

Varicocele Surgery
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Hello. My name is Harris Nagler. I'm the Chairman of the Sol and Margaret Berger Department of Urology at Beth Israel Medical Center in New York City. Today I'm going to demonstrate microsurgical varicocelectomy. Varicocele is an important cause of male factor infertility. A varicocele is varicose veins that surround the testicles. They are common. Ten percent of normal men will have varicoceles. However, 30 to 40 percent of infertile men will have varicoceles. The correction, or removal, of varicoceles will improve sperm production in about 50 to 70 percent of males. 30 to 40 percent of those patients will be able to achieve a pregnancy without any further intervention. Therefore, varicocelectomy is an important part of the treatment armamentarium in the management of the infertile couple. We are now going to go to the operating room where I'll demonstrate microsurgical varicocelectomy.

Today we're going to be performing a subinguinal microsurgical varicocelectomy. We see here the incision that is below the level of the external ring. It's a horizontal incision, as you can see, and measures about two to three centimeters in length. We incise the skin, spread the subcutaneous tissues using electrocautery for hemostasis. We're going to be extending this incision down through scarpa's fascia and identify the spermatic cord as it's crossing over the pubic tubercle. Gently spreading the tissues, we place Roux retractors. These are placed in the trousers of the surgeon and in the operative assistant so we only need two surgeons in the operating room to perform the procedure this way. Again, gently spreading the tissues, we reposition the retractors beneath the next layer of scarpa's. So a small incision gives us great access. Most of this dissection is done by blunt dissection using the natural planes of the body to expose the structures that we're interested in. Soon we're going to be going under the operating microscope. You'll have a better view.

Most of this is done by tactile sensation. The finger of the surgeon is placed into the wound and we're mobilizing the spermatic cord. And as you can see, we're elevating that into the wound right now, pushing the structures over the finger, making sure that we have the entire spermatic cord, which contains the varicocele, contains the vas deferens, the testicular artery. I'm passing a Penrose drain underneath the spermatic cord at this point and this will help maintain its visibility in the wound. A clamp is being placed on either end of the Penrose drain, spermatic cord is nicely elevated and easily visualized and being prepared for the rest of the operation. Using fine forceps and a dissecting clamp, we're opening up the external cremasteric fascia.

We can see through that nicely and therefore we know there's no structures that we're concerned about injuring. Using a bipolar forceps, which minimizes tissue injury, we obtain hemostasis, again spreading the tissues rather than cutting them. And this prevents inadvertent injury to any other structures. I think you can appreciate the blue structure, the vein that is beginning to become apparent. That is the varicocele. It's being lifted through the defect that we've created in the external cremasteric fascia and a second smaller Penrose drain is going to be passed underneath these vascular structures. This again helps stabilize the area that we're concerned about and allows for more meticulous dissection.

Hemostasis, again, is being obtained with the bipolar forceps, avoiding any injury specifically to the vas and the testicular artery.

I'm in the process now of identifying the vas deferens. The vas has been mobilized and is now being circled with a white Vessiloop. The vas, which is white, is going to be easily identified with this white Vessiloop, which will prevent us from inadvertently injuring the vas during the operation. You'll see when we're under the operating microscope that the color coding is actually very helpful in keeping track of the different structures that we need to. The artery will be passed- will be encircled with a red Vessiloop and veins will be encircled with a blue Vessiloop. This will help us during the dissection. Again, this is especially important under high power magnification of the operating microscope. With the high power, we have less of a panoramic view and are looking specifically at small structures.

In order to help identify the artery, we are using interoperative Doppler. The operation is designed to occlude, or block off, all the abnormal venous channels while at the same time maintain the arterial blood supply to the testicle. Obviously, when all the veins are blocked, the blood must leave the testicle in some way, and that, the blood leaves the testicle through channels along the vas deferens. So again, the vas is encircled in a white Vessiloop but not only is the vas in that Vessiloop but the veins and artery of the vas are encircled in that white Vessiloop. It is those venous channels that help drain the blood from the testicle after we've blocked off all the veins that form the varicocele. You can see the veins are becoming more apparent as we clear off the structures. Again, I'm using the Doppler to help identify where the artery is. And once I identify that, it will be encircled with a red Vessiloop. So this is an auditory localization as well as visual because we can see arterial pulsations at times or vessels that appear to be arterial.

