	<ul style="list-style-type: none"> - The answer on USMLE if patient loses sensation to lower lateral leg. In contrast, if sensation loss is upper lateral leg, that's common peroneal nerve instead. - Often confused with saphenous. Good way to remember is: suralL is Lateral, therefore saphenous must be the one that's medial.
Superior gluteal nerve	<ul style="list-style-type: none"> - The answer on USMLE if patient has Trendelenburg gait → opposite side of pelvis will fall while walking, so patient will tilt trunk toward side of lesion while walking to maintain level pelvis. - Innervates gluteus medius and minimus.
Inferior gluteal nerve	<ul style="list-style-type: none"> - The answer on USMLE if patient cannot squat, stand up from a chair, or go up/down stairs. - Innervates gluteus maximus.

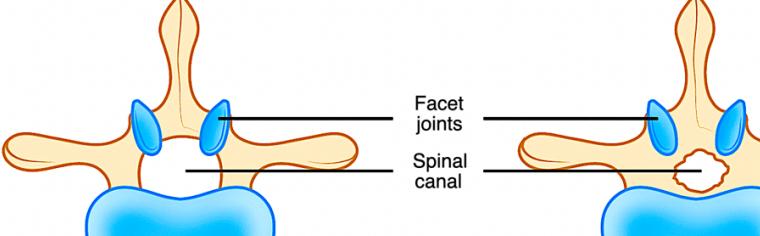
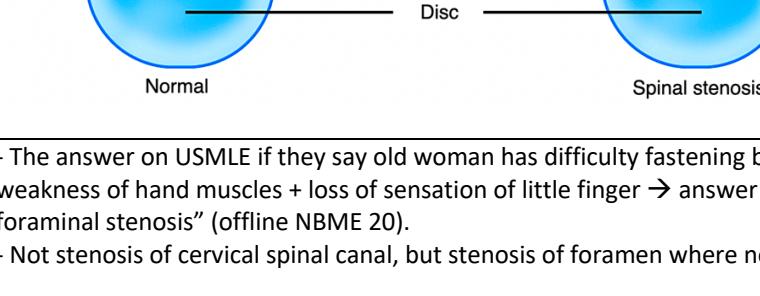
- "Do I need to know hip dislocation stuff? I've seen an occasional question like that but don't really get it?" → Not super-high-yield, but you just need to know that posterior hip dislocation causes a

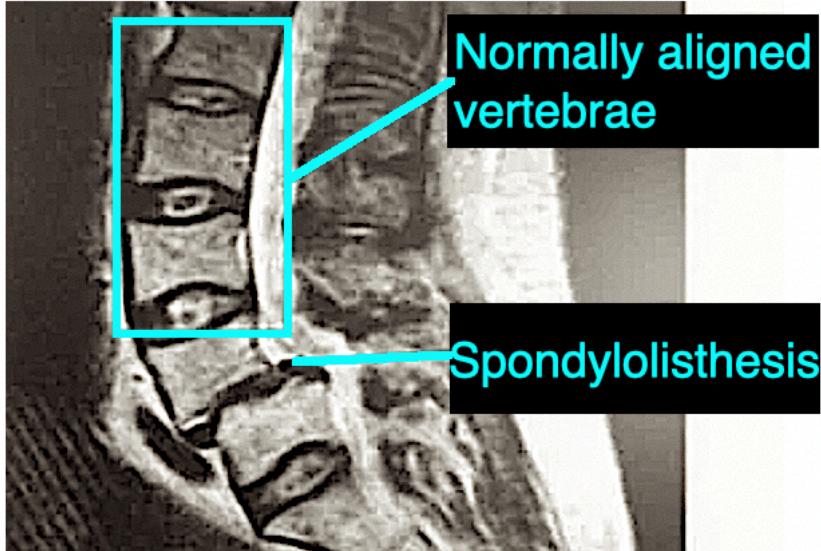
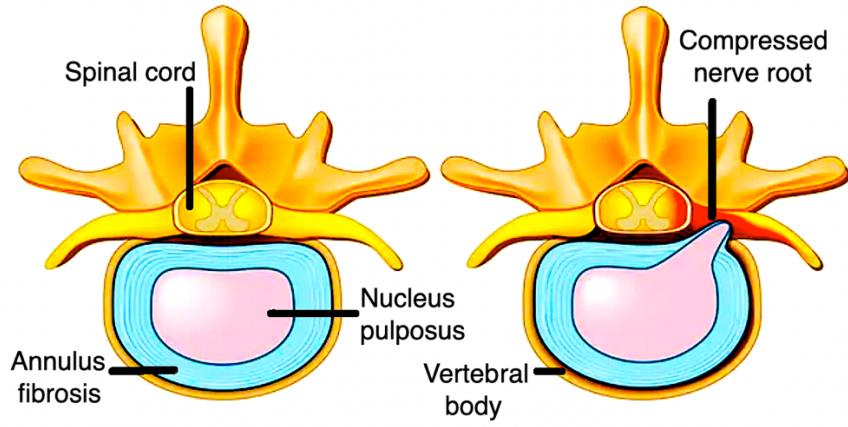
shortened and internally rotated leg; anterior hip dislocation causes a shortened and externally rotated leg.



- “What are some HY things I need to know about MSK spinal stuff?” → I talk about neuro-related stuff a lot more in my HY Neuroanatomy PDF, but below is a table of some HY MSK spinal stuff.

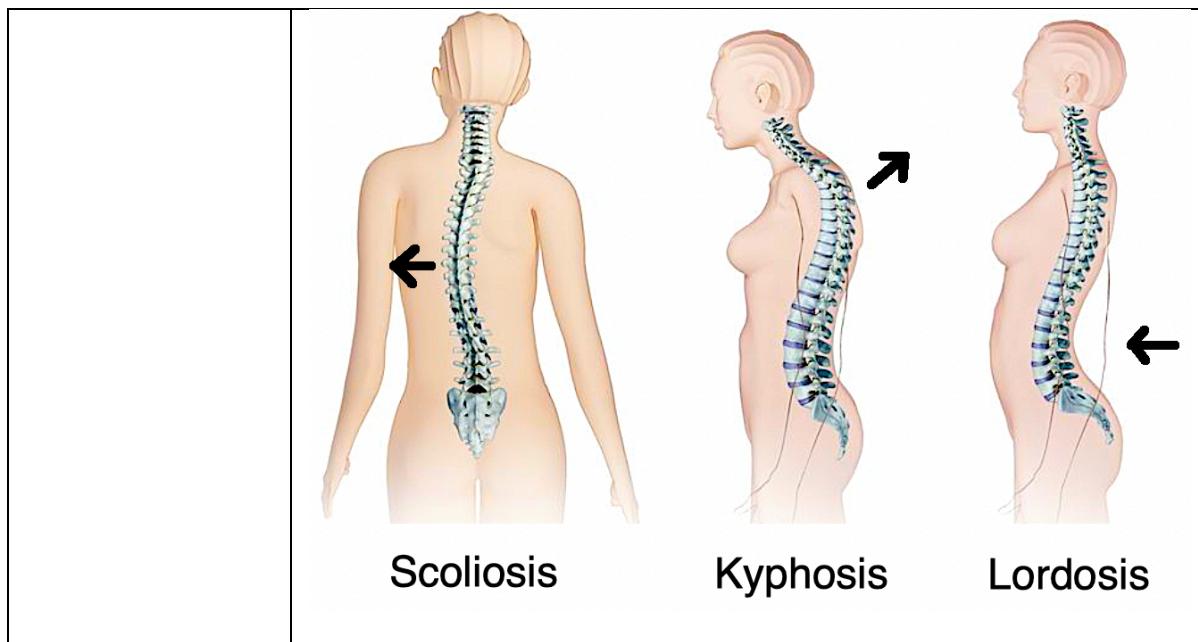
HY MSK spinal conditions for USMLE	
Cervical spondylosis	<ul style="list-style-type: none"> - The answer on USMLE if they say patient over 50 has neck pain + MRI shows degenerative changes of cervical spine. - Can occur in lumbar spine, but USMLE likes cervical spine for this. - Technically defined as degeneration of pars interarticularis component of vertebral body. <p>Pars interarticularis</p> <p>Spondylosis (pars articularis stress fracture)</p>
Atlantoaxial subluxation	<ul style="list-style-type: none"> - Increased mobility between the first (atlas) and second (axis) vertebrae. - Really HY on 2CK Surg and Neuro forms in patients who have rheumatoid arthritis. - Must do CT or flexion/extension x-rays of cervical spine prior to surgery when a patient will be intubated; I've seen both of these as answers for different Surg Qs. - Q on one of the Neuro CMS forms gives patient with RA not undergoing surgery who has paresthesias of upper limbs → answer is just MRI of cervical spine (implying atlantoaxial subluxation has already occurred).

	<ul style="list-style-type: none"> - Narrowing of the spinal canal. - The answer on USMLE if they mention a patient over 50 who has lower back pain that's worse when walking down a hill (i.e., relieved when leaning forward), or when standing/walking for extended periods of time. - Can cause "neurogenic claudication," where the vignette sounds like the patient has intermittent claudication, but they'll make it clear the peripheral pulses are normal and that the patient doesn't have cardiovascular disease; this shows up in particular on 2CK Neuro CMS forms. - Technically an osteoarthritic change of the spine; therefore increased risk in obesity (but not mandatory for questions).
Lumbar spinal stenosis	 <p>The diagram illustrates two lumbar vertebrae. The left side shows a 'Normal' spine with a large, blue-filled spinal canal and a thick, blue-filled intervertebral disc. The right side shows a spine with 'Spinal stenosis', where the spinal canal is significantly narrower and the intervertebral disc is bulging, compressing the nerve root. Labels indicate the 'Facet joints', 'Spinal canal', 'Disc', and the 'Normal' and 'Spinal stenosis' conditions.</p>
Cervical foraminal stenosis	<ul style="list-style-type: none"> - The answer on USMLE if they say old woman has difficulty fastening buttons + weakness of hand muscles + loss of sensation of little finger → answer = "C7-T1 foraminal stenosis" (offline NBME 20). - Not stenosis of cervical spinal canal, but stenosis of foramen where nerve exits.  <p>The diagram shows a cross-section of cervical vertebrae. A vertical line points to the narrow opening where a nerve root exits the spinal canal, labeled 'Foraminal stenosis'. The spinal canal is shown above, and the surrounding bone structures are visible.</p>
Spondylolisthesis	<ul style="list-style-type: none"> - The answer on USMLE if they say a "step-off" between infra-/suprajacent vertebrae. In other words, they'll say one vertebra "juts out" or has a "step-off" compared to those above/below it. - Can be due to trauma or idiopathic development.

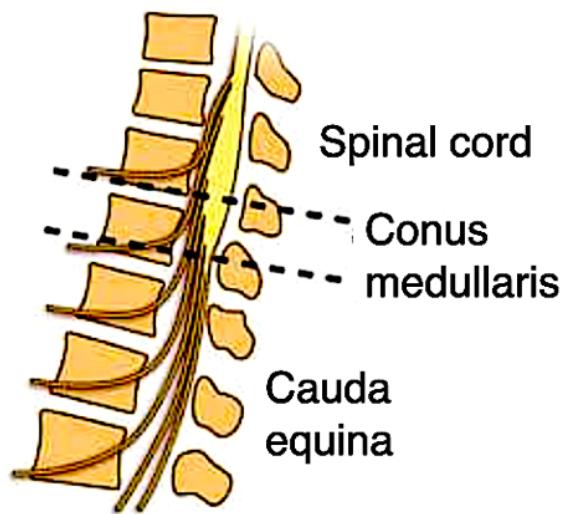
	 <p>Normally aligned vertebrae</p> <p>Spondylolisthesis</p>
Disc herniation	<ul style="list-style-type: none"> - Herniation of nucleus pulposus through a tear in annulus fibrosis.  <p>The answer on USMLE if they mention radiculopathy (i.e., shooting pain down a leg) after lifting a heavy weight or bending over (e.g., while gardening). They can write the answer as “herniated nucleus pulposus.”</p> <p>As I mentioned with the radiculopathies above, be aware of the L4, L5, and S1 differences.</p> <p>Be aware that cervical disc herniation “is a thing,” meaning it’s possible and also assessed on USMLE. 2CK neuro forms ask this a couple times, where patient has shooting pain down an arm, and answer is “C8 disc herniation.”</p> <p>If suspected, newest NBMEs want “no diagnostic studies indicated.” X-ray and MRI are not indicated unless there is motor/sensory abnormality (i.e., weakness or numbness). But for mere radiculopathy (i.e., radiating pain), no imaging necessary on new NBME content.</p> <p>Straight-leg raise test is not reliable. Mere pain alone is a negative test. The test is only positive when they say it reproduces radiculopathy/radiating pain. There is a 2CK Q where they say straight-leg test causes pain (i.e., negative test) and answer is “no further management indicated” (i.e., Dx is only lumbosacral strain).</p> <p>Tx is NSAIDs + light exercise as tolerated. Bed rest is wrong answer on USMLE.</p>
Lumbosacral strain	<p>The answer on USMLE if they say patient has paraspinal muscle spasm following lifting of heavy box without radiculopathy. If they say radiculopathy, the answer is disc herniation instead.</p>

	<ul style="list-style-type: none"> - Straight-leg test can cause pain (i.e., negative test). The test is only positive if they it reproduces radiating pain. - Do not x-ray. This is really HY for 2CK. Apparently lumbar spinal x-rays are one of the most frivolously ordered tests, and USMLE wants you to know that you do not order one for simple lumbosacral strain. - Tx is NSAIDs + light exercise as tolerated. Bed rest is wrong answer on USMLE.
Sciatica	<p>- 90% of the time is due to disc herniation.</p>
Meralgia paresthetica	<ul style="list-style-type: none"> - Straight-leg test classically (+) – i.e., reproduces radiating pain. - Tx = Light exercise as tolerated + NSAIDs. Bed rest is wrong answer on USMLE. - On one of the 2CK CMS forms, ibuprofen straight-up is listed as the answer. <p>- The answer on USMLE if they say patient has pain or paresthesias running down the lateral thigh.</p> <p>- Due to entrapment of lateral femoral cutaneous nerve.</p> <p>- Often seen as incorrect answer choice on Step, so at least be aware of it.</p>

	<p>Lateral femoral cutaneous nerve</p> <p>Posterior branch</p> <p>Anterior branch</p> <p>Area of pain</p>
Scoliosis	<ul style="list-style-type: none"> - Sideways curvature of spine, creating an S- or C-shaped curve. - Usually idiopathic; affects 3% of population; girls 4:1. <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>Normal Spine</p> </div> <div style="text-align: center;"> <p>Scoliosis Rib Rotation</p> </div> <div style="text-align: center;"> <p>Scoliosis X-Ray with Rib Rotation 35.1° 25.7°</p> </div> </div> <ul style="list-style-type: none"> - Can be associated with Marfan syndrome, Friedreich ataxia, NF1. - Adams forward bend test used to diagnose. - USMLE wants you to know most children do not need treatment, but that curvatures will remain throughout life. - Answer = bracing if curvature is >25 degrees and child is still growing. - I've never seen surgery as answer for scoliosis on NBME; literature says recommended only when curvature >40 degrees.
Kyphosis	<ul style="list-style-type: none"> - Abnormal convex curvature of thoracic spine. - Usually idiopathic due to old age; can be due to degenerative disc disease and compression fractures (osteoporosis). - If severe, can in theory cause restrictive lung disease due to impaired chest wall expansion.



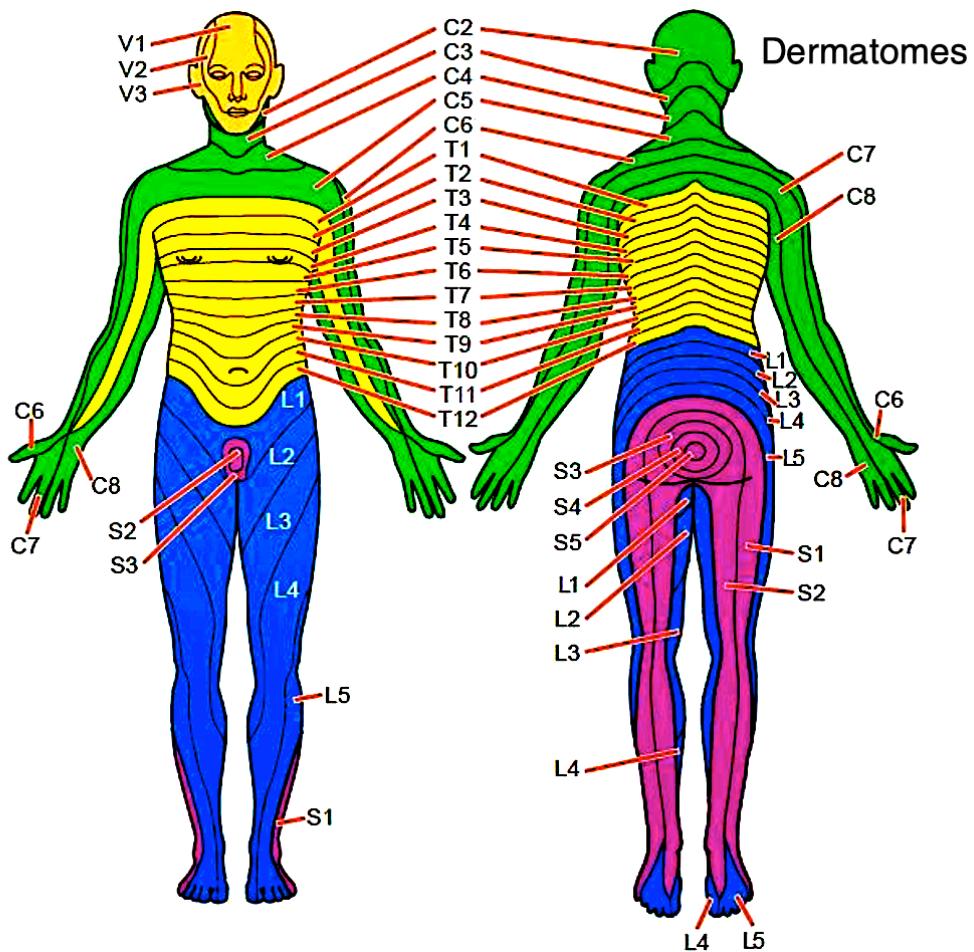
- “What do I need to know for cauda equina syndrome versus conus medullaris syndrome?”



- The spinal cord ends at L1-L2. The terminal cone of the spinal cord is the conus medullaris. The nerve fibers that branch from the spinal cord and run inferior to it are the cauda equina.
- Resources make these conditions way more complicated than they need to be. For USMLE, all they really care about is: both conditions can cause urinary retention and pain in the legs; conus medullaris syndrome is sudden-onset (think cone is “sharp”) and causes perianal anesthesia; cauda equina syndrome is gradual-onset and causes saddle anesthesia. If you look these conditions up online, you’ll see numerous differences listed side by side. Waste of time for USMLE.

- USMLE likes breast, prostate, and lung metastases to the spine as important cause of cauda equina syndrome.
- 65M + painful neck + no neurologic findings + elective MRI shows degenerative changes of cervical spine; Q asks most likely diagnosis → answer = cervical spondylosis; this is merely osteoarthritic degenerative changes to the cervical vertebrae; it is idiopathic, but often has familial association.
- 63M + pain in buttocks and thighs when walking + no cardiovascular disease + peripheral pulses normal; Q wants to know diagnosis → answer = lumbar spinal stenosis; this presentation is “neurogenic claudication,” where the vignette sounds like intermittent claudication due to aortoiliac atherosclerosis, but the patient will have no cardiovascular disease history and they’ll say peripheral pulses are normal; this is due to osteoarthritic changes in the lumbar spine.
- 67M + lower back pain worse when standing or walking for 30 minutes + relieved when leaning forward; Q wants diagnosis → answer = lumbar spinal stenosis; classically pain in lower back that is worse when standing or walking for extended periods of time; it is worse when leaning back + better when leaning forward.
- 79F + difficulty fastening buttons + weakness of hand muscles + numbness in 5th finger; Q wants diagnosis → answer = “C7-T1 foraminal stenosis” (cervical spinal stenosis).
- 61F + vignette is big rambling paragraph of nonsense + they tell you there’s a “step-off” of one vertebra relative to another on palpation; Q wants to know diagnosis → answer = spondylolisthesis.
- 24M + lifted heavy box + severe paraspinal muscle spasm on left + no radiating pain + straight-leg test elicits pain; Q wants next best step in management → answer = “no diagnostic studies indicated”; Dx is lumbosacral strain; negative radiculopathy makes disc herniation less likely; straight-leg test is negative if pain alone is elicited; it is only positive if **radiating** pain is elicited.
- 48F + gardening + sudden-onset severe pain down right leg; Q wants next best step in management → answer = x-ray; diagnosis is disc herniation. X-ray will not visualize herniation, but it is done prior to MRI to rule out other DDx, such as infections, tumors, and spinal misalignments.
- 48F + gardening + sudden-onset severe pain down right leg + straight-leg test elicits radiating pain; Q asks what is most likely to confirm diagnosis → answer = MRI.

