



**The Curbsiders: Internal Medicine Podcast**  
**Episode 260: "Peripheral Artery Disease"**  
**Audio Transcription**

Paul 9:17

Mr. Aries is a 72 year old male. He's presenting with a three month history of bilateral ignorant and like cramping every time he walks to the grocery store and probably elsewhere. The pain goes from his hips to his feet. He's not been to a doctor in 30 years, so he's unsure of his past medical history. He's not been diagnosed with anything anyway. He says that when he stops walking, his pain significantly improves but the pain comes back he begins walking into brisk pace or if he walks for more than five blocks. He is not taking any medications currently and he is now retired from a career as a police officer. His family history significant for a brother father and paternal grandfather all who have died of heart attacks. His social history is noteworthy for a 50 pack year smoking history and he is a current tobacco user and smokes one pack per day. His diet is perhaps not the best sort of high in saturated fats and microwave meals and high in sodium, the remainder of his resistance is unremarkable. Really, it's just the leg pain he's going to use to see his vital signs are significant for blood pressure of 160 over 90. And his exam is significant for a lateral displaced PMI, which I checked for every time he's got an S4, and an abnormal vascular exam that we will discuss. The vascular exam specifically is as two plus credit pulses no breeze, he's got two plus real pulses bilaterally. His abdominal exam revealed no palpable pulsatile masses never bilateral coming from oral artery bruits which again is something I listened for every time. Each and every visit Popliteal and poster tibial pulses were not palpable. So you get all this information. I think we're painting a clear picture of someone who has underlying vasculopathy probably. But before we even get there, I think we're gonna start basic and just ask you to define peripheral arterial disease for since that is the topic of the show, and I think the topic of Mr. Aries' issues.

Vlad 10:48

Yes, absolutely. Thank you. So Mr. Art Aries definitely sounds like our classic patient with risk factors for peripheral artery disease. And I think the most simplistic way to define our peripheral artery disease as a disease of the peripheral arteries. And that's very free. You know, I it took me a while to think about how I'm going to define that, but it's most commonly is atherosclerotic involvement of peripheral arteries, which cause flow limiting blockages within the peripheral artery circulation, and peripheral arterial circulation most commonly when people think of PAD is the lower extremity arteries. So anything in the iliac arteries, femoral popliteal arteries are below the knee arteries. But of course, PAD also involves other peripheral arteries like the carotid arteries, and the renal arteries and in the upper extremity arteries. So I would say any atherosclerotic involvement of the peripheral arteries of the body outside of the coronary

circulation would qualify as PAD. That's, that's the most common type of PAD. There are less common types of PAD, which are non atherosclerotic and I think are going to be outside of what we're going to be talking about today.

Stuart 12:00

So, Vlad, just a real quick question, what proportion of patients with cardiovascular disease have peripheral arterial disease?

Vlad 12:08

That's a great question patients with cardiovascular disease, you can almost assume that they will have peripheral artery disease, it depends on the study that you look at, but probably about 30 to 50% of all patients with coronary artery disease will have comorbid peripheral artery disease, and it depends on the patient population that you look at, but they're very, very comorbid.

Matt 12:31

And is it defined as they would have symptoms, or that if you did angiography on them, you would find a stenosis of at least a certain degree. You know what I mean?

Vlad 12:42

Yeah, that that's, that's a good point. It's most of most of the patients of that 30 to 50% will be asymptomatic. So this is taking patients that are asymptomatic and screening them in a formal way if they have coronary artery disease, and just looking at a large number of patients that are asymptomatic and screening them for PAD that will help those percentages. If you actually look at how many patients with coronary artery disease have symptomatic peripheral vascular disease. That's a much lower percentage

Matt 13:10

I know there's some classifications that you had mentioned in in our correspondence beforehand, the Fontaine and Rutherford, are those clinically, like, important for us as internist? Like, how would you recommend we think about the degree or the spectrum of disease with peripheral arterial disease because we were just talking about asymptomatic disease. So how do you think of it on a spectrum?

Vlad 13:36

So both so there are two main classifications for a PAD that are used one is Fontaine and one is Rutherford. The most useful way to think about it is to stratify patients as first is whether they have symptoms or not so asymptomatic PAD or not, so patients that have Fontaine class one, or Rutherford Class 0 are asymptomatic. Outside of that patients have symptoms, the secondary split and that classification is to determine if the patients have claudication or critical limb ischemia. And both of these classifications since system start with claudication, and as progressive stages increase in both of these classifications, they progress to critical schemas, for example, in Fontaine classification classes 1, 2a and 2b are claudication, in Rutherford classes 1, 2 and 3 are claudication, and everything else is critical in the scheme. So I think it's

very important clinically to determine whether or not the patient's has claudication which will put you into one direction of treatment versus of the half critical limb ischemia. Fundamentally claudication is any type of pain that occurs with ambulation classically in the calves that resolves with rest, and that's your typical clot against a patient that only has symptoms with ambulation work like climbing up steps or some sort Have exertion and then that results with the rest. Whereas patients with critical limb ischemia are those patients that either have rest pain. So they don't have to emulate to have their symptoms or nocturnal pain when they're laying down, ulceration, or gangrene. So rest pain, ulceration, and gangrene are your critical limb ischemia patients and those are the patients that you really want to pick out quickly because they will have significantly higher risk of having the major adverse limb event and have an amputation where versus patients that have claudication are much, much lower, much lower risk for limb threatening ischemia and amputation.

Matt 15:40

I like that that's a so it's asymptomatic versus symptomatic. And then if they're symptomatic, split into the claudication, or were critical limb ischemia, that's, that's good I can I can remember that that's easier than the than the other tables, which I imagine are when when vascular Doc's are communicating with each other, they probably know those cold but for me, I, I think I can remember the way you just laid it out.

Vlad 16:03

Yeah, absolutely.

