NARRATOR: During the next hour, Marshfield Clinic and St. Joseph's Hospital in Marshfield, Wisconsin, will broadcast live over the internet a panel discussion of a carotid artery stenting procedure. This 1-hour webcast will include pre-taped segments of the procedure.

TIMOTHY SWAN MD: Carotid artery stenting is a process where, from within the blood vessel, we place a scaffold to hold the artery open to correct areas of narrowing. Patients who need this procedure are generally symptomatic patients who have high grade stenoses, stenoses on the order of 70% or greater in their carotid arteries, also patients who are asymptomatic, for whom medical therapy is contraindicated, could also undergo this procedure.

TIMOTHY SWAN MD: When compared to the surgical procedure, carotid artery stenting has been demonstrated to have lower rate of death, myocardial infarction, and stroke in high risk patients. You, the viewer, can send in questions to the surgeons during this webcast by clicking the MDirectAccess button on the screen.

TIMOTHY SWAN MD: Welcome to St. Joseph's Hospital and Marshfield Clinic's live webcast presentation today on carotid artery stenting, a new procedure designed to reduce the risk of stroke and prevent stroke, actually, in patients with carotid artery stenosis. I'll be the moderator for today's presentation. I'm joined today by Dr. Marvin Kuehner, a vascular surgeon from Marshfield Clinic and St. Joseph's Hospital; by Dr. Percy Karanjia, also a neurologist at Marshfield Clinic; and Mr. Rob Bohl, who is a nurse practitioner with Marshfield Clinic. Today we'll be discussing and reviewing a carotid artery stenting procedure. I welcome my three panelists as we discuss this procedure today.

This webcast is designed to introduce carotid artery stenting to both the public and a professional audience. I know that we have viewers in the medical field, as well as potential patients viewing this today. We would ask that if you have any questions about the procedure, you use the MDirectAccess button on your screen to address questions to us. They’ll be sent by email and we’ll try to address as many of them as we can today. If we don’t get to your question during the show today, we’ll try to respond to you by email after the show is over.

High resolution imaging is really necessary to see the carotid stent and the filter that is used in this procedure. Unfortunately, the technology used for this webcast does not allow us to present to you high resolution imaging, so we have prepared an animation that demonstrates the carotid stent and the filter, and we’d like to show that to you at this point. Here’s a carotid artery with a plaque narrowing the artery. A filter is inserted and deployed in the internal carotid artery beyond the stenosis. A balloon is then inserted, inflated to predilate the lesion in some cases. In other cases, we just put the stent in directly. Now you see the stent being deployed in this feature. Subsequently a balloon is reinserted and used to dilate the stent itself. Finally, the filter is removed. If any debris has been captured in the filter, it is removed as well.

I’d like to now introduce the epidemiology of carotid artery stenting. If we could have that first slide, please. Carotid artery stenosis is most often due to atherosclerotic disease. It can be due to fibromuscular disease, carotid dissection, external compression of the carotid artery by tumor or by fibrotic process secondary to
radiation, and vasculitis can also cause carotid artery stenting. Clinically, it presents with transient ischemic attacks, amaurosis fugax or transient monocular blindness, hemiparesis or hemisensory loss, difficulty with speech or vision, carotid bruit. The real question fundamental to understanding what’s going on with the patient is whether they’re symptomatic or asymptomatic because that is a good triage point. We know that carotid artery disease is the cause of 30% of the ischemic strokes in this country. Translated into population statistics, that’s 6 males out of 1,000 males annually will have a stroke secondary to carotid stenosis and 4 females out of a population of 1,000. 85% of strokes are ischemic. It’s the third leading cause of death in the United States and the leading cause of adult disability. Over 700,000 new cases of stroke are presenting annually, resulting in 164,000 deaths and greater than 200,000 permanent disabilities per year. This is a significantly expensive disease process, running up the costs to roughly $54 billion a year. Treatment is basically designed as stroke prevention. If 85% of strokes are caused by carotid stenosis, we need to do something about that. Traditional medical therapy has been used, but surgical repair has become the gold standard. Carotid endarterectomy is that surgical procedure, but the new procedure that’s becoming available is carotid stenting, endovascularly repairing the artery. Carotid artery stenting evolved to treat patients at high risk for carotid endarterectomy. It’s established as the standard for endovascular intervention in carotid artery and high risk patients. Trials have shown that carotid endarterectomy is not as good as carotid artery stenting in that patient population. There are ongoing trials that are comparing carotid endarterectomy and carotid stenting, like the CREST trial, and other trials are designed to expand carotid artery stenting beyond high risk patients.

