

Transesophageal Echocardiogram (TEE)
Shawnee Mission Heart & Vascular Center,
Shawnee Mission, Kansas
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Good evening. My name's Bill Ritter. I'm a cardiologist at Shawnee Mission Medical Center at our Heart and Cardiovascular Center, which is located in Shawnee Mission, Kansas. Shawnee Mission, Kansas in greater Kansas City area and the county of Johnson County and in the city of Marion. Tonight, we're going to have a two-part program. First, we're going to have a cardiac procedure performed live. This will be a transesophageal echocardiogram performed by one of my partners, Dr. Jeff Bissing. And then secondly, we're going to have a panel discussion about mostly peripheral vascular disease. Dr. Mike Beasley and Dr. Joe McBride will be our panel discusses about vascular disease. So good evening, gentlemen.

Good evening.

And first of all, we like to go live to our presentation. This is a transesophageal echocardiogram procedure. It's a fairly common procedure that we do, and we will tell you more about what the procedure is like and indications as we go through the procedure. So we're going to turn this over now to Dr. Jeff Bissing. Are you there, Jeff?

Good evening, Bill. We're getting ready to start this transesophageal echocardiogram, kind of update you to where we are right now. We have a patient who's a young patient who had a echo done of their heart from the outside of their chest. And that basically showed a valve that looked to be structurally abnormal, probably born with that situation. So we're doing a transesophageal echocardiogram where we put a probe down into the esophagus, which is your swallowing tube. And from there, we can get better images of the heart to really see what's going on a little bit. So that's what we're going to be doing tonight. We've already kind of started ahead of you. We've already got the probe down, the patient's comfortable and sedated. And I think what we're going to do next is start looking at some images. And I think as we go through this, I'll try to point out as best I can what we're looking at on these images of the heart. And we'll just kind of go through and show some anatomy, basically what's normal anatomy and potentially what's not completely normal anatomy. So we'll go ahead and get started here and start looking at some pictures.

This right here, as you look at this on the screen, there's a thin structure in the middle there. That's actually the tricuspid valve, and that's the valve that separates the top chamber on the right side of the heart, called the right atrium and the right ventricle. Blood typically doesn't have oxygen and comes back to the heart and comes back into that top chamber on the left there, goes through that tricuspid valve that's kind of flipping in and out there, and goes into the right ventricle. From there, blood flow goes over to the lungs and gets oxygen. Once it gets to the lungs and gets oxygen, we'll kind of look a little bit later at where it goes from there.

What I kind of want to focus on first is kind of in the center of the screen. Looks like a circular type of structure. You can give more Versed if you want. Looks like a circular type of structure and you see a valve in there too that's opening and closing. The interesting thing about the anatomy here is what you see is kind of two leaflets. And I hope you can see that well, in there as well Bill. But basically two leaflets in what we would call a bicuspid aortic valve. Typically-

And it normally is what, three cusps, Jeff, is that right?

That's exactly right. Typically, these aortic valves have three cusps and basically it's three leaflets. And as you see here kind of we can zoom in on that aortic valve, and we'll show you a little bit more here. But that aortic valve typically would have three leaflets that open and close. Now the good thing here, just looking at this really quick, is you can see that there are two leaflets and they open and close. And that's the structures coming in the center there. And they still open well, so there's not a lot of calcification or a lot of problems with this valve right now. It looks like it really opens up nice. We're a little bit concerned from the initial ultrasound that probably there was a high gradient across this valve. But really I'm a little bit skeptical of that right now, given the fact that the valve-

-- is opening well?

-- really opens well and really looks good. So we're going to kind of rotate things around. We're going to stay focused on that valve and, by having some rotation in here with this device, we can actually look at the valve in what I would say is a different plane.

You can look at that very clearly.

In the center of your screen right now is, again, the aortic valve opening and closing. To the right, the narrow tube, that's actually the aorta. So blood flow is going through that valve and goes out through the aorta and goes to the rest of the body. It's the way to get that oxygenated blood that I was talking about before out to the rest of the body. So it goes out through that valve and we'll kind of look at anatomy a little bit more. I'm going to kind of pull back here.

Okay.

And you can see the aorta a little bit here too, which is the structure lining the whole screen there for you. And that really looks pretty good, looks probably like a normal size aorta. We're going to slide back down and go back to this valve again.

Isn't it a beauty of TE, this procedure, doing it, we can see the valves so well?

Absolutely can see them much better, no doubt about it. So, you know, kind of do a regular echo from the outside as a sort of initial screening. And the benefit here is that with this procedure I can actually get much better images of the heart and kind of see things a little bit more defined, which can help in a lot of things. A lot of situations as far as the people have abnormal valves and need surgery or things done, gives us surgeons a lot better detail on what's going on. We're going to put some color across this aortic valve now and kind of-

So you're much closer with the transesophageal probe, which in the esophagus, right. The esophagus runs right in back of the heart and is just a very short distance. So isn't that why we get better pictures? We don't need to put sound waves through the heart or the chest and all that?

Absolutely

-much closer to the structures?

We absolutely get much better images, no doubt about it. And the benefit of this is that you can, again, detail anatomy much clearer. You know the outside, you can get pretty good images. I will say, though,

that a lot of times, depending on the patient, because a lot of times anatomy of the patient makes it very difficult to get images from the outside of the body, whereas pretty much with anybody you can really get good transthoracic images. We're kind of just looking here and what all this color is, is across that same valve we were looking at earlier, the idea here is that we can see if this valve leaks a lot or has a lot of blood flow going the wrong way, which would normally be seen -- where the valve is located there -- would normally see a color jet going off to the left, which we really don't see here. I'm going to come back around on this valve.

This is sort of like weather radar, isn't it Doppler weather radar the same thing in a way?

It is. It's kind of like looking at the storm coming, potentially.

This is Doppler technology and you see things coming and going.

That is. And right now we're back to, again, kind of a short axis view looking -- what we call looking down on the valve again like we started out the procedure with. And I'm doing this with a color basically to look and see if this valve leaks much at all, which it really doesn't.

Very little.

As I say, at the top of the screen right in the middle of that circle, a little orange jet you see.

That little dot there, red dot sort of?

Absolutely. And you used to kind of associate that, I was always taught that that was kind of like the fire at the top of a smokestack. And that's how you could kind of see that. That might help people at home see that a little bit better. So, so far -- we can go off color if you want, Jessica -- what this really has shown us is the aortic valve really is just a bicuspid valve. It looks like it opens really nice, doesn't have a lot of leakage of blood flow and really does not look like it's markedly stenotic or anything, really seems to me to open up well. I'm going to go back around a little bit again. I just want to make sure with looking at this valve a little bit closer, and I really don't see- sometimes you'll see a membrane potentially or something that obstructs flow out of that valve. But I tell you, I really don't see that.