Paul 16:04

I'm assuming that part of the point of differentiation is that when you reach critical limb ischemia, then that changes urgency, right. That's the point that we're making here. So it's critical that your time

Vlad 16:13

Absolutely, yeah. If you if you find a patient in clinic, who you suspect has peripheral artery disease, and you find find out that they have critical limb ischemia, the urgency of revascularisation is much higher. So whereas person who has claudication, you don't necessarily have to revascularize them at all, and maybe, maybe never. And the standard of care for those patients, as we'll go over in detail is going to be medical therapy and exercise program. And only if they fail that first line of non invasive therapy, will you even consider vascularization versus critical limb ischemia, you want to improve blood flow as fast as you can to heal either their ulcer reduce the extent of their gangrene or heal their resting. So that's really the main differentiator, whether you're going to send them for surgical or percutaneous revascularization. Or if you have a lot of time to try medical therapy and non invasive therapies for Claude Akins,

Matt 17:14

it struck me that talking about the history, so with Mr. Aries here, it struck me that there this might go be under recognized or that there might be a delay in diagnosis, because sometimes

you might think this is like a back pain or a radiculopathy. So can you tell us like the classic claudication? And then maybe tell us what what's like what are some of the a typical cases that you commonly see, and maybe that our audience can look out for as generalists like to make sure we don't miss until the point where the person has critical limb ischemia.

Vlad 17:48

Yeah, that's, that's a really important point. And we see that in clinic quite often that patients will come in with leg pain. And the first thing to differentiate is whether or not you're dealing with a vascular pathology or not, because that it will, of course, completely change your treatment strategy and diagnostic strategy. So the most classic descriptions of typical claudication irregardless of what the symptoms are, is that it's exertional in nature, so if the patient has exertional leg discomfort, and the leg discomfort can be either at the level of the calf and the level of the foot, or at the level, the level of the thigh, that points you to a vascular type of pathology. And typically patients will develop these symptoms with exertion and the symptoms will then resolve were significantly improved with rest. That's, that's your typical claudication. And then when you divide it further, the further differentiation is based on which level of the arteries involved so if the patient has obstruction of the arteries, at the level of the superficial femoral artery, the popliteal artery, they will have one set of symptoms versus if they have more proximal disease, either at the level of the aorta or the iliac artery, they will have a different type of symptomatology. And more specifically, if patients have femoral popliteal disease or below the knee disease, tibial obstruction, they will have claudication symptoms that are typically described as pain in the calf or pain of the ankle or pain in the foot. They will typically not have any symptoms involving the thigh, the back the hip or the buttock. Whereas patients that have symptoms, the other symptoms, so if they have thigh symptoms, back symptoms, hip symptoms that are exertional in nature, that's typically aorta iliac disease, and those symptoms are not present with femoral popliteal disease. So that's the classic type of claudication description. So one is that exertional or not, if it's exertional, it may be vascular. And then if it's vascular, do I have thigh, hip, and buttock involvement? In which case it may be your iliac versus is it sparing those territories and it's only involving the calf, the ankle, the foot, and In which case, it's most likely femoral popliteal, or tibial. So those are the typical claudication symptoms, the common culprit that presents as pseudo claudication, or the pathologies of the back and the sciatic nerve, so any of the neuromuscular pathology, so patients will come in and they'll complain of back pain, or they'll complain of leg pain or shooting pains down their legs. And it may sound like they're having claudication. But what mainly differentiates it for me is the fact that the symptoms are not exertional. They may be in and they're classically positional. So patients will have symptoms in one position, for example, when they're standing upright, or standing for a long time. And then if they change the position, in the most classical description of that is that they will be at the store, they will get a cart shopping cart, and they will lean onto the shopping cart and that relieves their symptoms. That's very atypical of vascular pathology is much more typical of a musculoskeletal pathology, because when they lean forward, they open up the space between their vertebra and they relieve the pressure on the nerves that are most likely causing their pain or they open up the vertebra. And they're relieving the pressure on the herniated disc that they have. So if you have positional symptoms, it's very unlikely to be vascular, versus if you have exertional symptoms, it's much more likely to be vascular.

Paul 21:58

So we gave you a lot of physical examination data. Tell me a lot of which admittedly, I don't do routinely though I also this is not my bread and butter. So can you just talk me through sort of what your physical examination looks like when you suspect medication like how, obviously the pulse examination is gonna be critical, but just just talk us through exactly what your what your progress is, and how it helps you if you don't mind?

Vlad 22:21

Absolutely. One thing that that I do in all patients, that I suspect peripheral vascular disease of the lower extremities, or any vascular bed is a check first to check blood pressures from both arms. That's something that MAs do routinely, for our patients during the physical during the initial vital sign assessment. And if there's a discrepancy between the two blood pressures, then they'll usually repeat them to confirm that or not. Because if there is a discrepancy, and it's real, and especially if the discrepancy is more than 20 millimeters of mercury difference between both arms that will clue me in further that perhaps I will find an abnormality in a different vascular bed as well. Maybe a bruit in the carotid were brewing the abdominal aortic examination or an absent pulse somewhere, you know, the difference between the blood pressures is not common. But if it's present, it's a valuable site physical sign to look out for. And then in a patient like this, who is presenting with multiple risk factors peripheral artery disease, and is complaining of leg pain, I want to evaluate the vascular system and kind of understand whether or not I can clue in myself into a are the pulses normal or not. So does the first step are the pulses completely normal or abnormal. And when I say that, the pulses in general, are graded from zero to three, zero being absent three being a bounding, one being diminished, and two are normal. And the reason the three is important is because if you notice that somebody is pulsar, bounding, much more impressive than you expect, especially in the popliteal artery area, or in the abdominal area, that may mean that there is an aneurysm present, or you have a very high pulse pressure, for example from aortic regurgitation, and that is causing your pulses to be bouncing. So normal pulses are two. But if you notice that the pulses are zero, completely opposite or very, very bounding something, something is off the pathology, it could be aneurysm, or something or something different, like AR. So that's the that's that's kind of what I'm looking out for in terms of the pulse exam intensity. The next step is to figure out Are any of the pulses absent and then to figure out at what level are they absent? So if you examine the common femorals , and the common femoral arteries, pulses are abnormal. And that's the most proximal pulse that you can evaluate. Then you're clued into the fact That you're going to likely have a pathology above that level. So if you have a right common femoral artery at polls, that's an option, then you have to have either an obstruction, stenosis, or an occlusion above that. So either in the aorta or in the iliac artery, it's also important to figure out are the pulses absent bilaterally or unilaterally because of the pulses are absent bilaterally in the common femoral areas specifically, then there could be a unifying reason for that, which is in the Aortic obstruction, maybe the aorta is obstructed right above the iliac arteries. And that's why both common femoral artery pulses are absent. If one common femoral pulses present and the other common femoral pulses absent or reduced, then it's less likely that it's an aortic obstruction, there may be aortic disease, but you may be dealing with a unilateral iliac artery pathology, if

