Vascular Surgery Jeopardy

Chris Owens and Diana Kim
Disclosures

› I have no disclosures relevant to Vascular Surgery Jeopardy
Rules!

› All questions vetted through two vascular surgeons CDO and WJG
› Everyone is invited to play including our Industry friends
› You each have an answer sheet with fill in the blank responses
› Singles, groups, and teams allowed but it might be hard to split the prizes
› Smart devices really should not be used
› Mostly case-based questions
› Please do not yell out the answers
› Hecklers will be swiftly neutralized
› Have fun
Case 1. 64 year old man with claudication

- Pain occurs predictably after about 50 yards, it has been stable for past 6 months and he reported that it was a gradual onset prior
- Described as right calf tightness which is relieved following sitting down for a few minutes. Denies pain in the left but doesn’t push himself. The right stops him first.
- Works as a grocery store manager and walks the floor and this is starting to interfere with him being able to perform his job to his satisfaction
- Former smoker, none in the last 2 years but 100 py history
- Hypertension, hyperlipidemia, slightly overweight BMI – 29 kg/m²
- Denies coronary disease or diabetes mellitus
- Meds: aspirin, statin, ACEi, and a beta blocker
Case 1. 64 year old man with claudication

- Normal and well appearing, HR 75, BP 134/86
- No stigmata of hypercholesterolemia
- Heart, lungs, and abdomen are normal
- Vascular examination: palpable femoral arteries bilaterally, right and left popliteal, posterior tibial and dorsalis pedis pulses can not be felt.
- Bilateral DPA and PTA Doppler signals present: biphasic left and monophasic right
- Resting Right ABI = .76 Left ABI = .82
Question #1. Based on the figure below, which arterial level(s), aortoiliac, femoropopliteal, and/or tibial have significant stenosis?

- Aortoiliac: PSV 88 cm/s, PI 8
- Femoropopliteal: PSV 55 cm/s, PI 2.5
- Tibial: PSV 36 cm/s, PI 1.4
The correct answer is femoropopliteal and tibial. The femoral has a triphasic pulse, normal acceleration time and the pulsatility index is normal. The distal EIA and the CFA should have the highest peak systolic velocity in the lower extremity at 110 – 115 cm/second.
Question #2. The pulsatility index (PI) is shown in the figure below. What is the formula for its calculation and how is it different from resistive index?
Pulsatility index (PI), first introduced by Gosling and King in 1974 is a measure of the variability of blood velocity determined by the Doppler ultrasound velocity spectra. It is equal to the differences between peak systolic velocity (PSV) and minimal diastolic velocity divided by the mean velocity, or (PSV-MDV)/mean velocity. The resistive index (RI) is the (PSV-EDV)/(PSV). The PI is associated with wall shear stress (WSS) particularly the oscillatory shear index (OSI). A PI less than four in the lower extremities indicates obstruction. The resistive index (Pourcelot’s index) has been more closely associated with downstream resistance at the level of arterioles. Refs. *Am J Surg* 131 (1976) Mar:295-297 and *Semin Vasc Surg* 26(2014) 95-104
Question #3 Below are shown normal and abnormal velocity spectra recordings from the distal anterior (left) and posterior tibial (right) artery. What is the maximal normal value of the systolic acceleration time (green line to orange line)?
Q3. A normal systolic acceleration time is below 133 ms. However, we accepted any value below 200 ms as correct.

As the value climbs to above 200 ms, the spectra waveform develops a rounded upslope (pulses parvus et tardus) or a weak and late pulse. *Semin Vasc Surg 26(2014) 95-104*
Question # 4. Concerning the images below, which of the following is not true

A. The technique was found to be “safe” when 70 cc of air was inadvertently given to a patient instead of contrast.

B. Higher doses administered generally result in higher pulmonary artery pressures.

C. It is invisible, colorless, and odorless.

D. The incidence of allergic reaction is reported to be 0.7%, well below iodinated contrast.
Q4. D Of course you can’t be allergic to CO2 as you are breathing it into your lungs as you are reading this sentence (.04% or 400 parts per million). CO2 is invisible, colorless, and odorless. Pulmonary hypertension is a relative contraindication as CO2 angiography can raise pulmonary pressures briefly. Believe it or not A is true – so next time you are compulsively trying to remove that last air bubble for your lower extremity angiogram, keep that in mind.
The photo to the right is from a 59 yo woman with a 5 year history of diabetes mellitus, referred with the diagnosis of venous stasis ulcer. The ulcer had been present > 3 weeks, does not itch, but she is concerned by the redness. She has no history of thrombophilia