- 48F + gardening + sudden-onset severe pain down right leg + straight-leg test elicits radiating pain; Q asks most appropriate treatment → answer = “analgesics + exercise as tolerated”; analgesics = NSAIDs; bed-rest is wrong answer on USMLE for both lumbosacral strain and disc herniations.
- 50M + high BMI + 24-hour history of pain starting in lower back and shooting down left leg; Q wants treatment → answer = NSAIDs; Dx is sciatica; 90% of the time due to disc herniation; diagnosis is made by x-ray (negative) and then MRI (showing disc herniation).
- 55F + pain + paresthesias in lateral thigh + no history of trauma; Q wants diagnosis → answer = meralgia paresthetica.
- 74M + lifted heavy suitcases around the house + sudden-onset pain and tingling in lower back + suprapubic mass + has not urinated for past 24 hours + perianal anesthesia; Q asks diagnosis → answer = conus medullaris syndrome; findings tend to be sudden-onset (cone is “sharp”/sudden); perianal anesthesia is characteristic; both conus medullaris and cauda equina syndromes can present with urinary retention and pain in the lower back / legs.
- 74M + one-month of gradually increasing lower back and leg pain + physical examination shows saddle anesthesia + post-void volume is 400 mL + history of lung cancer; Q wants diagnosis → answer = metastases to cauda equina; 2CK NBMEs love mets to the spine in breast, prostate, and lung cancer, with impingement on the cauda equina.
- “Do I need to know dermatomes for USMLE?” → USMLE doesn’t crazy-obsess, but you need to have an idea of the basics → C6 is thumb; C7 is middle finger; C8 is pinky; nipples are T4; umbilicus is T10; groin and lower back are L1; anteromedial leg is L4; sole of foot is S1.
- 57F + burning/itching pain along lower back close to the hip on the left; Q asks which dermatome this represents (answers are T10, L1, S1) → answer = L1; diagnosis is shingles (herpes zoster; VZV).



- "What do I need to know about lower limb reflexes / radiculopathies?"

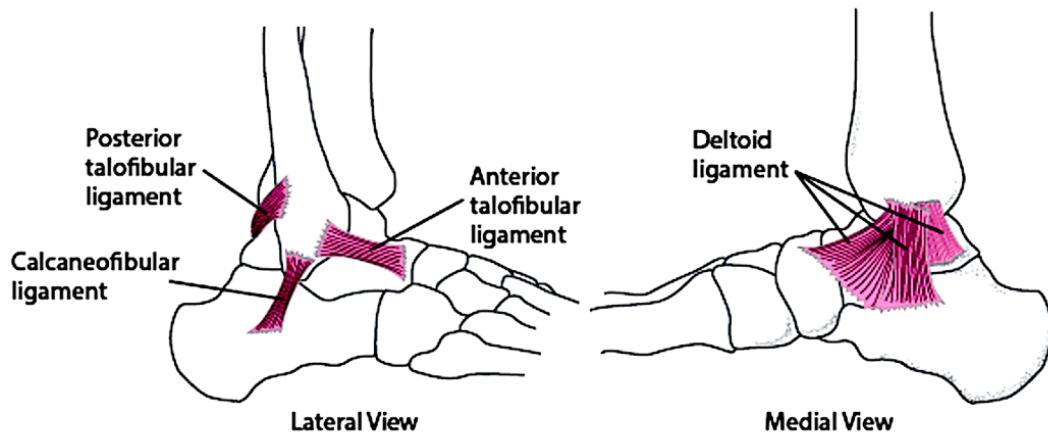
Lower limb reflexes / radiculopathies	
L4 radiculopathy	<ul style="list-style-type: none"> - The answer on USMLE if patient loses knee (patellar) reflex + has weakened knee extension. - Pain / paresthesias / numbness in L4 distribution (anterior thigh + medial leg). - Disc herniation of L3-4. - Just remember that L4 is the one where the knee reflex is fucked up.
L5 radiculopathy	<ul style="list-style-type: none"> - The answer on USMLE if patient loses dorsiflexion. - Pain / paresthesias / numbness in L5 distribution (lateral + anterior leg). - Disc herniation of L4-L5.
S1 radiculopathy	<ul style="list-style-type: none"> - The answer on USMLE if patient loses ankle (Achilles) reflex + has weakened plantar flexion. - Pain / paresthesias / numbness in S1 distribution (sole of foot + lower leg). - Disc herniation of L5-S1. - Just remember that S1 is the one where the ankle reflex is fucked up. - SALT → S1, Achilles, Lateral leg dermatome, Tibial motor issue (plantar flexion).

- 41F + pain radiating down distal anterior thigh, knee, medial leg, and medial foot; compression of nerve root in which intervertebral foramina is most likely the cause of her symptoms? → answer = L3-L4.
- 41F + random leg sensory issues + knee jerk is impaired; Q asks nerve root → answer = L4.
- 41F + random leg sensory issues + ankle jerk is impaired; Q asks nerve root → answer = S1.

- 41F + big paragraph of nonsense + loss of sensation of sole of foot; Q asks nerve root → answer = S1.
- 65F + gradual-onset inability to stand on the tippytoes + diminished sensation on sole of the foot + MRI is shown below; Q wants most likely diagnosis?



- Answer = Disc herniation of L5-S1; USMLE doesn't expect you to be a radiology expert; the diagnosis is inferable based on the vignette alone; MRI shows herniation of nucleus pulposus of L5-S1 disc with impingement on the spinal cord.
- "Do I need to know ankle sprain stuff for USMLE?" → For both Steps 1 and 2CK Family Medicine, yes.



- Anterior talofibular ligament is on the lateral side of the ankle and will be injured if the foot inverts (rolls inward). This is the most commonly injured ankle ligament.
- The deltoid ligament is stronger and on the medial side of the ankle. This injury is more rare and occurs if the ankle forcibly everts (rolls outward).
- There is a Q on one of the Step 1 NBME exams where they show some arcane x-ray of the ankle + tell you the patient had forcible eversion of the ankle + they ask what's injured → answer = deltoid ligament.

- 23M + playing basketball + lands on right ankle where it forcibly everts; x-ray is shown below; left side of x-ray shows prior to ligamental repair; right side is after repair; Q asks which ligament is injured:

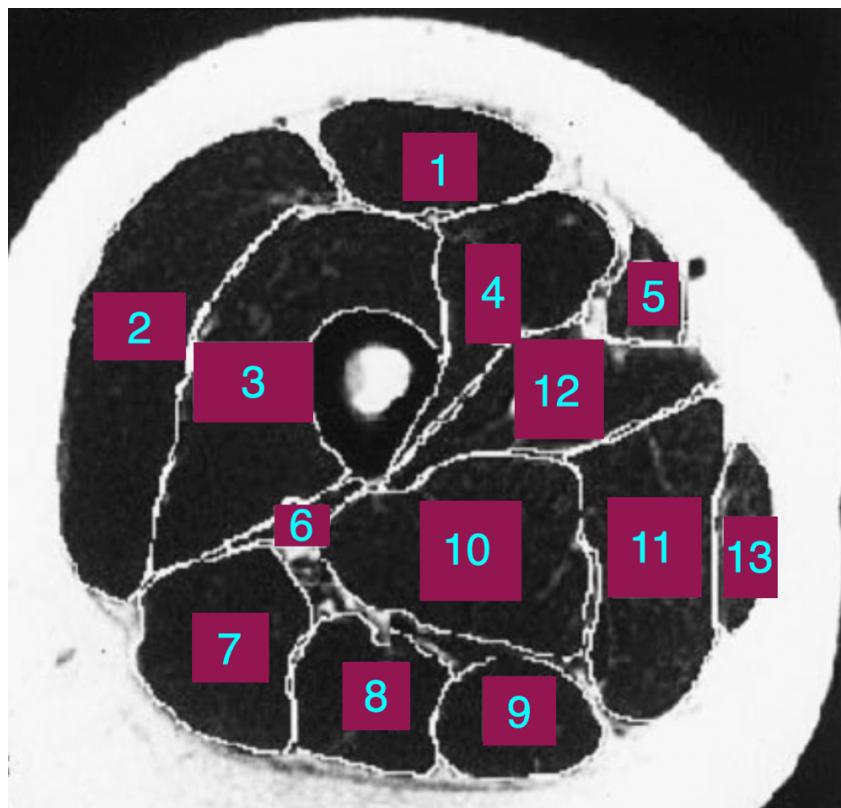


- Answer = deltoid ligament; notice the large joint space on the medial aspect of the ankle in the left x-ray.

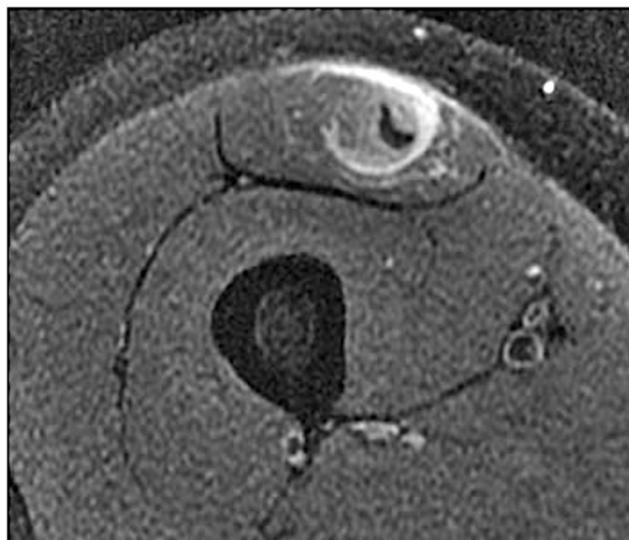


- 25M + twisted ankle yesterday + moderate edema of lateral side of ankle with ecchymoses + tenderness to palpation lateral and anterior to lateral malleolus + patient can weight-bear; Q asks, in addition to 2-day ice pack application, what is next best step in management? → answer on family med form = “use a soft protective brace and early range of motion exercises”; wrong answer = “x-ray of the ankle to rule out fracture.” For 2CK Family Medicine, you need to know Ottawa criteria for suspected ankle fractures. Before development of this criteria, x-rays for the ankle used to be ordered frivolously, with most showing no fracture. Only order an x-ray for the ankle if:

- Pain in the malleolar zone, AND any of the following:
 - Tenderness **posterior** to the lateral or medial malleolus; OR
 - Tenderness on the tip of the lateral or medial malleolus; OR
 - Patient cannot bear weight when walking four steps.
 - The above might seem nitpicky and pedantic, but this is HY for 2CK FM as I said.
- 40M + playing basketball + rolls ankle + pain anterior to lateral malleolus + swelling of ankle + no pain posterior to lateral malleolus + patient can bear weight; Q wants next best step in management → answer = rest, ice, compression, elevation (RICE); wrong answer is x-ray; the patient doesn't fulfill the Ottawa criteria for x-raying the ankle; he has pain in the malleolar zone but does not have pain posterior to the malleolus or on the tip of the malleolus, and he can bear weight.
- 26F + went running and rolled her ankle + pain in lateral ankle + tenderness posterior to malleolus + can bear weight; Q wants next best step → answer = x-ray of ankle; patient fulfills Ottawa criteria for x-ray → she has pain in malleolar region + tenderness posterior to the malleolus; although she can bear weight, the former two findings satisfy the Ottawa criteria.
- “Does USMLE care about knowing all of the muscles and their insertions/origins, etc.” → USMLE does have random Qs where they show MRI cross-sections of the thigh:



- 1 = rectus femoris; 2 = vastus lateralis; 3 = vastus intermedius; 4 = vastus medialis; 5 = sartorius; 6 = biceps femoris short head; 7 = biceps femoris long head; 8 = semimembranosus; 9 = semitendinosus; 10 = adductor magnus; 11 = adductor longus; 12 = adductor brevis; 13 = gracilis.
- 34M + plays soccer + pain in the leg + MRI cross-section shows muscle that's injured; Q asks which muscle it is:



- Answer = rectus femoris.
- "What do I need to know about the arthritis conditions for USMLE?"

HY Arthropathies / joint pathologies for USMLE	
Osteoarthritis	<ul style="list-style-type: none"> - OA is non-inflammatory and also known as degenerative joint disease. - Since it is non-inflammatory, WBCs in joint aspirates will be low (i.e., <10k/μL). In addition, patient will not have elevated ESR. - Hip, knee, and hand findings are usually asymmetric (e.g., "asymmetric joint space narrowing"). This is in contrast to RA, which is usually symmetric. This pattern isn't mandatory, but you should still commit the general association to memory. - "Eburnation" is a term that refers to the ivory-like appearance of bone in OA at sites of cartilage erosion. - HY causes are obesity, being big and tall, or lifting heavy weight on the legs over many years. Patient is usually, but not always, over 40-50. In contrast, RA starts younger (20s-30s). - Highest yield point to know is that weight loss is the number-one way to prevent and treat OA. - Apart from weight loss, acetaminophen is correct before NSAIDs, since OA is non-inflammatory, so NSAIDs won't do any better + NSAIDs kill the kidneys. - Steroids (both oral and intra-articular) are wrong fucking answer for OA. OA, once again is non-inflammatory. Steroids have no role. - Injection of glycosaminoglycans and use of capsaicin cream are also wrong answers on USMLE. - I'd guess 80% of NBME vignettes for OA are a patient over age 40-50 with very high BMI (>40). There is Q on 2CK NBME form where Dx is OA in young woman (32; unusually young), but she is 6'2" and BMI 30 (big and tall).

	<ul style="list-style-type: none"> - OA of the hands affects the DIPs (Heberden nodes) in addition to the PIPs (Bouchard nodes). <p>The diagram consists of two side-by-side illustrations of a human hand. The left illustration shows a normal skin surface, while the right illustration shows the underlying skeletal structure. Two specific areas are highlighted with black boxes and labeled: 'Heberden nodes' points to the small, bony protrusions at the very tips of the fingers (distal interphalangeal joints), and 'Bouchard nodes' points to the larger, more prominent bony protrusions just below the PIPs.</p>
Rheumatoid arthritis	<ul style="list-style-type: none"> - RA does not affect the DIPs (MCPs + PIPs only). So if you ever get a hand x-ray and instantly say "No idea what I'm looking at" → Relax. Just say "Do I see anything fucked up with the DIPs" (i.e., osteophyte-looking swellings, etc.). Yes? Cool, we know immediately it's not RA (and likely OA). - In contrast to OA, RA is inflammatory, where joint aspirate will show generally >20-50k WBCs/μL. USMLE doesn't give a fuck about exact numbers (i.e., "what about 10-20k?"). You should just be aware, more or less, that <10k/μL is non-inflammatory for OA, but >20k is where we say, "Ok, there's something inflammatory here." ESR will also be high if they list it. - In contrast to OA, RA is symmetric. As I mentioned up above, the association of symmetry for RA versus asymmetry for OA isn't a 100% mandatory finding, but you should be aware of that general distinction. - "Pannus" is a term that refers to growth of new bone within joints in RA. - Most RA vignettes will be a woman 20s-40s. NBME exams like to mention other autoimmune diseases in either the patient or family member (i.e., brother has IBD, or sister has SLE, or patient has T1DM), since "autoimmune diseases go together." The HLA associations are not strict. Do not pigeon-hole that stuff. - If USMLE vignette sounds like RA, they want "arthrocentesis" as first step in diagnosis. They won't force you to choose between this and antibodies. - For antibodies, anti-cyclic citrullinated peptide (anti-CCP) is more specific than rheumatoid factor. Both should be ordered for RA. - Tx for RA is HY. Two arms of management: 1) symptoms; 2) disease progression. For symptoms, give NSAIDs first, followed by steroids. These do not slow disease progression. NSAIDs and steroids are for symptoms only. For disease progression, we use disease-modifying anti-rheumatic drugs (DMARDs), which slow disease progression. Methotrexate is given first, followed by adding an anti-TNF-α agent (i.e., infliximab, adalimumab, or etanercept). - Rheumatoid arthritis can cause pulmonary fibrosis / restrictive lung disease. This is called rheumatoid lung. At the same time, methotrexate can <i>also</i> cause pulmonary fibrosis. So restrictive lung disease in RA patients is often a mix of rheumatoid lung and methotrexate-induced pulmonary fibrosis. - RA can cause serous pericarditis (friction rub), as can other autoimmune diseases, such as SLE. - Low hemoglobin in RA = anemia of chronic disease; obviously this could be for any autoimmune disease, but this shows up a lot in RA NBME vignettes. - Swan neck = extension of PIP and flexion of DIP; Boutonniere = flexion of PIP and extension of DIP.

	<p>Boutonniere deformity</p> <p>Swan neck deformity</p>
	<ul style="list-style-type: none"> - Rheumatoid arthritis + neutropenia + splenomegaly = Felty syndrome. - Rheumatoid arthritis + pneumoconiosis = Caplan syndrome. - As I mentioned earlier, atlantoaxial subluxation is really HY on 2CK Surg and Neuro forms.
Juvenile rheumatoid arthritis	<ul style="list-style-type: none"> - 2CK Peds forms love JRA. It will sound like regular RA but just in a kid. - USMLE will structure these Qs where they want you to pick between JRA and septic arthritis (SA) as answer choices. This can be confusing since SA can occur in patients with JRA. They might say a kid has a low-grade fever and a warm, red, painful knee (sounds like SA), but then they say he's had similar episodes in the past (i.e., they want JRA over SA). This is because SA is usually a one-off event; for JRA, however, the vignette will say "intermittent" or "episodic." Low-grade fever can occur in autoimmune flares (not limited to JRA; HY for sarcoidosis as well). - "Salmon-pink" maculopapular rash only in ~50% of JRA Qs. Often described as a buzzy finding, but I'd say about half of JRA vignettes don't even mention rash. - 2CK forms are obsessed with anemia of chronic disease in JRA. HY point is that MCV can absolutely be low. Resources push normal MCV for AoCD. This is absolute nonsense. Plenty of 2CK NBME Qs give MCV as 70s in AoCD. - Diagnosis and treatment are same as RA.
Psoriasis	<ul style="list-style-type: none"> - 15% of patients with psoriasis will get arthritis before any skin findings. - Can cause "pencil-in-cup" deformity of the DIPs. <ul style="list-style-type: none"> - Plaques are described as silvery and scaly and over extensor regions (elbows); plaques can also show up on the face (i.e., forehead and lip). - Auspitz sign is bleeding of the scales if removed. - Munro microabscesses = pathognomonic for psoriasis = collections of neutrophils in stratum corneum of epidermis.