Dr. Karanjia, if you would, would you talk about the CREST trial and its significance?

PERCY KARANJIA MD: Yes. The CREST trial, what it stands for is carotid revascularization endarterectomy versus stenting trial. This is a multicentered national NIH-sponsored trial that compares carotid stenting versus carotid endarterectomy in patients who have had a TIA, which stands for transient ischemic attack. That means people who are symptomatic with some of the symptoms that Dr. Swan mentioned earlier on and have at least 50% stenosis, stenosis meaning narrowing of the artery by angiographic criteria, or some asymptomatic patients that have a higher grade of stenosis. We don’t need to go into all those numbers, but just to make sure that people with 80% narrowing if you were to do an ultrasound or 60% on angiography, if they’re asymptomatic. So the numbers may be a little confusing, but people at high risk for stroke are the ones that are being selected for this trial. Then there are exclusionary criteria so that you want to pick people that are reasonably safe to undergo both of these procedures, both carotid endarterectomy and carotid stenting.

TIMOTHY SWAN MD: Thank you. Preassessment of these patients should also include a complete neurologic examination. Standard informed consent needs to be acquired. There is a potential economic impact on patients and families who undergo carotid stenting. It’s not a cheap procedure and to date a number of insurance companies are not covering the carotid stent procedure, although that is changing as more and more indications are proven scientifically. We need to premedicate patients with antiplatelet medications and acquire a baseline 4-vessel cerebral angiogram. Neurologic evaluation needs to be performed the day before the procedure and 24 hours after the procedure, and should be performed by an independent, non-operator neurologist, somebody who is detached from the procedure itself. Preoperatively, we like to get an EKG. Following the procedure, an EKG and CK enzymes as well. Pre-procedure medications would include aspirin and Clopidogrel. Intra-procedure medications include Heparin to maintain an ACT of greater than 250 seconds. Post-procedure, aspirin and Clopidogrel are continued for 2-4 weeks. Contraindications to doing carotid artery stenting include an inaccessible lesion, tortuous vessels, either in the aortic arch, or occlusion of the aorta, precluding deliver of the catheter-based system to the artery that you’re trying to treat. Unfavorable anatomy is another contraindication to doing this procedure. If the internal carotid artery is redundant and you place a relatively stiff stent within the carotid artery, that stent will act to create a pseudostenosis within the artery beyond the stent because of the redundancy. Ipsilateral intracranial stenosis of 50% or greater. If you have stenosis downstream from where you’re planning to work, you should avoid doing carotid artery stenting. Patients who are 80 years of age and older are probably not good candidates for carotid artery stenting and some literature suggests that they
shouldn't be stented at all. If a patient has a contraindication to anticoagulation or antiplatelet therapy, then stenting should be avoided.

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I'd like to move along to the lab and see what's going on at this point, preparing a patient now for doing the carotid stenting. The groin is being numbed. This is the access point for the arterial system. It's the safest access point that we have, so numbing the skin and then placing a needle through the skin, into the artery that goes down the right leg, but instead of going downstream with blood flow, we go upstream against blood flow, directing a wire through the needle and the right common femoral artery. Subsequently the needle will be removed and over the wire a sheath will be placed. The sheath is a catheter through which other catheters and wires can be placed. It minimizes the trauma to the artery in the groin. At this point a catheter is inserted and under fluoroscopic guidance is directed to the carotid artery that we're intending to operate on. In this case, the patient has had a previous cerebral angiogram. We know there's favorable anatomy in the arch, so we can deliver a catheter to the intended vessel. We then do a cerebral carotid angiogram and then a cerebral angiogram demonstrating the stenosis. Today's patient has had previous surgery on the carotid artery and there is recurrent stenosis within the operative bed. In just a second we'll also be doing an intracranial injection of contrast material to establish the baseline appearance of the intracerebral vasculature so that if an untoward event occurs at the conclusion or during the procedure, we'll have some idea about how to treat that deficit. Here's the intracranial run, demonstrating the intracerebral vasculature. Dr. Kuehner, at this point would you run through alternatives to carotid artery stenting from your perspective as a vascular surgeon?

