

ROB MCBANE: Hi. My name's Rob McBane. I am the director of vascular medicine at Mayo Clinic in Rochester. Today we're going to talk to you about abdominal aortic aneurysms. And I'm delighted to have three very esteemed colleagues from our vascular surgical section.

To my immediate right I have Dr. Tom Bower, who is the chair of vascular surgery. Next to him I have Dr. Gustavo Oderich, who is the chair of the endovascular program. And then I have Dr. Randy DiMartino, on my far right, who is the chair of quality for endovascular and vascular surgery.

So this is a really important topic. Guys, we have a lot of abdominal aortic aneurysms in our country, a big rupture risk. Dr. Bower, tell me, what would you say to the average cardiologist or primary care physician, what's important about this disease? And how should they be thinking about abdominal aortic aneurysms?

TOM BOWER: Well, I think you're right, Rob. Ruptured abdominal aortic aneurysms account-- they've been the 10th or 15th leading cause of death in this country. I think there's pretty good data that suggests that single screening for men over the age of 65, that are smokers, is a reasonable thing to do.

The key is to identify them early, to refer to a vascular specialist, certainly a vascular surgeon. We usually make that recommendation once the aneurysm reaches or exceeds 4 and 1/2 centimeters in diameter. I think it's important to know the clinical trial data regarding results, and use that as guidelines in management. And so generally, aortic aneurysms, once they reach or exceed 5.5 centimeters in diameter, that's the point in which we begin to consider repair, whether it be by open or endovascular techniques.

ROB MCBANE: Very good. And so we use this number of 5.5, but clearly, our patients range from petite elderly females to older, maybe larger, men, and the whole spectrum therein, Tom. Can you tell me, is this a firm criteria of 5.5? Or if we have an older smaller individual woman, perhaps, would we consider repair at a smaller size?

TOM BOWER: The answer is yes. So we individualize care based on a variety of things, including size. So for someone that's petite, someone that has a family history of abdominal aortic aneurysm or other aneurysms, someone that has a family history of ruptured aortic aneurysms, patients with connective tissue diseases, [INAUDIBLE] arthritis, for example, in women is particularly problematic in terms of rupture risk, if they have aortic aneurysms. And so we will individualize size criteria and weighed against patient age, comorbidity, life expectancy, and their anatomy for repair.

ROB MCBANE: Very good. Now, in recent years, Dr. Oderich, in recent years, we've had a paradigm shift in the approach to abdominal aortic aneurysms. Open repair and now endovascular repair has become more in vogue, if I could say such. Can you tell me, which patients should we be repairing open, and which patients should we be sending for endovascular repair? And how do you decide which you would do for these patients?

GUSTAVO ODERICH: So there has been a number of prospective trials, Rob, comparing open surgery and endovascular. And pretty much, every single of them has shown short-term advantages for endovascular, such as decreased mortality, morbidity, blood loss, faster recovery. The downside of endovascular is on the higher number of reinterventions. So these patient do need close follow-up, and they are subjected to more reinterventions when we talk about aortic-related problems.

With open surgery most of the reinterventions are not aortic-related. They are related to the laparotomy, either due to a hernia or a bowel obstruction. And they are not insignificant. In the latest trial it's about 15% for each group.

So when we talk about endovascular the real issue is anatomy. We want patients with good anatomy so that the stents replacing healthy segments of the aorta, that they're not going to be subjected to migration of the device, loss of seal and endoleak.

For years, the devices that we had available, they were suitable for aneurysms that had the healthy segment below the renal arteries. The traditional lumen diameters that we see on the instructions for use are between 10 to 15 millimeters, at least, of a healthy aorta.

Now we know a number of predictors that are not associated with good outcomes. The more angulation you have, the more calcium thrombus you have surrounding the renal arteries, those devices don't last long. And treating failures of these devices is more difficult.

So I would say nowadays, for a patient with an infrarenal aneurysm that has excellent anatomy, endovascular therapy has become the first line of treatment. However, if the patient doesn't have good anatomy, or has borderline anatomy, or other issues that Dr. Bower alluded that are very important, such as family history. So those patients tend to progress disease over time, particularly if they are the younger group, then we look more into open surgery and innovative devices, such as fenestration and branch devices.

ROB MCBANE: Very good. Now, tell me, how about age? How is age going to play into this decision-making? For example, if you have maybe an 80-year-old individual with a lot of comorbidities, or perhaps a 60-year-old individual who is otherwise super healthy, does that weigh into your decision-making?