	<ul style="list-style-type: none"> - HY point for USMLE is that psoriasis is part of the HLA-B27 constellation (PAIR → Psoriasis, Ankylosing spondylitis, IBD, Reactive arthritis). - For example, if 22M has silvery plaque on elbow and forehead + bloody stool → the latter is most likely IBD due to HLA-B27 association. - Don't confuse psoriasis + IBD combo with dermatitis herpetiformis + Celiac disease combo. - Treatment for plaque psoriasis is topicals first → USMLE wants calcipotriene (vitamin D derivative), triamcinolone or hydrocortisone (both corticosteroids), and coal tar. Choose in that order if you are forced. Chronic application of topical steroids causes dermal collagen thinning, so they are not preferred prior to topical vitamin D. - Oral meds are given if patient fails topicals, OR if patient has systemic psoriasis (i.e., arthritis). Oral methotrexate is HY on new NBME material as the first-line oral agent used. - An old Step 1 form has oral acitretin (a vitamin A derivative) as an answer, where methotrexate is not listed.
Sacroiliitis	<ul style="list-style-type: none"> - Sacroiliitis is broad term that refers to arthritis of lower back; ankylosing spondylitis (AS) is most severe form. - Vignette will almost always be male 20s-40s who has lower back pain worse in the morning that improves throughout the day. - There is Q on 2CK Peds CMS form where AS is diagnosis in an 8-year-old, but this is not typical demographic. - Lower back pain in patient with IBD, psoriasis, or reactive arthritis points toward sacroiliitis (HLA-B27 PAIR). - High ESR and anemia of chronic disease high-yield. - Diagnose with x-rays of the lumbosacral spine and sacroiliac joints. - "Bamboo spine" (vertebral body fusion) is buzzy x-ray finding in AS. 
Lupus	<ul style="list-style-type: none"> - USMLE wants "slit-lamp examination" to look for anterior uveitis in ankylosing spondylitis. Any autoimmune disease can theoretically increase risk of this eye finding, but for whatever reason USMLE likes it for AS. - Severe AS can lead to restrictive lung disease (normal or ↑ FEV1/FVC). - For whatever magical reason, up to 20% of AS patients can present with aortic regurgitation due to inflammation of the aorta (bounding pulses). - Treat same as RA.
	<ul style="list-style-type: none"> - Arthritis is most common presenting feature of lupus (90%). USMLE vignette will pretty much always give arthritis in lupus Qs.

	<ul style="list-style-type: none"> - Anti-double-stranded-DNA (dsDNA) antibodies go up with acute flares and are most closely related to renal prognosis for lupus nephritis. - Anti-Smith (ribonucleoprotein) antibodies are most specific for SLE (more than dsDNA). - Anti-histone antibodies occur in drug-induced lupus (usually arthritis and mediastinitis following procainamide administration). - Anti-phospholipid syndrome due to lupus anticoagulant (antibodies against β_2-microglobulin or cardiolipin in patient with SLE) → patient presents with recurrent miscarriages, as well as thromboses in spite of elevated aPTT test. - Anti-phospholipid syndrome can cause false-positive syphilis VDRL test (HY). - Malar rash is type III hypersensitivity. Harder Qs won't mention this finding because it's too buzzy. You need to know thrombocytopenia is frequently seen in lupus due to anti-hematologic cell line antibodies. Antibodies can also target WBC and RBC → looks like aplastic anemia, but it's not → answer = "increased peripheral destruction," not "decreased bone marrow production." - Mouth ulcers, discoid lupus (skin lesions), and primary CNS lymphoma are HY for SLE. The latter can occur in any autoimmune disease, but HY for SLE. - Can cause lupus cerebritis (confusion / delirium-like episodes) and transverse myelitis (can present as Brown-Sequard syndrome). - Similar to RA, lupus can cause pericarditis. - Flares cause decreased serum complement protein C3. - Congenital complement protein C1q deficiency causes ↑ risk of developing SLE; sounds nitpicky but it's on new Step 1 NBME exam. - For lupus nephritis, biopsy as the first step in management; steroids first is wrong answer; biopsy first sounds wrong but it guides management. - Lupus nephritis = diffuse proliferative glomerulonephritis (DPGN) on USMLE. - Treat flares of lupus with steroids. USMLE doesn't care about other Tx's.
Gout	<ul style="list-style-type: none"> - Can cause arthritis of knees and hands, as well as gouty tophi (monosodium urate crystal deposition). - Classic patient is middle-age guy who drinks alcohol, eats a lot of meat, and drinks bags of nucleic acids. - Patient need not have hyperuricemia to have gout; likewise, patients with hyperuricemia can be asymptomatic and not develop gout. - Monosodium urate (uric acid) crystals are needle-shaped and yellow (negatively birefringent) under polarized light. - Crystals causing urolithiasis are radiolucent on x-ray. - Tx for acute gout is indomethacin (NSAID), then oral corticosteroids, then colchicine, in that order. If patient has renal insufficiency, use corticosteroids. If patient has allergy to NSAIDs, colchicine is answer on NBME exam (steroids not listed for that same Q). - Tx for chronic gout (i.e., Tx between attacks to decrease recurrence) is xanthine oxidase inhibitors first (i.e., allopurinol or febuxostat). Do not give xanthine oxidase inhibitors for acute gout, as they can worsen flares (sounds paradoxical, but it's what happens). - I have not seen probenecid asked as an actual Tx for gout on NBME. They want you to know it inhibits organic anion transporter (OAT) in the kidney, which both inhibits reabsorption of uric acid and secretion of beta-lactams → therefore can be used to maintain serum levels of beta-lactams. - Do not give probenecid to patients with Hx or urolithiasis (due to the drug causing increased excretion of uric acid within the renal tubules).
Pseudogout	<ul style="list-style-type: none"> - Aka calcium pyrophosphate deposition disease; causes rhomboid-shape blue (positively birefringent) crystals under polarized light. - Biggest risk factors are hemochromatosis and primary hyperparathyroidism. - Will present one of two ways on USMLE: 1) as a monoarthritis of the knee, or 2) as an OA-like presentation of the hands in someone with hemochromatosis or primary hyperparathyroidism.

	<ul style="list-style-type: none"> - Tx acute pseudogout same as "regular" gout. - Tx of chronic pseudogout = treat the underlying condition.
BCP disease	<ul style="list-style-type: none"> - Basic calcium phosphate deposition disease presents as "Milwaukee shoulder," which is a cold (non-inflammatory) effusion of the shoulder. - "Lower yield," but good for students who want 280+ on 2CK.
Septic arthritis	<ul style="list-style-type: none"> - Biggest risk factor is abnormal joint architecture → will present in four main groups on USMLE: 1) patients with prosthetic joints (you can't have more abnormal architecture than an artificial joint); 2) RA/JRA/OA patients; 3) young healthy patients with recent trauma (e.g., car accident) or high-intensity exercise causing microtrauma (e.g., kickboxing/soccer tournament, long hike); 4) sickle cell disease. - USMLE will give hot, red, painful joint in one of the above patient groups, almost always with a fever. - First step in management is arthrocentesis. A high-yield point is that joint aspirate can be negative for organisms. Do not rule-out SA if NBME says no organisms. - <i>Staph aureus</i> is most common pathogen for the first three groups above. - <i>Gonococcus</i> is the answer for sexually active patients; presents two ways on USMLE: 1) monoarthritis of the knee in sexually active young patient, with no other information provided; or 2) as a triad: monoarthritis or polyarthritis; cutaneous papules; tenosynovitis (inflammation of tendon sheaths). - Treatment is surgical drainage of the joint + antibiotics. USMLE doesn't care about the exact antibiotics.
Reactive arthritis	<ul style="list-style-type: none"> - Classically presents as triad of 1) urethritis or abdominal infection, 2) polyarthritis, and 3) "eye-itis" (i.e., conjunctivitis, episcleritis, or anterior uveitis). - <i>Chlamydia</i> is the classic organism that causes reactive arthritis. <i>Gonococcus</i> does not cause reactive arthritis on USMLE. - <i>Rubella</i>, Hep B+C, and <i>Yersinia</i> can also cause reactive arthritis. - Part of HLA-B27 constellation (PAIR), as mentioned above.
Toxic synovitis	<ul style="list-style-type: none"> - Aka transient synovitis. 2CK pediatrics forms are obsessed with this. - Presents as hip inflammation/pain in child after a viral infection. - Toxic synovitis is diagnosis of exclusion, meaning the vignette gives you various findings that make septic arthritis less likely. Leukocytosis and inability to bear weight make septic arthritis the likely answer over toxic synovitis. Hard questions will not mention warmth or redness as ways to differentiate. Fever can present in both. - Treatment is NSAIDs (ibuprofen) → asked on 2CK Peds.
Post-traumatic arthritis	<ul style="list-style-type: none"> - Pain in joint that can present soon, or many years after, injury, where other DDx are ruled out. - Shows up on 2CK form where it first sounds like patient has patellar tendonitis (i.e., 2 years of knee pain first worsened with basketball but then progresses to more constant pain), but then they go on to say that patient had fracture to proximal tibia 30 years ago and has varus deformity of the knee; answer = traumatic arthritis, not patella tendonitis. The implication is that the etiology for the patient's arthritis is ultimately linked to the varus deformity from the prior injury.

- 49F + left knee pain + BMI 40 + Q asks what would most likely have prevented this patient's condition
→ answer = weight loss; diagnosis is osteoarthritis (OA). As easy as it gets, but this Q is rampant on USMLE.
- 32F + 6'2" + right knee pain + BMI 30; Q asks, in addition to weight loss, what is the most appropriate treatment for this patient → answer = acetaminophen; diagnosis is OA; patient here is young, but big

and tall; NSAID as first answer is wrong. As I mentioned above, OA is non-inflammatory, so NSAIDs don't help more than acetaminophen + they kill the kidney.

- 60F + taking high-dose naproxen for the past 6 weeks for treatment of her OA + has peripheral edema; Q asks the most likely reason for this patient's edema → answer = "increased renal retention of sodium" or "decreased renal excretion of sodium"; patient is inappropriately self-medicating with high-dose NSAID for her OA, resulting in analgesic nephropathy; HY for 2CK Family Med forms.
- 28F + painful wrists and knee + history of thyroiditis + Q asks for next step in management → answer = arthrocentesis to diagnose RA; if Q asks what you're looking for on arthrocentesis, answer = leukocytes. Student asks, "But what about antibodies though?" I agree with you, but 2CK forms are obsessed with "arthrocentesis" or "aspiration of the knee joint" as the answer for next best step in diagnosis/management for these questions; they will not force you into a box where you need to choice antibodies versus arthrocentesis.
- 29F + history of intermittent wrist and knee pain + presents today with fever 101 F and a hot, red, painful knee; Q wants next best step in diagnosis? → answer = arthrocentesis; diagnosis is septic arthritis in patient with underlying RA.
- 59M + pain in his hands + x-ray is shown below; Q asks the mechanism for this patient's condition:



- Answer = "degenerative joint disease"; diagnosis is OA; image is showing Heberden nodes. If you look at x-ray, the DIPs "look a little swollen"; if you get a hand x-ray like this on USMLE

and have no idea what you're looking at, just ask yourself, "Do the DIPs look fucked up in any way?" → if yes, answer is definitely not RA, and is probably OA.



- 34M + walks in bent over at the waist with chest pain + painful wrists and knee + hemoglobin of 10 g/dL; Q asks how to treat the patient's hematologic findings → answer = "no specific therapy indicated"; patient has RA; autoimmune diseases can present with serous pericarditis (patient bends / leans forward to relieve chest pain) and anemia of chronic disease; even though we treat the underlying condition (i.e., the RA in this case), I've seen NBME write "no specific therapy indicated" for anemia of chronic disease in this situation; do not give EPO for AoCD unless the etiology is renal failure. EPO is wrong answer otherwise.
- 49F + advanced rheumatoid arthritis + undergoing cholecystectomy; Q asks what needs to be done prior to surgery → answer = "flexion and extension x-rays of cervical spine"; must look for atlantoaxial subluxation in RA patients prior to intubation; answer can also be "CT of cervical spine"; I've seen both on 2CK CMS forms.
- 51M + advanced rheumatoid arthritis + paresthesias of upper limbs; Q asks next step in diagnosis → answer = MRI of cervical spine; Q has nothing to do with surgery, but upper limb neurologic findings in RA patient suggest atlantoaxial subluxation.
- 42F + sore wrists and knee + diffuse pruritis + high serum cholesterol, direct bilirubin, and ALP; Q asks for treatment of jaundice → answer = ursodeoxycholic acid (ursodiol); patient has rheumatoid

arthritis and primary biliary cirrhosis; remember that “autoimmune diseases go together”; USMLE also wants you to know MOA of ursodiol is “decreased secretion of cholesterol into bile”).

- 41M + sore knees + high ESR + low neutrophils + spleen palpable; Q just asks diagnosis → answer = Felty syndrome; diagnosis is just asked straight-up like this on one of the 2CK forms.
- 22M + low back pain worse in the morning and gets better throughout the day + occasional hand pain; Q wants to know next step in diagnosis → answer = x-ray of sacroiliac joints; diagnosis is ankylosing spondylitis and psoriatic arthritis; both are linked via HLA-B27 (PAIR → Psoriasis, Ankylosing spondylitis, IBD, Reactive arthritis).
- 29M + back pain worse in morning and gets better throughout the day + x-ray of spine shown below; Q wants to know next step in management?



- Answer = slit-lamp examination; diagnosis is ankylosing spondylitis with x-ray showing bamboo spine; USMLE wants you to know annual slit-lamp examination for anterior uveitis is part of workup.
- 28M + silvery, scaly plaque on elbow + scraping of the plaque causes bleeding; Q asks for the most appropriate treatment → answer = topical calcipotriene (vitamin D derivative); Tx of psoriasis is topicals first → topical calcipotriene, then topical steroids (triamcinolone or hydrocortisone), then coal tar.
- 44M + long history of plaque psoriasis that responded well to topicals + has increasing hand pain over past year + x-ray shown below; Q wants to know the most appropriate treatment:



- Answer = methotrexate; x-ray shows pencil-in-cup deformity of DIP of 2nd digit;
methotrexate is first-line oral agent for systemic psoriasis (psoriatic arthritis), or if patient has unremitting plaque psoriasis that fails topicals.
- 39M + long history of psoriasis that does not respond to topicals; Q asks for oral treatment + methotrexate is not listed → answer = acitretin (oral vitamin A derivative used for psoriasis).
- 9F + painful knee + has had a few episodes similar to this before + hemoglobin 10 g/dL + MCV 72; Q asks most likely hematologic diagnosis → answer = anemia of chronic disease due to JRA; you need to know that MCV can absolutely be low in AoCD; this is exceedingly HY on 2CK forms; I see students all of the time erroneously eliminate AoCD because of low MCV; absolute nonsense.
- 6M + runny nose for 3 days + now has left hip pain + temperature is 100.5 F + hip is not erythematous or warm; patient can bear weight on the hip; Q asks for next step in management → answer = ibuprofen; diagnosis is toxic (transient) synovitis; this is viral infection that, for whatever magical reason, can cause inflammation of the hip that can be misdiagnosed as septic arthritis; recognize that this is a common condition and if septic arthritis is less likely (i.e., kid can bear weight; there is no leukocytosis; hip is not red and hot), do not draconianly stab the kid in the hip for a joint aspirate.
- 10M + painful left hip for 2 days + fever of 101 F + leukocytes elevated + cannot bear weight on the hip + question says nothing about warmth or redness of hip; Q asks next best step → answer = arthrocentesis; septic arthritis must be ruled out here; for these types of Qs, you have to use your intuition; remember that for toxic synovitis, they'll usually say viral infection precedes the hip pain + no leukocytosis + patient can bear weight.

- 8F + intermittent knee pain and salmon-pink body rash + presents today with hot, red, painful knee with limited mobility; Q wants to know most likely diagnosis (JRA not listed) → answer = septic arthritis; as discussed earlier, JRA is a risk factor for septic arthritis, so although patient has JRA above, the acute diagnosis is SA; USMLE will often give this type of Q where they have “toxic synovitis” as a wrong answer choice (easy, since we discussed above toxic synovitis is hip pain after viral infection; toxic synovitis is never the knee); salmon-pink body rash is buzzy for JRA, but I’d say it only presents in half of NBME vignettes tops.
- 30F + arthritis of hands + low platelets + no other information; Q asks most likely diagnosis → answer = SLE; you need to know lupus can present with low platelets due to antibodies causing peripheral destruction; arthritis is most common presenting feature of lupus.
- 31F + arthritis of hands + low platelets + low WBCs + low hemoglobin; Q asks mechanism for this patient’s hematologic findings → answer = “increased peripheral destruction”; wrong answer = “defective bone marrow production”; in SLE, patients can have antibodies against their hematologic cell lines; isolated thrombocytopenia is most common, but antibodies resulting in leukopenia and erythopenia also can occur; this looks like aplastic anemia (e.g., from Parvo), but it’s not.
- 34M + sore hands and knee + malar rash + question asks what’s most likely to be deficient in this patient → answer = C1q; for whatever reason, complement protein C1q deficiency is a cause of lupus. Also remember that in acute flares, C3 decreases and dsDNA Abs increase.
- 36F + arthritis + thrombocytopenia + positive syphilis test; Q asks what’s most likely to be seen in this patient → answer = antibodies against phospholipid; patients with SLE who have anti-phospholipid syndrome can have false-positive VDRL syphilis screening.
- 45M + sore knee + drinks alcohol + takes daily aspirin for ischemic heart disease; Q wants to know treatment for this patient’s condition → answer = indomethacin; steroids are wrong answer; diagnosis is acute gout; student says, “But why do we give NSAID as Tx if patient is taking daily aspirin, which is an NSAID?” → it’s what the NBME exam wants; daily low-dose aspirin is actually a risk factor for acute gout.
- 45M + sore knee + joint aspirate shows needle-shaped crystals + patient has history of NSAID allergy; Q asks most appropriate treatment (steroids not listed) → answer = colchicine; used for acute gout in patients who can’t take NSAIDs (e.g., peptic ulcers or allergy).

- 45M + renal insufficiency + sore hands + tophi visible; Q asks most appropriate treatment for acute presentation; answer = steroids; in renal insufficiency, avoid NSAIDs and colchicine.
- 45M + presents with swollen and painful big toe; Q asks which of the following will decrease recurrence of this patient's condition → answer = allopurinol; xanthine oxidase inhibitors (i.e., allopurinol or febuxostat) are first-line for chronic gout to decrease recurrence.
- 45M + being treated in hospital with IV nafcillin for MSSA endocarditis + is administered probenecid; Q asks reason for this management → answer = decreases renal clearance of beta-lactam; probenecid inhibits organic anion transporter (OAT), which both prevents reabsorption of uric acid and secretion of beta-lactams; uricosurics not used first-line for chronic gout because they increase risk of uric acid stones.
- 39M + left knee pain + hyperpigmentation of forearms + increased serum glucose; Q asks what is most likely to be seen on joint aspirate → answer = calcium pyrophosphate; diagnosis is pseudogout; biggest risk factors are hereditary hemochromatosis and primary hyperparathyroidism; patient here has "bronze diabetes," which is buzzy presentation for hemochromatosis; hyperpigmentation is hemosiderin deposition; high glucose is from iron deposition in tail of pancreas.
- 50F + painful hands with soreness of DIPs + overweight + serum calcium 11 mg/dL (NR 8.4-10.2); Q asks most likely diagnosis → answer = pseudogout, not OA; pseudogout can present as an OA-like presentation in patients with primary hyperparathyroidism or hereditary hemochromatosis.
- 40M + painful knee + joint aspirate shows rhomboid positively birefringent crystals; Q asks most appropriate treatment → answer = indomethacin; treat acute pseudogout exactly the same as "regular" gout. However, for chronic pseudogout, treat the underlying condition.
- 40M + sore shoulder + ESR not elevated; Q asks what's most likely to be seen on joint aspiration → answer = basic calcium phosphate → BCP crystals cause "Milwaukee shoulder," which is a cold (non-inflammatory) shoulder effusion.
- 28M + painful red knee + fever 102 F + went hiking for 12 hours two days ago; Q asks for the most likely organism → answer = *Staph aureus*; USMLE wants you to know that otherwise young, healthy patients who've had recent microtrauma (e.g., hiking, soccer/kickboxing tournament) or overt trauma (i.e., car accident where knee hit the dashboard) can get septic arthritis.

