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### Unclog the Arteries: Treatment Options for Arterial Disease

Narrator:

Welcome to Medical Breakthroughs from Penn Medicine, Advancing Medicine Through Precision Diagnostics and Novel Therapies.

Dr. Mennen:

This is Reach MD, and I am your host, Dr. Barry Mennen, and with me today is Dr. Grace J. Wang, vascular surgeon and Director of the Vascular Laboratory at the Hospital of the University of Pennsylvania. She is also Assistant Professor of Surgery and Assistant Professor of Radiology also at the University of Pennsylvania. Today we will be discussing arterial disease including peripheral artery disease and carotid artery disease.

Dr. Wang, welcome to the program.

Dr. Wang:

Thank you very much. It's really an honor to be here today.

Dr. Mennen:

We love having you. What are the different types of arterial diseases?

I am your host, Dr. Barry Mennen. Thank you all for listening.

Dr. Wang:

So, when I think about arterial disease, I really think about two separate categories of disease. The first is arterial occlusive disease, which is usually secondary to atherosclerosis or a plaque buildup or accumulation in the vessels, and it really does cause stenoses or narrowing of the blood vessels which then impede perfusion of either an extremity, or in the case of the carotid artery, it can predispose to stroke. And the other type of broad arterial disease would be aneurysmal disease, which is also secondary to atherosclerosis but tends to weaken the wall of the artery and cause aneurysmal degeneration of the aorta, for example.

So, those are two very different broad categories of arterial disease, but the preventative management of each of those disease processes are somewhat similar in that, as vascular surgeons, we are very in tune with the fact that since these are atherosclerotic processes, our patients are really encouraged to not smoke, to take their aspirin daily. Statins have also been shown to really improve outcomes, both following surgery as well as in the long-term. So, I think that while we separate those arterial diseases into these broad categories, many times the medical management of vascular patients are quite similar.

Dr. Mennen:

Could you tell us about the patients most at risk for developing these diseases and how they are diagnosed?

Dr. Wang:

The ACC/AHA guidelines make a Class 1 recommendation that anyone who is older than 50 years with a history of smoking or diabetes or over the age of 70 years should undergo testing with bilateral ankle-brachial index, which is essentially the systolic ratio at the ankle divided by the brachial artery, to serve as an overall screening test for whether or not they may have peripheral arterial disease. Those are the risk factors that we consider highly associated with peripheral artery disease.

And there are various gradations of severity of lower extremity disease. So, you can have a patient with normal circulation where they don't have any cramping when they walk, or you can have patients who have some minimal or moderate occlusive disease where with walking 5 blocks they may experience cramping in their calf, which stops with rest. That would be defined as someone with mild to

moderate vascular insufficiency. And then, its most severe form, patients can actually have foot rest pain, which awakens them at night leading them to dangle their leg over the side of the bed, or they can have foot ulcers which they are unable to heal because they really don't have enough blood flow going to the foot. In those latter categories, rest pain and tissue loss, those are signs of critical limb ischemia where, if a vascular surgeon is not consulted for revascularization, the patient is at risk for losing their limb.

And this is an important thing because I do believe that with earlier detection of mild disease, we would be able to counsel patients about the importance of smoking cessation, of appropriate lipid management and eating healthy and all the things that we know are good for the arteries and good for the heart. I think that if we could do more in terms of primary prevention in the earlier stages of peripheral artery disease, we would be able to treat the epidemiology of peripheral artery disease in a more effective fashion.

Dr. Mennen:

Now, is there any link between peripheral artery disease and carotid artery disease? Does one influence the other, perhaps?

Dr. Wang:

Yes, probably in 30 to 60% of patients with peripheral artery disease, they will have concomitant carotid disease, because atherosclerosis is a systemic process, and so, if someone comes to me with evidence of PAD, or peripheral artery disease, then it's incumbent on me to also check with a screening carotid duplex to look for carotid disease, and really vice versa as well. There's a similar relationship in patients who have known carotid stenosis which may be found earlier, for whatever reason, and then, really, they should be screened as well for peripheral artery disease.