It's really moving very well isn't it?

It absolutely is. I think you would agree with that that, you know you don't see any obstruction of flow coming through there at all.

The shape is abnormal but the opening's good and the flow's good.

Which is what's important for this young lady, absolutely, absolutely. We're going to go back and kind of take a little tour now and look at some other parts of the heart.

Some other structures?

Yeah, you might go ahead and give her a little bit more Versed, Shelly, that would be great. You doing okay, sweetheart? Okay. All right, this here is going to be some pictures of the left ventricle on the bottom right of the screen. And that's the part of the heart-

There are the pumping chambers?

Absolutely, squeezes out all the blood through that aortic valve and squeezes it to the rest of the body. The heart function, you can tell the heart really squeezes well there on the right side of the screen.

And this is a beautiful, normal looking heart, excellent function and squeezing and this is a very helpful test, as is transthoracic echocardiography to look at heart function. We do this all the time in the hospital

with patients with heart failure and other conditions to get an idea how strong or weak their heart is and tailor their treatment accordingly. Isn't that right?

That's exactly right. I'm just going to have you put some color across that mitral valve. That mitral valve is right kind of in the center of the screen now, kind of where Jessica's got that little box. And we're going to look at color flowing across the mitral valve just to see if there's any leakage back through there, which we all have some degree of leakage going back through those valves. You don't have perfectly tight valves. It's really not a system that can work with that. And if you notice very once in a while if I get kind of a good enough image here and not play around so much.

Just a teeny bit.

Absolutely, an orange jet heading up north there. And that little orange jet is what we could call a little bit of mitral valve regurgitation, which I would call basically trivial and physiologic, in other words, normal for most people and normal for this young lady.

Nothing to worry about then.

Nothing to worry about there at all.

The left atrium, you see that up there? Can you show us the-

Absolutely.

-- left atrial appendage which sometimes comes in and I think you can show it there.

Yeah I think let's go ahead and look at that left atrial pitch.

There it is.

And we'll zoom in on that. Let me --

Why don't you give us a little update on what that's for sometimes and what happens with that.

Jessica, if you want to go ahead try and zoom in on that.

Because this is an important structure, not in this patient since this is perfectly normal.

That's exactly --

We use the transesophageal procedure for looking at a structure.

That's exactly right. I mean this structure on the right there is a little bit of a crescent structure. And actually that aortic valve is back there on your left again. And that crescent structure is actually called the left atrial appendage. And you cannot see that structure from a regular echocardiogram from the outside of the body. And it becomes important because a lot of people have a rhythm called atrial fibrillation. And when people have a rhythm called atrial fibrillation, you can see how that little crescent structure seems to squeeze and go in and out. It's normal with this patient, but in patients with atrial fibrillation it becomes kind of where it flutters. It doesn't squeeze well. And it's a place where blood can actually pool. And the problem with that is, if you form a blood clot in there, the first place it's going to go if it gets dislodged is up to the brain, typically a stroke. It also through goes to the upper extremities or lower extremities. So a lot of times we use this procedure in patients how have atrial fibrillation. We may not know how long they've been in it. We get them started on some blood thinner, then do this procedure, and look and see. And if there's no evidence of a blood clot in this structure, then it's actually safe at that point to do a procedure called a cardioversion, where we actually shock their heart back into a normal rhythm. So very useful

procedure for looking for patients to have clots in their heart before we shock their heart back into rhythm. And again, the only way you can see this structure is basically with the procedure we're doing tonight, Bill.

Right, and then if they do have, or even if they don't have clots, with atrial fibrillation we recommend usually Cumadin or Warferin for their anticoagulation, at least for a short time. Isn't that right?

Absolutely.

In certain patients, even lifetime because of the risk of stroke. One of the most common causes of stroke, especially in the older patient, is atrial fibrillation with a clot forming in that left atrial appendage where Jeff just pointed out, clot getting loose and then going to the brain and also can go to other parts of the body also like the legs and cause trouble there. So it's a really important finding. And this is by far the best way to see it. And we're getting beautiful views of this structure tonight.

I think now we're kind of- what we would typically call a five-chamber view, which I think is good to see. On the right on the bottom is actually the left ventricle again with the mitral valve up there on the right in the middle. And above that is the left atrium. On the bottom left is the right ventricle, the tricuspid valve and then the right atrium above that. And every once in a while you'll see the aortic valve come into play there as well too. And this is some very nice images so you can see.

Yeah, beautiful.

-- see the whole thing. We're going to now put some color over here on the right side of the heart, the tricuspid valve.

This is the part that goes to the lungs, is that right?

That's exactly right. So blood flows coming down through that top chamber on the left through that tricuspid valve that we got some color going across now and goes into the bottom chamber on the right. From there, it goes to the lungs and comes back into that top chamber over on the right, through that mitral valve, down into the left ventricle -- always called the pumping chamber somewhat of the heart -- and blood flow goes then out through that aortic valve that we saw earlier, has two cusps. And that's how you get oxygenated blood flow to the rest of your body.

And sometimes we have some little holes in the heart?

We do.

Especially up there in the atrium?

We do, so right now don't see a lot of tricuspid regurgitation, or leakage, going back through that bicuspid valve. The structure in the middle up top that divides the left atrium and the right atrium, you'll see it right in the dead center of the screen, colors kind of going across there. And that actually is an area where holes can be. And actually when you're not born yet, you have a hole that's naturally there, called the patent foramen ovale. And that's because you don't need oxygenation from outside, you get oxygen from your mom. And so basically what we do with that is after you're born, a lot of people that will close, some people it partially closes, some people it never closes. The people that it closes, sometimes can open up. But it's an important structure. We always look on transesophageal echocardiogram because you potentially, if you have a hole there, it's a way to get a piece of plaque or something that would normally be filtered out through the lungs to get that to go across and actually, again, a way to cause a stroke. You have then potential blood clot or plaque that goes through that patent foramenal valley and goes up to the brain or goes to the extremities and cause a lot of problems. So you know, another good thing to look for, if people are having recurrent strokes or mini-strokes, called TIAs, we can look at this area and see if there's any problems with basically a hole in the heart. And there are procedures that we can actually do here at Shawnee Mission where, if it's big enough and people have had those symptoms, actually can close those up with a closure device, a device actually that's what we call percutaneous, so not a surgical

procedure but actually done through the leg. And patients can have it done and go home the next day. We're going to kind of keep looking at this.