- 24M + med student + knocked up however many chicks the past year + presents with sore knee + joint aspiration shows no organisms; Q asks the most likely diagnosis → answer = *Gonococcal* arthritis; if Q is overt about sexual activity in younger patient, they want *Gonococcus*.
- 26F + history of rheumatoid arthritis + presents with hot, red, painful knee and fever of 102 F; Q asks most likely organism → answer = *Staph aureus*; if Q doesn't emphasize unprotected sexual activity + patient has clear risk factor for SA, then *S. aureus* is more likely than *Gonococcus*.
- 14F + sickle cell + painful, red, hot knee; Q asks most likely organism → answer = *Staph aureus*; *Salmonella*, although a common cause of osteomyelitis in sickle cell, there is not increased risk of it causing septic arthritis.
- 28M + sexually active + painful acromioclavicular joint + gram-stain of joint aspirate shows gram-negative diplococci; Q asks the next best step in management → answer = "culture of joint aspirate"; weird question and answer, but this is on 2CK NBME; disseminated *Gonococcus* can cause septic arthritis of a variety of joints; after gram stain is performed, you still want to do a culture of the aspirate to check for antibiotic sensitivities.
- 27M + painful knee and wrist + cutaneous papules along the wrist; Q asks for the most appropriate treatment → answer = ceftriaxone + azithromycin; diagnosis is *Gonococcal* arthritis; HY to know it can present with cutaneous papules; must co-treat for chlamydia with azithromycin or doxycycline.
- 23M + sore hands and knees + urethral discharge + red eyes; Q asks most likely organism → answer = *Chlamydia*; wrong answer is *Gonorrhea*; reactive arthritis is classically *Chlamydia*; *Gonococcus* does not cause reactive arthritis.
- 17M + pain, redness, and swelling of shaft of left forearm + fever of 103 F + WBCs 14,000/ μ L; Q wants most likely organism → answer = *Staph aureus*; Dx is osteomyelitis; *S. aureus* is most common organism overall, especially when etiology is idiopathic.
- 8M + sickle cell disease + pain in foot for 3 weeks + fever 102 F + WBCs 14,000/ μ L; Q wants most likely organism → answer = *Salmonella spp.*; if Q gives you sickle cell with osteomyelitis, the organism they want is *Salmonella*. You still need to use your head though. If they say "gram-positive coccus" in patient with sickle cell, that would be *Staph aureus*, not *Salmonella*. The latter is a gram-negative rod.
- 42F + severe diabetes + gangrenous foot ulcer + sterile probe placed to base of ulcer and cultured; Q wants to know most likely organism → answer = polymicrobial on new 2CK NBME. Both *Staph aureus*

and *Pseudomonas* are wrong answers, which settles the long debate for what USMLE wants for this answer.

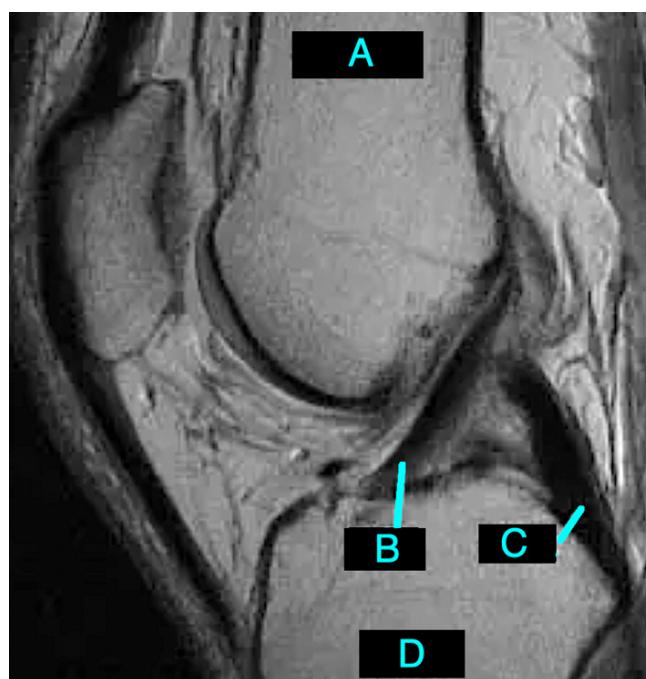
- 47M + immigrant to USA from Albania + history of tuberculosis + pain over T9/T10 vertebrae; Q wants diagnosis → answer = vertebral osteomyelitis (Pott disease).
- 28M + migrant worker + rigid abdomen + fever + holds right lower extremity in extension + PPD shows 16 mm induration; Q asks which muscle is most likely to be affected in this patient → answer = psoas major; you don't have to worry about the anatomy here; just know that TB can cause psoas abscess.
- 56M + IV drug user + diabetes mellitus type II + left-sided back pain radiating to flank + fever 102 F + pyelonephritis not listed as answer; Q wants diagnosis → answer = psoas abscess; just be aware of it as a DDx; most likely organism is *Staph aureus*; Tx = surgical drainage + IV antibiotics.

Other random joint/MSK disorders	
Lateral epicondylitis	<ul style="list-style-type: none"> - Tennis elbow. - Lateral elbow pain worsened when patient extends wrist against resistance. - NBME asks "extensor carpi radialis brevis" as answer for site of inflammation. - Tx = "forearm strap" on 2CK FM forms.
Medial epicondylitis	<ul style="list-style-type: none"> - Golfer elbow. - Medial elbow pain worsened when patient flexes wrist against resistance. - Inflammation at flexor carpi radialis and pronator teres. - Tx = forearm strap.
Radial head subluxation	<ul style="list-style-type: none"> - "Nursemaid elbow"; HY for 2CK Peds. - Child stops using arm + arm pronated and partially flexed. - Hx of child having arm pulled/yanked, or child holding hands and running with older sibling + the child falls, resulting in elbow pull. - Tx = hyper-pronation, OR supination when arm partially flexed. Either is correct. Both will not be listed at the same time as answers.
Olecranon bursitis	<ul style="list-style-type: none"> - Elbow pain, usually following contact injury. - Tx = compression bandage + NSAIDs. Steroid injection is wrong answer on USMLE.
Trochanteric bursitis	<ul style="list-style-type: none"> - Vignette will be lateral hip pain that is worsened with palpation + lying on one's side in bed. - Tx = NSAIDs.
Septic bursitis	<ul style="list-style-type: none"> - USMLE will give inflammation of knee joint that sounds like septic arthritis, but they will say there's no joint effusion. This is how it presents in a 2CK NBME vignette, where students constantly ask "why not septic arthritis?" And they say in the vignette there's no joint effusion. - Tx = antibiotics.
Prepatellar bursitis	<ul style="list-style-type: none"> - Aka housemaid's knee; presents as anterior knee pain in people who are frequently on their knees (painters, plumbers, etc.). - Tx = NSAIDs.
Patellar tendonitis ("Jumper's knee")	<ul style="list-style-type: none"> - Inflammation of patellar tendon. - The answer on USMLE if they describe anterior knee pain that initially occurs only after finishing sports (e.g., basketball game), then progresses to more chronic pain. - Tx on NBME = "quadricep strengthening exercises."
Patellofemoral instability	<ul style="list-style-type: none"> - Presentation is annoyingly similar to patellar tendonitis, but do not confuse.

	<ul style="list-style-type: none"> - Patellofemoral instability is misalignment of the patella at the trochlear groove of the femur. - Q can mention crepitus. - Shows up on 2CK Peds CMS form 6 as teenage girl who has knee pain worse after jumping or running + has crepitus → answer = "patellofemoral instability" (patellar tendonitis / "jumper's knee" not listed as answer).
Patellofemoral pain syndrome	<ul style="list-style-type: none"> - Aka chondromalacia patellae; name implies softening of cartilage in the knee. - The answer on NBME if they say pain that worsens when sitting for long periods of time, or when going up or down stairs. - Classic in obesity or those who squat heavy weight (knees think you're obese). - Tx = quadriceps strengthening exercises.
Anterior cruciate ligament injury	<ul style="list-style-type: none"> - ACL is answer if (+) anterior drawer test or Lachman test → excessive anterior displacement of tibia relative to femur. - Classically injured when knee is hyper-extended, or with a rotational force on a fixed, planted knee.
Posterior cruciate ligament injury	<ul style="list-style-type: none"> - PCL is answer if (+) posterior drawer test → excessive posterior displacement of tibia relative to femur. - Classically injured when knee hits the dashboard in car accident.
Lateral collateral ligament injury	<ul style="list-style-type: none"> - LCL is the answer if varus test induces excessive lateral motion of the knee compared to the unaffected side. - Varus test = hand placed on medial knee and pushing outward + other hand placed on lateral ankle and pushing inward.
Medial collateral ligament injury	<ul style="list-style-type: none"> - MCL is the answer if valgus test induces excessive medial motion of the knee compared to the unaffected side. - Valgus test = hand placed on lateral knee and pushing inward + other hand placed on medial ankle and pulling outward.
Lateral meniscal tear	<ul style="list-style-type: none"> - Lateral knee pain where patient experiences "locking" or "catching" of the knee in partial flexion. - Diagnosed with McMurray test → internal rotation of leg with concurrent knee extension causes lateral knee pain / "catching."
Medial meniscal tear	<ul style="list-style-type: none"> - Medial knee pain where patient experiences "locking" or "catching" of the knee in partial flexion. - Diagnosed with McMurray test → external rotation of leg with concurrent knee extension causes medial knee pain / "catching."
"Unhappy triad"	<ul style="list-style-type: none"> - Refers to a trio injury of the ACL, medial collateral ligament, and either the medial or lateral meniscus. - Students are sometimes fanatical about this triad as though it has yieldness. USMLE doesn't give a fuck. I cannot recall a single NBME question that has ever assessed this. This Dx primarily resides within the domain of Qbank, not the NBME.
Pes anserine bursitis	<ul style="list-style-type: none"> - The answer on USMLE if patient has inferomedial knee pain.
Iliotibial band syndrome	<ul style="list-style-type: none"> - The answer on USMLE if they say lateral knee pain, usually in a runner. - Iliotibial band runs from the hip to the knee. Pain may occur anywhere along the hip, lateral thigh, and lateral knee, but is worst in the latter. - Tx = conservative with physiotherapy; NSAIDs for pain.
Osgood-Schlatter disease	<ul style="list-style-type: none"> - Buzzy vignette is knee pain in fast-growing teenage male who plays soccer. Don't pigeon-hole things, but that's classic vignette. - Inflammation of the patellar ligament at the tibial tuberosity. - Mechanism is repeated stress on the growth plate of the superior tibia.
Plantar fasciitis	<ul style="list-style-type: none"> - The answer on USMLE if they give severe heel pain that is worst when first getting out of bed in the morning.
Morton neuroma	<ul style="list-style-type: none"> - The answer on USMLE if patient has pain + abnormal growth occurring between the 2nd and 3rd metatarsals, usually worsened with high-heel shoes. - Benign growth/tumor of intertarsal nerve; cause is idiopathic. - First step in diagnosis is x-ray to rule out arthritis + fractures. Ultrasound is then done to confirm Dx, which will show thickening of interdigital/intertarsal nerve. - Tx = orthotics (comfortable shoes) + steroid injection.

Neurogenic joint	<ul style="list-style-type: none"> - Aka Charcot joint, where patient injures joint due to lack of joint sensation from peripheral neuropathy. - Usually seen in diabetes; can also be seen in neurosyphilis. - The answer on USMLE when they say diabetic patient has "disorganization of the tarsometatarsal joints" on foot x-ray.
Growing pains	<ul style="list-style-type: none"> - No, this is not a joke. This is the answer straight-up on a 2CK NBME form. - Vignette is healthy child age 3-12 who awakens from sleep with throbbing pain in the legs. - No treatment necessary. You just need to know this Dx exists and isn't a troll.
Tibia vara	<ul style="list-style-type: none"> - Aka Blount disease.  <ul style="list-style-type: none"> - Bowing of the tibias after the age of 2 years in a patient whom rickets has been ruled out. - Can be unilateral or bilateral. - Bowing of one or both tibias is sometimes normal until age 2 years. - Treatment is surgery (osteotomy).
Talipes equinovarus	<ul style="list-style-type: none"> - Aka clubbed foot.  <ul style="list-style-type: none"> - USMLE just wants you to know that this is treated initially with serial casting. - Usually idiopathic; can be seen in Potter sequence. - Not the same as rocker-bottom foot (aka congenital vertical talus), seen in Edward syndrome.
Arthrogryposis	<ul style="list-style-type: none"> - You just need to know this is fancy name for a child born with multiple joint contractures. - If they give you a child with not just a clubbed foot, but also knee and/or elbow contractures, etc., the answer is arthrogryposis.

- 34M + left knee pain that is worse when sitting for long periods of time, or when going up or down stairs; Q asks for treatment → answer = “quadriceps strengthening exercises”; diagnosis is chondromalacia patellae (aka patellofemoral pain syndrome).
- 50M + started playing recreational basketball two years ago + knee pain initially worse with activity but now is present even when not playing; Q wants diagnosis → answer = patella tendonitis (“Jumper’s knee”).
- 16F + plays volleyball + pain in knee past 6 weeks worse when running or jumping + exam shows crepitus; Q wants diagnosis → answer = “patellofemoral instability” (patellar tendonitis / “jumper’s knee” not listed as answer); shows up on 2CK CMS Peds form 6.
- 65M + Q gives big paragraph of unnecessary info + they tell you guy has lateral hip pain that is worse when palpated and while lying on his side in bed; Q just asks diagnosis → answer = trochanteric bursitis.
- 50M + started playing recreational basketball two years ago + knee pain worse with activity but now is present even when not playing; patient had fracture to proximal tibia 30 years ago that was treated with open reduction and internal fixation; x-ray shows varus deformity of knee; Q wants diagnosis → answer = post-traumatic arthritis, not patella tendonitis.
- 28M + playing football + injures knee + increases anterior displacement of tibia on examination; Q wants to know what is injured on the following MRI:



- Answer = anterior cruciate ligament (choice B). A = femur; C = PCL; D = tibia.
- 39M + right knee pain + started after working on his knees while fixing kitchen sink; Q asks next best step in management → answer = ibuprofen; diagnosis is prepatellar bursitis ("housemaid's knee").
- 34F + painful, red, warm knee + joint aspiration shows no effusion; Q asks most likely diagnosis → answer = septic bursitis; vignette will sound like septic arthritis, but there will be no effusion.
- 15M + plays a lot of soccer + 5'11" + painful knee; Q wants mechanism of pathology → answer = inflammation of patellar ligament at tibial tuberosity; diagnosis is Osgood-Schlatter.
- 22M + plays basketball + right heel pain for 5-10 minutes after getting out of bed in the morning; Q asks mechanism of pathology → answer = inflammation of planta fascia.
- 16F + in car accident + hits her left knee on the dashboard + physical exam shows excessive posterior displacement of the tibia; Q asks for diagnosis → answer = PCL injury (dashboard injury).
- 19M + hurt his knee wakeboarding + physical exam shows excessive motion of lateral aspect of knee when pressure applied to medial knee; Q asks diagnosis → answer = lateral collateral ligament injury; test described is the varus test.
- 24M + hurt his knee wakeboarding + medial knee pain + vignette mentions "catching" or "locking" of the knee; Q wants diagnosis → answer = medial meniscal tear.
- 6F + awakens from sleep with terrible throbbing in her legs + 60th percentile for height and weight; Q asks diagnosis (and they list like 15); answer = growing pains; no treatment necessary.
- 4M + serum vitamin D is normal + x-ray is shown below; Q wants diagnosis:



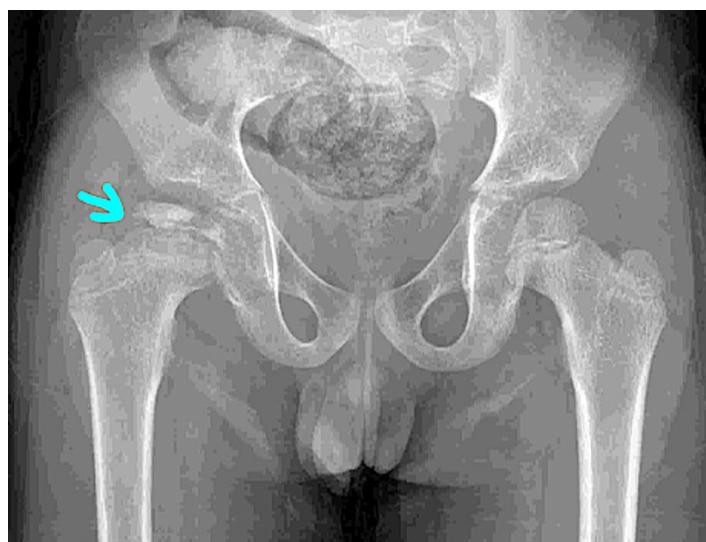
- Answer = tibia vara (Blount disease); bowing of the tibias can be normal up until age 2; after age 2 it is called tibia vara, if rickets has been excluded. 2CK Peds forms will write the answer as "tibia vara," not Blount disease.
- 65M + BMI 30 + pain on the inner side of the left knee a few centimeters below the kneecap; Q wants diagnosis → answer = pes anserine bursitis; the answer on USMLE if they give inferomedial knee pain.
- Neonate born at term + perfectly healthy + feet bent inward; Q wants to know treatment → answer = serial casting; observation is wrong answer; diagnosis is talipes equinovarus (clubbed feet).
- Neonate born at term + clubbed feet + multiple joint contractures; Q asks for diagnosis → answer = arthrogryposis.
- 44F + wears high-heels + has severe pain under foot along the 2nd and 3rd metatarsals; Q asks for treatment → answer = orthotics first, then steroid injection second; Dx is Morton neuroma.
- 70M + long-standing diabetes + pain and ulceration of foot + x-ray shows disorganization of the tarsometatarsal joints; Q wants most likely explanation for these findings; answer = "absence of normal joint sensation"; Dx is neurogenic joint (aka Charcot joint).

HY Pediatric hip disorders for USMLE	
Primary hip dysplasia	<ul style="list-style-type: none"> - Aka developmental dysplasia of the hip. - Mechanism is "poorly developed acetabulum." - Initial diagnosis is with Ortolani and Barlow maneuvers, where a "clicking and clunking" is elicited on physical exam. - After the O&A maneuvers, next best step is ortho referral. Sounds wrong, but if it's listed, it's the answer before going to imaging. - Definitively diagnose with hip ultrasound if <6 months of age; hip x-ray if >6 months of age. - Treatment is "abduction harness," aka Pavlik harness, which positions the child's legs in a frog-leg-appearing manner.
Legg-Calve-Perthes	<ul style="list-style-type: none"> - Aka idiopathic avascular necrosis of the femoral head. - If the etiology for the avascular necrosis is known (i.e., Gaucher, sickle cell, corticosteroids), then the diagnosis is just "avascular necrosis," not LCP. - Vignette will be child 5-8 years old with hip pain. - First step in diagnosis is hip x-ray, which will show a "contracted" or flattened femoral head. The word "contracted" is HY and synonymous with avascular necrosis. - If x-ray is negative, diagnose with bone scan or MRI (on 2CK Peds form). - Tx = hip replacement.
Slipped capital femoral epiphysis (SCFE)	<ul style="list-style-type: none"> - Classic vignette is a 10-13-year-old (pre-adolescent) overweight boy with a painful limp. - NBME will write answer / mechanism as "displacement of the epiphysis of the femoral head." - Resources tend to emphasize obesity as the main risk factor, but maybe only ~1/2 of NBME Qs for SCFE give the child as overweight. This causes problems for students, where they rely on seeing high BMI to think SCFE.

	<ul style="list-style-type: none"> - This has led me to conclude that the age matters the most, since they will always give a kid who's about 10-13-ish. If they give you a kid who's younger, think LCP instead. - 2CK NBME Q gives 13M with painful gait + no mention of weight → answer is SCFE. - Another 2CK Q outright says BMI 20 in a 13-year-old who's 6 feet tall, and answer is SCFE. - X-ray shows "ice cream falling off the cone." - Offline 2CK gives Q where they say x-ray in 5-year-old shows "contracted capital femoral epiphysis" → answer is LCP, not SCFE. As I said above, "contracted" is HY for LCP. In this case, the younger age + the word "contracted" win over the words "femoral capital epiphysis." <p>Tx = surgical pinning.</p>
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- 4-month-old boy + clicking and clunking on physical examination; Q wants next best step in imaging → answer = ultrasound; diagnosis is primary hip dysplasia; do ultrasound under 6 months; x-ray over 6 months.
- 4-month-old boy + clicking and clunking on physical examination; Q wants next best step in management → answer = ortho referral; ultrasound is wrong answer. Referrals in general sound wrong for USMLE, but you need to know this exception in the case of primary hip dysplasia.
- 7-month-old boy + clicking and clunking on physical examination; Q asks, in addition to ortho referral, what is next best step in management → answer = x-ray; ultrasound is wrong answer.
- 4-month-old girl + clicking and clunking on physical exam; Q asks for mechanism of patient's condition → answer = "poorly developed acetabulum."
- 4-month-old girl + clicking and clunking on physical exam + ultrasound of hip shows poorly developed acetabulum; Q asks for next best step in management → answer = abduction harness; students tend to memorize "Pavlik harness," but you need to know USMLE often writes this as "abduction harness."
- 5M + right hip pain + walks with limp + x-ray shows contracted capital femoral epiphysis; Q asks straight-up for diagnosis → answer = Legg-Calve-Perthes, not SCFE. Once again, it's on the NBME exam, so if you think it's weird or disagree, don't take it up with me; take it up with NBME.
- 8M + sickle cell disease + painful hip pain and limp; Q asks diagnosis → answer = "avascular necrosis"; Legg-Calve-Perthes is wrong answer; remember that LCP is *idiopathic* avascular necrosis; if the cause is known (i.e., sickle cell, Gaucher, corticosteroids), LCP is wrong.