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MARVIN KUEHNER MD: Okay, Tim. Thank you. It's always nice to be introduced as an alternative to any kind of treatment, but I think it's important for people to remember that open carotid endarterectomy has been around for at least 50 years. It's still considered, I think, by many to be the gold standard. There's probably 170,000-200,000 operations still being done each year and the results have been very, very good over time. The stents have only been done for a few years and the results are still coming in and actually they're pretty good, so I don't need to be a cheerleader for either way of doing this.

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These are the numbers of operations that we've done at the Marshfield Center over the last several years. As you can see, our numbers are decreasing to some extent. I don't have any reason for that. The protection devices for the stenting became approved, I think, in August 2004 and I think there's just been another device that's been approved recently. People as early as 2003 were predicting that stenting would replace virtually 75% or more of open carotid endarterectomies. I don't think that's quite happened yet, but I'm not sure that we have really seen all of the impact of what this procedure is going to mean for our open operations.

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This is a specimen from an open carotid endarterectomy. The common carotid artery is labeled on the left of the screen and the internal carotid artery on the right side. In between these two, you see all of that hemorrhagic debris, which is the material that we do these operations for. This material can break loose and embolize to the brain or to the eye and cause all kinds of catastrophes there. Every time I see a lesion like this, I always wonder how can you stick a wire through here or how can you do a manipulation through here and not really cause problems in the brain? The brain tends to be a very unforgiving end organ, but interestingly enough, the stenting procedure seems to be very, very safe. It also is important to remember, I think, that the operation is prophylactic. We don't really treat anything. We prevent new events from occurring from a lesion like I just showed you or preventing a further event from a lesion that has already caused a problem, so this is strictly a prophylactic thing. Patients are evaluated and if they are suspected to have carotid artery disease, we kind of follow this algorithm. On the left is the asymptomatic patient. On the right is the symptomatic patient. We go down through this, but basically what we do is end up with a duplex scan that we, for the most part, are operating on now, based on the results of that. We skip angiography. Angiography is very safe, but it does have a finite number of complications that can occur. We can avoid those by just simply skipping to operation. Obviously with the stenting procedure, one needs to do an angiogram somewhere in that algorithm.

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The indications are listed here. I think we've already talked about these. Basically a symptomatic patient with a stenosis of over 60%, I think, is a satisfactory candidate for an operation. If they're asymptomatic and have
stenosis over 80%, we would operate on that patient if they have a reasonable life expectancy, and that means just that. I’m not sure how you cut off life expectancy by any age or any other factors other than comorbidities. These people are all high risk patients, as far as I’m concerned. Most of them are in their 60s and above. They have significant medical comorbidities which are listed here, but none of these things prevent us from operating on these people; they may just make it a little more hazardous. Some of the things that really worry me as personal problems are anatomic abnormalities. The contralateral occlusion really isn’t much of an issue, but someone who’s already got a palsy of their vocal cord or they’ve had prior neck radiation, they have recurrent stenosis, the lesion is very high, maybe very low, actually, and some people actually can’t extend their neck enough for us to get adequate surgical exposure, so these are all things that make it somewhat hazardous to operate on a patient, more so than actually their medical comorbidities. I put all these things together in a couple of charts that you can just kind of read down here. Coronary artery disease I don’t think is really necessarily a contraindication for either. Some people require concomitant coronary artery bypass along with their carotid surgery, and we do those at the same time. We’ve been doing that for a long time and our results have been really quite good. Pulmonary disease, I think, is somewhat of a relative contraindication to an open operation. As you can see here, I think people that have significant aortic arch disease, have severe angulation in their arteries, the arteries are tortuous, those probably are best treated with an open operation. Obviously a patient that may have a chance for bleeding postoperatively is not a good candidate for an operation in their neck. The other issues that you see here are, I think, again, relative indications for an open operation. If you have a plaque that looks unstable on any of the preoperative studies, an echolucent plaque on ultrasound, an embolus or a thrombus that is actually floating on the plaque, and then probable circular calcification of the artery all make those rather risky for a stent and they’re also risky for an open operation as well, but probably safer. Restenosis and post-radiation stenosis I think everybody accepts as being clear cut indications for a stent. These patients can all have complications. We like to say that our complication rate is somewhere in the range of 3% cardiac and stroke risk. This pretty much is the same type of numbers that are quoted for the stenting procedures. Obviously there’s really very little in the way of wound problems with the stenting procedure. The neurologic issues are pretty much the same for, I think, both methods of attack. Something I’d just like to mention here that people don’t talk about very much is reperfusion injury. This occurs in those patients who have a high grade stenosis and may get a successful revascularization, but then in a day or two or three will develop cerebral edema from the perfusion and can actually go on and have strokes or they can actually die. This has also been reported with the stenting procedure, unfortunately. The nerve paralysis is primarily an issue that we see mostly with recurrent stenosis re-do operations and rarely occurs with any of the primary procedures that we do. I’ll turn it back to Dr. Swan.

