An aneurysm causes localized widening or enlargement of an artery that may subsequently rupture, causing life-threatening bleeding. During this live webcast, surgeons from the Cardiovascular Center at Brigham & Women’s Hospital in Boston will demonstrate a newer endovascular technique that reduces recovery time and hospital stay for patients with abdominal aortic aneurysms. Today’s program is part of Brigham & Women’s ongoing educational efforts to bring the latest information in health care to physicians and patients. During the program, you may send your questions to the OR surgeons at any time. Just click the direct access button on the screen. This is a Harvard Medical School CME-accredited webcast.

ANTHONY WHITTEMORE, M.D.

Good afternoon, everyone. On behalf of Brigham & Women’s Hospital, we’d like to welcome you to our live webcast. During this time, we are focusing on the new approach, the endovascular approach, to repair of abdominal aortic aneurysm. My name is Andy Whittemore. I’m the Chief Medical Officer at the Brigham & Women’s Hospital and former Chief of the Division of Vascular Surgery. It is our hope that during the next hour, whether you are a patient, an interested person, or a physician, you will learn more about the nature of abdominal aortic aneurysms and the therapeutic options that are currently available for their management. My colleague, Dr. Mike Belkin, is the Chief of the Division of Vascular and Endovascular Surgery at the institution. He will be performing the surgery. Assisting him will be Dr. Ed Gravereaux, who is the Director of Endovascular Surgery at the institution. In addition, they will be assisted by Dr. Louis Willen*, who is in his final year of training in vascular surgery, and assisting me here in fielding the questions that we hope you will all submit is Dr. Chris Owens, who is in his first year of vascular training as well.

Throughout this webcast, we will be responding in real time to your questions. If you have it, please send it in to our website, as seen below, to livesurgery@partners.org, and ultimately Dr. Belkin and I will provide you with the information you need. Also, continuing medical education credits are available with this live webcast during the next 24 hours. For more information, you can click on the CME button on our website as well.

If we could turn to a few slides that we have prepared for you, just to introduce the subject matter. Abdominal aortic aneurysms, on slide #7, demonstrate a dilatation of the
aorta. In general, we are talking about the section of the aorta, down in the abdomen, that is outlined by the box on the figure to your left. It’s highlighted in the middle section, which shows a normal aorta, just below the two renal arteries and above the division of the aorta into the two major arteries that supply blood to the legs. The far right hand picture is a diagram of an aneurysm that shows a dilated segment in the most common section of the aorta. Occasionally they will extend down into the leg arteries as well, but 90% of the time they are confined to the segment illustrated.

The diagnosis of aneurysms, unfortunately, are made due to an incidental finding or on a physical exam. There are no specific symptoms that warn you that they are present, unless they are about to rupture, so most of these aneurysms are picked up on physical examination or incidental to a CT scan or an x-ray that is obtained for a different purpose. The risk factors that are associated with the formation of aneurysms include those that are associated with coronary artery disease; that is, a history of smoking, hypertension, diabetes, and a variety of other conditions. We are really uncertain as to their cause. The indications for repair we will expand on as the hour progresses, but in general, we wait until the aneurysms reach a size of about 5 cm in maximal diameter. Aneurysms that are smaller than this measurement don’t rupture and, in general, we have recommended repair at the 5 cm mark.

The gold standard for repairing aortic aneurysms is the conventional open surgical repair. This is carried out through a long midline incision and, since the aorta lies against the spinal column, in the back of the abdominal cavity, a fairly significant dissection is required to expose the operative view. The prosthetic graft is then sewn directly into the aneurysm cavity, which we open after we put clamps to stop the blood flow temporarily. This is a tried and true method that, as I’ve said, we’ve used for over 50 years. It has a proven track record. Once it is repaired, it’s done and it’s behind you. The newer approach has not been around as long, but we’ll tell you more about that again during the hour. This is a photograph of the aneurysm as it appears through that long abdominal midline incision and this is the graft having been incorporated, sewn into the normal caliber aorta at the top and down to the normal caliber aorta just above the point at which the artery divides into the two leg arteries.

A little over 10 years ago, Juan Perotti* introduced the current technique of an endovascular approach and this was truly innovative. Juan did his pioneering work and over the past 5 years this procedure has really become incorporated as a major modality in our armamentarium to repair aortic aneurysms. The graft is essentially inserted through two small groin incisions, as we’ll show you very shortly. They are modular grafts that are of a variety of different configurations. They are seated with different arrangements at the top of the graft and Dr. Belkin will walk us through on some of the differences in the graft.