- 8M + hepatomegaly + hip pain + macrophages with wrinkled tissue appearance; Q asks mechanism for disorder → answer = deficiency of glucocerebrosidase; diagnosis is Gaucher disease; for Gaucher, you just need to know it's the answer if you get a glycogen storage disease + a bone problem.
- 9F + painful left hip + x-ray shows no abnormalities + diagnosis is made using bone-scan; Q just asks the most likely diagnosis → answer = Legg-Calve-Perthes; x-ray can be negative initially; in this case, the next best step is bone-scan or MRI.
- 7F + hip pain + x-ray is shown below; Q asks for diagnosis:



- Answer = Legg-Calve-Perthes; student says, "No idea what I'm looking at." Relax. If we try to imagine, the right femoral head (left side of image) looks "contracted" or "flattened." Once again, this is HY and buzzy for avascular necrosis.
- 59F + advanced rheumatoid arthritis managed with multiple medications + MRI of pelvis is shown; Q wants diagnosis:



- Answer = avascular necrosis; etiology is chronic corticosteroids in the setting of advanced autoimmune disease; the right femoral head (left side of image) appears hypointense (more black). The necrotic / lack of bone in the black superior portion of the femoral head means the remaining white part of the femoral head is “flattened” or “contracted.” The left femoral head (right side of image) shows a small area of necrosis as well (black medial portion).
- 13M + left hip pain + walks with antalgic gait + 95%tile for weight; Q asks mechanism for patient’s condition → answer = “displacement of the epiphysis of the femoral head”; diagnosis is SCFE; classic vignette is overweight pre-adolescent boy with a painful limp; “antalgic gait” just means walking with a painful limp; it is non-specific and I’ve seen this descriptor used in LCP vignettes as well.
- 12M + left hip pain + BMI 20 + 6’0” + x-ray is shown below; Q asks diagnosis:



- Answer = slipped capital femoral epiphysis; x-ray shows the “ice cream slipping off its cone”; student is confused because the Q says BMI is normal; as I said earlier, although the kid being overweight is HY and buzzy, plenty of NBME Qs either don’t mention the BMI or will say it’s normal; it’s the **age** that matters (i.e., 10-13).
- “Do I need to know the mechanism of PTH on bone?” → Yes, it’s HY.
 - PTH binds to **osteoblasts**, not -clasts. This sounds paradoxical, since osteoblasts build bone and PTH has the role of causing bone resorption (in order to increase serum calcium).
 - After PTH binds to the **osteoblast**, it will express RANK-ligand (RANK-L) on its cell surface.
 - RANK-L then binds to RANK receptor on osteoclasts, which in turn resorb (break down) the bone.

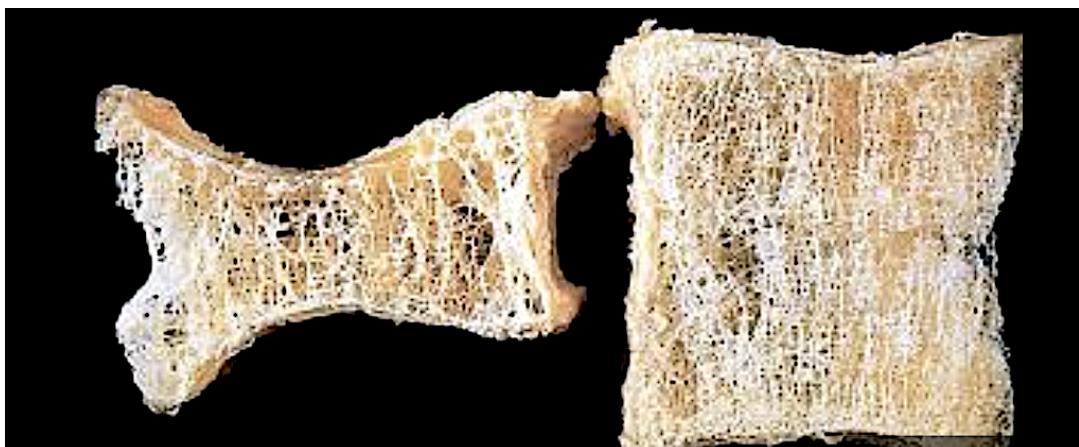
- “What do I need to know about OPG in relation to RANK-L. Can you quickly clarify.”
 - Osteoprotegerin (OPG) is protective of bone loss. It is a RANK receptor decoy (i.e., it looks like RANK receptor), and therefore acts as an endogenous competitive inhibitor of RANK-L.
 - In other words, if more OPG is present, then RANK-L will bind to OPG instead of RANK receptor, thereby resulting in less osteoclast activation and less bone resorption.
 - OPG is suppressed by cytokines (namely IL-1). Therefore, too much cytokine activity can cause osteoporosis. In fact, IL-1 is also known as osteoclast-activating factor.
 - Estrogen suppresses cytokine activity (IL-1) on bone, resulting in an increased OPG/RANK-L ratio and lower risk of bone resorption. In post-menopausal state, ↓ estrogen → ↓ suppression of IL-1 on bone → ↓ OPG/RANK-L ratio → ↑ bone resorption → osteoporosis.
- “What do I need to know about alkaline phosphatase (ALP) and bone?”
 - USMLE really wants you to know that increased **osteoblast** activity causes high ALP. This is why ALP levels go up when PTH is high, or why ALP is elevated in Paget disease of bone.
 - There is Q on one of the Step 1 NBMEs where they give weird craniofacial syndrome + serum ALP is low; they ask what cell is defective → answer = osteoblast; students have freaked out to me over this Q (“We need to know this crazy/weird syndrome??”) → No. The syndrome is irrelevant. The Q says low ALP, so they just want the osteoblast as the cell that’s fucked up.

HY Bone density/architectural conditions	
Osteoporosis	<ul style="list-style-type: none"> - Bone density >2.5 SD below the mean as compared with young adult woman. Osteopenia is 1.5-2.5 SD below the mean. - Bone densitometry done at age 65 (2CK Family medicine). - If Q forces you to choose between female gender and age as most important risk factor, choose female gender. - If Q gives you a female and forces you to choose between family history and age, choose family history. - Males are unlikely to develop osteoporosis, even with family history of females with the disorder. - If Q gives two women without family history and asks what is most protective against osteoporosis, answer is ethnicity. Black race is protective against osteoporosis. - If Q gives old woman who has femoral fracture + no mention of osteoporosis in the question, answer = “activity level before fracture” as most important predictor of success in the rehabilitation of the patient → weight-bearing exercise during life is protective against osteoporosis later. - USMLE loves corticosteroids and Cushing as causes of osteoporosis. - Compression fractures = osteoporosis on USMLE; e.g., patient with RA on steroids who has compression fracture → easy Dx of osteoporosis. - As discussed above, USMLE loves cytokine effect on bone causing osteoporosis; they will show a highly trabecular/hollowed out vertebral body, then ask what caused this → answer = “IL-1” straight up.

	<ul style="list-style-type: none"> - Low/low-normal BMI causing osteoporosis is HY; 2CK NBMEs have a couple of nonsense Qs where they give BMI of 19 and 20 in young woman, where they ask what patient is at increased risk of; answer = osteoporosis. Student says, "Wait, but isn't low BMI under 18.5?" I agree. But it's on NBME. - Metatarsal stress fracture HY in low-BMI young female runners who have low bone density. - USMLE also is known to assess low vitamin D in the setting of intestinal malabsorption (i.e., CF, Crohn) as cause of osteoporosis, even though that makes no sense, since low Vit D causes osteomalacia. - Serum calcium, phosphate, PTH, and ALP are all normal in osteoporosis. - Tx = weight-bearing exercise first (NBME has "go for a long walk outside daily" as correct; wrong answer = "increase participation in swimming pool-based exercise classes to at least three times weekly"). - Calcium and vitamin D are the first medical / pharmacologic treatment. - Bisphosphonates can be used after Ca^{2+}/VitD. - Teriparatide is an N-terminus PTH analogue that stimulates bone development. - Denosumab is a RANK-L monoclonal antibody.
Osteomalacia/ Rickets	<ul style="list-style-type: none"> - Osteomalacia = vitamin D deficiency in adults; rickets = vitamin D deficiency in children. - Rickets = craniotabes (soft skull), rachitic rosary (bony knobs at costochondral junctions), genu varum (bowing of tibias). - Osteomalacia means softening of bone; activated vitamin D (1,25) is necessary to convert unmineralized osteoid into mineralized hydroxyapatite, therefore hardening bones. - In both rickets and osteomalacia, patient will have "increased unmineralized osteoid," or "deficient mineralization of osteoid." - Important cause of Vit D deficiency on USMLE is intestinal malabsorption (i.e., CF, Crohn). Chronic pancreatitis (pancreatic burnout leading to steatorrhea) also HY. - Renal failure leading to osteomalacia (due to \downarrow synthesis of 1,25) is called renal osteodystrophy; if they ask the bone condition patient has in renal failure, choose osteomalacia. - "Pseudofracture" on x-ray is buzzy finding in osteomalacia/rickets. - Patients have $\downarrow \text{Ca}^{2+}$, $\downarrow \text{PO}_4^{3-}$, $\uparrow \text{PTH}$ (due to \downarrow negative feedback at parathyroid glands). - I discuss vitamin D metabolism and PTH/endocrine relationships in high detail in the HY Arrows PDF.
Osteopetrosis	<ul style="list-style-type: none"> - Osteoclast dysfunction resulting in recurrent fractures in children due to bone density being too high. Sounds weird, but bone strength is based on balanced internal architecture of canals and networks, not just density alone. - HY DDx against osteogenesis imperfecta and child abuse. - Osteoclast dysfunction is due to deficiency of carbonic anhydrase II. This enzyme inside osteoclasts normally allows osteoclasts to form H^+ to resorb bone. - Granulocyte-macrophage colony-stimulating factor (GM-CSF) causes the differentiation of osteoclast precursors into osteoclasts. This is asked on one of the Step 1 NBME forms, where they give osteopetrosis and ask something along the lines of, "The cell lineage that's fucked up in this condition requires which of the following" → answer = GM-CSF.
Osteogenesis imperfecta	<ul style="list-style-type: none"> - Collagen I defect that results in recurrent fractures in a child; important DDx are child abuse and osteopetrosis. - Blue sclerae too buzzy and often not mentioned. - Conductive hearing loss due to defective ossicles (middle ear bones). - Many different types of OI, some resulting in miscarriage. Harder vignette can mention child with multiple fractures, where the mom has Hx of recurrent miscarriage.
Paget disease	<ul style="list-style-type: none"> - Idiopathic disorder of increased bone turnover. Bone is described as having mixed osteoblastic and -clastic phases, where bone appears heterogenous on x-ray. - Buzzy vignette is male over 50 who's hat doesn't fit him anymore + has tinnitus (narrowing of acoustic foramina). - 19/20 questions will give isolated increase in serum ALP. You need to know Ca^{2+}, PO_4^{3-}, and PTH are all normal in Paget disease. There is one Q on a 2CK CMS form where ALP is given as not elevated, but it's a one-off Q and rare.

	- High-output cardiac failure can occur due to intraosseous AV-fistulae, where patient has an S3 heart sound with high, rather than low, ejection fraction.
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- 62F + shows graph with lines of bone density for two different women without family history of osteoporosis; Q asks what is the reason why one woman has higher bone density than the other → answer = ethnicity; black race is protective against osteoporosis.
- 64F + image of vertebral column shown below; Q asks what is responsible for this patient's condition:



- Answer = Interleukin-1; IL-1 is aka osteoclast-activating factor; post-menopausal state → ↓ estrogen → ↓ suppression of cytokines (namely IL-1) on bone → ↓ OPG/RANK-L ratio → ↑ bone resorption → osteoporosis.
- 22F + runs a lot + BMI 20 + no other issues; Q asks what patient is at increased risk for → answer = osteoporosis; makes no sense, as BMI isn't low, but this is asked on 2CK NBME form.
- 34M + bitemporal hemianopsia + 20-lb weight gain past 6 months + compression fracture; Q asks what the tumor is secreting → answer = ACTH; patient has Cushing disease; cortisol can cause osteoporosis; compression fracture = osteoporosis on USMLE; student asks, "But why can't TSH be the answer? Can't hyperthyroidism cause osteoporosis?" → Two points: 1) Patient here has weight gain, not weight loss. If patient has hyperthyroidism, we wouldn't have weight gain; 2) Despite this notion that hyperthyroidism could in theory cause osteoporosis, I've never seen that assessed on NBME material.
- 72F + fractures femur + no mention of osteoporosis; Q asks, during the rehabilitation process, what is the most important predictor of success in this patient → answer = "activity level before the fracture" → protective of bone density / osteoporosis.

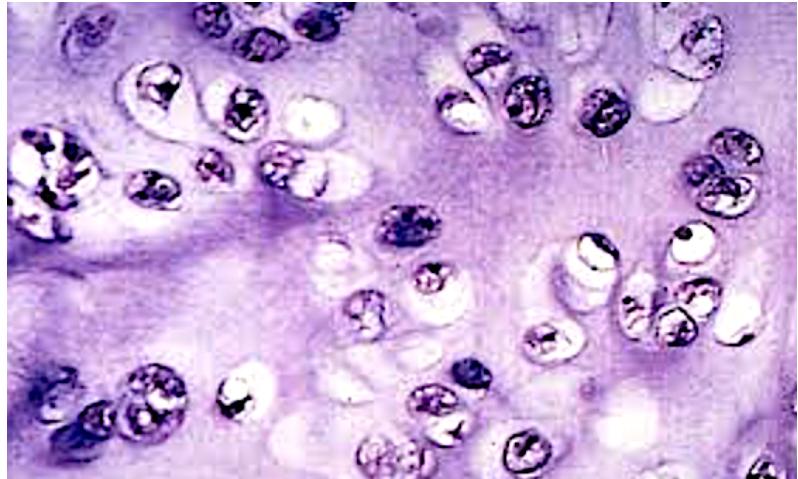
- 4M + came to USA from Ireland with parents one year ago + has bowed tibias; Q asks serum calcium, phosphate, and PTH → answer = low calcium, low phosphate, high PTH; diagnosis is rickets with genu varum.
- 70F + type II diabetes + renal failure + left hip pain; Q asks most likely MSK diagnosis → answer = osteomalacia; renal failure causes low vitamin D, resulting in osteomalacia; renal osteodystrophy = osteomalacia cause by renal failure.
- 70F + renal failure + left hip pain + x-ray shows pseudofracture; Q asks what's most likely responsible for this patient's condition → answer = "decreased intestinal absorption of calcium"; we have osteomalacia due to low 1,25-D3, causing reduced intestinal absorption. "Pseudofracture" is buzzy for osteomalacia.
- 70F + left hip pain + x-ray shows pseudofracture; Q asks arrows for calcium, phosphate, PTH, and calcitriol → answer = low calcium, high phosphate, high PTH, low calcitriol (aka 1,25-D3); even though vitamin D is low, **phosphate is always high in renal failure**; so even though, yes, vitamin D deficiency causes low calcium and low phosphate in the setting of rickets/osteomalacia, if the patient has renal failure, the renal failure "wins" when it comes to phosphate. Exceedingly HY.
- 3M + recurrent fractures + increased bone density; Q asks which type of molecular signaling is fucked up → answer = GM-CSF; diagnosis is osteopetrosis, which is caused by either deficiency of carbonic anhydrase II, or a problem with GM-CSF signaling; osteoclasts are defective.
- 6M + recurrent fractures + engages well with the parents + mom has history of recurrent miscarriages; Q asks mechanism for patient's condition → answer = "defect of procollagen synthesis"; diagnosis is osteogenesis imperfecta (collagen I gene mutation); USMLE doesn't actually care about the exact collagen step that is defective; the answer will be the only one that refers to collagen.
- 56M + tinnitus in left ear + S3 heart sound + ejection fraction 70% (NR 55-70); Q asks next best step in management → answer = "check serum ALP levels"; diagnosis is Paget disease of bone; almost all Qs will give isolated increase in serum ALP (calcium, phosphate, and PTH are normal); high-output cardiac failure can occur from intraosseous AV fistulae.
- 16M + falls off bike while BMX dirt jumping + broken radius + cast applied + now has acutely increased severe pain in arm; Q asks for most likely diagnosis → answer = compartment syndrome; although circumferential burns are fixated on as hyper-HY for compartment syndrome on USMLE, it's

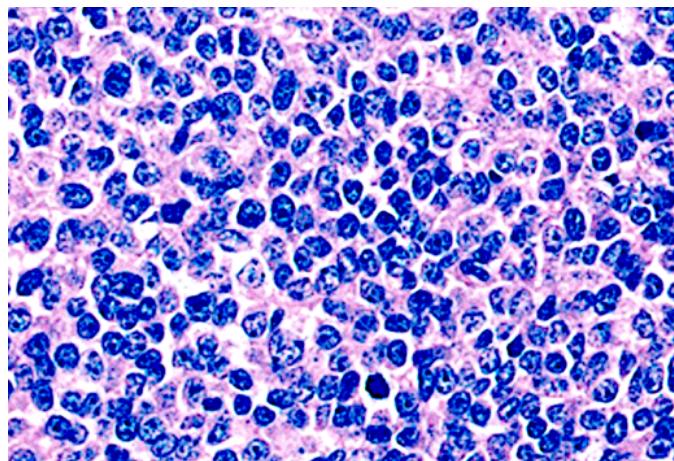
to my observation NBME cares less about this and more about **acute casting** as the highest yield cause. If a limb is placed in a cast before swelling has maximized, compartment syndrome can result, where the patient experiences increasingly severe pain and paresthesias of the limb

- 20M + housefire + 3rd-degree burns all over legs + severe pain in left leg; Q asks for next best step → answer = “measure compartment pressures”; treatment is then “fasciotomy.”
- 67F + ruptured diverticulitis + undergoes laparotomy; 12 hours after procedure, there is oozing from suture site + partial dehiscence; Q just asks diagnosis → answer = “abdominal compartment syndrome” → occurs when intra-abdominal pressure rises, causing multi-organ dysfunction → can be due to peritonitis with edema, as well as massive volume resuscitation. Essentially, just know compartment syndrome isn’t limited to the limbs – i.e., abdominal compartment syndrome “is a thing” / exists.
- 34F + central chest pain + worsens when reaches behind her back and over her head + pain on palpation; Q wants diagnosis → answer = costochondritis; any chest pain on USMLE that worsens with change in positioning (except pericarditis, which worsens when leaning back), think MSK etiology – i.e., costochondritis.
- 34F + pain in chest + worse when reaching behind her back and over her head + there is no pain on palpation; Q wants treatment → answer = NSAIDs; diagnosis is costochondritis. I’ve seen NBME Qs where they mention pain that changes with position **and/or** with palpation – i.e., it need not be both.
- 25M + recently recovered from viral infection + severe right lateral chest pain + no friction rub + increased serum creatine kinase; Q wants diagnosis → answer = pleurodynia; this is asked on 2CK FM forms. Despite the name, this has nothing to do with the lungs/pleura. It is intercostal muscle spasm following viral infection (i.e., viral myalgia) that presents as lateral chest pain; CK can be elevated due to increased muscle tone.
- 47M + alcoholic + found on bench in park + urine dipstick shows 2+ blood + urine RBCs negative; Q wants most likely diagnosis → answer = rhabdomyolysis; alcoholic is huge risk factor; urinalysis classically shows false-positive blood on dipstick, where the dipstick can’t differentiate between free myoglobin and RBC hemoglobin, but light microscopy will be negative.
- 47M + alcoholic + found on bench in park + serum potassium elevated + urine shows brown pigmented casts; Q wants most likely diagnosis → answer = rhabdomyolysis; urine can be either false-

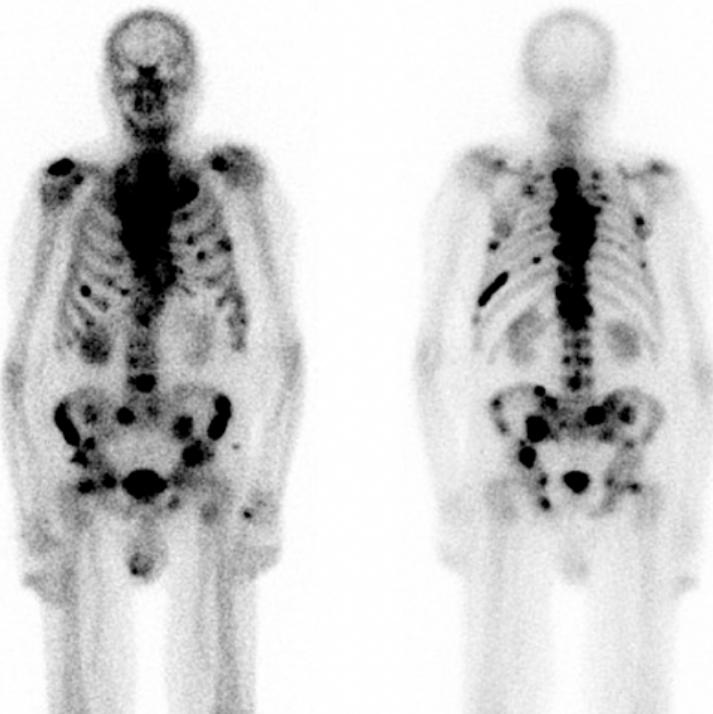
positive blood on dipstick or characteristic of acute tubular necrosis (i.e., brown pigmented casts, or dirty/muddy brown granular casts).