the common femoral pulses are normal, then the next pulse to evaluate is the popliteal pulse. That's a more challenging pulse to evaluate in terms of physical exams, I've always had trouble doing that that's a resident, I remember. And it took me a while to really figure out how to do it. And you know, there are different ways to do it. One is to bend the knee, and to put your both of your hands behind the popliteal fossa and press into it and try to find the pulse that way, I find that the vascular surgeons are very good at that, I was never as good in doing it that way to find a different way easier, which is you keep the leg flat, and you put one hand behind the knee and the other hand on top of the knee joint, and you press down, and you begin with the hands underneath the popliteal fossa and you tried to find a puppet to false. And I find that that's a much easier way to do it. So if the common femoral pulse is present, but the popliteal pulse is absent or reduced, then that suggests that there is a, there's a blockage or obstruction to the level of superficial femoral artery, and then you go down to your tibial pulse was to dorsalis pedis and the posterior tibial pulses. And that, let's say your common femoral is normal, your popliteal artery pulse is normal. But your dorsalis pedis or tibial pulses are absent or reduced, that tells you that there is a presence of peripheral artery disease. And the disease is likely below the level of knee. So those are some of the ways that you can figure out is, is the exam normal or not? And if the exam is not normal, then what is the level of disease that I'm looking at?

Paul 22:37

Let me ask this is something that comes up when I'm talking to students about checking pulses. And this question comes up every time and then when I try to answer a lot of tap dancing, and then I just avoid eye contact, but it always comes up. If the very at the most distal pulses are perfectly normal. Why not just start there? And what's the utility of going more proximally like if you know you've got a good dorsalisa pedis and a good tibial pulse, what's the point of having to chase your way all the way up the femorals? If you have a sense that you have good flow all the way distally? So help me to answer that question better than I've been doing.

Vlad 27:27

I suspect your answer is perfect to begin with. But you know, the problem is collaterals. The problem for physical examination and of course, collaterals are great for us as humans, but you can have a completely occluded common aorta, let's say and you you may have an absent common femoral artery pulse, but you at the same time can have a completely normal popliteal artery pulse, dorsalis pedis and posterior tibial pulse. And the reason for that is there's a lot of collateral circulation in the lower extremity that can compensate for an occlusion or obstruction. So if the iliac arteries occluded at the level of external iliac, but your internal iliac arteries patent and then the internal iliac will then connect to the profunda and then revascularize, the circulation from the common femoral all the way down, so your iliac artery may be occluded, but your common femoral pulses present partial pulses present in the pedal pulses that are present. So if you started your physical examination with the feet, and you check the pedal pulses and you notice that a great dorsalis pedis and posterior tibial pulses are two plus, I'm done. There's no peripheral artery disease, you may miss the fact that there's iliac artery obstruction. Now, of course, how would you know that if the femoral artery pulse is normal, the popliteal artery pulse is normal. Your suspicion is really based on the symptoms if the patient has no symptoms.

Common femoral pulses, normal old distal pulses are normal, you're probably not going to do more interrogation than that. But if the patient has symptoms that are typical of claudication in your pulses, your pulse exam is normal or only partially abnormal. Another way to kind of clue yourself in is to listen for bruits. So you may have a normal common femoral pulse, but you listen to you listen to it, and you'll hear a very loud or harsh bruits that suggests that there is some disturbance or turbulence to flow that is more proximal and you may have iliac artery disease. So you really have to examine the old pulses to make sure that one pulse is absent, but everything else is present because of the collateral circulation.

Paul 29:58

But this is as much physical exam talk because we've ever done on the show. I don't think I've ever been. I should probably head over the steering wheel to somebody else though.

Matt 30:07

Well, I wanted to talk a little bit recognizing arterial ulcers. Can you talk a little bit about that? I mean, I usually think of venous stasis ulcers, right? You know, we're used to seeing those people's skin is stretched and they get some weeping wounds on their shins or they get the medial ankle ulcers from venous insufficiency. Where do you see the arterial ulcers, which ones are most common?

Vlad 30:30

ones that I look for most are the toe ulcers and the, the one that's missed the most, which is the kissing toe ulcers.

Stuart 30:41

Wait, what do you mean by that?

Vlad 30:43

So kissing toe ulcers are the the ulcers that are in between the toes, so the only way you'll see if they're under inner aspect, the medial aspects of the toes, so the only they're not on the tips. And the only way you'll see it is if you take, let's say, the first and second toe, and you pull them apart a little bit to look at the webbing is. And you'll notice that there is a pinhole ulcer right there. And that's a physical exam feature that should be done in all patients that are diabetic, and all patients that are have a suspicion for peripheral artery disease, because you will otherwise miss it. The common places to see it otherwise are at the tips of the toes, which is the most distal circulation from the area of obstruction. So if you have an obstruction at the level of the of the femoral artery, the toe circulation is the most distal. So the common places I look at are the toes and in between the toes. And I would say that that's, that's probably a good place to start.

Matt 31:39

Is the kissing ulcer or in the webbing of the toe? Or is it where the two toes are kind of rubbing against each other? Where there's like pressure between the adjacent toes?

Vlad 31:49

Usually it's it's the areas of pressure, it's on the actual toes rather than the webbing. Okay, yep.

Matt 31:55

Got it.

Paul 31:56

Hence the kissing. I wondered where the kissing was. Yeah,

Matt 31:58

I think I've maybe have seen those before and not recognized exactly what that was.

Vlad 32:05

I've been using that term for such a long time. And I don't think that I came up with that. But I really hope.

Paul 32:10

I hope that you did not. And it's totally upsetting.

Matt 32:14

Okay, well, we've so we've talked, we've talked a lot about the physical exam here. Paul, are we are we ready? What are we ready to move on to next?