GUSTAVO Absolutely. So when we are talking about the extremes of age, it's oftentimes the decision becomes easier.

ODERICH: Because on the octogenarian, obviously, we'll try to do the least invasive approach. And we may be more prone to select an advanced endograft with fenestrations or branches.

On the younger patient, we are worried about longevity, prognosis, the need for surveillance with the endografts. So if we look on that perspective, we would favor open surgery.

Now there are some other outcomes that a younger patient may be more attracted to-- endovascular. One of them is sexual dysfunction. So oftentimes, we look at patient preference to select this therapy. And again, it really boils down to the anatomy, because if it is a younger patient with borderline, or bad anatomy, or a strong family history of aneurysms, we would probably favor an open repair.

ROB MCBANE: Very good. Dr. DiMartino, so tell me about quality of endovascular repair, quality of surgery. How are we going to - we have a huge number of patients in this country over the age of 60 with aneurysms, numbers ranging from 4% to 9%. Can you comment on quality, not only of the delivered procedure, but also of the follow-up and other variables that need to be addressed for patients to improve their survival?

RANDY DIMARTINO: Sure. I think one of the things that's been notable in the past 10 years since we started endovascular aneurysm repair with operator experience, there's been a significant decline in operative mortality and complications. So very early trials had much higher complication rates than what we're seeing now. So I think with time, and with the comfort of the delivery systems, and the improvement in the delivery systems of the devices, we're doing this a lot safer now. And so what we're seeing now are much better results than we were seeing 5 to 10 years ago.

For things that are ongoing that we need to do in terms of aneurysm repair, I think one of the main things is patient selection. And so understanding which patients may be better, as Dr. Oderich alluded to for open versus an endovascular repair, but also incorporating things like life expectancy into the overall decision tree in terms of their rupture risk of their aneurysm. So there are several vascular quality groups in the region that collect data on surgeries, such as aneurysm repair, open or endovascular, looking at factors that may better select patients and lower post-operative complications.

ROB MCBANE: Speaking of postoperative complications, you have a wonderful manuscript recently published in the *Journal of Vascular Surgery*. There's the procedure. The guy gets through the procedure well. He's ready for dismissal. Anything that you could comment upon regarding postdismissal therapies to improve survival?

What types of medications should these patients be on? And is it a big deal? We've fixed the aneurysm. How important is it to control risk factors?

RANDY DIMARTINO: I think it's extremely important. Once we've repaired the aneurysm, their long-term survival is going to be dictated by cardiovascular events. Often 75% of these patients will suffer a cardiovascular event. And if you looked at coronary arteriograms, maybe only 10% of them are actually normal for people undergoing aneurysm repair. So cardiovascular disease is very prominent in this patient population.

Some proven medications, like aspirin and statin therapy, can have a substantial effect on long-term survival, most likely from MI and stroke risk reduction. And so those that are discharged without those kind of medicines have a much lower survival at five years than those who are just able to be discharged on them and stay on them at one year, which is what we were able to show in our study using data from both New England and as well as nationally. And so I think it's extremely important to remember that secondary prevention of cardiovascular events is paramount.

ROB MCBANE: Absolutely. So I would highly recommend this paper for review. It's very, very important.

The middle of the night, Tom, you get the phone call. Your resident's in the emergency department with a 75-year-old gentleman. He's unstable and he has a ruptured abdominal aortic aneurysm.

How are you going to decide whether you're going to fix that ruptured aneurysm-- open or with endo? And is that important decision-making, or do we just do what's quickest and most available? How are you going to decide which of those two approaches you're going to use?

TOM BOWER: Well, I think the key in managing ruptured aneurysms at any institution is they have protocols in place for the management of them. And then to have a team of people that can take care of it.

So one thing we fortunately have in our health system is the ability to look at CT imaging from our Mayo health care sites. And if we can review those scans in advance, then we're prepared to get that patient immediately to an operating room. And our operating rooms where we can do endo, or open, or hybrid operating suites, and it's an operating room setting. So there has been a paradigm shift in treating patients with ruptured aneurysm from open techniques to endovascular repair. Two recent randomized trials in the Netherlands didn't show much of an advantage, but there's always criticisms of trials like that.