- 82F + found on floor in house by the staircase + 1+ blood on urine dipstick + urine light microscopy shows 3-4 RBCs/hpf; Q wants diagnosis → answer = rhabdo. You need to know 3-4 RBCs/hpf is still considered negative. This is on 2CK CMS forms and students get it wrong thinking that 3-4/hpf isn't considered negative, but it is.
- "What do I need to know about bone tumors?"

HY bone tumor points for USMLE	
Chondrosarcoma	<ul style="list-style-type: none"> - Highest yield bone tumor for USMLE. - Can occur in any long bone, as well as the pelvis/hip. - USMLE describes it as "glistening" or "shiny" in appearance. - The histo image below is highest yield bone tumor image on USMLE. I've seen this described in NBME answer choices as "neoplastic chondrocytes embedded in lacunae," or "neoplastic chondrocytes filling lacunae." <div style="text-align: center; margin-top: 10px;">  </div> <ul style="list-style-type: none"> - This image shows up across numerous NBME and COMP exams. - I've seen chondrosarcoma on Step 1 NBME written as "neoplastic chondrocytes filling lacunae."
Osteosarcoma	<ul style="list-style-type: none"> - Most common primary bone cancer; usually in patients age 10-30. - <i>Rb</i> mutations (congenital retinoblastoma) are associated with osteosarcoma (HY) – i.e., 1-year-old boy has enucleation of eye for retinoblastoma; what is he at risk of developing later in life? → answer = osteosarcoma. - Can also occur in Paget disease of bone patients (older age). - Buzzy findings are "Codman triangle" and "Sunburst appearance." - Codman triangle = periosteal reaction with lifting of periosteum off the bone. - Sunburst appearance = periosteal reaction described on NBME as "spiculated new born formation."

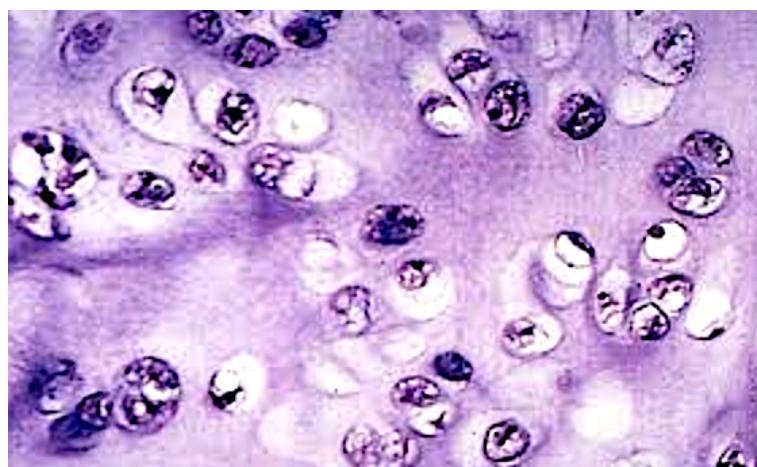
	
	<ul style="list-style-type: none"> - The white arrow is the Codman triangle; the white star is the sunburst appearance. - I've seen osteosarcoma on Step 1 NBME written as "pleomorphic neoplastic cells producing new woven bone" as correct answer choice.
Ewing sarcoma	<ul style="list-style-type: none"> - The answer on USMLE if they give bone tumor in a child that presents similarly to osteomyelitis (i.e., fever and bone pain in a kid). - If bone scan is performed, it is most likely to show uptake in the diaphysis; in contrast, osteomyelitis will show uptake in the metaphysis. - Histo will show "small blue cells of neuroendocrine origin" and/or "onion-skinning." - I've seen an NBME answer choice say "closely packed, small, round, uniform neoplastic cells." 
	<ul style="list-style-type: none"> - Associated with t(11;22) translocation; don't confuse this with the 22q11 deletion in DiGeorge syndrome.
Osteoid osteoma	<ul style="list-style-type: none"> - The answer on USMLE if they give a bone tumor that presents with pain relieved with NSAIDs.
Osteoma	<ul style="list-style-type: none"> - The answer on USMLE if they give a bone tumor in Gardner syndrome (Familial adenomatous polyposis + soft tissue tumors [usually osteomas or lipomas]). - Benign bone tumors that usually grow from the skull.
Giant cell tumor	<ul style="list-style-type: none"> - Aka osteoclastoma. - Age of onset usually 20-40. - Has a "soap bubble" appearance.

	
Unicameral bone cyst	<ul style="list-style-type: none"> - Underrated diagnosis for USMLE. Asked on 2CK exam. - Benign bone tumor that looks similar to osteoclastoma but age of onset usually birth to age 20, rather than 20-40. 
	<ul style="list-style-type: none"> - Unicameral means “one chamber”; it is fluid-filled.
Metastases	<ul style="list-style-type: none"> - USMLE loves cancer mets to the vertebrae, particularly breast, prostate, and lung mets. - The exam will not show images of spinal cancer mets, but they will give vignette of either lytic lesions of vertebrae in patient with background of cancer, or will give neurologic syndrome (i.e., of cauda equina). - Diffuse bone pain in patient with background of cancer = mets.

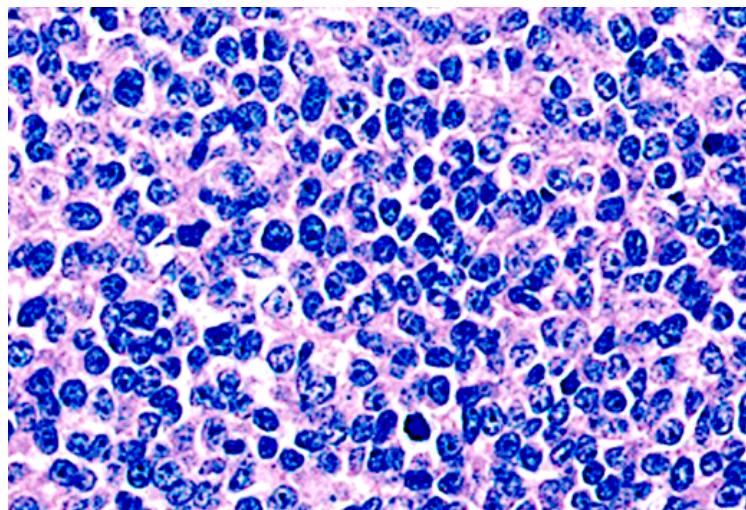


- Above image shows Technetium-99 bone scan of cancer mets. Similar imaging is on 2CK IM forms for prostate mets.

- 1-year-old boy + leukocoria (white pupil) + Q wants to know what he is most likely to develop later in life → answer = osteosarcoma; diagnosis is congenital retinoblastoma; *Rb* mutations cause both retinoblastoma as well as osteosarcoma.
- 20M + pain in left distal femur + x-ray shows elevation of periosteum and spiculated new bone formation; Q wants diagnosis → answer = osteosarcoma; elevation of periosteum = Codman triangle; spiculated new bone formation = sunburst appearance.
- 61M + pain in left hip + histo image below; Q just asks for diagnosis straight-up:



- Answer = chondrosarcoma; easy if you know this HY image.
- 54M + pain in right hip + x-ray shows tumor + biopsy shows glistening / shiny lesion; Q wants to know what is most likely to be characteristic of this lesion → answer = “chondrocytes embedded in lacunae”; diagnosis is chondrosarcoma.
- 25F + pain in proximal tibia + x-ray shows lesion + pain is relieved with ibuprofen; Q wants diagnosis → answer = osteoid osteoma; this is the answer on USMLE if they give a bone tumor where the pain is relieved with NSAIDs.
- 18F + 1-cm hard mass growing from skull + father died of colon cancer at age 32; Q wants diagnosis → answer = Gardner syndrome presenting with osteoma. Gardner syndrome = familial adenomatous polyposis + either osteoma or lipoma.
- 12M + fever 101 F + pain in left forearm + bone scan shows uptake in the diaphysis; Q asks diagnosis → answer = Ewing sarcoma; can present similarly to osteomyelitis, except bone scan is more likely to show uptake in the diaphysis; in osteomyelitis, the uptake is in the metaphysis.
- 12M + fever 101 F + pain in left forearm + biopsy with histo image of lesion shown below; Q asks for the genetics:



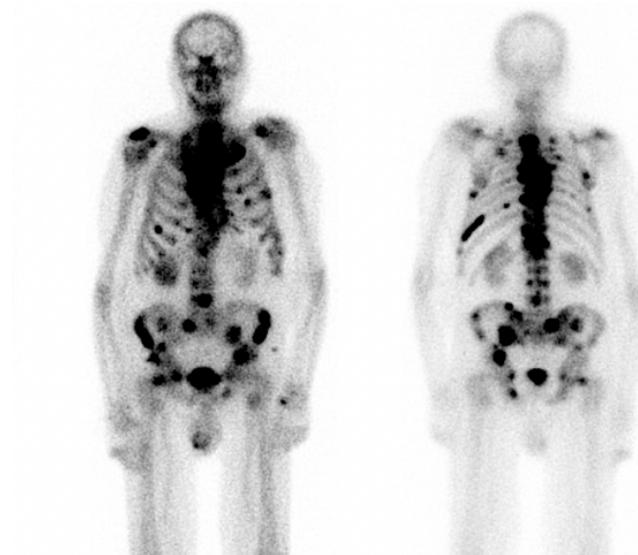
- Answer = t(11;22) translocation; diagnosis is Ewing sarcoma; image shows the small blue cells of neuroendocrine origin.
- 17M + pain in upper left humerus + x-ray shown below; Q wants diagnosis:



- Answer = unicameral bone cyst. This is an underrated diagnosis for USMLE but shows up on the real deal.
- 37M + pain in right elbow + x-ray is shown below; Q asks diagnosis (answers are all bone tumors):



- Answer = giant cell tumor of bone (osteoclastoma); x-ray shows soap-bubble appearance. In contrast to unicameral bone cyst, which occurs usually from birth to age 20, osteoclastoma usually occurs age 20-40.
- 55M + diffuse bone pain + high serum calcium; bone scan is shown below; Q wants diagnosis:



- Answer = metastatic malignancy (most likely prostate cancer if no past medical history); wrong answer is primary hyperparathyroidism; metastases are important cause of high Ca^{2+} .
- 32M + large, yellow, soft infiltrating mass in gluteus maximus + biopsy shows irregular vacuolated cells + clear cells with many mitoses; Q asks diagnosis → answer = liposarcoma (offline NBME 20); lipoma is wrong answer (presumably would sound less sinister / not invasive, clearly); lipoma = benign tumor of fat (Gardner syndrome); liposarcoma = malignant tumor of fat; rhabdomyoma = benign tumor of striated (skeletal or cardiac) muscle (usually tuberous sclerosis with cardiac rhabdomyoma); rhabdomyosarcoma = malignant tumor of striated muscle (usually sarcoma botryoides in pediatrics).
- “What do I need to know about fracture types for USMLE?” → I’ll give summary here:

HY bone fracture points for USMLE	
Spiral fracture	<ul style="list-style-type: none"> - Pathognomonic for child abuse. - Caused by rotational/twisting force applied to a limb. - USMLE doesn't expect you to diagnose based on imaging.
Simple fracture	<ul style="list-style-type: none"> - Aka closed fracture – i.e., the skin is not broken and the underlying bone does not pierce the skin.
Compound fracture	<ul style="list-style-type: none"> - Aka open fracture – i.e., the skin is broken and the underlying bone pierces the skin.
Comminuted fracture	<ul style="list-style-type: none"> - Fracture where the bone is broken in at least two pieces.
Greenstick fracture	<ul style="list-style-type: none"> - Bone bends and cracks instead of breaking completely into two pieces. - More common in Peds than adults. - Children's bones are more flexible than adult bones adults' bones because they have ↑ collagen content and ↓ mineral content, allowing them to bend more. - When a force that would cause a complete fracture in an adult bone is applied to a child's bone, it might only cause a greenstick fracture, which is an incomplete fracture with the bone bending and breaking only on one side, resembling a green branch of a tree that bends and splinters on one side without breaking completely.
Linear skull fracture	<ul style="list-style-type: none"> - Most common type of skull fracture, where there is a break in the skull but the bone has not moved.

	- USMLE wants you to know this is classically associated with epidural hematoma (asked on 2CK CMS form).
Base of skull fracture	- Presents with tetrad of Battle sign (bruising over mastoid process), raccoon eyes (bruising around the eyes), rhinorrhea, and otorrhea.
Metatarsal stress fracture	- The answer on USMLE for pain in the metatarsal area of the foot in long-distance runners with low BMI. - Rather than asking diagnosis directly, USMLE will often give a vignette where a female long-distance runner with low BMI already has a metatarsal stress fracture, and then they'll ask what she's at greatest risk of developing → answer = osteoporosis.
Clavicular fracture	- Occurs with fall on outstretched hand (FOSH), or occasionally as a result of handlebar injury / impaction, with force transferred up to clavicle. - Most common site of break is the middle-third of the clavicle. - Tx = Figure-of-8 sling.
Scaphoid fracture	- As discussed earlier, will present as pain over anatomic snuffbox in patient with FOSH. - X-ray will usually be negative acutely. Must do thumb-spica cast to prevent avascular necrosis of scaphoid, followed by repeat x-ray in 2-3 weeks.
Lunate fracture	- The answer on USMLE if FOSH with pain in central palm + no pain over anatomic snuffbox.
Hook of hamate fracture	- Cause of distal ulnar nerve injury / Guyon canal syndrome. - Often from handlebar injury / impaction.
Surgical neck of humerus fracture	- Causes axillary nerve injury → loss of deltoid function + sensation over deltoid.
Midshaft fracture of humerus	- Causes radial nerve injury → wrist-drop + pronated arm.
Supracondylar fracture of humerus	- Aka "distal shaft fracture." - Causes median nerve injury → motor/sensory dysfunction of forearm muscles, first three fingers and thenar region.
Vertebral compression fracture	- Synonymous with osteoporosis on USMLE (i.e., post-menopausal, corticosteroid-use, Cushing syndrome). - Will often give point tenderness over a vertebra.
Pseudofracture	- Band of low-density bone that looks like fracture on x-ray but not actual fracture. - Synonymous with vitamin D deficiency (osteomalacia/rickets) on USMLE. - Can be seen in renal failure, since 1,25-D3 is low. Osteomalacia due to renal failure is called renal osteodystrophy.
Orbital floor fracture	- USMLE wants you to know this can cause entrapment of inferior rectus and inferior oblique muscles. - Vignette will say guy got hit in eye by baseball + has impaired upward gaze. - I talk about extraocular muscles and lesions in my neuroanatomy document, but this is one notable point you should be aware of here.

- 24M + car accident + linear skull fracture; Q asks what type of bleed is most likely in this patient? → answer = epidural hematoma.
- 4M + x-ray shows spiral fracture of left femur; Q asks next best step in management → answer = contact child protective services; spiral fractures are pathognomonic for child abuse.
- 20M + car accident + high blood pressure + bradycardia + bruising around the eyes and behind the ears + low GCS score; Q asks for most likely reason for the patient's high blood pressure → answer = increased intracranial pressure; Cushing reflex = triad of HTN + bradycardia + bradypnea due to

increased ICP; patient here has base of skull fracture (Battle sign + raccoon eyes); Q need not mention all four findings (i.e., rhinorrhea + otorrhea as well).

- 36M + avid cyclist + pain in clavicle + x-ray shows fracture of middle-third of clavicle; Q asks next best step in management → answer = figure-of-8 sling.
- 37M + cyclist + mild weakness of finger abduction/adduction + has positive Froment sign; Q asks which structure is most likely compressed → answer = “deep branch of ulnar nerve at the hook of hamate.”
- “What do I need to know about myopathy / muscular dystrophies for USMLE?”

HY myopathies / muscular dystrophies for USMLE	
Duchenne / Becker muscular dystrophy	<ul style="list-style-type: none"> - XR disorder caused by mutation in dystrophin (<i>DMD</i>) gene. - Mutation results in disruption of α-/β-dystroglycan, which is required for proper internal cytoskeletal anchoring of the muscle cell to the extracellular matrix. - Presents with pseudohypertrophy, where muscles appear large but are replaced with fibroadipose tissue (connective tissue stromal cells). - Duchenne presents in a young boy who implements Gower maneuver to stand up (uses arms to walk up off the floor because leg muscles are weak). - Becker presents in adolescence or young adulthood (less severe form of Duchenne). - Duchenne is classically frameshift mutation; Becker is classically not frameshift.
Polymyalgia rheumatica (PMR)	<ul style="list-style-type: none"> - Usually patient over 50 with proximal muscle pain and stiffness. - No weakness on physical exam + creatine kinase (CK) levels are normal. If one or both of these findings is present, the answer is polymyositis, not PMR. - Can present with high ESR and low-grade fever (any autoimmune disease flare can present with low-grade fever). - PMR can present with or without temporal (giant cell) arteritis. Temporal arteritis can present bilaterally on NBME exams; do steroids first to prevent blindness, followed by biopsy second. - Temporal arteritis can cause jaw claudication (pain in the jaw during episodes). In contrast to temporomandibular joint dysfunction (a separate diagnosis), jaw claudication will not be precipitated by eating. - No specific diagnostic test; diagnosis is made clinically. - Tx = steroids. NSAIDs are wrong answer and are not proven to be effective.
Polymyositis / Dermatomyositis	<ul style="list-style-type: none"> - Usually patient over 50 with proximal muscle pain and stiffness. These findings are not unique to PMR. The USMLE will happily give pain and stiffness in polymyositis vignettes. - Key distinction between polymyositis and PMR is that polymyositis will present with 1) muscle weakness on physical exam, and/or 2) increased serum CK. - The muscle weakness *must be on physical exam.* If the patient complains of “weakness” but there is no physical exam findings mentioned in vignette or physical exam shows 5/5 strength, there’s no weakness. Patients will sometimes mention “weakness,” even though they really just have pain and/or stiffness. - If polymyositis presents with skin findings, it is called dermatomyositis – i.e., Gottron papules (violaceous papules on the knuckles), mechanics’ hands (rough-surfaced hands), shawl rash (body rash), heliotrope rash (violaceous eyelids / periorbital rash; don’t confuse with malar rash of SLE). - Patients often positive for anti-Jo1 antibodies.