Were you able to do a bubble study tonight or not?

Yeah, I absolutely am. I'm just going to look at another view here and again, that septum is up on top again. And what I'm going to do is put some color across there again. I just want to make sure you get really good images.

Right.

Make sure nothing's going across here.

This has been really helpful, the TE for strokes, because we do find at times a neurologist asks us to do these procedures lots of times when they have patients with strokes because they're unsure of the cause. And again, as we talked about clots in the heart, especially the left atrial appendage and also at times a hole in the heart like patent foramen ovale, can be a specific cause. If they know about that and can treat accordingly, either with medications or a closure device or whatever. So this procedure is really helpful to the neurologist.

You can take down the color if you want. That's absolutely right. What we're going to do now, Bill, is what you were talking about a minute ago. We're going to agitate some saline, so some bubbles, and actually inject this through an IV. This will come into the heart in the right side through the vena cava over there on your right. The top structure up there at the very top corner of the screen is the septum again. And what we're looking for is any bubbles that go across there. I'm going to find a right position that I kind of like, personally.

What he's doing, this is just salt water, or saline, which we use in the hospital all the time. And you just shake it up. It's not a lot of extra bubbles thrown in there. It's just bubbles that are already dissolved, their oxygen already dissolved in the saline, which is normal. Shake it up and then these little -- what we call micro bubbles which you can't even see with the bear eye but with the sonogram the sound waves bounce off these little bubbles. And as you're going to see, you're going to be seeing sort of like a snowstorm of little bubbles. And again, these are not bubbles that are big enough to see. These are micro bubbles. But they show up very well with sonography because the sound waves bounce off of them.

That's exactly right. We're going to go ahead and do that part now. So go ahead and inject here, Shelley, and we'll get some images. You'll see the bottom part there fill up with a lot of white structures. Those are the contrast to the bubbles. And we want to make sure that they don't go into the other side. A few may go into the other side after about seven or eight beats, and that's kind of normal. I can tell you right now on this one that there's no evidence of a patent foramen ovale. It's a great study and there's no evidence of anything going across there at all.

It really outlines all the structures. And you can see that where the bubbles are is where the blood is. So you could just picture in your mind now where the blood is flowing through. It's flowing through where those bubbles are. Bubbles are mixed in with the blood. So the dark areas in these echoes are actually the areas filled with blood, the inside of the heart chambers.

That's exactly right. I think that's a great point too of the bubbles can kind of direct you on how flow's going a little bit through the heart. One other structure I wanted to look at down here before we move to a little different area -- you might give her a little bit more Versed and Fentanyl. We're going to look at the pulmonic valve down here in the bottom of your screen on the right. A little bit hard structure to see but you can see it down there. We just got a little bit more bubbles in there because we gave her a little bit more medicine, trying to keep this young lady comfortable. We're going to put some color down here, Jessica is, and she's going to kind of show you where that pulmonic valve is down there. I'll see if there's anything going across there. Typically a lot of patients, and younger patients typically have some

pulmonic valve insufficiency down here, but you know, we don't really see a lot. The bubbles obscure our view a little bit with this right now, but really don't see a lot.

Looks like the pulmonary artery is good, pulling her on track.

I would agree. It does not look dilated or enlarged at all. I think that's a great point again.

We're really not finding too much, other than an abnormal, were we?

I think that's exactly right. I think, to me -- you can take me off color.

And that was- you'd call that a congenital valve?

You know, it is. It looks like a, you know, bicuspid valve that's congenital, born with it is what that means. And actually aortic valve, bicuspid valve is the most common congenital anomaly we find that people are born with, very common. And so not too unusual to see that here.

So with TEs, we really do- what we're trying to do is study patients that has specific structural problems or we can't see possibly as well as we should through the chest or through the transic- transthoracic approach. And we also took for complex abnormalities that we might not be able to figure out otherwise, injecting bubbles, for instance, like we just did here to see what the blood flow is like and where it goes. It defines structures better than the standard echo would be. And then also look for blood clots and other sources for stroke and other neurological problems.

That's exactly right. And if you notice, I've actually gone to a little different position here and actually we're down in the stomach now. And the esophagus basically leads food down into your stomach. And I'm actually down to the stomach now, and what we're looking at is the heart from back up. There's a circular structure on the right and actually that's that left ventricle again, pumping blood out to the rest of the body there. And to the left of that, on the other side, the dark space, is actually the right ventricle. So you know function of the heart is absolutely really good with this young lady.

What if a patient has a heart attack? What would you see there or has what we call coronary heart disease?

You know, somebody that had a heart attack or even sometimes in the midst of having not enough blood flow to that ventricle, we would see a wall of the heart so where it's circular you notice everything moves in at the same time. Everything contracts. And what we would see is potentially one of those areas not moving at all, maybe even bow out the opposite way when everything else comes in.

So right now I'm going to do a little bit different view.

This is a very helpful test for us, or echocardiography is in general, maybe not so much in terms of esophageal but the transthoracic to see patients acutely in the emergency room, we can do a study.

Absolutely.

Acutely look at their heart and get an idea if they're in heart failure for if they're having heart attack, have coronary blockage, have a bad valve. So echocardiography is really a very helpful tool in general.

I agree with you again on that. You know it's a way that, you know, if they had a wall motion and you were suspect that something was going on with a blockage in the heart artery, it would just give you a lot more information as well too. We're just now looking back. We've already looked at some of these structures but just from a different view. And that's the mitral valve that colors on there and you see that valve kind of flipping in and out there. Blood's pumping, as you see that top part squeezing, so ejecting blood through that valve or back the other way. And you can't see the aortic valve right now but we're looking for color leak in the opposite way and there's really none. You can take me off color if you want there.

Yes, it's really a beautiful study of a normal heart other than one valve, looks like.

Absolutely, and there's the tricuspid valve, so again that valve that's on the right side of the heart. And I really- this image is a really good image to get to. Sometimes you can't see this valve that well up top and you come down here and you can absolutely see it. We'll put some color across that one.

Is that a right atrial appendage down there?

That is, that actually is a right atrial appendage. We looked at the left atrial appendage earlier. The right atrial appendage is down at the bottom part of your screen. Again, probably not as well looked at, hard to see actually in most patients. And this young lady's got great images for us to look at, but again another place for a potential blood clot to form. Again, no leakage through that tricuspid valve there either. We're going to go off color here and basically I'm going to- actually right there I can just kind of show you a little bit. To the left there you see a structure that looks a little bit more dense, it's got a little bit of black spots in it- look like in it. And that's actually a normal appearing liver. And from where you are, looking back up, the heart's over there on the right and the liver's there on the left, just to kind of give you some structures there.