We have a diagram, an animation for you to look at, which outlines the major steps in this approach. This is the aneurysm that you’re looking at, at the moment, and a guide wire has been inserted just above the renal arteries. Over that guide wire is threaded a catheter and a sheath. As the sheath ultimately will be withdrawn, the graft, as you’ll see,
will be deployed through the right iliac artery, so the graft has seated and we are now putting a guide wire up the left iliac artery into the shortened portion of the left limb. Again, a sheath is passed and the left lower segment is deployed.

Patient characteristics, by and large, are important in deciding which approach to use. A patient’s age has a bearing on their risk for major surgery. There are many co-morbid conditions associated with aneurysm formation, such as severe pulmonary disease, severe congestive heart failure, a number of other issues that might favor the endovascular approach, as it is a much less invasive procedure, as you will see shortly.

One of the major drivers, increasingly, is patient preference. Patients have been doing their homework. We will frequently see patients who have downloaded reams from the internet and they come to us very well informed and really have already made a decision. Not everybody who would like to have an endovascular graft can have one, however. There are anatomic considerations that need to be looked at and I am going to switch over to the operating room at the moment, to Dr. Belkin, and have him walk us through what some of those considerations are.

MICHAEL BELKIN, M.D.

Thanks, Andy. Everyone, welcome again. Welcome to the Brigham & Women’s endovascular OR suite. Thank you for participating with us today as we perform a live case of endovascular repair of an aneurysm on the internet. Andy, you’re quite right, one of the most important factors is the anatomic criteria in selecting patients for endovascular care. There are a number of particular measurements we have to make in order to ensure a patient is a good candidate. The most important, perhaps, is the quality of the neck; that is, the normal aorta between the renal arteries and the aneurysm, which Andy may be able to point out during the slide, that segment has to be 15-20 mm in length under ideal conditions. It must not have too much tortuosity and it should have minimal thrombus and calcium. We also have to know the diameter of the aneurysm distally, just before it branches, in order to ensure that the graft can fit through there easily and there has to be good anchor zones in the branch arteries, that is the iliac arteries below.

As you can see from this slide here, we have to perform a number of very detailed measurements I order to determine if a patient is a good candidate for endovascular repair. On top of that, to design and order an appropriate graft that will fit his or her aneurysm precisely.

Having shown this, let’s go on and present the patient that we’re going to be talking about today and operating on. This patient is a 66-year-old male whose aneurysm was first discovered in 2002. It has been followed with serial imaging studies and now has grown to 5.6 cm, which is an appropriate size for repair. His past history is remarkable for coronary artery disease, hypertension, and hyperlipidemia. His current medications include Lipitor, Lopressor, and aspirin. He has a family history of aneurysm, which is
very common. Approximately 20% of patients who have aneurysms will have first degree relatives who have aneurysms as well, so there is a strong family history.

This slide here shows a reconstruction CT scan of his aneurysm. In the upper right corner, you can see the neck of the aneurysm and the lower renal artery, where we will implant the graft. On the lower right, you can see the belly of the aneurysm at its largest size. Down in the left lower corner, you can see the iliac arteries.

So at this point, let me turn over to the field here and, before we get started, I would like to introduce the team who is participating in the repair here. First of all, I would like to introduce Dr. Ed Gravereaux, who is my colleague and partner. He is the Director of Endovascular Therapy and the Surgical Service here at the Brigham. Dr. Louis Wynn* is also here. He is our second year vascular surgery fellow. Jean Chichites* at the end of the table here is our surgical tech. At the top of the table, we have the anesthesia team, led by Dr. Stanley Leson*, who is the senior vascular anesthesiologist, along with Ty Price, who is an anesthesia resident working on the case today. Then also in the room, who you might not see from time to time, but are here and very important in the smooth flow of this case, are our vascular circulating nurses, Ursula Begoni* and Sue Driscoll. You can see they’re wearing their Patriot hats. I wonder why. There must be something going on this weekend. I don’t know what that’s about. Over here, Steve Cannery*, who is our radiology tech, who runs our machinery during the case. Finally, in the back corner is Lisa Marie Fahey, who is our endovascular coordinator.