Paul 32:22

Sorry, we should probably go all the way back to the patient. I mean, we did talk about some of the physical exam features, but then you actually said fairly early on Vlad that this is a patient who has all the right risk factors for peripheral artery disease. So I wonder if we could take a couple steps back and actually talk about what comorbidities that you think about and and how that impacts how you actually manage PAD?

Vlad 32:40

Sure. Our patient here is a 72 year old male, who is a smoker and has family history of coronary artery disease. Essentially, any of the traditional risk factors for coronary artery disease are fair game for as risk factors for peripheral artery disease. So you think about older male patients, smokers, patients who are diabetic, have hypertension, have history, family history of coronary artery disease. And in obesity, I would say that those those are the main risk factors that I think of for peripheral artery disease and our patient, although, since he has not been to a doctor in a long time, and is currently unknown to have any of the traditional risk factors such as diabetes, hypertension, hyperlipidemia, I suspect that if he was actually evaluated for those things, he may have some or all of those things. But the clear risk factors that he has is the fact that he's an older male smoker and has family history of CAD.

Paul 33:37

All right, so we have Mr. Aries, he is in front of us. He has all the right risk factors for PAD. He's got all the right symptomatology for it, we got an exam that feels like slam dunk home run. So I talk us through your workup now. So what what next, so tell us Let's be in pretend dumbing yourself down, maybe that's not the right way to say it. But take yourself back to primary care clinic and talk about what the initial workup would look like. And then maybe what you would do after you get fttc, the initial workup

Vlad 34:02

In a patient like this a couple of things I would think of right off the bat. One is, I recognize that he has not been to a physician's office in a long time, and that he may have some of the risk factors that we spoke about. And first of all, he should get himself screened for diabetes, hypertension, and hyperlipidemia. Because if he has any or all of those risks, treatment of his suspected peripheral artery disease will be focused on modifying all those risk factors very aggressively. That would be number one. Number two, I would counsel him about smoking cessation, since that is one modifiable risk factor that will significantly impact his overall prognosis from cardiovascular standpoint and from peripheral artery disease standpoint. So those would be first two things that I would think about that I would speak about. But the next thing is that since we are suspecting peripheral artery disease, and he is at risk for it, and he's given us a history of claudication at this point, I think it's appropriate to order a screening test to determine whether or not he actually has a PAD. And the most common screening test and the most appropriate test to perform would be ABI or ankle brachial index. That could be done in a vascular lab in an outpatient setting, or sometimes can actually be done in the clinic itself, depending on your availability of the vascular Doppler and time. If a person was to perform this test in the clinical setting during the initial visit, you would need to measure brachial blood pressures in both arms and also measure the pressures at the level of the ankle. In order to do that, in order to actually measure the pressure or the level of the ankle, you would need a Doppler probe, which you would put over the dorsalis pedis and posterior tibial and inflate a blood pressure cuff over the ankle above this above the patient systolic pressure, and then slowly come down just like you would check blood pressure in the arm. And while you're deflating the blood pressure cuff your Doppler is under the dorsalis pedis. And when you hear the first signal of blood flow over the dorsalis pedis pulse, that's your systolic pressure at the level of the dorsalis pedis and you can repeat that at the level of posterior tibial. So now you have blood pressure measurements in both arms, you have to systolic pressure at the level of the dorsalis pedis at the level of posterior tibial. And then the next thing you would have to do is you would take the larger of the two measurements from your blood pressures in the arms, and you would take the larger of the measurements between the posterior tibial in the dorsalis pedis, and you would do a ratio, let's say your posterior tibial pressure is the highest and your right arm pressure is higher than the left, then you would take the ratio of the systolic pressure of the posterior tibial and divide that by the systolic pressure from the right arm and that would give you the ankle brachial index. And there are there are various values that are determined is normal and abnormal. In general, a value of ABI between one and 1.4 is normal, in anything under 0.9 is abnormal. So that that would be the next the next step in evaluation was patient.

Stuart 37:13

Excellent. I just want to point out that my first day on vascular surgery and walk into the OR and the attending says I need to go get ABIs on these patients. He gave me a list of like five patients. I looked at him with like this puzzled look. And he's like you don't know what ABI's are? I said, Yeah, sure, why not? I'll figure it out.

Matt 37:32

And then you traveled through time, did this moment right now.

Stuart 37:35

I know. I know. I yeah. So I actually pulled up the old dusty book and figured Oh, I need the Doppler probe for it. But no, that was that was one of - I swear that was the most harrowing day of my med school career.

Vlad 37:51

Did you get them the measurement?

Stuart 37:53

I did. I did. And I think two of them were abnormal. If i remember correctly. Laughter

Paul 37:58

There were a lot of unnecessary surgeries that day. Laughter

Matt 38:05

In my experience, a lot of the times rather than just getting a simple ABI, there's usually some other tests that go with it. Sometimes they'll say PVR, like post volume recording or continuous wave Doppler. Can you talk to us like what are the what are the common tests that are paired with this? And why do why do we add these extra tests to the ABI's? But my understanding is the ABI is sort of like a binary, you know, Is this normal? Is this abnormal? If it's abnormal, then you're going to start looking to try to localize you know where the abnormality is. But what do these other tests tell us?

Vlad 38:40

That's a great question. It's exactly what it's exactly what you're saying. So ABI itself literally measures the ABI the level of the ankle. So it tells you, if the ABI is abnormal, you have peripheral artery disease, if the ABI is normal, then you may not have peripheral artery disease. And the reason I'm saying may not have it is because you're most likely measuring resting ABI. If the patient has symptoms, you truly don't know if they have underlying PAD, unless you perform the exercise ABI. So that's actually one other thing that can be added to a patient's evaluation if the ABI is normal, but the history is so good. And your suspicion clinical suspicion for underlying peripheral artery disease is high. Then you say to yourself, like it does not make sense that this ABI is normal and a patient who has every risk factor for PAD and has symptoms of claudication then the next step would be to perform exercise ABI, which then may become abnormal because the patient outstrips the perfusion that they have addressed with exercise. And that results in a drop in an ABI.

Stuart 39:49

That's kind of like the correlation with myocardial perfusion scan.