What if you had a pericardial effusion, or fluid around the heart, what would happen there?

Let me just grab a little bit of a view here and I'll-

Pericardial effusion is what we call fluid around the heart in the heart sack. It surrounds the heart.

That's exactly right and I'm going to- basically I think this was a pretty good view because there's the heart right there, a little bit smaller, again you see the pumping chamber, which is the left ventricle, on your right the right ventricle -- over on your left actually and then the liver on top of it. You would typically, if they had an effusion, you'd see a dark black space all the way around there from where the liver is and all the way around the heart. It would look like it's encased in a black circle. And that would be a pericardial effusion, or a lot of fluid. And we all have some fluid around the heart, it's kind of protective, but you don't want a lot basically.

What happens if you get a lot of fluid?

You know if you get a lot of fluid, it constricts actually the way the heart relaxes, which is a little bit different than squeezing, but if the heart can't relax normally and accept the blood flow that's coming to it, at that point you basically have some problems with pressure and you can't get the volume or pressure over to the left side to pump out. And people have a lot of problems with their blood pressures and actually an emergent situation, short of breath, swelling, emergent situation in most situations where we actually in the catheterization lab stick a needle through the chest wall into that space which we do under actually regular echocardiography with ultrasound and drain that fluid off for people. It can be a life-saving procedure.

Do they ever do these procedures during heart surgery, Jeff?

You know they do. A lot of times like not in this young lady, but say that valve that we looked at, that aortic valve needed to be replaced, which was not the case here at all, but in patients that it did, it's a good way to put the probe down during surgery, after they get surgery done before they take the patients off what they call the heart-lung bypass machine, good opportunity to basically look and make sure the work that you've done has worked well and that that valve is doing okay.

Before they close them up they can double-check, right?

Absolutely. I mean the worst thing you want to do is put a new valve or repair a valve and go ahead and close somebody up and then your repair's really not as good as you wanted it to be. So I can tell you from

experience. I have a family member who's had a mitral valve done and actually that was the situation. They did the valve, tried to repair it, spend three hours trying to repair the valve, could not get the valve repaired, and then actually said, "You know what, these images aren't good enough, we're not closing up, we're just going to put a new valve in." So very helpful in that situation.

Very good.

I think we're coming to the end here. I'm going to look at one more structure, which actually-

You're going to look at the aorta coming out?

I am.

Okay. Go ahead, Jeff.

You know what, I'm going to try- let me just one more image down here. And Jessica, who's my great echo tech-

She's doing a good job flipping the switches, isn't she?

She is, she reminds me a little bit-

All these tests depend on the technicians. I mean the doctors do some of the work but I'll tell you , the behind the scenes work by nurses and technicians in all hospitals is maybe a lot more than gets appreciated.

First, can I get some more pictures here?

Jeff, I have a question here. And it's a good one that says, what kind of sedation do you use for this procedure?

We give patients medicines called Versed and Fentanyl both of which- Versed has some amnesiac effect to make the patients comfortable. Fentanyl is a pain medication and in combination, typically keep people really relaxed and comfortable during this procedure. Dosage for that is dependent on all the patients, a little bit or a lot, just depends on what you're used to a little bit. I think we're going to go ahead and finish up.

How long do you usually keep these people in after we finish up here?

Typically watch them for about an hour or so is about all we need to. Can't drive that day after you have the procedure done. I also tell patients you shouldn't be making any business decisions that day as well too. But you know, somebody needs to drive you home, need to take a day easy during that time. And typically a lot of times you can feel like you're kind of just worn out and tired from having all the sedation.

Can you get the aorta there?

I am, we're going to take a little look here.

This is sort of the last segment, I think, of the study.

Yeah, we're about done. A little artifact here, see, that may be about as good as we get right up there.

That looks good.

But the aorta looks good.

This is the descending thoracic aorta.

Exactly right.

-which is coming out the heart and circles around and goes down the back towards the abdomen and the legs. So we're going to be-

And I think we're done.

-talking about actually the aorta in a minute here. So that's a little- you can see it's a rather large round structure there that carries all the blood out from the heart to the rest of the body. So of course, it's a very important thing to visualize. And with TE, he didn't get to show it very much at that point, but with TE we can sometimes see blood clots as well as plaque and other abnormalities of the aorta which are really important to know about. That was a great job.

Well thank you, thank you.

Everything go in there okay?

Everything's doing great. Patient's doing great. She's already waking up and we're going to kind of-

So you're going to go talk to the family and keep an eye on the patient for a few minutes, make sure everything's okay and then you're going to rejoin us in that room there and we'll be asking you some questions.

Yeah, I'll join you back-

-and stump the expert.

That will be perfectly fine. I'll be back in a few minutes. I'm going to go talk to family and make sure this young lady's doing okay and get her back with her family and then I'll rejoin you in a few minutes.

Okay, well thanks for a job well done there. Appreciate it.

Absolutely.

And we especially appreciate the patient and the patient's family for proceeding with this. We really do. Shawnee Mission really appreciates you helping us out with this telecast tonight or Netcast. Anyway, we're going to switch gears a little bit. Our center is concerned about all aspects of vascular care, cardiac and peripheral vascular. And tonight, we started out with a cardiac portion of our care -- transesophageal echocardiogram. We also have a very active cardiac cath lab, which we do cardiac casts, angioplasties, coronary stents, and other cardiac procedures. And we're going to actually have a whole hour tomorrow night at another Webcast to go over this sort of thing. So tonight we're going to switch from the heart a little bit and we're going to join our panelists here and talk more about peripheral vascular disease and then also about general treatment of vascular disease and we'll be glad to answer any questions you might have. And you can send these in live as we're talking. I'll be glad to address them as they come up. First of all, I'm going to ask Dr. Mike Beasley about aorta disease, abdominal aortic aneurisms, which are a common problem we run into and if you could tell us what that is. We saw the aorta a little bit, didn't see it all the way down to the abdomen but we saw it going towards the abdomen. If you could just tell us a little bit about what happens when you have an abdominal aortic aneurysm and what the best treatment is, that sort of thing.