So let’s turn now to Ed, who will tell us where we are in the case. Before we do that, can we roll in that last roll-in section. This shows how we have arrived at the point we’ve arrived at. We’ve made two small oblique incisions and we’ve dissected down through the subcutaneous tissue and ligated the bleeding vessels and exposed the arteries, as you can see here. We take time to control these arteries very carefully with these rubber loops so we can prevent any bleeding around the catheters during the course of the operation. You see the side branches are also controlled with these small loops. Once we have the vessel completely exposed and we’re ready to go, we will actually cannulate this vessel and you’ll see here a needle being introduced into the artery in one moment. There’s the needle being introduced and then through that needle we introduce a guide wire. You can see that guide wire being passed right now. That gets us right to where we are now. This is where we are now, with the exposure complete. If you look down at the field, you can see our completed exposure. We have some sheaths and catheters in, and Ed will take over and describe exactly where we stand.

EDWIN GRAVEREAUX, M.D.

Keeping that image on the screen, it’s a little different from the roll-in tape we just saw, simply because of the patient’s body habitus, so we have arterial exposure through the cut-downs and we actually made a very small counter-incision in the skin inferiorly, which just provides a better angle for the tracking of the stent graft device, which would avoid torquing it or kinking it. Very important. On the live fluoro screen, currently you can see a pigtail catheter at the L1-2 junction. We have a wire coming through the other
side. I’m just going to take you north to the cardiac silhouette. We have a very stiff Amplatz guide wire, which you can see curving around just at the top of the descending thoracic aorta, which will provide perches. It’s a stiff 0-3-5 guide wire over which these devices will track. Moving back down, we’ll get into position and show you an arteriograph run. That’s essentially the lay of the land at this point.

MICHAEL BELKIN, M.D.

This is an aortogram showing this patient’s aneurysm. You can see the location of the arteries and we use this as a road map for our repair. Why don’t we go ahead and put our sheath in.

Jean, while we’re getting ready to put the sheath in, why don’t you take the device out and we can get it prepped. Fogarty catheters, Fogarty clamps, one curved, one straight.

So what we’re going to do now is take this small sheath out and replace it with a large sheath. That sheath is an 18 French sheath, through which we will introduce the main device during the procedure and you’ll see that happen in a few moments. This device is 18 French, which makes it about 6 mm in diameter. So now you’ll see this larger sheath coming up the table here.

EDWIN GRAVEREAUX, M.D.

On fluoroscopy, you can see the nose cone of our device. It’s the sheath for the device, actually heading up, tracking over the stiff guide wire. We bring that into proximity to our pigtail catheter and we use this to orient.

MICHAEL BELKIN, M.D.

Okay, Jean, down below there, why don’t you show how we prep this device here and maybe you can slide down there and give us a description of what the device entails.

EDWIN GRAVEREAUX, M.D.

Jean is very carefully removing the device. There’s an outer sheath, which is removed, and an inner cannula. The device itself is actually furled up and held in place, this device, with a suture, a constraining suture which, when unfurled, will rapidly deploy the stent graft. This model is a W.L. Gore Co. device called the Gore Excluder. It’s a modular device. It’s Nitinol wire, which is self-expanding, thermosensitive metal stents, over which a PTFE material is used to cover, so Jean is going to flush this out for us, remove all the air bubbles, if possible.

Without touching this to anything, we’re holding this in the air and I’m confirming our stent graft marker positions, especially where the contralateral limb orifice is, which is the long marker.

MICHAEL BELKIN, M.D.
This marker here, on the left, that long marker, denotes the contralateral limb, which you’ll see pop open in a couple of minutes. The marks up here denote the upper portion of the graft and this is where the opening gate is and this is the bottom of the graft. It’s hard to tell the anatomy of the graft right now, with it constrained within this device, but it will be quite clear when we deploy it.

We’re going to load this device into the sheath, as you see right here. So, as you watch, you can see the grafting placed up through the sheath. That’s in good position right there. Now we’re going to pull the sheath back a little bit. At this point we’re going to shoot an arteriogram to localize the origin of the renal arteries and this will be our road map for the deployment of the upper end of the graft.

EDWIN GRAVEREAUX, M.D.

I’m going to adjust now to get our contralateral limb orifice facing the correct direction.

MICHAEL BELKIN, M.D.