Dr. Mennen:

Yes, I was going to say, as a generalist, I'm much more likely to pick up carotid artery disease before peripheral by listening for bruits or being just more attune to that.

Dr. Wang:

Absolutely, and we see that more so in practice as well. We're more likely to have patients sent to us because their primary has picked up on a bruit in the neck rather than someone who may have, sort of, ill-defined knee pain when they are walking, which may not sound like classic symptoms of claudication, but if they have diabetes and they're a smoker and they're over the age of 50, we really should be checking ABIs in those patients because they may have latent peripheral artery disease. There wouldn't be anything to do surgically from that standpoint, but I do think that identifying it does go a long way in terms of convincing the patient that these behavioral modifications really do have to happen and really target things in the early stage to that. As vascular medicine specialists, not just surgeons, we're really trying to get patients to be responsible for their health before they reach those end stages of peripheral artery disease. I think very frequently as surgeons we can do these operations to bypass very long occluded lesions in the leg, and we can do endarterectomies to treat carotid disease, and we can do these things, but if there was a way to detect these occlusive diseases sooner, we might be able to prevent some of these operations.

Dr. Mennen:

You touched on this before, but why is it so important to get this disease diagnosed and treated as early as possible?

Dr. Wang:

Well, the primary prevention of stroke, for example, in carotid disease is very important. If you can do an endarterectomy and prevent stroke, which is still the fourth leading cause of death in the United States and, obviously, billions of dollars in terms of healthcare taking care of patients who have suffered from devastating strokes, that's the large impetus for during surgery is really to prevent a massive stroke in these patients.

In terms of peripheral artery disease, we know that the large majority of patients with peripheral artery disease have very sort of atypical symptoms, and we're taught in medical school, as well as the questionnaires that are out there to detect mild to moderate claudication are very much geared towards these very consistent symptoms that occur with an actual consistent distance that the patient walks. So, the patient walks 1 or 2 blocks, they develop calf cramping in their leg, it stops, when they stop it stops, they resume walking and then to have very similar symptoms again. But many times, in particular, women can have very, sort of, atypical symptoms that are associated with lower extremity ischemia. So, I think that it's really incumbent on us to check an ABI in those patients because the Rose questionnaire is really not the most sensitive instrument out there, and we do still have to maintain a high clinical suspicion in those populations of patients.

Dr. Mennen:

Now, can peripheral artery disease and carotid artery disease be medically managed, and, if so, when do we do surgical intervention?

Dr. Wang:

So, it's interesting, because particularly in the carotid space, there are some neurologists who feel that we have become so good at

medically optimizing patients with asymptomatic carotid stenosis that they may not need a carotid endarterectomy or a carotid stent, and that's actually the subject of the CREST-2 trial currently, which is enrolling, which is really geared toward studying asymptomatic patients with carotid stenosis who were either randomized to medical treatment or either carotid stenting or carotid endarterectomy.

Dr. Mennen:

What was the level of stenosis for entry in the study?

Dr. Wang:

Seventy percent by duplex or another imaging modality. So, we wouldn't be doing the study unless there was clinical equipoise regarding the medical management of those patients, but their risk of stroke could be as low as 1% per year in some of the more recent meta-analyses that have been published on asymptomatic carotid stenosis. So, it really does behoove us, as surgeons and as interventionalists to understand that if we're contemplating operating or doing a stent on someone with asymptomatic carotid stenosis, we really have to be sure that we can do it with good outcomes, that the stroke rate and the perioperative morbidity rate has to be less than 2 to 3% really to justify a prophylactic operation for someone who's asymptomatic, because in and of itself in the era of statins, as well as aspirin, that patient may be best served being medically managed, and we have to weigh that as clinicians against all of that patient's anatomic and medical factors which may increase their risk of complications. I can't emphasize that enough. You really do have to look at the risk-to-benefit ratio for every patient that comes to you.

Dr. Mennen:

When surgical intervention is needed, what are the options available for each?