I'd be glad to. Arterial aneurismal disease is a gradual weakness of the artery, which if undetected over time can enlarge to a point where the artery actually could leak or rupture or bleed internally. And that could be a life-threatening situation. The most common place for that to occur is in the abdominal part of the aorta just below the kidney arteries. These are fairly common in that aneurismal disease of the

abdominal aorta occurs in about 2 percent of the population. And Medicare nowadays allows an initial ultrasound screening after age 55 to detect these things, because if not detected from an ultrasound or a CT scan or X-rays done for some other reason, they can go undetected very easily.

If they don't get detected, what happens in the end?

Well if they continue to enlarge and leak and bleed, then most people die immediately or [crosstalk] because too late is too late.

That's right. It's about still a 50/50 chance of making it, once a person hits the emergency room with a leaking abdominal aneurysm. The traditional treatment for elective repair of aneurysmal disease has been the open technique, obviously through a large, long midline abdominal incision. That's been the traditional treatment since the '50s. It's still probably the best treatment in that it definitively takes care of the aneurysm. During the last 10 or 15 years, endovascular procedures such as an endovascular aortic stent graft have been developed for treatment of aneurysmal disease. Initially-

What is a stent?

Well a stent, which Dr. McBride can talk about peripheral stents in a little bit, but a coverage stent graft is a device that is placed up through the arteries in the groin. And once it's released, it self-expands. And what it's designed to do is seal off the weakened sack of the aneurysm so that there's no arterial pressure to the sack. Eventually the sack shrinks.

So it's like a tube inside the tube. The artery is a tube and you're putting another tube inside, expanding it and reinforcing the wall so the wall is sort of reinforced, is that right?

Well the healthy wall is reinforced and eliminating pressure to the abnormal, unhealthy wall that gradually expands. The trouble with the stent grafts is that they're not perfected to the point where we can just do one and forget about it. We still have to keep following them, follow the patients a couple of times a year with a CT scan to make sure the sack is shrinking rather than expanding. And unfortunately, not everyone's anatomy make as stent graft possible. There are certain things, relationship to the kidney arteries, how twisty or tortuous the arteries are that would prohibit the use of a stent graft.

Aren't the stent grafts initially were sort of used for the high-risk patient, high surgical risk patient?

Initially when they first came out that was for the high-risk patient who otherwise wouldn't be able to undergo the open technique. But, you know, the devices have become so good now that more and more people are electing to use that treatment rather than the open technique.

The outcomes are about the same now?

Outcomes are very similar, very similar, yes.

Good. Is there any special, other things that the patient needs to do like take special medications or have other treatment besides receiving a stent, say, or open surgery for this aneurysm?

Well there's no medications that will take care of an aneurysm since just the procedure itself. But taking an aspirin a day does help prevent clots in any type of arterial procedure, treatment procedure. And, of course, most of the vascular patients that we take care of these days are on statins to lower their cholesterol.

Right, statins are a group of drug which were used commonly in all phases of vascular disease to try to lower the cholesterol, especially the LDL cholesterol which is so-called the bad cholesterol. And a lot of studies have shown that lowering the bad cholesterol prolongs life in coronary disease and also improves vascular disease in the legs and the carotids and, as Dr. Beasley said, the aorta. So that's a very important type of medication we emphasize. We also want to control a patient's blood pressure, optimize

it. Aspirin is important and also a big deal is cigarette smoking. A lot of patients with peripheral vascular disease and heart disease, unfortunately, are heavy smokers. And one of the main ways to improve their overall condition, prevent more trouble is cigarette cessation, smoking cessation. So we emphasize that every day in the hospital because it's such a big important thing to do. Anyway, let's go to more, Joe, let's go some more to the peripheral vascular side here and go down the leg- down the aorta into the legs.

Okay, well peripheral vascular disease or peripheral arterial disease, we tend to think of it as a disease affecting the blood vessels, the arteries in the legs in that a person doesn't get enough blood flow to their legs to maintain their usual level of activity. This is usually manifest in symptoms such as difficulty walking the patient's usual distance sometimes a patient will actually get pain typically in the calves but can be other portions of the legs, can also just get a feeling that the one leg or both go to sleep or that the legs- I've had patients say they feel like wood or that they feel very heavy. And a lot of times that can be caused by blocked arteries to the legs.

How's the best way to detect this if a patient does have symptoms?

Well when the patient presents with symptoms, a very easy test that can be done that can ferret out a lot of this disease is what's called an ankle brachial index or a comparison between the blood pressure at the level of the ankle to the arm. Normally the blood pressure in the legs should be higher than the arm and if it's less, then if the blood pressure in the leg is less than the arm then that's an indication that, if the patient has symptoms, that it's warranted to maybe do further investigation.

They probably have a blockage.

Probably have blockage, correct.

Then you go on to do other studies? What else would you do next?

Well obviously a history and physical exam and just have someone examine your pulses and see what those are like and talk to your doctor about what sort of symptoms you're having. But then other tests that can be done are what's called a CT angiogram, which is injecting X-ray dye in the hand and taking CT scans of the arteries in the legs. A conventional angiogram can also be done.

To die test the artery?

Which is a dye test of the artery where we inject X-ray in the arteries down the legs, very similar to coronary angiogram where dye is injected into the heart arteries. And also sometimes ultrasound can be performed of the legs to look at the wave forms and what the flow actually looks like to the legs.

And you also use stents like Dr. Beasley does and I do in the heart, is that right?

Yes, now the stents- the stent graft that Dr. Beasley uses, that's typically to sort of provide an almost new lumen, whereas the stents that we would use a little bit lower down or possibly sometimes even in the thigh arteries would be to hold an artery open to exclude a- kind of get the plaque or calcium out of the way and to hold things open. It works a little bit differently but it's very similar to the ones that you put in the heart.

Yeah we put in- ones that you use are medicated stents at this point or not?

There are a couple of studies so far that those have- that one that Cook Incorporated had sponsored. And of far those haven't ferreted out. I wonder if it's a little bit different. Is it flow?

Just anatomy.

And the sizes of the vessels.

Right.

Let me explain a little bit. We all actually use stents these days. Stents, as we said, are tubes holding open arteries or opening them up, in our case usually in the heart. We do that to improve blood flow into the- beyond the blockage to the rest of the heart or legs or aorta, a lot of organs involved in the aorta, of course. And stents have been a real godsend for a lot of us but do have some -- at least in the heart -- some potential problems of maybe clotting up. So we need to use medications. You've all heard on TV about ads for Plavix, which is an important platelet inhibitor. It prevents clotting. We also use aspirin very importantly to prevent clots in the arteries. And sometimes the newer stents have medications inside of them which prevent re-narrowing in the area where the stent is placed so that it's an extra guarantee or preventive measure to try to keep these stents open so they don't re-close. So that's an ongoing thing. Stents are being developed all the time. There's always some problem with them in development. But overall, they've been a very excellent addition to our treatment of vascular disease. Jeff, you're back, I hear.