We’re just spinning it until we get that contralateral limb in the ideal position. That’s looking pretty good right there. So we’ll do a run here. What you can see here now is, this is the normal aorta above the aneurysm. Here’s the location of the renal arteries, the two arteries to the kidneys on normal aorta, and here’s the neck of the aorta above the aneurysm. The aneurysm starts down here, as you can see, so what I’m going to do is mark this screen and these marks will serve as a road map for our deployment of the graft. Our goal will be to lay in the graft right about here, right below the renal arteries, and deploy out to complete the repair. I think the best way to do this is to set it up and then we’ll show the deployment. Before we do that, let’s look right here and show the mechanism of deployment. The way that’s done is, this is a valve that I released and then there’s a wire that we pull out and it’s attached to the constraining sleeve. As it opens up the sleeve, the graft will deploy, just as you saw on that video, so I think the best view for the audience would be to actually see the deployment on the screen, so if we can get the live feed, we can actually watch the deployment. Watching there, you’re going to see the graft open up. Here’s the deployment. One, two, three, boom, there it is.

So you can see now, the graft has deployed immediately below our line, which is the intended goal and the graft has deployed out into the left iliac system. On the right side, we have an open limb here, and we’re going to cannulate that in order to gain access for the contralateral limb.

We’re removing the device now. What we’re going to do is, we’re going to take a very large compliant balloon out, pass it up over the guide wire, and tack down the area of the proximal graft. We’ll iron it out and make sure it’s well opposed to the aorta above so there’s no pleats or wrinkles or anything that impairs our seal. If we go to live fluoro, you’re going to see the balloon come up into position. Here’s the balloon going up into
position and in a moment you’ll see the balloon dilate with contrast. This is just for us to seat the graft in position. There you see it going up and tacking down that edge.

So let’s get ready on the other side with the guide wire and a Berenstein catheter. That’s just used to iron out any wrinkles or folds in the graft.

EDWIN GRAVEREAUX, M.D.

This graft also has hooks on the outside, which we’re hoping will engage the arterial wall. Dr. Belkin will go over a little bit later some of the styles of stent graft available. There’s three FDA-approved devices. Some do have hooks. Some rely on radial strength only of the stent. Some rely on bare metal stents which actually project suprarenal.

MICHAEL BELKIN, M.D.

Now our goal is to gain access to the contralateral open limb, in order to complete the repair. At this point, we have inserted the graft in the upper portion, in the left branch. So, Any, while we’re setting this up, if any questions have come in, this might be a good time to take them.

ANTHONY WHITTEMORE, M.D.

This is going along about as well as could be expected so far. We’ve had some interesting questions that have come in to us. A question from a patient living here locally, in Ashland, MA, whose mother and two of her mother’s sisters have had aneurysms. She is concerned about the risks of inheriting that tendency. While it is a risk, no doubt, it’s more frequently inherited by first degree relatives, or your mother’s siblings. It is less common for the process to be passed from one generation to another. Having said that, it does happen and I think most of us would probably advise you and your siblings to have an abdominal ultrasound at some point in your late 40s or early 50s, just to be sure.

MICHAEL BELKIN, M.D.

I agree with that completely, Andy. Any time you have a first degree relative in your family, if I ever see a patient has an aneurysm, I immediately urge them to have all their siblings and children checked.

Let me just mention what Ed’s doing here, while we’re talking. He’s trying to get a wire access into that open limb on the other side. You can see him tickling his way in there. This can be a tedious part of the procedure. Sometimes it takes 30 seconds and sometimes it takes 10-15 minutes.

EDWIN GRAVEREAUX, M.D.

In live cases, it’s always 10-15 minutes.
MICHAEL BELKIN, M.D.

So I do agree with that, Andy. I think screening in first degree relatives is essential.

ANTHONY WHITTEMORE, M.D.

There’s another question that has come in from a little bit further away, from Switzerland, a patient who is asking about our clamping off the blood supply to the lower extremities during conventional arterial repair and also intermittently, as you’ve seen here, with balloon occlusion. The answer to that is that the legs are very forgiving and can actually tolerate 4-6 hours of what we call warm ischemia, so there’s rarely a problem from cutting off the circulation temporarily.

MICHAEL BELKIN, M.D.

True enough, Andy. The legs are very tolerant. If we have to clamp above the renal arteries, that’s when we worry a little bit more about ischemic time. We like to have the arteries above the kidneys clamped for only about 30 minutes, but the legs are quite forgiving, as you said.

ANTHONY WHITTEMORE, M.D.

Another question, Mike, you might address the issue of anesthesia. One of the advantages of this minimally invasive technique is that it can actually be done under a variety of different kinds of anesthesia, from local to regional to general anesthetic. I have noticed that this particular patient has been put to sleep and is undergoing general anesthesia. Can you make a comment about why that choice?

MICHAEL BELKIN, M.D.