Physical Examination

› Slightly overweight woman
› Vital signs normal, BMI 27 kg/m²
› Normal vascular examination
› The ulcer was sharply delineated, tender & had yellow patches within its bed
› HGBA1c was 9.8%, WBC = 7.2 x 10⁴
› ALL other laboratory values were normal

**Question 5. What is the diagnosis?**
Q5. Necrobiosis Lipoidica Diabeticorum. Key giveaways were the history of diabetes, well circumscribed lesions with yellow patches within it.
Question #6. The lateral DSA shows the peroneal artery reconstituting the dorsalis pedis artery and the posterior tibial arteries. What are the names of its terminal branches labelled 1 and 2?
Q6. We accepted the following answers as correct. Perforating, communicating, peroneal, or lateral calcaneal. Isn’t funny how some things that you see every day, occasionally you know least about. Its like sharing an office with someone for a while where it is no long polite to ask their name. So you don’t.

I spent more time on this question than any other. There is just no good atlas or source that really spells it out and there are many contradictory sources.

But this is what I think, (1) is the perforating artery and (2) is the peroneal artery which will give off the communicating artery to anastomose with the posterior tibial artery. Because of the controversy, I accepted the lateral calcaneal artery or perforating artery for both.

Knowledge of the peroneal anatomy is critical for lower extremity vascular reconstructive surgery. Exposure in the upper calf is performed by taking the soleus attachment off of the medial surface of the tibia and entering in to the deep posterior compartment where the artery lies next to the fibula. In the lower calf where the soleus is no longer attached to the tibia, fibers of the flexor hallucis longus muscle cover the peroneal artery. Distally the artery runs behind the tibiofibular syndomosis to supply blood to the lateral half of the plantar surface of the heel via the lateral calcaneal artery. You can hear this artery with a Doppler probe just behind the lateral malleolus. The lateral calcaneal artery and the medial calcaneal artery (from the posterior tibial artery) form the calcaneal ramus. For hind foot ulcers, one of these two arteries must be patent. The lateral DSA shows the perforating branch providing collateral blood supply to the dorsalis pedis artery. The communicating artery branches distally and moves lateral to medial to supply collateral circulation with the posterior tibial artery.
The angiogram to the right and the photograph below are from a 28 year woman who is a heavy smoker and has gangrenous changes to her foot. **Question # 7.** What is her diagnosis?
Question # 8. Which histopathological feature distinguishes her disease from necrotizing vasculitis?
Question #7 Buerger’s disease. I think everyone got this one.

Question #8. Thromboangiitis obliterans, Buerger’s other name provides some clues to the answer. The disease has an acute, intermediate, and chronic phase. In the acute phase the hallmark, and what distinguishes this disease from all others is an occlusive, highly cellular thrombus with relative sparing of the vessel. The key is preservation of the internal elastic laminae through all 3 phases whereas of vasculitides and atherosclerosis there is striking disruption of the elastic laminae.

There is a great review in the NEJM by Jeffrey Olin Sept 21 2000, Vol 343 issue 12.
A 65 year old man presents with claudication and post-prandial abdominal pain. He had a previous aortobifemoral bypass 5 years ago. He has weakly palpable femoral arteries and ABIs of .42 bilaterally.

**Question # 9. What operation should he have?**
Question 9. Visceral aorta endarterectomy through a bucket handle incision aortotomy as described by Jack Wylie.
Question # 10. A 72 yo man is referred to you with below ophthalmologic incidental finding, which of the following is true?

a) His risk of having ipsilateral > 70 % carotid stenosis is about 25%

b) The incidence of duplex ultrasound finding a significant carotid stenosis is higher if the ocular finding is symptomatic than asymptomatic

c) The presence of this finding lowers the threshold for operative intervention of carotid stenosis

d) Patients with this condition have a higher rate of progression of carotid stenosis than those without and should undergo a more intensive duplex ultrasound surveillance program
Q10. I am embarrassed to say it but this one was straight from VSEP review questions. I liked the picture and bet some audience members had never seen such a beautiful example of a Hollenhorst plaque. The correct answer is b. In a study of 130 patients with a Hollenhorst plaque or a retinal artery occlusion, asymptomatic patients rarely had simultaneous carotid stenosis; only 6 patients required carotid intervention. No stroke or transient ischemic attack was identified in follow-up of patients with this condition and serial carotid Duplex scans failed to identify progression of carotid stenoses. Stroke-free survival rates were high.