Dr. Wang:

We will do peripheral artery disease first. So, when intervention is required, I generally will do a CAT scan or a CTA if their creatinine can tolerate it because that will give you a good anatomic overall map of where the occlusive lesions might be. In general, any lesions in the iliac arteries or in the pelvis or in the superficial femoral arteries, which are in the thigh, those blood vessels are generally larger and respond well to endovascular therapy and have pretty good short- and mid-term patency rates. So, for most patients and reviewing the CAT scan, if those look like amenable endovascular lesions, i.e. they're not extremely long, then I will attempt an endovascular first strategy. For any lesions that cross the knee joint or for any occlusions that are below the knee, i.e. in the tibial vessels, I tend to favor bypass simply because we know that the stents in smaller vessels don't behave as well and their primary and secondary patency is very poor no matter what you do in terms of a stent or with a balloon, whether it be drug-coated or drug-eluting. So, those are sort of my general approaches for treating peripheral artery disease.

Now, in certain clinical scenarios that you may be able to think of in your mind like a very elderly 90-year-old who's extremely frail and who has tibial disease but can't tolerate an open bypass surgery or maybe doesn't have the conduit such as vein and the only thing you can really offer them is endovascular therapy, that might be a person where I would favor an endovascular approach simply because it's the only thing that I can offer them. But I would say that, in general, I do favor endovascular therapy for anything basically above the knee and then bypass surgery for anything below the knee.

For carotid disease, it is based on the literature in a sense that, as well as the SVS guidelines, which is our national society, I think if a patient can tolerate carotid endarterectomy, whether they be symptomatic or asymptomatic, that's the preferred modality. So, if they're symptomatic and have at least a 50% carotid stenosis or if they're asymptomatic and have a 70% stenosis, then intervention is usually recommended, or in the symptomatic stenosis category, is required to prevent stroke. If they meet high surgical risk criteria from an anatomic standpoint, i.e. they have a high carotid bifurcation above the second cervical level or they have an irradiated neck or if it's a radiation field for whatever reason or if they have a tracheostomy or a central line catheter, for example, those are all situations where you wouldn't want to be making an incision and sewing a patch into an artery because it might get infected. Those are patients that you would favor stenting.

Dr. Mennen:

Now, what new minimally invasive and endovascular techniques are on the horizon at Penn?

Dr. Wang:

Well, I think that with regard to carotid stenting, there is stents are essentially, you know, have been relatively, the technology for stents, have been relatively stable. The late area of controversy has been the mode of cerebral protection, and by cerebral protection, most of the earlier trials have used essentially a filter, wires, or some sort of a net which are deployed distal to the carotid bulb plaque and deployed into the distal internal carotid artery, and the function of that is really to catch any debris that occurs during stenting and angioplasty of the carotid plaque.

More recently, there has been a trial that has been initiated called the Transcarotid Artery Revascularization Trial where they are using a

flow reversal device, which actually involves placing a balloon into the external carotid artery and then putting a sheath into the common carotid artery and then connecting that sheath to the femoral vein and, essentially, causing flow reversal during the angioplasty and stenting procedure. The flow reversal ensures that no debris will embolize distally into the internal carotid artery but rather will be sucked backwards from the common carotid artery into the femoral vein. So, this mode of cerebral protection has been thought to, perhaps, be less risky than those filters which need to traverse the plaque before being deployed. You're not really protected from embolizing if you have to kind of wiggle your wires through the plaque before deploying it. Secondly, since the stent is being deployed through the carotid artery rather than through the femoral artery, it really obviates the risk of embolization from cannulation of the common carotid artery at the arch either for the left side or cannulation of the innominate and subsequent selection of the right common carotid artery. We know from prior trials that where patients were wearing a transcranial Doppler device is that there were embolic events noted just simply with cannulation of the head vessels. So, by using this reversal device where we're actually just accessing the carotid artery rather than coming through the femoral and accessing the arch vessels, it's thought that we will decrease the embolic risk.

So, there are many exciting things in the realm of carotid stenting with regard to how we're protecting the brain during these procedures, and I think it may lend some insight and cast some controversy in terms of like which patients may do better with endarterectomy versus stenting.

Dr. Mennen:

Dr. Wang, thank you for being with us today and sharing your insights on peripheral artery disease and carotid artery disease.

I am your host, Dr. Barry Mennen. Thank you all for listening.

Narrator:

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