TIMOTHY SWAN MD: Thank you, Dr. Kuehner.

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PERCY KARANJIA MD: There is another alternative also that we mustn’t ever forget and that is the medial alternative. That means medicines, including aspirin, Clopidogrel, Aggrenox, and similar agents. We need to always remember that as being an alternative and it’s not that we have to go to a procedure necessarily in all patients, but in very selective patients.

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TIMOTHY SWAN MD: Thank you. I’d just like to remind the audience that if you have questions, please use your MDirectAccess button on your webpage. That will send an email to us. We’ve gotten one question in already and I’ll get to that in just a second. Rob, you wanted to add something?

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ROBERT BOHL NP: Dr. Kuehner, the issue of reperfusion injury to the brain, waiting 4-5 weeks usually reduces that fairly substantially, wouldn’t you say?

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MARVIN KUEHNER MD: No. I think this can occur after any high grade stenosis is repaired. The reperfusion that you’re talking about, I think, has to do with the injury that can occur after a stroke. Yeah, we like to wait a while for that. The time that is necessary has actually been shortened in recent years. We used to wait a month or 6 weeks. Now I think 10 days or so is perfectly safe.

TIFFANY SWAN MD: Thank you. The question that we had from the audience dealt with longevity of the carotid stent. As a lead-in to that, Marvin, would you talk about the gold standard for carotid endarterectomy and its longevity, restenosis rates, that sort of thing?

MARVIN KUEHNER MD: Well, the operation's been around since about 1955 or so, as we currently do it. There are a little bit different methods that people use. For the most part, we're patching most of these arteries now and that probably cuts down on the degree of restenosis. The numbers are probably somewhere in the range of 3-5% recurrent disease with time. Maybe 1-3% of those patients will have symptoms again related to that artery. They can have a restenosis without symptoms.

TIFFANY SWAN MD: Thank you. With carotid artery stenting, the question specifically was what is the recurrence rate of stenosis in carotid artery stenting? Unfortunately, we don’t have a good history with carotid stents to be able, like carotid endarterectomy, to say it’s never going to happen or it happens in 1 patient out of 10. We just don't have that information and that’s what the trials are designed to help us with. The good thing about carotid artery stenting, however, is that by the nature of the stent, we can also put in a balloon if restenosis occurs and redilate or put in a second stent, similar to the first, so it doesn't burn any bridges from a repeat therapy standpoint. So if restenosis occurs, there are other therapies that can be performed, particularly if it’s becoming a symptomatic stenosis.

We've got a videotape of a procedure that we recorded about a year ago and I'd like to show you that now. It is focused on the fluoroscopic portion of the procedure. It does not show the catheter moving at the groin, etc., but this will give you an idea of how the procedure goes. At this point, we're inserting the filter that's being deployed above the area of stenosis, which is in the middle of your screen. The filter is deployed and subsequently a stent is inserted. The stent is then deployed after a control angiogram and you can see the patient here moving under fluoroscopic guidance. The patient is awake during these procedures. We don’t use any sedation. We need to monitor the neurologic status of the patient. We confirm the location of the stent by doing an angiogram, making sure that we’re going to deposit it in the correct location. Subsequently we then deploy the stent. This is going to be very difficult to see, particularly on your website viewing system, but you’ll see the stent being deployed here in just a second. We're again reconfirming position. Okay, now the stent deployment. It's deployed from the head toward the foot. It is a self-expanding stent that as you uncover it, it opens up and fills the vessel, so proper sizing measurement before the procedure and that sort of thing is required so we select the appropriate sized device. Following stent deployment, we do a balloon angioplasty to model the stent to the desired opening of the vessel. Here the vessel is almost all the way open, just from the stent deployment itself. We will subsequently blow up the balloon within the stent, as you'll see going on here. We try to keep the balloon within the margins of the stent so as not to disrupt the lining of the blood vessel beyond the margins of the stent to cause restenosis because of injury to the vessel lining. Finally, we recapture the filter by advancing a recovery catheter and capturing the filter back into the recovery catheter and following the recovery of the filter, as you see happening here. We remove that whole system and do a completion angiogram to document the appearance of the carotid artery at the conclusion of the procedure. At this point, I’d like to go back to the angiographic suite and see if we can proceed with the procedure.