I think here, if the anatomy is suitable, and again, I can't overemphasize the importance of anatomy, whether you treat an aneurysm electively, or whether you treat it with branch or fenestrated devices, as Gustavo talked about, or whether it's a ruptured aneurysm. So anatomy is key. So if the anatomy is poor, it's a ducts renal aneurysm or it's a suprarenal aneurysm, that patient, more than likely, currently here, is going to be treated with open repair.

And the care protocols are important, because we'll bring patients right down from the helicopter pad into the operating room. We bypass the emergency room if they have reasonable imaging that we can see in advance. You don't want to waste time in the ER in these cases.

The second advance that's happened, which has actually been beneficial for open repair of aortic aneurysms, is the ability to put in an intra-aortic occlusion balloon, through a transfemoral approach, which can be done while the patient's awake, even while the anesthesiologist is prepping the patient.

ROB MCBANE: Very good. Thank you.

Dr. Oderich, you've been pushing the envelope. You've been-- we used to just do infrarenals. And now, are you doing juxtarenals, suprarenals? You have perhaps one of the world's largest experience in such procedures. Tell us, what is the future for extending the procedure beyond just the infrarenal aortic segments?

**GUSTAVO
ODERICH:**

So there is a lot of developments in novel technologies to extend the endovascular therapy to territories where the aorta has side branches. Traditionally, as we spoke before, the stent grafts that are currently commercially available, they are limited to aneurysms in the infrarenal aorta and in the thoracic aorta. So the aortic arch and the thoraco-abdominal visceral segment of the aorta have, at large, been untouched for years.

In essence, these vessels can be incorporated either using openings in the stent graft, called fenestrations, which are typically reinforced by a ring, or a branch, a cuff, that is pre-sown into the stent graft. These devices are available already in Europe, Canada, South America, Asia, and the United States. There is an early version of a fenestrated that is applicable just to renal aneurysms, involving only the renal arteries, that is already commercially available.

Here at Mayo, we currently have 14 clinical trial programs and two investigational device exemption protocols, which allow manufactured devices to be fashioned with essentially any design of combination of fenestration and branches. So we have expanded indications, oftentimes, to patients with thoraco-abdominal aneurysms, arch aneurysms, and pararenal aneurysms.

When we decide whether a patient's going to be treated by this technology versus open surgery, then longevity of the patient and clinical risk becomes a very important part of the decision-making. If the patient is in the younger group and healthy, we still lean towards doing open surgery. But more and more, there is an increasing number of patients being treated by these novel technologies.

ROB MCBANE: Randy so you see a patient and he has an aneurysm that may be on the small side-- 3 and 1/2 centimeters. What is going to be your recommendations for follow-up and surveillance of that patient? Does he need to come back and see you every three months, or can the primary cardiologist or primary provider take care of that patient for the interim?

RANDY DIMARTINO: Well, I think the primary thing is making sure that there is a surveillance protocol setup for the patient. Because one of the biggest predictors of rupture is going to be a gap in surveillance. So even a small aneurysm, like 3 and 1/2 centimeters, needs to be at least checked by a year. And then probably yearly thereafter, if it's in that same size threshold.

If it gets to a 4 and 1/2 or larger, you need to decrease that interval to every six months, particularly if it's the first time identifying it because you don't know what the growth rate of the aneurysm is. Even aortas as low as 2 and 1/2 to 3 and 1/2 centimeters probably need to be checked within 3 to 5 years in order to ensure that it hasn't become larger, and may need more close surveillance at that time.

ROB MCBANE: And what should tip off the clinician that this is an unstable aneurysm, either by physical features, by historical features, or by imaging features?

RANDY DIMARTINO: Rapid growth is usually one of the criteria we say is an indication for more urgent repair, and anything more than about 10% per year would be considered rapid growth. Any aneurysm that appears tender, or they have abdominal or back pain in the setting of a known aneurysm, needs an immediate evaluation.

ROB MCBANE: Dr. Oderich, endovascular repair. You have a 65-year-old patient and their family. And they want to know, with this endovascular repair of their aneurysm, what kind of complication rates might they experience? What are the risk for mortality, heart attack, renal failure? What kinds of numbers would you quote them at our institution?

GUSTAVO ODERICH: Well, we looked at our mortality in the last 1,000 endovascular aortic repairs. While I've been here, it's 0.1%, 0.2% mortality rate, which is remarkable. Even when we look at the national trials, that is actually very good for community data that's under 1% for EVAR.