Yeah, in fact back in here in the echo room. Basically just want to let you know first off the patient is doing great. The family is all doing good. So I thought maybe we'd just review a little bit and go back to some of the images we got and maybe I can point things out now since I don't have-

Yeah we have a human pointer instead of just a word pointer.

I do, I kind of have some free hands now so basically the study was pretty much a normal study as far as the structure of the heart, except for the thing that we knew going into this was the potential of an abnormal aortic valve. And again, that valve is bicuspid. And what I'm going to show you is actually in these images, and there's also a little arrow here, but basically the valve, this is the aorta right here. And we're cutting through and looking down on that valve at this point. I can kind of point out some of the structures again now that I can point. This is actually a tricuspid valve over here. This is the right atrium, the right ventricle. And this actually the left atrium. So there's that septum that divides the right and left atrium again.

That's the hole in the heart place.

The is.

Because the clots go through sometimes.

Absolutely so that's the hole in the heart place. And this valve, even though it's two leaflets, as you can see it's kind of divided in the middle where there's a leaflet on each side here. You can see that opening and closing. Normally it would be like tri-leaflet where it would be like triangles basically.

But the opening's good and we didn't see much gradient, at least by color flow or by what you saw tonight?

I would agree. I mean that valve clearly looks like it opens really well and I'd be surprised if there was a significant gradient in there at this point. We're going to look at another image again so I can kind of go back and show you what things look like, a little different view. We'll go up here and basically what I'm going to show you here is the same thing again. This is still that aortic valve, just cut on edge a little bit. This is the aortic root. So again, blood flow's coming from the left ventricle being squeezed out, goes through this valve and goes out through this aorta. As you can see right here, the valve clearly opens well. We had a little bit of concern again going into this that there was a significant gradient across that valve. And I think that gradient was a false gradient, probably related to some other color flow, I would think, because this valve just opens way too well.

Did you see much turbulence here with the color flow?

You know, I did not either. I did not think there was a great deal of turbulence through there at all and not a lot of aortic valve insufficiency, which would be leaking of blood flow back this way, so as the heart squeezes, it's supposed to go this way, it tends to come back and really didn't see that much at all as well.

So an important point here is this transesophageal procedure really augmented and helped us because, with the standard transthoracic approach, or through the chest approach, this patient had findings that suggested that there might be quite a bit of narrowing of the valve and much more severe than it appears with this. So we're getting really different information and much clearer information with this study. So it demonstrates that this type of procedure is especially good at evaluating valve disease.

I agree. I think it clearly points out again what we talked about a little bit earlier that the fact of doing the study, you know it is an invasive procedure. Clearly, as you can see, patients do very well with having this procedure done. And the added benefit we get out of this procedure for this patient, specifically, is going to be huge because we were talking a little bit before we did this about very active young lady, soccer, running, all you know active sports. And I think clearly with seeing this now, she just truly has a bicuspid valve, which a lot of people have. But with no gradient, it's going to let her be active and still do all the things she wants to do. It's something that needs to be followed long-term, we need to watch that valve and routine echoes, not transesophageal echoes, but routine echoes to find out how that valve does. But you know I think it changes what was going on significantly for us at this point. And a good point about this is a very important procedure that changes the course of things significantly.

It really helped us in patient management as well as just diagnosis, didn't it?

I agree. This will absolutely change management and how we treat this young lady at this point.

Mike?

Bill, I have a question at this point. I often see patients who have a condition called atrial fibrillation and, if untreated, they can develop clots in their heart and those clots can flip out of their heart, go to the brain, cause a stroke or more often when I'm treating them they go to an arm or a leg and I'm having to do an operation to clean them out. Would you say that once that condition has occurred, that it would be better to go straight to a transesophageal echo rather than a regular echocardiogram?

If there's actually a clot that's been --

If there's actually a clot that's been diagnosed from the heart.

I think in your case, when you see a patient with a clot in the leg or an arm or something like that, we should definitely do a transesophageal echo because their images are better as you could see here for valves but there are also- see the left atrial appendage. We can see a myxoma, which is a somewhat unusual tumor or other tumors of the heart, other clots in the left ventricle, a lot of different areas we haven't touched on. But it would be very helpful.

In fact, Bill, if we come back in here I can actually show you again what Mike was talking about. And again, we showed this earlier but that's that left atrial appendage that you and Mike were talking about where people in atrial fibrillation get a clot inside here, this is really clear in here. This black means it's good. A clot would look like a white floating structure.

Brown glass or hazy white.

But again, exactly what you said. That thing flies out of there and can go anywhere in the body and then have some problems with that. So that just shows you kind of what you guys were talking about right there.

Yeah I think everybody should be very helpful because it's a very major thing and we want to see if it's anything we can correct of what medication would be helpful. Atrial fibrillation, which I don't know if the audience is too familiar with, but it's a very common condition where it's an irregular heartbeat that occurs. It's fast. Lot of times an irregular patient may have symptoms or not and it depends on the heart rate basically how much symptoms occur and if there's any other underlying heart disease involved. But the big risk is the risk of really a stroke that happens all of a sudden. The patient may not even know they have atrial fibrillation and are doing fine. And all of a sudden, they get a clot in their leg, as Mike says, and you know the leg goes numb and white and that sort of thing. Or they may have an unexpected stroke out of the clear blue sky. So atrial fibrillation is a very important thing to know about and to treat. And under many circumstances -- not all but many -- patients do require long-term anticoagulation with a medication called Warferin -- its a generic name of Coumadin the brand name -- in order to prevent these complications. And with good management, Coumadin or Warferin is a very tricky drug and it's a blood thinner that needs to be managed right. Too much can cause bleeding, not enough won't be effective. So a blood test, called a protime, is done. And this can be done in a doctor's office or in a lab and done every so often. And that regulates the amount of -- you use a protime to regulate the amount of Coumadin you want to give the patient. And this may vary from time to time so you just can't do one blood test and forget it for six months. You need to do it, you know, on a regular basis or once a month or whatever the doctor recommends. And it depends on the individual patient. But it has to be watched carefully and monitored. If that's done, then the blood thinner Warferin/Coumadin is relatively safe and very effective.

Is there anything else new in the peripheral vascular disease side that we need to know about here tonight? Is there some new equipment that's come aboard or are we doing other things in that arena?