At this point we’re trying to introduce some Heparin into the patient. We’ve already measured the size of the vessel and selected our filter based on the size of the carotid artery and selected a stent based on that. Those need to be prepared. It takes about 10 minutes for the anticoagulant that we administer to take effect and get an ACT, which is an activated clotting time, above 250 seconds. It’s important that we get all of the air outside of
the system. Air is bad inside of vessels or inside the brain, so it’s something we try to avoid by removing air from the system.

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The embolic protection devices that we use have been shown to you in an animation and at this point I’m also showing it to you here on a slide inside of a simulated vessel as to how it would be deployed. Protection devices are designed to reduce procedure-related ischemic events. Embolic protection devices were introduced to reduce those ipsilateral events during the procedure. However, there’s no scientific evidence documenting the necessity for these devices, but there has been a trend toward their use, more because of intuitive thinking about them than a scientific basis. Currently the stroke and death rate for carotid artery stenting is about 2% when using protection devices, such as the filter that I demonstrated to you. That is, in experienced hands, operators who have done 25-50 carotid stents should have their stroke and death rate down around 2%. If you’re doing it without distal protection, and in some cases you anatomically cannot use a filter, then the stroke and death rate is in the 3.2% range. There was a global registry of carotid artery stenting where 11,000 procedures were performed and it showed a stroke and death rate of 5.3% for unprotected placement of a carotid stent and a 2.2% stroke and death rate during the use of protection. There was one study in France that halted the study because unprotected angioplasty and stenting created a three times greater incidence of 30-day stroke and death when not using protection. There’s a whole confounding issue here and I alluded to that earlier. It relates to operator experience. We know there’s a reduction in the 30-day stroke rate with increasing operator experience, particularly when doing unprotected procedures. Any protection device will not reduce complication rates to 0 because they’re only effective during the interventional phase of the procedure. During the deployment of the filter, there’s a possibility of dislodging some plaque or clot and causing a stroke as a result there. There is no protection during the early post-intervention phase, the 30 days after the procedure, where the bare metal stent is exposed to the bloodstream and clot could theoretically form on the stent. These are the stents that we use during the procedure. There are tapered stents and standard stents, depending on the vessel’s shape at angiography.

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PERCY KARANJIA MD: Are drug-eluding stents available for the carotid artery?

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TIMOTHY SWAN MD: There are no drug-eluding stents at this time. Great question. The drug-eluding stents that have been approved for use so far by the FDA are strictly limited to applications in the heart. Generally they’re not large enough to be used in carotid arteries. They could be used off label if we could get hold of stents that are large enough, but at the present time, no, drug-eluding stents are not available.