That is definitely an advantage to this procedure, that it can be done under local anesthesia in thin patients. If not local, it’s usually done under regional, but there’s a certain amount of patient preference. Some patients just really don’t want to be involved in the process at all. They don’t want to know what’s going on. They prefer to be asleep and we don’t mind that. That’s certainly acceptable if they’re a good risk for general anesthesia. I would say that at this point probably 80% of our patients are repaired under regional or local anesthesia and 20% prefer to go to sleep.

ANTHONY WHITTEMORE, M.D.

Great. So you’re now attempting to get this wire into that short right stump.

MICHAEL BELKIN, M.D.
Right. John, if we can take a live picture over here, I can show exactly what we’re trying to achieve here. You can see, Ed’s working this catheter right here. The idea is to get a wire through that circle so we can park another limb here to complete the repair.

ANTHONY WHITTEMORE, M.D.

So Mike, how about the issue of inducing hypotension? Do you bother to induce hypotension when you’re deploying this?

MICHAEL BELKIN, M.D.

With this graft, we don’t. It’s a very rapid deploying graft. I think if a patient was particularly hypertensive, we would try to get their main arterial pressures down around 70, but as you saw from the deployment, it’s very rapid. The graft does not tend to move down at all in the arterial stream, so if they’re normotensive, we don’t bother doing that. That is certainly more of an issue when we perform stent grafting in the thoracic aorta, where grafts can really move quite quickly because of the pulsatility of flow in the chest. Sometimes in the thoracic aorta, if we really have a precise localization in mind, we can use a medicine that actually will stop the heart for 30 seconds, allow us to do the deployment, and then the heart will start right back up.

ANTHONY WHITTEMORE, M.D.

Mike, while you’re talking about the thoracic aorta, we do have a trial ongoing here. If we could go to the slide, slide #23 on our PowerPoint, we have a picture of this. Mike, do you want to comment on this at all?

MICHAEL BELKIN, M.D.

Great, Andy. This slide that we’re looking at here, now, shows a newer technology. This is the use of endographs for repair of thoracic aneurysm, so what we’ve been showing up until now is repair of an aneurysm in the abdominal aorta. This is an aneurysm up in the chest, behind or above the heart. If the aneurysm has appropriate anatomy, a graft can be deployed to repair them as well, similar in fashion to what you see here today. This is not commercially available yet. It is still an experimental or investigational technology, I would say. We happen to have protocols here at this hospital which are investigating these devices. My hope is that within 6 months or so we will have grafts which are commercially available and the technology will be more widely available.

ANTHONY WHITTEMORE, M.D.

Mike, while we have that picture on the screen, you’ll see there are some wire struts that are above the actual fabric and go across the left subclavian artery orifice. We have similar issues with the graft that you are using now in the infrarenal aorta, with all prototypes, and the reason we need such a long neck to seat the graft is to be sure that we
don’t interfere with the blood flow to the kidneys. What are the issues involved with that, Mike? What are the consequences?

MICHAEL BELKIN, M.D.

That’s a great question, Andy, and this is one of the raging debates right now among graft manufacturers and among endovascular surgeons. Certain grafts have these bare wires that extend above the graft. The graft we’re using today does not have that technology. Those bare wires can be very useful in situations where you’re concerned about the neck of the aorta. They can gain further perches above the aneurysm to ensure that the graft does not move or slide, which can be a problem postoperatively.

Let’s go back to live fluoroscopy now and show that Ed has now put a wire through that open limb, which we were talking about before, if you can see my finger here, pointing. That’s the goal. Now, what we’re going to do to make sure that we’re through, darn sure because sometimes those wires can fool you. They can be in back of the graft and this is only a 2-dimensional view. We’re going to put a pigtail catheter within the aortic graft itself and we’re going to confirm that it’s present inside the graft, so we’re going to spin that pigtail, which you can see right now. It spins freely and that tells us that we have excellent localization through that rim.

ANTHONY WHITTEMORE, M.D.

Mike, while you’re on that subject, we’ve had a question come in from someone who is very well informed and is asking why you’re trying to selectively cannulate the right short limb. Why not use a curved catheter of one sort or another through the left and enter retrograde into the right limb?

MICHAEL BELKIN, M.D.

We do that sometimes. If we cannot gain access to a contralateral limb, and sometimes it can be difficult, we will use a shepherd’s hook type catheter to come over the top, as you suggest, but that’s another layer of complexity. Then we have to use a snare to snare the wire within the aorta proper, so we do that but that is more or less a fall-back position. I would say we have to do that in about 5% of cases. 95% of the time, we gain easy access as Ed did here today.