Well there's always new devices that come out. Sometimes they're reinventions of devices that we discarded 10 or 12 years ago. And so there is a lot of hype, I think, about laser and rotoblader, the newer device that's made out of a company about of Minnesota. But I think that the thing to know about peripheral vascular disease is that you really have a good team taking care of you because sometimes things are much better treated with surgical bypass and some things are better treated, depending on the patient, with either simple angioplasty or stenting.

So you'd say the team approach is the best approach?

Yes.

And I think we all agree with that. I know Mike does to but I strongly agree with that because we need to use everybody, put everybody's mind together when we see a patient. It's any patient really. We're talking about vascular disease and our cardiac and vascular center here at Shawnee Mission. But treatment of any patient with any type of disease process, the more collegiate an atmosphere you have and the more minds that work together, it just comes out better for the patient. We get all views of treatment and we try to do that on a daily basis in our vascular center. So the patient gets the best care and sometimes it's stents, sometimes it's surgery, sometimes it's just medication. Sometimes it's a combination of everything. So you really need to orient yourself to the individual patient and I think that's also one of the strengths of our hospital as we're a strong community-based hospital that really is interested in taking care of the whole patient and making the patient important and not just a number. And we try to do that through our entire program at Shawnee Mission including the cardiovascular programs, but also health aware programs where we have nurse clinicians screen patients to pick up problems that need treating, especially cardiovascular problems. We have a cardiac rehab unit which takes care of patients after our surgery or after myocardial infarction, a heart attack. And we also have a wellness and spiritual center which is very helpful to some patients to get over their illnesses and deal with it as best they can. So that's also a big help. So we look at the whole patient. You know one thing I like to ask Jeff about and that's the overall wellness situation. He has a personal experience with that. Are you there, Jeff?

Yeah.

I think it's good time maybe to bring this. It's sort of shifting gears a little bit away from vascular surgery, stenting and echoes but into a more, say, practical area here we all deal with every day.

Absolutely.

That's ourselves.

I would call it preventative maintenance. And I probably missed out a little bit earlier, but it doesn't hurt to reiterate a little bit, you know risk factors for all of this that we're talking about: vascular disease, cardiovascular disease, you know the risk factors are basically the same. You know and that's part of that is, you know, if you have diabetes managing your diabetes, if you have high blood pressure managing your high blood pressure, if you smoke you need to stop today. And you know watching your cholesterol. And I think the other one that's important that actually took me a little while to learn is diet and exercise, to be honest with you. Very important from that standpoint as well. Personal experience, I lost 110 pounds over the last two years. That was with diet and exercise, not any surgical approach for me. And you know you feel much better and it definitely- studies show, I mean those are some of the risk factors as well too. And I think that ties into general health and taking care of yourself as preventative maintenance. And I think being physically active as much as you can do and getting your weight down is very important, not only for your health long term but also to feel better. And I think that clearly ties into all this that we've been talking about.

Yeah I think that your, you know as Jeff said, your blood pressure will be lower, your cholesterol level will be lower. If you have diabetes, which we haven't talked about much, but diabetes is a very important disease that really deserves at least an hour by itself on another Webcast. But diabetes is very often associated with vascular disease. And the metabolic changes that occur with diabetes affect the lining of the blood vessels. And that's what we're really saying tonight that the lining of the blood vessels is abnormal, that fatty buildup occurs, cholesterol buildup occurs. It's commonly called plaque and this plaque builds up in the walls of the arteries and tends to cause narrowing and even total blockage. And when a total blockage occurs in the heart, for instance, that's called a myocardial infarction, or commonly a heart attack. And that's a very severe condition because when the blood stops to part of the cardiac muscle then that muscle dies. And that area is damaged. And if it's not treated promptly then you can have serious long-term damage to the heart muscle which is a main pumping thing in the heart and can really cause weakness and even heart failure and death. So we in cardiovascular disease like to prevent this sort of thing before it happens. So again, we stressed modifying risk factors and again, diabetes is another such risk factor that adds to the other risk factors. And to treat diabetes, one of the best ways is a good diet, weight loss and exercise along with medications as needed and also treatment of the cholesterol with statins, also a little aspirin, sort of a combination approach to treatment of vascular disease. So Jeff, had you had any other experiences with this? I bet you a lot of people have been asking you about your exercise program and things.

I would say, you know, basically-

Barely, right?

Yeah you got to have more go out than what comes in basically. So you got to eat less and burn off more calories. And my only advice to people, because I know it's a big, big thing these days as far as diet and trying to lose weight, the advice I can give people is, you know, pick one thing. Pick something very small to cut out of your diet. Don't go for everything at once like I'm going to cut my diet drastically, I'm going to start exercising all the time and I'm doing all this starting tomorrow morning. I think that sets you up for failure. I would tell you the best way, and what worked for me, was you pick the small things. Pick a few things that are, you know, I'm not going to eat stuff with sugar in it or sweets or junk food. I'm going to do whatever else I want, but I'm going to cut that out. Once you do that for a while and see results, then I think you start cutting towards more aggressive things. And then you know, then you put your exercise in on top of that and start to kind of be a little bit more active after that. I've gone from someone who, you know, really wouldn't want to go out and even go for a walk and much more of a mile. And a few weeks ago I actually ran a half marathon. So you know it can be done and I think you just got to take it slow and not try and change your life all at once. Otherwise, I think you set you up for a little bit of failure.

Take little small steps at a time, probably good advice in a lot of things.

Absolutely.

Mike, have you seen that happen with vascular disease too? I mean does exercise help treatment of vascular disease, especially the legs?

Well I would say the vast majority of the patients who I see with claudication, meaning that have difficulty walking because of blocked or narrowed arteries in their legs, the vast majority of those patients should initially be treated with an exercise program and modification of risk factors. And if they strongly adhere to those things and exercise, almost every one of them -- if they're not limb-threatening -- will never have a limb-threatening situation and will continue to improve their ability to walk. Now on the other hand, when someone comes in with a gangrenous toe or a non-healing ulcer when it is a limb-threatening situation then that's when you need to get real aggressive and get things opened up fairly quickly.

So really the treatment of peripheral vascular disease is predicated then on symptoms and findings. It's not just so it's there. If it's asymptomatic, there's no damage to the foot or limb with lack of flow then you can sort of treat it medically, isn't that right?

Absolutely. There are millions and millions of people in the United States with blocked arteries and if we thought we had to open up every one of them, we would break the system more than it's already broken.

Good, there's a question for Dr. Bissing I just heard, so Jeff, you want to take that question please?