In terms of major morbidity, that's also exceptionally low. I would say that the rate of major complications is under 2% to 3%. They need surveillance. We typically obtain imaging with a CT angiography at three to four months. Then every six months for the first year, or every year. If the CT shows that there is not an endoleak, and the aneurysm is decreasing in size, we pretty early go to a duplex ultrasound as their primary imaging modality for surveillance.

On the long run, there is about a 15% to 20% chance they may have a secondary reintervention. Most of those are for a type II endoleak. A type II endoleak comes from the lumbar arteries, and is retrograde flow into the aneurysm sack. Most of these reinterventions are done by means of percutaneous therapy as an outpatient.

ROB MCBANE: Dr. Bower, you have a 75-year-old gentleman, and he has elected to undergo an open repair for his abdominal aortic aneurysm. What kind of rates of mortality and morbidity would you quote this individual?

TOM BOWER: Well, Rob, as a lead in I'd probably say that our division has had a longstanding interest in the management of patients with aortic diseases, and in particular, aortic aneurysms. So I think we've really focused over the years in making sure that we have the ability to do both straightforward and complex endovascular procedures, as Dr. Oderich has alluded to, or open repair. And because of that, we've worked hard to gather data and publish in both of these areas. And now we're working on data to compare the two with similar anatomies.

So historically, infrarenal abdominal aortic aneurysm repair, here, in a 75-year-old man that's healthy, his operative risk could be near 0%. Nationally, you'll see data between 2 and 1/2% and a 4 and 1/2% to 5% mortality rate, depending on where the patient's having the repair.

Juxtarenal aneurysms, which means we have to clamp immediately above the renal arteries for a period of time to sow the graft right at the renal artery origins, in our last publication on that, it was a 0.9% mortality. And then if we move the repair to the base of the superior mesenteric artery, which means we either incorporate or separately reconstruct the renal arteries as part of that open repair, it's about a 2 and 1/2% mortality.

And the predictors and some of the complications you alluded to really are predictors of perioperative morbidity and mortality. So renal ischemia time, the length of time the gut goes without blood flow during these more complex open repairs, division of left renal vein as part of the reconstruction, all those factors, at least in our practice, have weighed in on whether patients die, or whether they have major repair operative complications, including renal failure.

So I think I'd reemphasize a point I made earlier. It's good to know that trial data, but you have to know your own results. And I think the future in managing patients like this could come to regional centers of excellence, where there's the capacity to fix both straightforward and complex aneurysms in a variety of ways, tailored to individual patient risk and anatomy.

ROB MCBANE: Fantastic. Parting comments, Dr. DiMartino? Quality in the future? Any parting comments for our listeners?

RANDY
DIMARTINO: Yeah. I think that overall, our treatment of aneurysms has improved over the past decade. As the technologies improve, our patient selection is getting better. We're able to reduce our complications.

I think improving the delivery of care, from the initial visit through their postoperative course, in terms of understanding CT scan usage and imaging modalities, is going to be important. And that's what we're going to probably see as far as care delivery paths improving for aneurysm repair overall.

ROB MCBANE: Very good. The future, endovascular?

GUSTAVO
ODERICH: I think endovascular is going to still further develop, and more and more patients will be treated endovascularly. Rob, there is still a patient that will need to be treated by open surgery. Let's take, for example, those with connective tissue disorders or extreme young age, where a stent graft probably is not going to last in an unhealthy, diseased aorta.

ROB MCBANE: As our leader and chairman, final comments?

TOM BOWER: Well, A, I think this is a very important disease. B, I think what's worked well for us is to have a multidisciplinary team.

So I have the fortune of having people, like Randy and Gustavo in our group, so we can collaborate, and talk, and share about patients, and determine the key things. Patient selection, which Randy has already alluded to. Anatomy, which Gustavo and I have both stressed significantly. And I think it's important to know your own results.

Here, we're seeing a growing number of EVAR explants, both for infection and endoleaks around the proximal or distal attachment sites. So you have to be able to take care of the patient from the beginning. And probably health care, in many areas of vascular disease, Rob, is headed towards managing chronic comorbid conditions over a continuum, which gets back to some of the points that Randy made.

And I think the more that we can collaborate, have a multidisciplinary team to approach patients like this, and push to get the best results with the highest quality, and then manage those patients long-term, those are really going to be the keys for managing patients with aneurysms and other vascular problems.

ROB MCBANE: Thank you all. Thanks for all your expertise and comments this morning.

Thank you, the listener, for being with us today. And I want to refer you to theheart.org, if you have any interest in watching further presentations of this and other diseases. Thank you for listening.