EDWIN GRAVEREAUX, M.D.

It took a little longer, but again, it’s a live case.

MICHAEL BELKIN, M.D.

What we’re going to do now is make a measurement to ensure that we’re getting the right length limb to complete our repair.
EDWIN GRAVEREAUX, M.D.

This is essentially to localize the hypogastric artery, internal iliac on the right side.

MICHAEL BELKIN, M.D.

So I think the hypogastric is right about here. Then here’s our limb, so we’re going to count the number of cm from our distal seating zone, which is here. 1, 2, 3, 4, 5, 6, 7, 8, 8.5 cm, so we would want to use the shorter graft, I think. We have 8 cm out, so the 10 cm graft would give us 7 cm. The 12 would give us 10 cm, might be a little long. I think we should put the 10 cm in.

Okay, so at this point we have deployed the main body and the ipsilateral limb is now out into the left iliac system. Now we’re going to deploy the contralateral limb.

ANTHONY WHITTEMORE, M.D.

While we have a little time here, you might address a question that has come in with regard to accessory renal arteries. How do you deal with them?

MICHAEL BELKIN, M.D.

There are times when patients have more than one renal artery and some of those small renal arteries can come off the aortic aneurysm or lower on the neck. They can, if these accessory extra-renal arteries are very large, supplying a large portion of the kidney, then this would be a contraindication to performing this procedure. In many cases, however, these small renal arteries actually supply only a small portion of the kidney. If they’re just a couple of mm or 3 mm in size, with larger arteries above, we actually will sacrifice the smaller lower pole vessels in the name of achieving a tight seal and a good repair, so we’re selective about it, but a significant lower renal artery could be a contraindication to this procedure. Good question.

So now we’re bringing a sheath up on the contralateral side that’s going to allow us to complete the repair just as you saw in that animation earlier. Now you’ll see the sheath going up and gaining access to the contralateral limb. That’s perfect. Our device is being prepped. Let’s take the dilator off and bring it right up.

Okay, going back to live fluoro, you’ll see the device going up through the sheath. If you watch that sheath on patient’s right hand side, the left hand side of the screen, you’ll see the device coming up through. Here it comes. Perfect. Now we’re going to pull the sheath back and we’re getting ready to deploy the contralateral limb, which should complete the repair.

So, what you see here is, this is the sheath that we just put in and here’s the graft. It runs from this marker here to this marker here. The design here is for us to match this marker up here with this large marker here, which is the main body marker and the main device.
We will now deploy this limb out into the right iliac system, thus creating a Y-graft to complete the repair.

Here comes the deployment. We’ll watch it on live fluoro. Okay, there we go. Great. Looks great.

Okay, now let’s take a 14.5 mm balloon and dilate up that junction site. While we’re doing that changeover, Andy, if you have any additional questions we can address?

ANTHONY WHITTEMORE, M.D.

We do, Mike. Just briefly, we’ve had a question from Charlotte, NC, regarding the size criteria for which we recommend repair. In general, as I was saying in our introductory remarks, we usually don’t recommend repair until and unless the aneurysm reaches 5 cm in maximum diameter. There are some that recommend waiting until it is 5.5 cm. The reason being that, although the repairs go along extraordinarily well under most circumstances, any intervention has its hazards and downsides. The risk of aneurysm of a rupture less than 5 cm is virtually 0, so we routinely recommend a 5 cm diameter. You might be tempted to repair it at less of a diameter, given the fact that the endovascular repair is so minimally invasive, but as we’ll perhaps get to a little later, there are complications and you need to be very sure.

MICHAEL BELKIN, M.D.

Excuse me for one second. Can we go back to live fluoro? What we’re doing now is, we’re inflating a balloon, as you can see, in the gate to make sure that the two pieces of the graft, the main body and the contralateral limb, are opposed, well opposed, without any wrinkles or pleats, and that balloon there just flattens that out.

Andy, I agree 100%. Our usual threshold is 5 cm. I think recent studies have shown that under intense surveillance, patients, particularly male patients, can be followed with aneurysms up to 5.5 cm, but I think the reality is, most patients, once they reach 5 cm, if they’re in good shape, are anxious for repair. If we follow those patients, fully 70% of them come to aneurysm repair within a couple of years, so I feel pretty secure in recommending 5 cm for out patients.

Now we’re going to use that soft balloon again to tack down the limb further. Once we’ve completed tacking down on each side, we will do a completion of the angiogram and see how we do. Any other questions while we’re doing this, Andy?