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I can proceed with another case example. This is a 79-year-old male who has bilateral carotid stenosis. He’s asymptomatic. Ultrasound shows a progression of stenosis on the left, now at about 70-79%, and a stable right-sided stenosis of 50-79%. The patient had a myocardial infarction in 2000. He has vocal cord paralysis from traumatic intubation and has chronic renal failure on the order of a creatinine of 2.0. This is the carotid angiogram. In fact, it shows a stenosis of 90% or greater, which is at variance with the ultrasound exam that showed an 80% stenosis. Here we have the intracranial examination demonstrating the vasculature prior to stenting. At this point we’re getting ready to deploy the filter. We’re measuring the carotid artery to assure that the correct size filter is selected and the correct size stent is selected. Once the filter size has been determined, we insert the filter. It’s going to be very difficult to see the filter until it’s beyond the stenosis. Right now the tip of the guide wire is trying to seek its way across that high grade stenosis. Very ginger manipulation of the filter and wire needs to be performed so that you don’t cause a dissection or dislodge some plaque in the process of placing the wire across the stenosis. The wire is now just crossing the stenosis and you’ll see the filter being delivered into the distal internal carotid artery. The filter will then be deployed. Now the stent delivery system has been placed across the stenosis. You will now see the covering sheath on the stent that releases the stent being withdrawn. It’s that large black dot up near the middle of the screen. We will now see it moving backwards. That is the covering sheath releasing the stent into the carotid artery. Following complete deployment, in this case we’re deploying the stent within the internal carotid artery alone, so the bottom marker on the screen that the delivery sheath is coming to now the stent is completely deployed all within the internal carotid artery. A
post-stent deployment angiogram is performed. You can see that the stenosis has been reduced, but it’s still significant. It’s on the order of 70% at this point, so a balloon catheter is inserted and placed within the stent and then the balloon is dilated. Usually dilatation of a balloon is on the order of 10-15 seconds. It doesn’t have to be a long inflation, just enough to remodel the stent and the area of stenosis. Again, all balloon inflations are done within the stent to try to prevent damage to the inside lining of the carotid artery and the subsequent stenosis that results. Right now the balloon is inflated. It’s up there now for about 10 seconds and the balloon will shortly be deflated and then the final angiogram will be performed. Here’s the angiogram, demonstrating the result following balloon angioplasty. Roughly about 20% residual stenosis. Because it’s a self-expanding stent, the stent will continue to open during the subsequent days and weeks.

Dr. Kuehner, we just got another email question. I’m sorry I have to read this to you. I can’t paraphrase it. It says I’m currently a student at the University of Minnesota and I just wanted to first say hello to my uncle. Hi Uncle Marvin. This person was wondering how recent developments and research of the stent procedures have decreased the future narrowing of an artery in the future.

MARVIN KUEHNER MD: I don’t think we have an answer for that, Stephanie. The stent itself I don’t think has any value as far as decreasing the disease. I think we have to look to medical treatment of atherosclerotic disease and that sort of thing to figure out how to prevent these things from happening in the future. The recurrent problems are present with a stent and they’re present with an operation.

TIMOTHY SWAN MD: Thank you. I’d like to go back to the angiographic suite and see where we’re at with doing the semi-live procedure, the previously taped procedure. At this point we’re inserting the stent delivery catheter, the guiding sheath. We have achieved sufficient anticoagulation so that the procedure is safe to perform. We’re directing the sheath over a guide wire, into the right common carotid artery. Subsequently we’ll be doing a couple of catheter manipulations and getting ready to deploy the filter. We’re going to do a carotid angiogram at this point, just to prove the location of the filter and prepare for placement of the stent. So we’ve roadmapped our way and are ready to proceed. Dr. Karanjia, could you talk about why carotid arteries get blocked to begin with?

PERCY KARANJIA MD: That’s a very interesting question to which I think the real answer is unknown. The process is called atherosclerosis. Basically it’s a wear and tear process that starts off quite early in life, certainly within the teenage years of life, and then goes on during the next several years into adulthood. The risk factors for vascular disease, besides age and sex, male sex being more common for atherosclerotic disease, are hypertension (that is, high blood pressure), cigarette smoking, diabetes, and problems with your lipids, with hypercholesterolemia. Those are the main risk factors. There are some other risk factors that people have been talking about. What seems to be very intriguing these days is the place of inflammatory diseases as participating in the process of atherosclerosis. You may not realize it, but there has been recent information even to suggest that gum disease actually has something to do with the atherosclerotic process, so if you’re going to start early, start brushing and flossing your teeth, amongst other things.

TIMOTHY SWAN MD: Alright. Let’s go back to the lab and deploy the filter and subsequently the stent, so if we can go back to that tape, please. Here’s the filter being inserted into a delivery sheath that we just deployed a couple of minutes ago. The filter and wire combination are covered by a covering catheter. You see the tip of the wire there just before the area of narrowing in the carotid artery. We use a roadmapping technique to demonstrate where the stenosis is and to help guide the wire, which you see the tip of right below the stenosis, curled up below there, so ginger manipulation of that wire is required to advance the wire and catheter beyond the stenosis. Again getting caught up in a little bit of plaque. Ginger manipulation, getting the filter beyond the area of stenosis and subsequently deploying the filter in the carotid artery above the area of narrowing. Doing the angiogram at this point, demonstrating again the area of narrowing, where the stent is to be deployed. The stent is now being advanced over the filter wire and the stent itself placed across the area of narrowing. The stent is centered in your screen now, in the upper part of the screen. That’s the bottom edge of the stent. The
stent is then deployed, as you see here. The covering sheath is slowly coming back and the stent deployment is occurring. Finally, following stent deployment, an angiogram is performed. This is after balloon angioplasty as well, as you saw in some of the other demonstration tapes. You can see that the area of narrowing is markedly reduced, down near 0, so it looks like the endarterectomy bed in this patient is back to its original size following surgery.