Described by Robert Hollenhorst in 1961, 31 patients with carotid stenosis, the term "Hollenhorst plaque" is used to describe cholesterol crystal embolization to the retinal circulation. This can be an incidental finding on an ocular exam. It is an age-indeterminate microatheroembolus from any proximal cardiovascular structure. Patients with a Hollenhorst plaque should undergo evaluation; however, the decision to treat a carotid stenosis can be made independent of the ocular finding. *Trans Am Ophthalmol Soc 2013;111:17-23*
A 76 YO MAN IS REFERRED TO YOU WITH A LOW GRADE FEVER, MALAISE, SHOULDER PAIN AND AN ELEVATED ESR = 110 MM/H AND CRP = 104 MG/L. A LONG-TAPERED STENOSIS IS VISUALIZED IN THE VERTEBRAL ARTERY

**Question 11.** Which of the following is not true regarding his diagnosis?

A. age of onset is usually >50

B. new onset of localized headache is an important diagnostic criteria

C. The disease can be present without constitutional symptoms

D. Temporal artery biopsy has a positive predictive value of 84-92%
Q11. D. A positive temporal artery biopsy is confirmatory of giant cell arteritis (PPV = 100%).

Prompt biopsy and initiation of steroids is critical to prevent blindness. Temporal arteritis is predominantly managed by rheumatology or ophthalmology. The rheumatological manifestations are usually mild to moderate while blindness can be complete and permanent. Treatment is long-term steroids. Takayasu arteritis is an important consideration and it is argued that they are a spectrum of the same disease. In general, patients with Takayasu are younger, have lower values of ESR and CRP, and the vascular pattern are typically short stenosis or occlusions rather than long tapered stenosis shown in the image shown. When performing a biopsy, it is recommended that at least 4 cm of artery be removed to maximize potential of seeing the disease if present.
Question # 12. 63 year old woman presents with abdominal pain without peritoneal findings. What is the most appropriate treatment?
The same patient’s presenting laboratory values were WBC 11,600 mm$^2$, hemoglobin 11.6 gm/dl, and platelets were 685,000 and decreased to 485,000 after hydration. She tested positive for Janus activated kinase 2 V617F (JAK2) mutation.

**Question #13.** Which of the following is least likely to be associated her underlying diagnosis?

a. The JAK2 V617F mutation is a more common cause of thrombophilia than antithrombin III, protein C, protein S, or the Factor V G1691A Leiden mutation

b. Polycythemia vera

c. Deep venous thrombosis

d. Essential thrombocythemia

e. Transformation into acute myelogenous leukemia is a common cause of death in patients with JAK2 V617F mutation
Q12. Systemic anticoagulation with heparin and transition to warfarin. The patient has mesenteric vein thrombosis.

Q13. C. Deep venous thrombosis. The JAK2 V617F mutation is the present in about 1/3 of patients presenting with mesenteric vein thrombosis (MVT) but it is not common in patients with deep venous thrombosis. It has a high association with myeloproliferative disorders (MPD) especially polycythemia vera (PV) and essential thrombocythemia (ET). MPDs are not straightforward to diagnose when patients present with acute MVT as dehydration, third spacing, and possibly hypersplenism makes peripheral blood values difficult to interpret. A bone biopsy is diagnostic for MPD which are generally divided into Philadelphia chromosome positive (chronic myelogenous leukemia) and negative (PV and ET) categories. Compared to other inherited thrombophilias, JAK2 mutations are frequent.
Below are photographs from a 32 yo man with unilateral leg swelling.

**Question #14.** What is the name of the test the examiner is doing and what is its significance?
Q14. Stemmer’s Sign. Lympedema
John Lane mentioned this about an hour before the test so I thought everyone would get it.

A positive Stemmer’s sign is the inability to create a skin fold by pinching the skin at the base of the second toe. It has a very high positive predictive value for the diagnosis of lymphedema and useful in distinguishing phlebolymphedema from chronic venous insufficiency. As proteinaceous interstitial fluid accumulates, chronic inflammation and fibrosis reduces the ability to pinch the skin. Uncomplicated venous insufficiency should not involve the foot.
Question 15. Regarding cranial nerve injuries during carotid surgery all of the following are true except?