ANTHONY WHITTEMORE, M.D.

Mike, we do have another question from Kalamazoo, Michigan, where a person is asking us about the durability of this. Is this repair permanent?

MICHAEL BELKIN, M.D.
Great question. Andy, there’s a slide that looks at the advantages and disadvantages of endovascular repair. Perhaps you can bring that up. The advantages of this approach are that the patients have decreased morbidity. There’s less complications with this approach, compared to open surgery. Most patients don’t have to go to the ICU. They’re in the hospital for only a day or so and then they go home. There’s certainly less blood loss compared to the open operation. The incisions are limited. You can use local or regional anesthesia and the recovery is very fast. But there are disadvantages to this approach, which I think patients and doctors must consider. There are increased vascular injuries because we’re putting these large catheters through arteries and we can have problems with injuries to these arteries, although the incidence is really less than 5%. Patients after this repair have to be watched very carefully over the long term because there can be a variety of problems that can develop and it’s only fair to say that approximately 10% of patients, at some point down the line, will require an additional intervention to keep this graft functioning well. The great majority of time, those interventions again are intravascular interventions done through the groin, through catheters, but very rarely the patient will have to be converted to an open surgery after having this repair. That’s probably about a 1% incidence over 5 years. These devices are expensive. You might think that these simple procedures that are done quickly, with short hospital stays, are more cost-effective than open repair, but because of the expense of the devices, there is no cost benefit, certainly no cost advantage, per se. As a tribute to modern surgery and modern anesthesia, open repair is quite safe. The mortality of open repair in expert hands is in the 1-3% range. Mortality of this procedure, it seems, is not that different. Certainly in high risk patients we might see a difference, but for all comers, there’s not a great difference in mortality, so that speaks to the advantages and disadvantages of this operation.

ANTHONY WHITTEMORE, M.D.

Mike, you might just expand a little bit on the follow-up that’s necessary after this procedure.

MICHAEL BELKIN, M.D.

These patients, as I said, are followed very closely. We see them one month after surgery for a physical examination and for their first CT scan. They’ll have a CT scan at 6 months, CT scan at 12 months, and a CT scan once a year. At this point, we’re recommending CT scans for life, so at this point there is intense surveillance to make sure these grafts continue to function well and there are no problems related to the graft function.

We are to the point now where we’re going to be shooting a completion arteriogram. The graft has been completely deployed and we’re getting our catheters into position to shoot an arteriogram and hopefully we’ll see a good technical result and good flow and no filling of the aneurysm cavity. That looks perfect.
EDWIN GRAVEREAUX, M.D.

Walk through it frame by frame. You can see the renal arteries are still patent, and the position of the graft.

MICHAEL BELKIN, M.D.

Right. So here’s the beginning of the run. What you see here is the aorta above the repair. It looks normal. We haven’t damaged it in any way. It looks quite healthy. Now you see the renal arteries, with both renal arteries filling nicely. The graft kicks in right here. This is where we deployed the graft below the renal arteries, which is where we wanted, and now you see the beginning of the filling of the two limbs of the graft. Now we’re going to follow that out, so frame by frame, you see the limbs filling out.

EDWIN GRAVEREAUX, M.D.

No further aneurysm sac filling at this point.

MICHAEL BELKIN, M.D.

I think for comparison purposes, we’ll bring up the other picture when we’re done here, just to show the difference between the two films, but this is a great anatomic configuration. No compression of the limbs. Very nice position and, importantly, filling up both hypogastric arteries. You can see this is the internal iliac arteries, which are filling well. We like to maintain normal flow.

EDWIN GRAVEREAUX, M.D.

The external iliacs are, of course, blocked by the sheaths at this point.

MICHAEL BELKIN, M.D.

For comparison purposes, let’s go back to the original angiogram so people can compare that. Maybe we can put them both up together and show them side by side. There’s our side by side views. If you can see that clear enough, on this side we have the pre-shot with the aneurysm filling. Now, post-repair, a nice configuration of the endograph with no flow into the aneurysm sac. This is just the sort of ideal result we look for. Nice job, Ed.

Andy, can we take some more questions? We’re going to remove our catheters and sheaths and begin the closure.

ANTHONY WHITTEMORE, M.D.