Vlad 39:55

Absolutely. Yeah. In a stress test environment, there's always a resting imaging study of myocardial perfusion and a stress portion of myocardial perfusion. And you may have a completely normal resting scan of myocardial perfusion because at rest, there is enough blood flow, even if a patient has multivessel coronary artery disease, let's say, but as soon as you introduce a stress agent, like exercise or a vasodilator, all of a sudden you increase the myocardial oxygen demand, and you outstrip the heart's ability to provide that in your repeat imaging after distress agent is abnormal. So it's very similar with exercise beyond resting ABI. So addition of an exercise portion is sometimes important. If there's high clinical suspicion, but a normal resting ABI, the next step is to figure out where at what level is the disease that you're suspecting, just like you were saying, and what there are a couple of ways to figure that out. So one is, instead of getting just a baseline ABI, which just measure gives you a value of the level of the ankle, you can actually get indices and the level of the popliteal artery and the level of the thigh, which would be measurement, blood pressure measurements, from the thigh, usually from high thigh, low thigh. So there are two thigh measurements at the level of the popliteal artery. And then in addition to the traditional ankle pressure, the reason that the ankle pressures usually recorded as a basic ABI is because that's that's the most distal pressure that you can obtain, in general, except for the toe brachial index, which we can, which we'll talk about later. But if you truly want to know the level of the disease, and you notice that the pressure in the thigh, the expected pressure in the thigh, and the index is normal in the thigh, the index is normal and the popliteal artery and suddenly abnormal at the level of the ankle. That clues you in that the level of the disease is somewhere between the popliteal artery in the ankle. Whereas if your abnormality is the level of the thigh, you have a much more proximal disease involvement of the iliac artery. And you would not have known that if you only measured the ankle, ankle brachial pressure, because that just tells you there is there's a pressure drop at some level. So that's, that's one, which is increasing the, the levels of measurement of ABI. And just like you said, not the next step would be to get a pulse volume recording this another way to determine the level of the disease and pulse volume recording is a visual demonstration of arterial blood flow at a level where the PVR is being recorded. A blood pressure cuff is placed over the level that you're recording. And it's usually the same levels, which is high thigh low thigh, popliteal and the ankle. And a waveform of blood flow is recorded onto onto the paper. And there's a typical waveform that is normal, which looks very similar to the invasive aortic pressure, if you look at it, so there's a very brisk upstroke. There's the notch. And there's a slower down stroke, as the disease as there's atherosclerotic involvement of the artery over which PVR has been recorded the expect the changes that take place of that PVR waveform. So usually, what happens first is that the notch goes away, and then the amplitude of the PVR waveform goes down. So what you're trying to do is to see is the PVR norm. Is the PVR recording normal at the level at their material level that I'm evaluating? So if your PVR waveform is normal, and the thigh level and then suddenly becomes abnormal popliteal artery level, then the disease process may be at the level of the femoral artery. versus if the, if the PVR waveform is

dampened at the thigh level, then again, that clues you in that maybe the disease process is starting more approximately, at the iliac artery level. So essentially addition of PVR. And the more extensive index assessment is a way to determine the level of the disease once you already figure out that peripheral artery disease is present.

Paul 44:06

So can I ask, but how that particular point, like how is that helpful? If so if you have someone who does not have critical limb ischemia, so you've established this proverbial disease, you're not in the realm of critical limb ischemia. And I think earlier, and we'll talk more about management, but you mentioned that the management is primarily gonna be risk factor modification and maybe, you know, there's not going to be it's gonna be medical initially, and we're not really doing any sort of surgical planning, I guess. Does knowing the specific level disease help you manage these patients initially at all? Or is this more to kind of plan further down the line or is this risk stratify? How is this useful this early in the workup?

Vlad 44:38

In general? The answer is you do not need to know that information.

Paul 44:42

Oh, great!

Vlad 44:43

I mean, that's, that's a great question. And in my practice, I get in patients that have that I suspect, who have peripheral artery disease based on their symptoms, but who do not have critical limb ischemia. Really, all I want to know is, what are their modifiable risk factors and treat them aggressively. And then do they have peripheral artery disease causing their symptoms with an ABI. And if their ABI is abnormal, and they have claudication symptoms, then my first level of management is noninvasive. And I really don't need to know if the blockage is at the level of the iliac artery or at the level of the femoral artery, because, as you said, it will not change my management. So usually, I would get the PVR assessment and any other more advanced imaging assessment only after I decide like this patient has failed initial management, conservative management and may need some sort of revascularisation. At that point, it becomes very important at which level the disease involvement is. And then you have to figure out is it femoropopliteal? Is it iliofemoral? Is it aortic? Is it predominantly below the knee because that will completely change the landscape of how you will approach the patient's revascularisation strategy. So so it's it's a great point, you do not need to know the level of disease until you're ready to think about revascularisation.

Matt 46:02

Okay, so for our guy, I was gonna say for our guy, if his ABI was normal, we would be -we're so suspicious, because this guy has all the risk factors, his exams abnormal, we'd probably put them on a treadmill and repeat the ABI. And then and probably that would be an abnormal test.

Vlad 46:21

Yep, absolutely.

Matt 46:23

And then we could proceed, we don't have to do the sequential pressures or the PVRs, we could, we could just give him a trial of medical therapy aggressively treat as risk factors. And we could do that upfront, and then probably until we were ready to send them to you because we think he needs a procedure. We don't really have to do all that advanced testing.

Vlad 46:44

Yes, I think from the testing standpoint, that's that's all you would do. And he had, we have the benefit of knowing that his peripheral exam is more abnormal, that is common femoral pulses are absent and his tibial pulses are diminished. So if this ABI was normal, I would definitely put him on a treadmill, I suspect given his reduced pedal pulses, we will find that ABI will be abnormal in his particular case. But I've been surprised before, one additional point that I would make is that when you're you're evaluating the patient in clinic, and you're ordering an ABI, in addition to medical therapy, and maybe it's a good time to talk about it. Now, another very important step in a management of this patient, in addition to medical therapy would be an exercise program. So the patient may not need revascularisation at this time, but exercise program is something that that is critical to the management of the patients and is recommended by the guidelines.