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At this point I'd like to ask Mr. Bohl, Rob, if you would talk about some post-procedure.

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MARVIN KUEHNER MD: I have a question here. We've seen several stenting procedures now, but you didn't mention what happens to the external carotid artery when you put some of these stents in. One of them was above. This one, the external was occluded, but what if it's open and you have to cover it?

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TIMOTHY SWAN MD: About 50% of the time we do end up covering the external carotid artery. In this particular demonstration case, you didn't see an external carotid artery. It had been sacrificed at the time of surgery. Like doing a surgical procedure, there's relatively little penalty for sacrificing an external carotid artery, so if during the stenting process we end up covering the carotid artery and it subsequently occludes the external carotid artery, it's generally not a problem. However, if the stent does cover the external carotid artery, the vast majority of the time that artery remains open because the stent itself is sort of like chicken wire. It allows a lot of blood flow through it and generally does not present a problem. Most often the atherosclerotic disease that involves the internal carotid artery isn't a problem in the external carotid artery. So Rob, can you do the post procedure here, please, with these patients?

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ROBERT BOHL NP: Following the carotid stenting, patients stay overnight in the hospital. Neurology follows them. We usually see them preoperatively and again postoperatively. Particularly for CREST patients, we do an NIH stroke scale. We are fairly aggressive in managing blood pressure for normal tension. Sometimes hypotension is a problem. After surgery, people are on aspirin for life and Plavix for at least 30-60 days. Follow-up visits usually occur at 1 month, 6 months, and 12 months with ultrasound and neurologic exam, usually annually thereafter.

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Complications of the procedure include vasospasm, which is natural narrowing of the blood vessel; dissection, which is an intimal layer of the vessel coming free; embolization; hypotension; and redundant vessel kinking.

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In conclusion, carotid artery stenting is very feasible. Currently it appears to have low technical morbidity and mortality and is equivalent to carotid endarterectomy. Long-term data at this point is not known regarding restenosis and stroke rate. Marshfield Clinic St. Joseph’s Hospital is part of a multicenter trial which is ongoing to demonstrate the equivalency of carotid stenting with carotid endarterectomy.

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TIMOTHY SWAN MD: Thanks. Could you talk a little bit about the health risks for patients who have carotid artery disease and what are the outcomes that you see in patients with carotid artery stenosis?

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ROBERT BOHL NP: One of the primary concerns for neurology, of course, that we’re worried about is stroke. People also can have occlusion of the retina with transient monocular vision loss. People with carotid artery disease do tend to have comorbidities, such as coronary artery disease and peripheral vascular disease. Transient ischemic attack, which is a temporary occlusion of a blood vessel in the brain which causes neurological symptoms is certainly a concern. The main concern we have with TIA is that patient is at high risk for stroke.

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PERCY KARANJIA MD: I think what we need to make clear is that the risk for stroke is very high within the immediate period after the TIA, so if you’ve had a TIA, you need to get in and see a doctor immediately because the first week is the highest risk period. As time goes on, the risk starts to diminish, so don’t let your doctor put you off. Get in and see him.

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TIMOTHY SWAN MD: Thanks, Percy. I’d like to remind our audience that if you do have a question, please email them using your MDirectAccess button and we’ll try to answer them on air here. If we’re unable to do so, we will try to answer them by email.
There was a question from an audience member about different manufacturers of the stent devices. While I don’t want to try to advertise for one manufacturer over another, let me put it this way. There are currently 2 approved devices made available by the FDA. A third is in the process of being approved. Only 1 of those devices, however, is available commercially and that’s the one that we happen to be using because it is commercially available. The others are in various stages of being prepared for commercial release. Again, use the MDirectAccess button for submitting email questions. Dr. Kuehner, could you maybe talk about whether this is an inpatient versus an outpatient procedure.