Again, Mike, it looks as though that’s gone along beautifully. We had another question that has come in from Michigan, this time from Ann Arbor, that addresses the issue of
symptoms associated with aneurysmal disease. In general, as I said earlier, there are no symptoms. In most of our patients, the aneurysm is picked up on an incidental examination, but there are occasional patients who have back pain in the lower back, extending around into the left flank and perhaps down the left leg. These symptoms usually are indicative of pending rupture or rapid expansion and are really very rare today, as we pick up most of these aneurysms early on. In fact, evidence is now emerging that supports routine screening of individuals for this disease process.

MICHAEL BELKIN, M.D.

I recommend everyone speak to their Congressman. This is a critical issue. Screening for aneurysms would save lives. Aneurysm rupture is the 13th leading cause of death of adults in this country. If we were to screen patients, the mortality would drop dramatically. The mortality of ruptured aneurysm for all comers is 90%. The mortality of elective repair is 1-2% in expert hands.

ANTHONY WHITTEMORE, M.D.

Mike, another question that you might address is, how do you decide which graft to use, of all the devices that are approved and now available. Perhaps I should go back to that slide that we showed a little bit earlier.

MICHAEL BELKIN, M.D.

This slide shows the three commercially available devices that we use. We use all these devices, depending on the patient’s anatomy and certain considerations. The graft on the left is the AneuRx graft. It has the longest track record of any of these three grafts which you see here. The beauty of that graft is, it can be very precisely located below the renal arteries, so when we’re looking for a very precise deployment, I will often use that graft. The graft that we used today is the graft in the center, the so-called Excluder graft. This graft is wonderful for its ability to track through tortuous vessels. It also has a lower profile and can easily pass through diseased vessels, so it has a lot of advantages in that regard. The third graft, to the right, is the Zenith graft, made by the Cook Company. This is the newcomer on the block. It’s an excellent graft. Its advantage is improved suprarenal fixation. Those bare wires actually pass up over the renal arteries and can anchor the graft in place and prevent it from migrating even a small amount. Migration can be a problem because if the graft slips down into the aneurysm cavity, the aneurysm can repressurize and again become a risk for rupture, so we really have to make sure we have very precise and strong fixation of the graft proximally.

All of these grafts come in multiple sizes and lengths, so through precise measurements, and perhaps we can bring up a CT scan here, briefly, that we have here that shows our CT technology. Most of these patients undergo, or all of these patients undergo a spiral CT scan with contrast. With three-dimensional technology, we’re able to delineate precisely the anatomy of the aneurysm. As you see on this slide, this 3D reconstruction shows our ability with 3D technology to measure the lengths within the aneurysm, which is critical
for designing and obtaining a graft which is long enough to fill the aneurysm and secure fixation above and below without covering any critical vessels, such as the renal arteries or internal iliac arteries, so the CT scan is an excellent tool for selecting the right graft.

ANTHONY WHITTEMORE, M.D.

Mike, we have time for just one more brief question coming in locally here from Malden. Do you have any criteria you use to assess renal function and is it a determinant of whether you can use this approach or not?

MICHAEL BELKIN, M.D.

Another good question. Ironically, you would think patients with poor renal function, you wouldn’t want to put them through a major operation, like an open operation, but in fact, renal insufficiency, as evidenced by a high creatinine or high BUN on blood test, is a relative contraindication to this technology, not only because the patients have to get dye during this procedure, but also because of the CT scans they have to get over time. It has been shown that patients with poor renal function who have these grafts inserted will have further decrements in renal function over time, so poor renal function, that is a creatinine over 2.5, would be considered, in our hands, a relative contraindication to this approach.

Well, Andy, thank you very much for hosting this. I hope the audience enjoyed our presentation today. We appreciate you taking the time to look in.

ANTHONY WHITTEMORE, M.D.

Michael, I think you’ll have a very grateful patient very soon. This went along as well as could possibly be expected. We’d like to thank you all for listening in with us and participating in this webcast. I would just like to remind you that this will be archived on our website at the Brigham and Women’s Hospital. Perhaps you can show that. It’s www.brighamandwomens.org and that will get you into our site. It will be archived there for some time to come in the future. I’d also like to remind you that CME credits are available through Harvard Medical School and we’ll have a link on that website for that purpose.

Once again, I’d like to thank everybody for joining us. My congratulations to the operative team, and it is a team, for a job exceptionally well done.

NARRATOR

Thank you for watching the live abdominal aortic aneurysm procedure from Brigham and Women’s Hospital in Boston, MA. For more information, to make an appointment or make a referral, please click the buttons below or contact one of our skilled coordinators at 1-800-BWH-9999, or email us at livesurgery@partners.org.