Absolutely, Bill. The question I have, which I'll just read, it said from a patient, said a TE has been suggested to determine the size of the PFO, which is patent foramen ovale, again that hole between the top two chambers I have, to help decide the need for closing this. Said I've been putting off, however due to anxiety about what the TE procedure will entail, discomfort etc., and also said the have a hiatal hernia. Can you allay some of the anxiety. Thanks in advance. I would first say, to answer that question, I hope tonight's presentation was some help in that. Clearly, as you could see, I mean the patient was comfortable during the whole procedure and the key is sedation. And, as I told the patient tonight before we started, you know we give plenty of medicine and that's so the patient's comfortable so we can get good images and see what we want to see. So basically what you do is, once the procedure starts, last thing most people remember is actually having the back of their throat sprayed to kind of numb it up and after that, don't remember much until it's all over. And so that's probably would I could say to allay your anxiety more than anything. The other point I would make about PFO, or patent foramen ovale that's opening up there, you know, depending on the size of it, it also depends whether it gets closed just based on if you've ever had any symptoms. Still recommending that patient, if they do have a patent foramen ovale up there in the top chambers of the heart, they need to have had some type of symptoms subsequently, a prior stroke, mini-strokes called TIAs or something, then have the hole that's big enough as well too. And then that's reason to close that thing but not just because there's a hole there is not necessarily a reason to close it all the time. So I hope that helps a little bit in allaying some anxiety. Like I said, watching tonight's procedure and seeing how well things went, hopefully that helps that person some.

Yeah I think the whole clinical picture is what you're saying is important, not just the presence or absence of a PFO, although that's certainly important. You need to look at the whole picture before you decide whether a PFO needs to be closed.

I would absolutely agree with you, Bill. You know, everything has got to be put together and not only testing but exam and history in all parts of medicine is how you decide how to treat people. And then you decide benefit versus risk and also that information is based on studies and things that we do.

I have another question here. I might start answering it and you can help me with this. But I have a heart murmur -- and how often this is a question -- I have a heart murmur and how often should I have an echo or a TE? I guess first of all, we ought to rely define or explain what a heart murmur is because this is a

very common problem. A heart murmur is a sound that the doctor hears while listening to the heart. It's a noise that's caused by blood flowing through the heart. And it's a noise can be either to a very normal finding which a heart maybe vibrates in a younger person. A lot of the younger patients, almost all of them have some mild heart murmur. That's because you hear the blood move though the heart. Just because this is sort of an analogy I like to give. You turn on the faucet, the pipes rattle but that doesn't mean the pipes are broken or you have something really wrong. It's just the blood flow or the flow in the pipes making the pipes vibrate and that can also be the cause, same thing is true of the heart. In fact, most heart murmurs, a large majority of them are very benign, they don't mean anything. Now a certain small amount are important to know about and to do something with. And that's what we were doing tonight. This patient that Jeff did the TE on presented with a heart murmur. Her physician heard it and he was concerned about, you know, the ramifications of it. So that's when we step up and do the examinations of an echocardiogram or even more so if that accurate, a regular echocardiogram through the chest is abnormal, we do the TE. And that's not done on every patient, as we say, just on selected patients. But how often do you think we should do a heart murmur, Jeff- I mean an echocardiogram of people with heart murmurs?

I would agree with you and I would say that, you know, just like tonight, I mean the first step is a transthoracic echo. And as I said a few minutes ago, this TE is an easy procedure to do from the standpoint of getting it done and allaying anxiety for that gentleman who sent that question. But you know it's still an invasive procedure. And if you don't have to have an invasive procedure done, you shouldn't have that procedure done. So I agree, you know hearing a murmur, you know murmurs can be about anything. And I think you start with the transthoracic echo. Depending on what that shows, I mean sometimes vascular anatomy is completely normal and you don't need any further follow-up with at that point. I think if you get the adequate images that you need on transthoracic echo that can be done in your doctor's office or cardiologist's office like ours, then you know, depending on what that lesion is or how bad that is, I think decides how frequent you need to have a repeat echocardiogram. And again, if it's severe or you can't answer that question, that's the time that you go to a transesophageal echocardiogram. But I guess I'd have a hard time just saying, you know, anybody with a murmur ought to have an echo, you know every year or something like that. I think it needs to be individualized and I think, depending on what the valve or issue is at that time.

This is sort of a follow-up question here. We're running out of time here, only have a couple of minutes left. But briefly, a follow-up question is, how do you decide when a heart murmur is serious enough to need surgery. Now it's not really the heart murmur we're talking a heart murmur, it's the heart valve abnormality, a heart lesion which is causing the heart murmur. So the heart murmur is not the disease, the valve abnormality or malfunction is the disease. But how do we tell it's serious enough to go to surgery and need to be fixed? Jeff, you want to approach that just a minute or so, real briefly?

Sure, I think, you know, that valve is involved and, you know, what the valve is like. The aortic valve that we looked at tonight had two cusps. A lot of times that valve will get narrowed and patients get in their 50's or so with bicuspid valve will start to get it really narrowed. Depending on how narrowed it gets and what the gradient is we kind of measure across that valve, and again patient symptoms kind of decides the time for going to surgery. So it really depends a lot on what the valve looks like, how the patient is clinically doing as a timing of surgery. It's very important though, you know these days we've gotten much better and doing surgical procedures, you know. We do all these surgical procedures here at Shawnee Mission and we've gotten good at this over many years. And actually I would tell you you're better off getting those surgeries done sooner versus later. You don't want to wait too long and at that point have more complication risk or have potentially a valve that we can't fix at that point because it's caused other problems like the heart not squeezing well because it's struggled for so long. You don't want to get to that point. But again, you don't want to do it if you don't need to do it. So really individualized, I think, based a lot on symptoms a patient has, depending on what valve it is, and what that valve looks like. We do have some criteria of when you should absolutely get that done.

I think the important thing is we don't want to do it too soon, have surgery, but we don't want to do it too late. So we need to sort of reach the happy medium and echocardiography and especially TE in this case, again, is really a helpful tool in order to decide when we need to do heart surgery.

I think we're out to time, actually. I've really enjoyed this panel discussion. I was sort of fearing it but I've enjoyed myself and I hope the other gentlemen, Dr. Beasley and Joe you also enjoyed yourself. And with Jeff, you did a great job, really appreciate it. And we again appreciate very much the patient and the family of the patient how let us do the TE and show this procedure live tonight. And from all of us at Shawnee Mission Medical Center, we thank you for watching us tonight and you can send us questions by e-mail and follow-through on our Web site. And we'd be glad to answer any questions at any time. So thank you again and good night.

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