MARVIN KUEHNER MD: Well, it’s a stay in the hospital type of procedure because I think once you do the stent, you like to keep them overnight and let them go home the next morning. That’s, theoretically at least, an advantage. With open carotid endarterectomy, many of those patients also go home the next day, so is that really an advantage or not? It’s hard to say. Clearly I think people who have a stenting procedure recover all of their function quicker than the people that have an operation, no matter what that operation may be, so I think from that standpoint it’s better. It is an inpatient procedure.

TIMOTHY SWAN MD: It is an inpatient procedure, but it is moving to the outpatient environment as technology and as our experience with this procedure evolves. Percy, did you want to add something?

PERCY KARANJIA MD: I was just thinking about relative costs of one versus the other procedure.

TIMOTHY SWAN MD: Do you want to try that one?

MARVIN KUEHNER MD: Stents cost more than operations.

TIMOTHY SWAN MD: They do. New technology is always more expensive.

MARVIN KUEHNER MD: But I think that will have to be reversed. I don’t think that’s going to continue. We’ve seen this sort of thing happen with other technology where we’ve gone from open to minimally invasive procedures. The costs for the minimally invasive procedures have to come down in order to make them generally acceptable.

ROBERT BOHL NP: Is it reasonable to expect that the costs for stenting will come down in the future?

TIMOTHY SWAN MD: I expect so.

MARVIN KUEHNER MD: Isn’t the main cost the actual stent?

TIMOTHY SWAN MD: The stent and the filter combination.

PERCY KARANJIA MD: And you have the angiograms also.

TIMOTHY SWAN MD: Angiograms is part of it, but there’s angiograms being done probably for 50% of the vascular surgeons in the country prior to doing the procedure, so the angiogram during the procedure itself is part of the procedure, so that’s not an additional expense borne by the patient.

Percy, could you talk a little bit about which carotid artery patients again should be looked at for stenting or endarterectomy. How would you, in your practice, select patients?

PERCY KARANJIA MD: When a patient is sent to me with a question of should this patient have carotid endarterectomy or not, the physician that sends the patient to me usually does this either having detected a noise in the neck, which is called a bruit, after listening to the neck, and if they’ve done that, typically the next thing they will do is obtain an ultrasound of the neck, which is called a duplex scan of the carotid artery. If that
shows a narrowing, then they will send them to me and I will evaluate them and make sure as to whether that percentage seems to be a high grade one or not. If they are high grade an in generally good health, then we may consider them for carotid endarterectomy or carotid stenting or put them in the clinical trial if they fit the clinical trial. The other group, people who are symptomatic, the moment they are symptomatic, what we do, the symptoms we go over are temporary weakness, temporary numbness, temporary loss of vision in one eye, and language problems. Those are the common symptoms. If they have these symptoms, then we can consider them as candidates for some procedure or medical therapy and we need to get them going as soon as possible.

TIMOTHY SWAN MD: Thank you. Do any of you have anything else you’d like to add about this procedure or carotid artery stenosis, in general?

ROBERT BOHL NP: Usually patients that present to the hospital, we like to admit them to the hospital if it’s an acute injury or event, often place them on blood thinners, such as Heparin, until the workup is completed. Primarily we want to get a carotid ultrasound looking for stenosis and an echocardiogram as well.

TIMOTHY SWAN MD: Alright. Thank you all for participating in this presentation. I appreciate it. Thank you, audience, for tuning in as well. Just a reminder that if you do have some email questions, you can continue to submit them and we’ll try to answer them offline. Any of those that we didn’t answer online we’ll try to answer offline as well. This program will be archived to the website and can be viewed for several months. If you are a provider that has patients who have carotid artery disease and you are considering them for carotid stenosis or if you’re a patient who has carotid disease and are interested in learning more about carotid artery stenting or carotid endarterectomy or medical therapy for your disease, please call 866-MFLD-4OR or 866-635-3467. Thank you Dr. Kuehner, Dr. Karanjia, Mr. Bohl, for your participation today. Thank you and goodbye from Marshfield.

NARRATOR: This has been a live webcast panel discussion of a carotid artery stenting procedure from Marshfield Clinic and St. Joseph Hospital in Marshfield, Wisconsin. For more information, to make a referral or make an appointment, click the buttons below.