A. The most commonly injured nerve is the hypoglossal

B. Injury to the structure labeled by the black arrowheads produces voice fatigue

C. Injury to the structure labeled by the black arrowheads produces hoarseness, impaired phonation and ineffective cough

D. Injury to the glossopharyngeal produces impaired swallowing and recurrent aspiration
Q15.C.
The most common CN to be injured is the hypoglossal. Injury to the glossopharyngeal is dramatic with significant impairment in swallowing and aspiration pneumonias. The structure identified is the superior thyroid and produces voice fatigue with injury.
A 29 year old man was referred for parathesia and coldness in the left hand. He is HIV positive treated with emtricitabine-tenofovir and lopinavir-ritonavir. He had difficulty writing and his hand felt clumsy. He had no left radial pulse, his heart rate was 60 and his left arm blood pressure was 105/65 and 115/65 on the right.

**Question 16.** Which of the following diagnosis is least likely?

A. Primary Raynauld’s disease  
B. Thoracic outlet syndrome  
C. Embolic disease  
D. Giant cell arteritis  
E. CREST syndrome  
F. Churg-Strauss disease  
G. Takayasu arteritis
CASE CONTINUED. 29 year old man with HIV. Noninvasive evaluation were consistent with dampened waveforms. On further questioning, he endorsed positive travel to Egypt two weeks prior. He denied insect bite or toxin exposure. He just completed a prescription of Cafergot 1 mg q Day PO X 14 days which he took for migraines in Egypt.

Question 17. Concerning his condition which of the following is false?

A. It could be caused by eating grain products contaminated with fungus Claviceps purpurea

B. It was formally known as St. Vitus dance named after the Monks who first described it and the convulsions peculiar to the disease

C. Its metabolism can be inhibited by protease inhibitors

D. It causes vasoconstriction through non selective 5HT-1 receptor binding, dopamine and alpha receptors
Q16 D. Giant cell arteritis.

All you had to know was that GCA is a disease of persons 50 years of age or older. GCA can affect the subclavian artery and could produce signs and symptoms similar to the patient in this question. However, the demographic of GCA (one of the 5 diagnostic criteria) is age greater than 50.

Q17 B. St. Vitus dance is another name for Sydenham’s chorea.

I thought cafergot would give this a way. I took this case from the late great John Porter and modernized it a little. Ergotism can be seen in individuals who are taking cafergot (caffeine + ergotamine) for migraines and protease inhibitors as both are metabolized by cytochrome P450 CYP3A4. The result is vasoconstriction, which left untreated can progress to gangrene and limb loss. The disease was known as St. Anthony’s fire after the burning pain and the monks of the order St. Anthony who cared for the patients in the middle ages. The treatment consists of immediate discontinuation of the ergot-containing product and the HIV medication. Avoidance of caffeine or nicotine and at times beta-blocker or calcium channel blocker can be used.
THE PATIENT BELOW WAS REFERRED WITH AN ASYMPTOMATIC LEFT CERVICAL BRUIT. LEFT BP IS 146/84, RIGHT BP 135/82. CAROTID ARTERY DUPLEX EXAM WAS NORMAL. BELOW IS THE PATIENT’S LEFT VERTEBRAL ARTERY EXAM TAKEN AT THE MID VERTEBRAL ARTERY (PSV 13.5, EDV 6.9 CM/S). THE PATIENT IS ASYMPTOMATIC AT REST AND DURING ACTIVITY. ESR =10 MM/H

The Doppler spectra has the appearance of a long crouching rabbit.
**Question 18.** In the patient presented what is the diagnosis and is the risk of stroke [less, same, or more] frequent than carotid stenosis?

**ASYMPTOMATIC LEFT BRUIT**

a. L. distal vertebral artery stenosis
   a. Less, same, or more

b. L. subclavian artery stenosis
   a. Less, same, or more

c. L. vertebral basilar insufficiency
   a. Less, same, or more

d. L. proximal vertebral stenosis
   a. Less, same, or more
Q18. D proximal vertebral stenosis, Less.