Matt 47:41

Can you talk about the structure that because I think it's not specifically it's it's not specifically like a home exercise program? Right. There's there's some sort of - wasn't there a landmark trial that that looked at this? The name of it, which is escaping me.

Paul 47:58

You can't remember the name?

Matt 47:59

I think it's a clever name, Paul.

Everyone 48:01

Laughter

Paul 48:04

Just absolutely brutal. Sorry about that -

Vlad 48:06

I love puns! No, absolutely.

Stuart 48:11

Isn't name of the trial CLEVER.

Vlad 48:13

Uh, you know it, you hit it right in the head.

Paul 48:16

I regret to inform you.

Vlad 48:18

Absolutely, its the name of the trial. Yeah, so that was one of the earlier trials that showed that you really don't need to rush into revascularisation. Even if you know the patient has significant peripheral artery disease and they have symptoms. So in that particular trial, patients that were enrolled had aortoiliac disease. So they either had obstructive atherosclerotic involvement of either the aorta or the iliac arteries, just like our patient is suspected to have. And they had claudication. So these were not patients with critical limb ischemia. And these patients were then randomized to three arms, which was medical therapy alone, medical therapy plus a structured exercise program, or medical therapy with revascularisation. And what was very interesting about the trial is that patients who were in the exercise program arm did just as well as those who underwent vascularization. The only incremental benefit of revascularisation that was realized is that there was some incremental reduction in patient symptoms. But there was certainly no change in terms of patients adverse events, or amputation rates, which basically showed that if you exercise patients and you establish good medical therapy, you instruct them to exercise that is a very good starting point, rather than directing them directly to revascularization. Now to your point that there are different ways to exercise a patient and one is to send them to a dedicated structured exercise program, which is basically like a physical therapy type office situation where patients attend in an outpatient setting, and they have a very specific exercise regimen that they attend at least three times a week for about 12 weeks, and that's, that's a trial of exercise that can be given to patients before revascularisation is considered.

Matt 50:06

And Vlad, just to interrupt for a sec, that seems kind of like the cardiac rehab model, which I think is similar three times a week for 12 weeks similar timeframe. It's, it's particularly meant for patients, you know, with cardiac issues, I just wanted to poll Paul and Stuart, have either you guys ever sent anybody specifically to a structured exercise program for peripheral arterial disease? is that something that we know exists is easily accessible for our patients?

Stuart 50:33

Definitely not during COVID.

Paul 50:35

Right, even under optimal circumstances, it's not something that I've taken advantage of like, I think I had some vague awareness that it existed, but it was not, you know, I think we're so medically minded. Right?

Matt 50:44

So we ask our friendly neighborhood interventionalist or vascular Doctor, what do you recommend?

Vlad 50:51

Yeah, I think that's, that's really important. Every patient that I see who has peripheral artery disease, that is formally diagnosed who has symptomatic PAD and claudication symptoms, every patient of mine, I institute a medical therapy program, and then advise them to either attend a structured exercise program, or give them a self directed exercise program if they don't want to or can't attend an outpatient facility. And I've had patients who were significantly symptomatic at the baseline when I first met them. And institution of those two interventions made random them completely asymptomatic and they did not require any further revascularisation. So that is, those are really the staples of treatment of PAD for claudication. And should be tried first and every patient before anything more aggressive is considered. Is there a specific handout that you give, like specific instructions, maybe we can either share with our audience are just included in our show notes?

Vlad 51:50

Yeah. So we have, we have that as part of our electronic medical record that gets printed out. And I hand that to the patients. And, you know, if the patients don't attend an exercise program, what I usually tell them to do as a self directed home based program is to go outside and walk for about 30 to 45 minutes, at least three times a week if they can, and they walk essentially to the point where they experience moderate claudication symptoms. And at that point, they can no longer walk, they stop and the rest the rest until their symptoms improved to the point where they can start walking again. And then they walk again, until they once again reach their symptoms, at which point they have to stop in the repeat this loop of exercise followed by claudication, followed by perseverance for 30 to 45 minutes. And the thought behind why that's effective. There are probably many, but one is that there's a concept of ischemic preconditioning, which is that you may be ischemic, because you have a blood flow limitation, but you're training your muscles to to work better under more ischemic environment. The other thing that we think that happens in the lower extremity circulation is that you may develop more collateral circulation as your exercise in the collateral circulation reduces your symptoms over time.

Paul 53:12

Alright, so let's bring it back to our patient. He comes back to your office and the interval he's been diagnosed with high blood pressure, type two diabetes, hyperlipidemia. He's got it all. He's got all the vascular risk factors, but we intervene on those things. And he's now taking lisinopril 20 milligrams is now normotensive. He is adhering with a statin. He has no issues with it at all. He started Metformin twice daily for his diabetes, which was not out of control but certainly worth working on. And he had a come to Jesus moment he has quit tobacco Cold Turkey has not touched a cigarette since he made the diagnosis. He has done everything that we could have asked him to and more. And he's completely on board with an exercise program. He's he's ready to run out the door if he's able to. So we have we have all the enthusiasm we have all the risk factor modification and we have patient buy in. But probably we should also talk Are there

any other medications we should be adding to this patient's regimen or what sort of evidence based medical therapy can we do to help ameliorate his symptoms?

Vlad 54:05

Great question. So all patients with confirmed peripheral artery disease should be on a low dose aspirin 81 milligrams that will reduce patients adverse events, and not only adverse limb events like amputation rates, but also will reduce their risk of adverse cardiovascular events like stroke, heart attack and stroke. This gentleman should be on a high potency statin which is either atorastatin 80 milligrams or rosuvastatin 40 milligrams if the patient's tolerated. So, and then there's a PAD specific medication called cilostazol, which has specifically been approved to increase the walking distance in patients with peripheral artery disease.

Stuart 54:49

real question about the statin, is that irrespective of what their pretreatment LDL is?

Vlad 54:55

yes, patients with symptomatic peripheral artery disease even if their LDL is 70. I would put them on high potency statin here regardless,

Paul 55:05

is there a secondary prevention plan at that point, right. Like at least according to ACC guidelines, there's the patients who weren't because they've already have established ascvd.