	<ul style="list-style-type: none"> - USMLE wants “electromyography and nerve conduction studies” as first step in management for polymyositis/dermatomyositis. This is what they ask on 2CK NBME forms. I have not seen them ask anti-Jo1 antibodies vs EMG+NCS as two separate answer choices. Usually anti-Jo1 antibodies are mentioned in the vignette rather than as the test you need to order. - Muscle biopsy is confirmatory, showing CD8+ T cell infiltration. The histo can be described as “CD8 + T cells and macrophages surrounding muscle fibers.” - For whatever reason, dermatomyositis can be a paraneoplastic syndrome of ovarian cancer (shows up on Step 1 NBME). <p>Tx = steroids.</p>
Fibromyalgia	<ul style="list-style-type: none"> - This is a psych condition, not an actual muscle disorder, but is often confused with polymyositis and PMR. - Labs will be normal. ESR will not be elevated. Patient will not have fever. - Will be described as woman 20s-50s with multiple (and often symmetric) muscle tenderness points. - Treatment is SSRIs. USMLE can write this as “anti-depressant therapy.” This confuses students (“But she doesn’t have depression though.”) → Right. But SSRIs are still anti-depressant medication.
Temporomandibular joint dysfunction	<ul style="list-style-type: none"> - The answer on USMLE if they give jaw pain that is precipitated by eating. - Often confused with jaw claudication seen in temporal arteritis. In the latter, however, the pain is not precipitated by eating.
Myotonic dystrophy	<ul style="list-style-type: none"> - Autosomal dominant, CTG trinucleotide repeat expansion disease. - Myotonia is inability to relax muscles. - The answer on USMLE if they say patient cannot relax grip on doorknob / handshake, or cannot let go of golf club. - Sometimes associated with early / frontal balding.
Hypothyroid myopathy	<ul style="list-style-type: none"> - Myopathy can occur in both hypo- and hyperthyroidism, yes, but this is especially HY for hypothyroidism on USMLE. - They will often sneak this in as proximal muscle weakness or increased CK in patient who has ongoing fatigue, dysthymia, menstrual irregularities, etc.
Drug-induced myopathy	<ul style="list-style-type: none"> - Classically seen when statins and fibrates are combined, but both drugs can cause myopathy independently. - Mild CK elevations are normal and expected in patients when commencing these agents. Dose does not need to be decreased for mild CK elevations. - USMLE wants “P450-mediated interaction” as the cause of the myopathy when statins and fibrates are combined.
Mitochondrial myopathy	<ul style="list-style-type: none"> - Broad term that can refer to numerous mitochondrial diseases. - USMLE wants you to know the patient has a mitochondrial disorder when he/she presents with hypotonia, ear/eye problems, and lactic acidosis. You want to memorize this tetrad as synonymous with mitochondrial disorders. - “Ragged red fibers” can be a buzzy descriptor in mitochondrial myopathy Qs. - Mitochondrial disorders are maternally inherited only. - Heteroplasmy refers to offspring having varying disease severity based on variation in allocation of diseased mitochondrial genes (I talk more about this stuff in my HY biochemistry PDF).
Inclusion body myositis	<ul style="list-style-type: none"> - The answer on USMLE if they tell you patient 50 or older has months to years of progressive muscle weakness + biopsy of muscle shows basophilic rimmed vacuoles.
Mixed connective tissue disease	<ul style="list-style-type: none"> - Answer on USMLE if they give you a patient who has anti-U1-ribonucleoprotein (U1-RNP) antibodies. - Patient presents as having combined features/symptoms from three different disorders → LPS → Lupus, Polymyositis, Scleroderma.

- 52F + 6-month history of pain and stiffness of shoulders + elevated ESR; Q wants diagnosis → answer = polymyalgia rheumatica (PMR); presents as pain and stiffness of proximal muscles, usually in patient over 50; Q will not mention anything about elevated CK or weakness on physical exam.
- 52F + 6-month history of pain and stiffness of shoulders + elevated ESR and CK; Q wants diagnosis → answer = polymyositis, not PMR, because Q mentions CK elevation. Pain and stiffness are **not** unique to PMR. They can absolutely be seen in polymyositis. The notion that they are unique to PMR is complete nonsense for USMLE purposes.
- 52F + 6-month history of pain and stiffness of shoulders + elevated ESR + normal CK + physical exam shows 3/5 strength in shoulders; Q wants diagnosis → answer = polymyositis; even though CK is normal, patient has weakness on physical exam.
- 60M + 6-month history of weakness, pain, and stiffness of shoulders + elevated ESR + no other info given; Q wants most likely diagnosis → answer = PMR, not polymyositis, because not only is CK not mentioned/elevated, but weakness *is not on physical exam*; patients will often report “weakness,” even when they don’t have true weakness and instead just have pain/stiffness; there is a 2CK CMS Q that is similar to this scenario.
- 64F + 6-month history of pain and stiffness of shoulders + elevated ESR + weakness on physical exam; Q wants next best step in diagnosis? → answer = “electromyography and nerve conduction studies”; diagnosis is polymyositis; Q will not force you to choose between anti-Jo1 antibodies and EMG/NCS, but the latter is correct on NBME forms; biopsy is confirmatory.
- 64F + 6-month history of pain and stiffness of shoulders + physical exam shows weakness + anti-Jo1 antibodies are positive; Q asks the most likely pathophysiology for this patient’s condition? → answer = “CD8 + T cells and macrophages surrounding muscle fibers.”
- 64F + bilateral temporal headache + slightly blurry vision on left + high ESR + bilateral hip pain; Q wants next best step → answer = “IV methylprednisolone”; temporal (giant cell) arteritis can show up bilaterally on NBME forms; do steroids first to prevent blindness, *then* do biopsy of temporal artery; the patient’s hip pain is polymyalgia rheumatica, which is linked with temporal arteritis.
- 64F + right-sided temporal pain + high ESR + low-grade fever + pain in the jaw + low hemoglobin; Q wants diagnosis → answer = giant cell arteritis; can present with jaw claudication; low hemoglobin is due to anemia of chronic disease.

- 64F + right-sided temporal and facial pain + worsens with eating + proximal muscles a little stiff; Q wants diagnosis → answer = temporomandibular joint dysfunction, not temporal arteritis; if it worsens with eating, then they want TMJ dysfunction, not jaw claudication.
- 45F + 6-month history of muscle pain; physical exam shows 12 symmetric tender points; ESR not elevated; Q wants treatment → answer = “anti-depressant therapy”; diagnosis is fibromyalgia; this is a psych condition treated with SSRIs; as mentioned earlier, students get confused here because the patient is not depressed, but SSRIs are still anti-depressant medication.
- 61F + 20-pound weight loss past one month despite no change in diet + fatigue + anemia + proximal muscle weakness + increased serum CK + pulling sensation in groin + Q shows image below; Q wants to know diagnosis (all cancers listed):



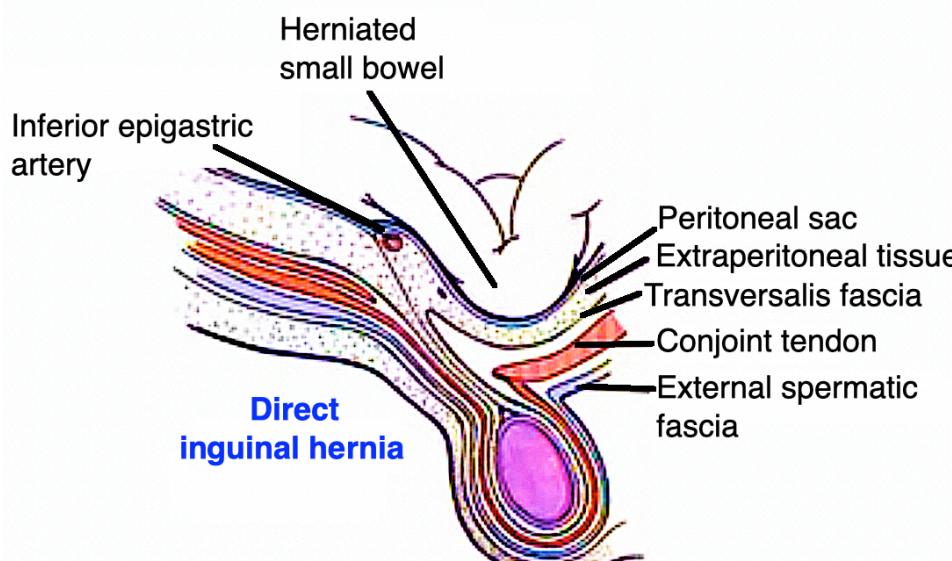
- Answer = ovarian adenocarcinoma; for whatever magical reason, dermatomyositis can be a paraneoplastic syndrome of ovarian cancer. → Google/literature says around 10-20% of women with dermatomyositis have ovarian cancer.
- 18M + frontal balding + difficulty letting go of handshake; Q wants diagnosis; answer = myotonic dystrophy; autosomal dominant; CTG trinucleotide repeat expansion.
- 44F + 6-month history of low energy and fatigue + gradually lengthening periods + HR 60 + hepatic AST, total cholesterol, and serum creatine kinase are elevated; Q asks most likely diagnosis → answer = hypothyroidism (Hashimoto); elevated CK is due to hypothyroid myopathy, which may or may not present with proximal muscle weakness in the vignette; transaminases can be elevated in thyroid dysfunction; USMLE likes menstrual irregularities, bradycardia, high cholesterol, dysthymia, doughy

skin, and carpal tunnel syndrome in hypothyroidism. Details such as cold intolerance, weight gain, brittle hair, and constipation are often omitted because they're too easy/buzzy.

- 66M + recently started taking atorvastatin + mild increase in serum creatine kinase; Q wants to know next best step in management → answer = no change in dose of statin; Dx is statin-induced myopathy; USMLE wants you to know that mild elevation in CK is normal and expected in patients who commence statins (and fibrates). The literature says the drug does not need to be discontinued unless CK elevations >10x the upper limit of normal are observed.
- 66M + started taking a statin and fibrate simultaneously + develops myopathy; Q wants mechanism → answer = "P-450-mediated interaction."
- 3M + hypotonia + weakness + lactic acidosis + poor hearing and vision; 7-year-old sister has normal vision and hearing, only mild weakness, no hypotonia, and only mildly elevated serum lactic acid; Q wants reason for discrepancy; answer = heteroplasmy; wrong answer = X-linked recessive disorder; the tetrad of hypotonia, lactic acidosis, and eye/ear problems is HY for USMLE.
- 3M + hypotonia + lactic acidosis + no mention of eye/ear problems + biopsy of muscle shows ragged red fibers; Q wants most likely inheritance → answer = mitochondrial.
- 3M + large calves + uses arms to walk up off the floor; Q wants inheritance pattern; answer = X-linked recessive; Dx is Duchenne muscular dystrophy.
- 3M + large calves + uses arms to walk up off the floor; Q wants organelle / cellular structure that is disrupted in patient's condition → answer = cytoskeleton; α-/β-dystroglycan are encoded by the *DMD* (dystrophin) gene and are required for proper anchoring of the muscle cell cytoskeleton to the extracellular matrix.
- 3M + large calves + uses arms to walk up off the floor + Q wants to know what will be seen on muscle biopsy → answer = "connective tissue stromal cells" or "fibroadipose tissue"; patient will have pseudohypertrophy, which is replacement of muscle cells with connective tissue.
- 3M + large calves + uses arms to walk up off the floor; Q wants molecular mechanism for patient's condition → answer = frameshift mutation; this results in truncated, non-functional protein due to early formation of stop codon.
- 18M + increasing muscle weakness and muscular enlargement + maternal uncle died of cardiomyopathy in his 20s; Q wants diagnosis → answer = Becker muscular dystrophy; less severe

form of Duchenne; usually due to non-frameshift mutations in the *DMD* gene. Becker usually presents in adolescence or young adulthood; Duchenne will be a kid.

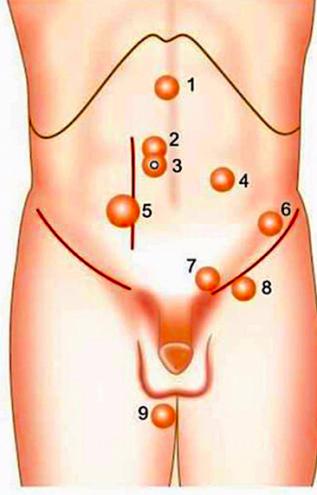
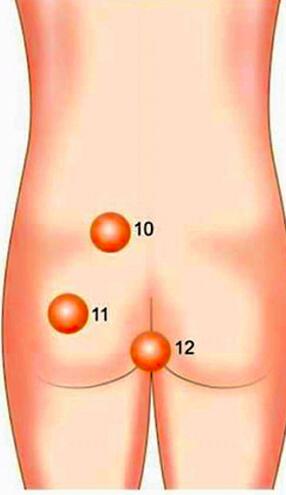
- 4M + short arms and legs; trunk and head are normal size; parents are normal; Q wants mechanism for patient's condition → answer = gonadal (germline) mosaicism; diagnosis is achondroplasia; disease is constitutive activation of *FGFR3* gene; results in failed cartilage conversion into bone; presents as shortened limbs but normal head size and postural height (trunk size); condition is autosomal dominant, but both parents will usually be of normal height, which means the original mutation occurred in a gonadal cell (usually a spermatogonia of the father), where the child has 100% of cells affected as a result, despite the father being unaffected. I also talk about this stuff in more detail in my HY Biochem PDF.
- "How HY is hernia stuff for USMLE?" → Unfortunately decently HY. But good news: I'll tell you exactly what you need to know for them for USMLE without all of the **absolute nonsense**.

HY MSK hernia points for USMLE	
Direct inguinal hernia	<ul style="list-style-type: none"> - Small bowel herniates medial to inferior epigastric vessels. - Occurs usually in older men. - Occurs due to weakness of abdominal wall musculature / transversalis fascia.  <ul style="list-style-type: none"> - The coverings of direct inguinal hernia = skin, superficial fascia, external spermatic fascia, cremasteric fascia, extraperitoneal tissue. - Hernia passes through Hesselbach triangle (inguinal triangle), which is an area of weakness in abdominal wall through which a direct inguinal hernia can protrude. - Boundaries of Hesselbach triangle: medial border = the lateral border of rectus abdominus muscle, aka linea semilunaris; lateral border = inferior epigastric vessels; inferior border = inguinal ligament.

	<p>The diagram illustrates the deep inguinal ring, inguinal ligament, inferior epigastric vessels, Hesselbach triangle, superficial inguinal ring, and spermatic cord passing through the inguinal canal.</p>
	<ul style="list-style-type: none"> - NBME wants “medial to inferior epigastric artery; superior to inguinal ligament” as the answer for direct inguinal hernia. - Q might say older patient has palpable mass in groin that reduces when he lies down, or worsens when he coughs. <p>Tx = “operative management” or “elective hernia repair,” since it is not an overt emergency but closure should be performed prior to any type of incarceration and strangulation (ischemia leading to pain, fever, and necrosis).</p>
Indirect inguinal hernia	<ul style="list-style-type: none"> - Small bowel herniates lateral to inferior epigastric vessels, through deep inguinal ring. - Seen classically in male infants, but can occur any age. - Mechanism is patent processus vaginalis. This is also the mechanism for hydrocele (asked on NBME). - NBME wants “lateral to inferior epigastric artery; superior to inguinal ligament” as the answer for indirect inguinal hernia. <p>The diagram shows the testes and surrounding structures, including the peritoneal cavity, peritoneum, patent processus vaginalis (open), processus vaginalis (closed), vas deferens, tunica vaginalis, and testes.</p>

	<p>- Tx = elective hernia repair. - For hydroceles, observation is the answer under the age of 1 (HY on Peds forms).</p>
Femoral hernia	<p>- Small bowel protrudes through femoral canal, inferior to inguinal ligament. - Account for 5% of hernias and more common in women (3:1) because of the wider anatomy of the pelvis in women.</p> <p>- Boundaries of femoral canal (and hernia) are: lateral border = femoral vein; medial border = lacunar ligament; posterior border = pecten ligament; anterosuperior border = inguinal ligament. - Tx = surgery.</p>
Spigelian hernia	<p>- Rare abdominal hernia (<2%) that occurs lateral to the linea semilunaris of the rectus abdominis, but Step 1 NBME asks it. You should also know this for 2CK Surg. - Usually in older adults.</p>

	<ul style="list-style-type: none"> - Highest yield point is that the medial border of the hernia is the rectus abdominis.
Umbilical hernia	<ul style="list-style-type: none"> - Small bowel herniation through the umbilicus. - Can occur at any age, but I've seen this show up on NBME in congenital hypothyroidism (i.e., cretinism). - Not to be confused with omphalocele in neonates. An umbilical hernia is completely covered by skin. In contrast, an omphalocele is a herniation merely covered by a thin, translucent layer of peritoneal membrane. It can be idiopathic, but is often associated with the Trisomy 13 and 18, and Beckwith-Wiedemann syndrome. <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>Gastroschisis</p> </div> <div style="text-align: center;"> <p>Omphalocele</p> </div> </div>
Paraumbilical hernia	<ul style="list-style-type: none"> - Small bowel herniation through the linea alba (tendinous, fibrous raphe that runs vertically down the abdomen). - Not to be confused with gastroschisis in neonates. A paraumbilical hernia is completely covered by skin and protrudes usually superior to the umbilicus. Gastroschisis is not covered by anything (not even a layer of peritoneal membrane as with omphalocele) and protrudes to the right of the umbilicus; gastroschisis is seen sometimes in Trisomy 13 and 18.
Epigastric hernia	<ul style="list-style-type: none"> - Small bowel protrusion in epigastrium through the linea alba, similar to paraumbilical hernia. - The difference is that epigastric hernia is further up in the abdomen in the epigastrium, whereas paraumbilical hernia is literally adjacent the umbilicus.
Incisional hernia	<ul style="list-style-type: none"> - Can occur at the site of any abdominal incision. Just know it's possible.

Obturator hernia	<p>- Rare hernia of the pelvic floor. Small bowel contents protrude through obturator foramen.</p>  <table border="1" data-bbox="763 339 1044 788"> <thead> <tr> <th colspan="2">Types of hernia</th></tr> </thead> <tbody> <tr><td>1.</td><td>Epigastric hernia</td></tr> <tr><td>2.</td><td>Paraumbilical hernia</td></tr> <tr><td>3.</td><td>Umbilical hernia</td></tr> <tr><td>4.</td><td>Spigelian hernia</td></tr> <tr><td>5.</td><td>Incisional hernia</td></tr> <tr><td>6.</td><td>Indirect inguinal hernia</td></tr> <tr><td>7.</td><td>Direct inguinal hernia</td></tr> <tr><td>8.</td><td>Femoral hernia</td></tr> <tr><td>9.</td><td>Obturator hernia</td></tr> <tr><td>10.</td><td>Lumbar hernia</td></tr> <tr><td>11.</td><td>Sciatic hernia</td></tr> <tr><td>12.</td><td>Perineal hernia</td></tr> </tbody> </table>  <p>- Despite being rare, obturator hernia is HY for 2CK Surg and shows up on 2CK exam. - You need to know that the Howship-Romberg sign is used to diagnosis obturator hernia. In this test, thigh extension, medial rotation, and abduction cause lancing pain in the medial thigh / obturator distribution due to compression of obturator nerve.</p>	Types of hernia		1.	Epigastric hernia	2.	Paraumbilical hernia	3.	Umbilical hernia	4.	Spigelian hernia	5.	Incisional hernia	6.	Indirect inguinal hernia	7.	Direct inguinal hernia	8.	Femoral hernia	9.	Obturator hernia	10.	Lumbar hernia	11.	Sciatic hernia	12.	Perineal hernia
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Sciatic hernia	<p>- Rare hernia of the pelvis with protrusion of small bowel through either the greater or lesser sciatic foramen. - Can mimic sciatica due to compression of sciatic nerve. - Just know this type of hernia exists. As I mentioned above, obturator hernia is HY for 2CK. They will usually list sciatic hernia as incorrect answer choice alongside it.</p>																										
Lumbar hernia	<p>- Rare hernia that presents with pain and herniation in the lower back.</p>																										
Perineal hernia	<p>- Rare hernia of pelvic floor. Can occur due to atrophy of the levator ani muscle.</p>																										

- 1-year-old boy + enlarged testis + scrotal mass that is reducible with pressure over deep inguinal ring; Q asks mechanism for patient's condition → answer = patent processus vaginalis; diagnosis is indirect inguinal hernia; mechanism is same as formation of hydrocele; since the hernia passes through deep inguinal ring (which is lateral to inferior epigastric artery), pressure applied to the ring can reduce the hernia. With direct inguinal hernia, in contrast, since it does not pass through the deep inguinal ring, this examination maneuver will not reduce the hernia.
- 12-year-old boy + testicular mass that enlarges with cough and reduces when lying down; pressure applied over deep inguinal ring hides hernia; Q wants to know whether the hernia is lateral vs medial to inferior epigastric artery, and whether it's inferior or superior to inguinal ligament → answer = lateral to inferior epigastric artery + superior to inguinal ligament; diagnosis is indirect inguinal hernia.