There is no flow below baseline so reversal is not present. The Doppler spectra is dampened and flow drops nearly to zero when the aortic valve shuts indicative of a proximal stenosis. The blood pressure in the left arm was higher than the right ruling out a subclavian artery stenosis.
Losartan, an Angiotensin II receptor (type-AT1) antagonist, also inhibits the TGF-β receptor and it may be useful in delaying aortic dilation if taken long term.

Other genes associated with this disease include TGF-β Receptor type 1, TGF-β receptor type 2, TGF-β, and SMAD3.

The genetic disorder is transmitted by autosomal recessive with variable penetrance inheritance.

The genetic disorder is caused by a defect in the transforming growth factor (TGF-β) receptor gene producing an increase in receptor signaling.

Question 19. Which of the following is false regarding his diagnosis?

A. Losartan, an Angiotensin II receptor (type-AT1) antagonist, also inhibits the TGF-β receptor and it may be useful in delaying aortic dilation if taken long term.

B. Other genes associated with this disease include TGF-β Receptor type 1, TGF-β receptor type 2, TGF-β, and SMAD3.

C. The genetic disorder is transmitted by autosomal recessive with variable penetrance inheritance.

D. The genetic disorder is caused by a defect in the transforming growth factor (TGF-β) receptor gene producing an increase in receptor signaling.
Q19. C. The patient has Loeys-Dietz syndrome an autosomal dominant inherited genetic disorder involving the TGF-β including SMAD3 family of genes. If I am not mistaken, all of the thoracic aortic aneurysm-related genetic disorders are autosomal dominant inheritance.

Angiotensin receptor blockers also antagonize the TGF-β receptor and may delay the dilation of the aorta.
A 48-year man with a history of alcoholism and methamphetamine abuse, presents with back and abdominal pain. His systolic blood pressure is 230 mmHg and aortic dissection is suspected. Initial laboratory values include hemoglobin 9.8 gm/dl, total bilirubin 4.3 mg/dl, and creatinine 3.5 mg/dl. His electrocardiogram demonstrates a heart rate of 46 bpm, Mobitz II heart block, and left ventricular hypertrophy. Which of the following medications should be used to treat his uncontrolled hypertension

**Question 20.** Which one of the following medications is most appropriate to manage his blood pressure.

a. Hydralazine  
b. Fenoldopam  
c. Nitroglycerin  
d. Esmolol  
e. nitroprusside
Q20 B Fenoldopam. Fenoldopam is an arteriolar vasodilator acting via a dopamine-1 agonist effect. It has a rapid onset of action and a short half-life (5 minutes). Fenoldopam may be the drug of choice for treatment of patients with renal impairment as its dopaminergic effect increases renal blood flow. Thus, fenoldapam is the most appropriate choice for the patient in this scenario.

Esmolol can be an excellent beta-blocker for treatment of aortic dissection, but contraindications to its use include certain rhythm and conduction disturbances, including severe sinus bradycardia, heart block greater than first degree, and sick sinus syndrome. Thus, esmolol would not be appropriate for this patient.

Nitroprusside is a vasodilator that produces both arterial and venous dilation, has a rapid onset of action, and has a short half-life (3-4 minutes). It is appropriate for control of severe hypertension, but its use is contraindicated in patients with hepatic and renal impairment.

Hydralazine is a direct vasodilator. Its use for aortic dissection should be avoided since it increases aortic wall shear stress and has prolonged and relatively unpredictable antihypertensive effects. Nitroglycerin has relatively weak effect as an arterial vasodilator and it is not a good choice for hypertensive emergencies.

Other treatment options might include a calcium channel blocker (eg, nicardipine) or an angiotensin converting enzyme (ACE) inhibitor.
Question 21. Name the structure in this prosection labelled 1.
Q21. Spinal Accessory Nerve
This patient with a medial toe ulcer and exposed tendon has an absolute ankle pressure of 46 mmHg and a second toe pressure of 28. His wound is dry and without surrounding soft tissue erythema. His WBC is normal and he is without fever.

**Question 22.** What is his WIFI classification?
Wound = 2
Ischemia = 3
Foot infection = 0

This was a hard test but I hope you enjoyed playing. Our winner was a ringer from University of Alabama. Congratulations to all who got in the top 3. Bravo to you. I enjoyed making the test and I learned a great deal. If this is something you want to remain in the symposium, please let us know. If you didn’t like it, let us know that as well.