Vlad 55:13

Exactly, PAD is essentially CAD equivalent. So high potency statin at that point. So in terms of cilostazol, it's a phosphodiesterase three inhibitor, and the medication has been shown to increase the walking distance in patients who have claudication. So you may not dramatically increase the walking distance, but for some patients who may not be extremely active in the outpatient setting to begin with, that additional use of cilostazol can improve their lifestyle and may avoid revascularisation.

Matt 55:44

So with cilostazol, I think just to point out to the audience, for patients with heart failure, reduced ejection fraction or just bad heart failure. I think it's contraindicated I don't exactly know why. But I've seen that pop up when you read about it, is that something that you put a lot of stock in, Vlad?

Vlad 56:02

Definitely, it's, it's contraindicated in patients with heart failure, if patients are in active heart failure, meaning that they have their functional class three symptoms. Certainly, if they have functional class for symptoms, whether they have a reduced ejection fraction, or preserved ejection fraction, I would not start this medication. Most patients usually are not insignificant heart failure syndrome, at the time of their evaluation, at least in my clinic, and I am able to start the medication. There are some other side effects like headache, diarrhea, sometimes

palpitations that patients experience there's one trial that show that those symptoms happen is as many as 20% of patients. But I'll tell you that I've prescribed cilostazol to many patients before and really this discontinuation rate is not that high.

Paul 56:49

And then who gets the dual antiplatelet therapy, I feel like it's always a kind of a mystery to me that patients will show up in my office, and suddenly they're on clopidogrel and they don't quite understand who's who's chosen for that. So I reading through it looks like someone who's "high risk", but who's high risk and how do you choose who who warrants dual antiplatelet versus low dose aspirin alone?

Vlad 57:05

Yeah, that's always a good question. And I think there's a lot of confusion about this topic because patients with coronary artery disease will frequently be on dual antiplatelet therapy. So, so similar question comes up with significant peripheral artery disease, I think is a general statement. dual antiplatelet therapy is not indicated for most patients with peripheral artery disease of the lower extremities. There is a trial called the Charisma trial, which looked at addition of dual antiplatelet therapy for high risk individuals for patients who have previously undergone revascularisation of their lower extremities, where it seems that addition of dual antiplatelet therapy does reduce the long term major adverse cardiac and limb events. But in my patients, if a patient has undergone revascularisation, one time, even if they've had stenting of their lower extremities, I will place them on dual antiplatelet therapy for about 30 days after their vascularization whether you stepped or not. And then typically I will stop there P2Y12 inhibitor whether it's Plavix or another agent, but if a patient has had multiple prior interventions, maybe they had bypass, maybe they've had critical limb ischemia in the past, those are the patients who I would consider doing to both therapy for long term.

Matt 58:21

So its 30 days after a revascularisation? Whether it's like does that mean, if it's surgical or endovascular, you would dual antiplatelet for 30 days, regardless of the level and then after that, they might just go to aspirin. But if they have you said, if they're having really bad ischemia, despite, you might put this on chronically.

Vlad 58:45

Exactly. And as you can see, there's really the guidelines are fairly vague in the define it based on high risk individuals, or those that have had revascularization in the past and I think that there's a lot of variation from practitioner to practitioner as to who places and doing the therapy right off the bat after revascularization and ongoing for the lifetime of the patient. Or, like myself, if I intervene once in the patient may not need another intervention, I just do it for 30 days. But in all honesty, if I intervene on the same patient multiple times, so they have restenosis or to have critical limb ischemia, then that gives me the kind of the second hit. Then I would consider doing the therapy for longer periods of time or maybe indefinitely.

Matt 59:33

There was the - was it the Voyager trial? Paul?

Paul 59:37

Geez, I hate this much.

Matt 59:40

This is rivaroxaban in peripheral arterial disease. It was like a 2020 New England Journal study. I don't know. Like I wasn't aware of this trial before prepping for this but this was like a very low dose like 2.5 of rivaroxaban twice a day, plus aspirin. And then there was a little bit of extra bleeding. If but tell us about this Vlad, was this practice changing for someone who does this for a living?

Vlad 1:00:07

Yeah, that I get that question quite a bit. The whole question about whether anticoagulation therapy should be considered in patients who have peripheral artery disease and otherwise do not have an indication for anticoagulant like afib or DVT comes up quite a bit. In my practice, I have not adopted low dose rivaroxaban for these patients, I think the results of the Voyager trial are provocative and I think there's more, you know, I would like to see more data come out on that pointer trial enrolled patients with PAD who have had revascularisation. So all these patients who've had vascularization. So seemingly the highest risk patients with PAD rather than those that are asymptomatic or only have claudication. without prior intervention in in those patients, there, there seem to be an improvement in their primary endpoint, which which included acute limb ischemia, major amputation, MI, ischemic stroke, but it was at the expense of higher rates of bleeding. So that's always kind of the balance of trying to reduce the long term major adverse limb and cardiovascular events. by either introducing the dual-platelet agent indefinitely or adding an agent like rivaroxaban, but then always having that outweighed or potentially balanced out by the risk of bleeding. So it's always hard to determine the net clinical benefit, will the patient is the patient have high risk of bleeding? Or is the patient at high risk of having a major adverse limit then? So I'm not completely convinced one way or the other yet? And so I do not generally prescribe that. But that's something that may change over time.

Matt 1:01:42

So it sounds like for right now, as far as your practice, not really, these patients are not getting anticoagulation, whether it's where there's warfarin, or the the newer agents, and it's mostly either single or dual antiplatelet therapy right now.

Vlad 1:01:58

Yes. And in fact, the the Voyager specifically looked at rivaroxaban. There is a trial that looked at warfarin, in addition to antiplatelet agent. It compared warfarin with an antiplatelet agent versus antiplatelet agent alone, and that trial is already more than 10 years, it's called the Wave trial. And in that trial, there was significant increase in the risk of life threatening bleeding in the in the group of patients that have warfarin, without any major improvement and major adverse limb events. So warfarin in general is not indicated. Of course, in that trial, they targeted the INR two to three, you can imagine that the situation maybe if they targeted a lower INR level, perhaps

there would be less bleeding events, and maybe it would have been safer. But similar, you know, with the Voyager, they used a very low dose rivaroxaban, where the bleeding events were still low - low enough to consider it. So I think I would not consider using warfarin. And if I would consider an agent like rivaroxaban. Or if data comes out for different NOAC, but not yet.