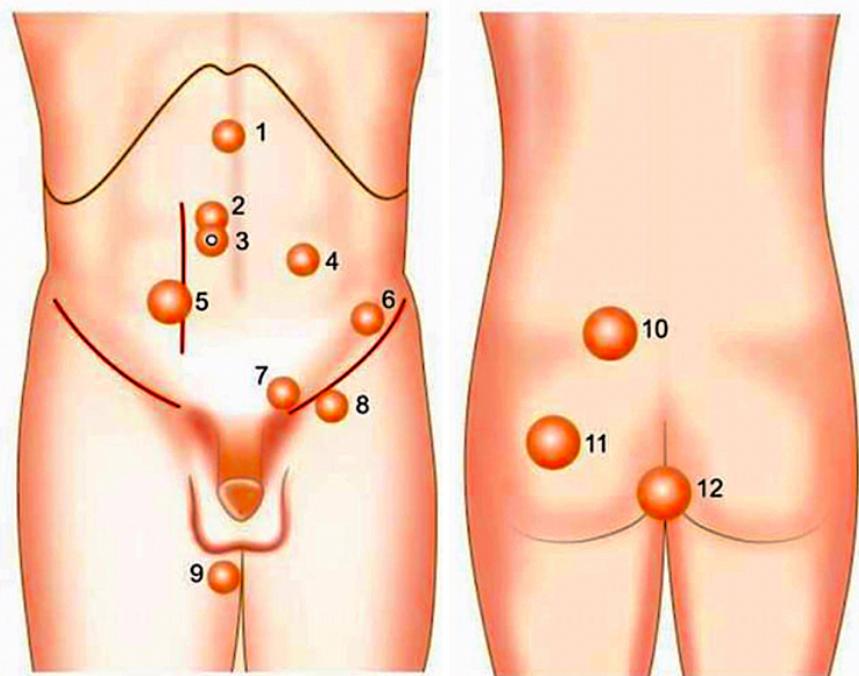
- 64M + bulging mass in groin + not painful; worsens with cough and improves when supine; Q wants location of hernia relative to inferior epigastric artery → answer = medial to inferior epigastric artery; diagnosis is direct inguinal hernia; usually occurs in older men.
- 40F + pain and palpable mass in groin inferior to inguinal ligament; Q wants to know which structure is lateral to the mass → answer = femoral vein; diagnosis is femoral hernia.
- 60M + Q shows CT scan of an abnormality with arrow pointing to it; asks for what the medial border of the hernia is (in other words, what is medial to the arrow)?



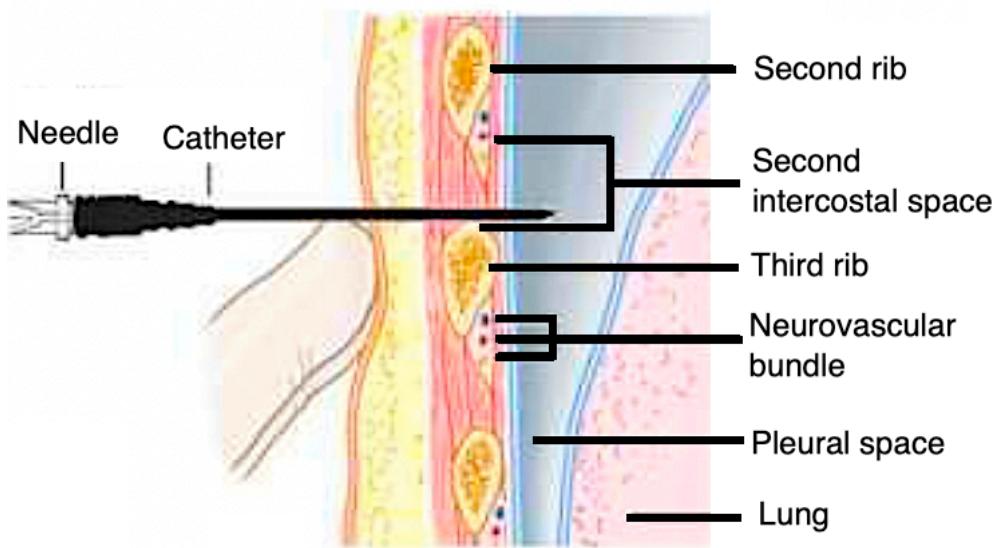
- Answer = **lateral border of rectus abdominus**; diagnosis is Spigelian hernia; hernia protrudes just lateral to the linea semilunaris.
 - Students get hysterical and worried when they see CT scans like this. Recognize that the USMLE doesn't care that you even know what a Spigelian hernia is in order to get this question right. If you chill out for a second and try to imagine what you're looking at in the CT, you can tell the rectus abdominis is at the superior part of the image, which means the hernia is just lateral to it.
- 55M + pelvic hernia + physical exam causes worsening of pain when ipsilateral leg is extended, medially rotated, and abducted; Q wants diagnosis → answer = obturator hernia; the Howship-Romberg sign is used to diagnose. The USMLE can be vague with this question, where they just tell

you “patient has hernia that’s worsened with this exam maneuver” and you have to know it’s obturator hernia.

- 8-month-old boy + large tongue + hypotonia + umbilical hernia; Q asks what would have most likely prevented this patient’s condition → answer = routine newborn screening; diagnosis is congenital hypothyroidism (cretinism); heel-prick test at birth tests for hypothyroidism, PKU, and galactose disorders, among others.
- Neonatal male + enlarged occiput + clenched fingers + rocker-bottom feet + protrusion of abdominal contents through umbilicus that are covered in thin membrane; Q wants diagnosis → answer = trisomy 18 (Edward syndrome); omphalocele is described; in contrast, gastroschisis protrudes to the right of the umbilicus and is not covered in a layer of peritoneal membrane.
- Identify the hernias:



- “Is there any chest wall MSK I should know?”
 - For a thoracentesis (removing fluid from the pleural space when treating a pleural effusion) or needle decompression (for pneumothorax), the needle should be inserted **just above the rib**. This is in order to avoid injury to the neurovascular bundle that sits at the inferior margin of each rib.

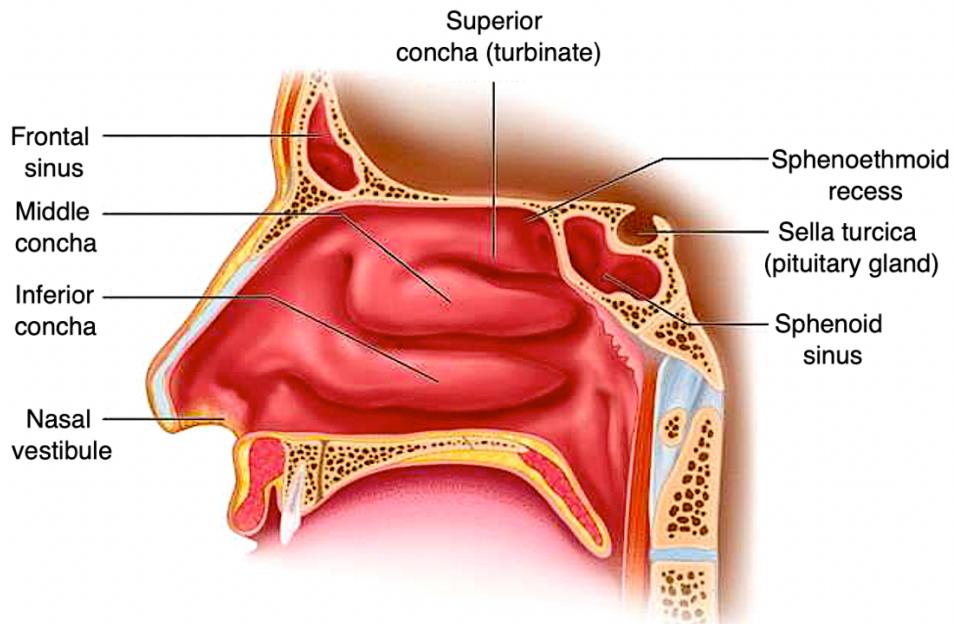


- For an intercostal nerve block, however, we *want* to anesthetize the nerve, so the needle should be inserted just below each rib (i.e., at the inferior margin).
 - 40M + car accident + severe, left-sided chest pain; Q asks, the most likely pathway of this patient's chest pain is carried by which nerve → answer = intercostal.
 - The numerical rib location for needle insertion for a thoracentesis varies depending on the source (i.e., literature says 8-10th ribs), but offline NBME 21 has Q where answer is **midaxillary line above the 9th rib**.
 - When performing a needle decompression followed by chest tube for pneumothorax, the typical location for insertion is the **second intercostal space** (just superior to the third rib).
- “Is there any high-yield neck anatomy I should know?”

HY neck MSK masses for USMLE	
Thyroglossal duct cyst	<ul style="list-style-type: none"> - The answer on USMLE if they say there's a painless, midline neck lump in a child that moves upward with swallowing or protrusion of the tongue. This buzzy description is seen for maybe only about half of Qs. - Can also be described as painless mass inferior to the hyoid bone that demonstrates uptake with a Technetium-99 scan. - USMLE wants “endoderm of foramen cecum” as the embryology.
Sternocleidomastoid injury	<ul style="list-style-type: none"> - The answer on USMLE if they say nodular mass in the lateral neck in an infant who had been born via forceps delivery (risk factor for damage to the muscle).
Branchial cleft cyst	<ul style="list-style-type: none"> - The answer on USMLE if they give idiopathic lateral neck mass in infant that may or may not have an opening to the skin.

- “Do I need to know nasal sinus/concha anatomy for USMLE? → There are rare Qs that show up asking sinus anatomy, but now that Step 1 is P/F, I'd say studying this is largely venturing into left-field territory. There is a question on one of the offline Step 1 NBMEs, however, where they say there is a

sinus infection with purulent discharge coming from the sphenoethmoid recess, and they ask for the location of this structure → answer = “superior to the superior concha.” You can memorize this one point, but as I said, I don’t think you need to be sitting in your room obsessing over nasal anatomy.



- “Are there any random HY points for pediatrics I should know?”
 - USMLE likes bone age on 2CK Peds forms. If an x-ray is done of the hand, the approximate age of the child can be ascertained; if the child is short and “bone age equals chronologic age,” that is genuine short stature (e.g., familial short stature; I’ve also seen this in Turner syndrome Qs); if the child is short and “bone age is less than chronologic age,” then the answer is “constitutional short stature,” or “constitutional growth delay,” which means the child’s growth curve is merely shifted to the right but he/she will catch up (i.e., boy is 4’11” in 9th grade but will eventually become average height); the Q will often say the parents are average height; if they don’t mention bone age for constitutional short stature Qs, they can say the child is Tanner stage 1 or 2 (prepubescent).
 - If child abuse is suspected, sometimes the answer can be “obtain skeletal survey” in order to evaluate for radiographic evidence of fractures at different stages of healing.
- “Is there any HY Pharm I should know in relation to MSK?”

Highest yield “MSK pharm” for USMLE	
Baclofen	<ul style="list-style-type: none"> - Agonizes GABA_A. - Used for spasticity, classically in multiple sclerosis, but I’ve seen one NBME Q where it’s used for random spasticity in an older dude.

	<ul style="list-style-type: none"> - Students frequently remember GABAB for this drug, but often say "antagonist" when I probe them further. So remember: it's an agonist, not an antagonist, at GABAB.
Benztropine	<ul style="list-style-type: none"> - Muscarinic (cholinergic) receptor antagonist. - Used to treat acute dystonia due to anti-psychotics. - If patient starts anti-psychotic and then gets stiff neck, oculogyric crisis (abnormal eye movements), or muscle rigidity without fever, the answer = benztropine.
Diphenhydramine / Chlorpheniramine	<ul style="list-style-type: none"> - First-generation histamine-1 (H1) antagonists. - Diphenhydramine is quite possibly the highest-yield drug on USMLE. - Used to treat acute dystonia, similar to benztropine, as well as motion sickness. - H1 blockers can treat allergies in theory, but they have nasty anti-cholinergic (anti-muscarinic) side-effects. - The anti-cholinergic side-effects are interestingly a <i>good</i> thing, however, when we want to treat acute dystonia. Psych Qs will either list benztropine or diphenhydramine (or chlorpheniramine) as the answer, but not both at the same time. - For whatever reason, anti-cholinergic effects treat motion sickness. Scopolamine is an anti-cholinergic used to treat motion sickness classically. But I've seen NBME ask diphenhydramine straight-up for this as well – i.e., the nasty anti-cholinergic side-effects are, once again, a good thing if the aim is Tx of motion sickness. - 1st-gen H1 blockers can cause cognitive dysfunction (delirium, as well as worsening of dementia) and drowsiness. Therefore avoid in elderly and locomotive/machine operators if at all possible. - 1st-gen H1 blockers can also cause anti-α1-adrenergic effects (orthostatic hypotension). - I talk about all of the pharm-related stuff in a lot more detail in my free pharm modules on the website.
Dantrolene	<ul style="list-style-type: none"> - Blocks ryanodine Ca²⁺ channel. - Tx for neuroleptic malignant syndrome (NMS) and malignant hyperthermia (MH). - If patient gets muscle rigidity and fever following commencement of anti-psychotic, or following administration of succinylcholine during surgery, answer = dantrolene. (Bromocriptine for NMS is low-yield and rarely seen on NBME). - NBME will sometimes give vignette of NMS or MH, and then the answer for Tx is "decreases sarcoplasmic calcium release." - In NMS and MH, the ryanodine channel, which allows calcium to move from the sarcoplasmic reticulum into the cytosol, gets stuck open, so high amounts of calcium moves into the cytoplasm. The cell then needs to use a lot of ATP to pump the calcium back into the sarcoplasmic reticulum. This generates heat → fever. Dantrolene closes this channel.
Succinylcholine	<ul style="list-style-type: none"> - Nicotinic receptor agonist / depolarizing neuromuscular junction blocker. - Functions like an antagonist due to desensitization of nicotinic receptors. - Used to paralyze muscles during general anesthesia. - Q on offline Step 1 NBME says patient has "prolonged apnea following anesthesia" and asks which drug caused it → answer = succinylcholine. - The depolarizing aspect means that it can cause transient twitching / increased neurotransmission prior to the antagonistic effects ensue. USMLE might rarely give you a graph-type Q where you have to infer this effect refers to succinylcholine.
Vecuronium / Rocuronium	<ul style="list-style-type: none"> - Nicotinic receptor antagonist / non-depolarizing neuromuscular junction blocker. - Used to paralyze muscles during general anesthesia. - NBME will give vignette saying MOA and then just ask for drug name straight-up.
Alendronate	<ul style="list-style-type: none"> - Bisphosphonate; inhibits osteoclasts. This MOA is HY. - Used for osteoporosis after Ca²⁺/VitD. - I've seen pamidronate (not alendronate) show up on 2CK forms for Tx of hypercalcemia (after normal saline is given). - Students get fanatical about bisphosphonates causing osteonecrosis of the jaw. The yieldness of this adverse effect is basically non-existent on NBME exams.

	USMLE wants you to know bisphosphonates cause pill-induced esophagitis . This is very HY for 2CK FM forms in particular (K^+ supplements also cause esophagitis).
Teriparatide	- N-terminus PTH analogue that can induce bone formation. Even though PTH causes bone resorption, this agent stimulates osteoblast-mediated bone formation more than it induces RANK-L-mediated activation of osteoclasts. - Can be used for severe/advanced osteoporosis.
Denosumab	- Monoclonal antibody against RANK-L. - Can be used for severe/advanced osteoporosis.

- 32F + history of multiple sclerosis with muscular spasticity; Q asks the mechanism of action of the drug used to treat her spasticity → answer = GABA_B receptor agonist; drug is baclofen.
- 45M + started on aripiprazole for schizophrenia + develops stiff neck; Q wants mechanism of action of treatment → answer = anti-muscarinic (anti-cholinergic); diagnosis is acute dystonia due to anti-psychotic use; treatment for acute dystonia is either benz tropine (muscarinic receptor antagonist), OR diphenhydramine or chlorpheniramine (both first-generation H1 receptor antagonists); any of these three drugs can show up as the answer on USMLE. The 1st-gen H1 blockers have nasty anti-cholinergic side-effects, but that's actually a *good* thing when we want to treat acute dystonia.
- 45M + started on antipsychotic + develop muscle rigidity + fever of 103 F; Q wants mechanism of action of treatment → answer = “inhibition of intracellular calcium release”; diagnosis is neuroleptic malignant syndrome (NMS); treatment is dantrolene.
- 45M + started on antipsychotic + develop muscle rigidity + temperature is 98.6 F; Q wants mechanism of action of treatment → answer = anti-muscarinic (anti-cholinergic); drug is either benz tropine (muscarinic receptor antagonist) or a 1st-gen H1 blocker (anti-cholinergic side-effects that are actually good for Tx); diagnosis is acute dystonia, not neuroleptic malignant syndrome (NMS); if the Q wants NMS, they'll give muscle rigidity + **fever**; in contrast, muscle rigidity + no fever = acute dystonia.
- 52F + undergoes surgery + develops high fever and muscle rigidity; Q asks what drug most likely caused this patient's condition → answer = succinylcholine, a nicotinic receptor antagonist that enables paralysis during surgery. It is known as a depolarizing neuromuscular blocker. Diagnosis is malignant hyperthermia, which has same mechanism as NMS, except it is classically caused by succinylcholine, not antipsychotics. Malignant hyperthermia is treated with dantrolene, same as with NMS.

- 52F + undergoes surgery with general anesthesia + receives vecuronium; Q just wants mechanism of action → answer = nicotinic receptor antagonist; drugs such as vecuronium and rocuronium are non-depolarizing neuromuscular junction blockers. In contrast, succinylcholine is a depolarizing blocker.
- “Anything I should know about random infections and muscle?”
 - USMLE likes **myalgias** = influenza virus when patient has head cold. Vignette will be big paragraph + they mention muscle pain in there + answers are all different viruses; answer is simply influenza.
 - *Taenia solium* (pork tapeworm; pork cestode) can cause cysts in muscle (myalgia).
 - *Trichinella spiralis* (pork roundworm; pork nematode) can cause triad of fever + periorbital edema + myalgias in patient who recently ate pork or **bear meat**.
- “Anything I should know about random immuno and MSK?”
 - Muscle pain at the site of injection of a drug or vaccine 3-7 days post-injection = Arthus reaction = type III hypersensitivity (immune complexes); was seen with Moderna Covid vaccine (“Moderna arm”).
 - Polyarthritis 3-7 days following injection of a drug = serum sickness = type III hypersensitivity (immune complexes).
 - USMLE will give you image of malar rash of lupus (type III hypersensitivity) and then ask which condition is most similar → answer = Arthus reaction, or serum sickness, or PSGN.
- “Anything random I should know about genetics and MSK?”
 - USMLE wants you to know the Hox genes, or homeobox genes, are necessary for proper body/limb patterning (i.e., body parts developing at correct locations).
 - They will say if Hox genes 9-12 are turned on, phalanges are produced; when only 9-11 are turned on, carpal bones are produced. Q asks, “why did carpal bones develop instead of phalanges?” → answer = 12 not turned on. Not hard, but I’ve seen this confuse students.
 - Newborn dies shortly after birth + autopsy shows transformation of lumbar vertebrae into thoracic vertebrae; Q wants mechanism → answer = “inappropriate expression of Hox genes normally transcribed cranially.” Cranially = toward the head; caudally = toward the “tail.”



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