Matt 1:03:07

Paul, it's been it's been a pleasure to just watch as he's naming these trials, just watch the Charisma trial. Really, I could tell that really was a sucker punch, right? Laughter. Paul did not like that one.

Everyone 1:03:20

Laughter

Paul 1:03:20

Thank you for mentioning.

Paul 1:03:22

I've had to brace myself sometimes. That one caught me by surprise, I'm sorry. So Mr. Aries, he's our dream patient. He's now exercised. I mean, he did it four times a week, he would do it till tears ran down his face, it wouldn't stop him. But and despite this, he's better. But his qualification walking free distances increased from 100 feet to 130 feet, but he's still having symptoms that are limiting his lifestyle, he still feels that he's not where he would like to be in terms of his baseline activity level. So what what Next, I guess sort of more broadly, it sounds like he's heading towards a more aggressive intervention. So so what what can we do for Mr. Aires, then who actually how do we think about sort of revascularisation in general?

Vlad 1:04:01

Yeah, absolutely. So this is, you know, Mr. Aries, kind of follow the typical trajectory, if somebody who has significant peripheral artery disease was very symptomatic in the beginning, in whom conservative treatment of medical therapy and access program was attempted, and he continues to have symptoms, despite, despite all these interventions in the symptoms of lifestyle limiting for him. I think one key thing to note is that patients may have symptoms, but they may not be lifestyle limiting. So even if they still have symptoms, despite all these interventions, but they're not lifestyle limiting because they don't get out of the house too much, or they're wheelchair bound, or they get up once a day. And that's when they have symptoms. Even in that situation. If they have symptoms, you probably don't have to do anything. But in somebody who is active or would like to be more active, like Mr. Aries, in that case, attempt at revascularisation. is at this point appropriate. So since we're thinking about revascularisation, before you decide what kind of strategy to select whether surgical or endovascular is where you have to understand what is the level of disease and definitively confirm, is the disease at the level of the aorta? Is the disease at the level of iliac? Or does he have multilevel disease, maybe he has an occluded aorta, and maybe he has superficial femoral artery occlusion on one or both sides, which will inevitably change the type of revascularisation that he would receive. So, so for Mr. Aires, he would require more imaging, and that imaging modality would then tell

us what level of disease he has, in terms of the imaging modalities that I prefer. In a patient like this in whom I'm suspecting iliac artery or aortic disease, I would usually obtain a CT angiography of the abdomen/pelvis. And that usually gives you a very good understanding of the anatomy. Of course, there's limitations to that to the study, if there's significant calcification of the atherosclerotic plugs that may get in the way of understanding exactly how severe the lesion is because calcium can create blooming artifacts or just make the lesion appear more severe than it is, but in most patients I find who have celiac disease, and I order CT angiograms and they tend to be very helpful in understanding. So if we were to perform CT angiogram, or different angiogram doesn't have to be CT, it could be MR angiogram, or it could even be in an invasive angiogram. I just tend to go for CT angiography because it's easier to obtain in our center, in a confirm that he had your to iliac obstruction. At that point, revascularisation would be indicated in the type of revascularisation would really depend on his risk factors and to some extent, his preferences. And I think over time, endovascular revascularization techniques have become much more advanced. And we can now approach many different lesion types, including aortic disease and aorta iliac disease with endovascular approach, but certainly aortofemoral bypass if the only issue was bilateral iliac disease or obstructed aorta would also be very reasonable, and has very good outcomes, long term outcomes. So I think that's something that would have to be both endovascular and surgical options are typically considered and based on either the patient preference risk factors for surgery or anatomical lesion location, you know, one path or the other path is selected.

Matt 1:07:22

Paul, are we at a point for take home points here?

Paul 1:07:26

Yeah, what can we fix Mr. Aries? That's it, let's let's end with a happy ending. So he got his endovascular treatment, he's now just doing cartwheels down the hallway and is eternally grateful. And everyone's very happy. So having said that, now, why don't we ask the great doctor what take home points you have for our listeners?

Vlad 1:07:41

Yes, I think the main take home points are that in any patient who has suspected peripheral artery disease, you have to screen them for other risk factors, especially if they have not been diagnosed, if you're seeing a patient with suspected PAD who has no other medical history, it's always very suspicious to me because usually PAD is not the first medical problem that the patient will have. So I think anybody would suspect a PAD should be screened for risk factors like hypertension, diabetes, hyperlipidemia. So that's number one.

Vlad 1:08:13

If the patient has suspected PAD, and are smoking, smoking cessation is a very important strategy to reduce the overall cardiovascular risk and reduce their overall adverse outcomes related to their lower extremity disease. The next take home point is that if the patient has confirmed peripheral artery disease, the first step in management of those patients is conservative therapy. In the conservative therapy is risk factor modification, smoking cessation,

PAD specific therapies, like aspirin, high potency statin and consideration of cilostazol in addition to an exercise program, which can either be performed in an outpatient setting or can be performed as a self directed program. And then finally, if patients have symptomatic PAD, that is lifestyle limiting, despite attempts at risk factor modification, conservative therapy, then revascularisation can be considered. And in those cases, further imaging should be performed, like getting PVR assessment, arterial duplex CT angiography, MR angiography or invasive angiography to determine exactly where the level of disease is, so that you can plan your revascularisation strategy. And it goes, the last thing is just to say that patients who have claudication, it's very important to distinguish those patients from those patients who have critical limb ischemia. Just to review, it's those patients who either have rest pain, ulceration or advanced gangrene because for those patients who have critical limb ischemia, any of the symptoms that I just named, for them, revascularisation is the the next step in management in has to be considered right away, as opposed to claudication where all the other strategies have you tried. So I think those are the main take home points.

Matt 1:09:59

Look between toes

Vlad 1:10:01

and look between the toes for the kissing ulcers!

Matt 1:10:04

All right.

Paul 1:10:09

This has been another episode of the curb ciders bringing you a little knowledge food for your brain whole.

Stuart 1:10:13

Yummy!