I have identified where the artery is and where the veins are. So a blue Vessiloop is now being passed around what appears to be just the veins of the varicocele. A second Vessiloop will be passed around the vessels that appear to have arterial sounds. So we've divided the spermatic cord into two bundles, one that has arterial blood flow in the red Vessiloop and a second that has just venous blood flow in the blue Vessiloop. We're confirming that the blood flow in the red Vessiloop is in fact arterial and the blue Vessiloop is just venous. Sometimes there can be transmission of arterial sounds to veins which will make the dissection somewhat more problematic. We're spending some time here go, again, separate the veins from the artery. The larger veins, which are clearly venous, can be transected at this point. We're dividing that bundle further into smaller bundles within a second Vessiloop.

So we've now got what we think are the veins in two separate Vessiloops. Again, we want to be certain that there's no arterial sounds within these structures. So using the Doppler, we explore the area, making sure that there's no arterial sounds. Once we've ascertained and are confident that the vessel that we're looking at is only a vein, we're going to place small titanium clips on the vessel to occlude it. We're going to place a second clip and divide the vessel between those two clips.

Once the vein has been divided we are opening up the vein so that we can measure the diameter of the vein. In this case the vein measures approximately 4 millimeters. Veins bigger than 3 millimeters are thought to represent brachials. We are going to submit a small portion of this vein for histologic confirmation and get prepared to continue our dissection. We reexamine the structures in the blue Vessiloop and again listen with a Doppler. In this situation there's arterial sounds or sounds that we think might represent arterial blood flow, so we change the blue Vessiloop to a red Vessiloop and again, what Doppler evaluate the blood characteristics.

We have a little bit of oozing here and potentially putting some pressure on the vessels with a gauze will generally stop that. Obviously we want to make sure that we have meticulous hemostasis, so we observe to be certain that there's no further oozing. We have a small vessel that looks like it's bleeding so we're going to put a second little clip on that to stop that. Again, a little pressure, a little time. We want to make sure that we haven't caused any arterial injury by that second clip, so we again use our Doppler.

So now we have two bundles of vessels which we think have arterial vessels within them. Both are within red Vessiloops. As you can see, there's no blue Vessiloop on the field at this point. Now one of the

complications of varicocele surgery is hydrocele formation. Hydroceles are fluid accumulations around the testicle and they occur because there's obstruction of both the lymphatic channels as well as the venous channels. And what you see now is me placing a yellow Vessiloop around a lymphatic. These lymphatic channels are very thin, clear almost look like glass noodles. And under the operating microscope you're going to see that a little bit better, but we've preserved some of those vessels with a yellow Vessiloop. Again, gentle pressure is placed on the vessels. I'm having a little bit of trouble hearing the arterial blood flow, so I place some Propaverine, which is a vasodilator, on the cord. This allows the artery to dilate up and will accentuate the blood flow that we hear with the Doppler. This is a very helpful maneuver and sometimes is critical in order to find the testicular artery. Here we have another vein. It's going to be clipped with a small titanium hemoclip. Patients will often ask if they can go through the airport security detector with titanium clips and the answer is yes. This is of no significance. They also could have MRIs because these are not ferrous iron-containing clips. Again, a large vessel, this one measures about 6 millimeters in size, again clearly an abnormality of the what's called the pampiniform plexus or the varicocele. So we're going to pass that one off and that will be our specimen. Again, gentle pressure for hemostasis.

At this point we've got the lymphatic channels in a yellow Vessiloop, we've got vessels which contain the artery in a red Vessiloop and we're ready to go under the operating microscope. Immediately, you can see the difference in the view under the operating microscope. The yellow Vessiloop has the lymphatic channel and you can see right through it. It looks like, again a glass Chinese noodle. The important part of hemostasis is just gentle, gentle pressure and pressure and patience. We see a large vascular structure in the red Vessiloop. We see the tiny titanium clips, which don't look so tiny under the microscope. And we're going to continue our dissection. Again the key part of this operation is to make sure that we've obstructed all of the veins while at the same time maintaining the arterial blood flow.

I'm dissecting out what appears to be lymphatic channels once again and there goes our yellow Vessiloop. Again, trying to preserve as many lymphatics as we can, though it's not critical that they all get preserved. There are many, many, many, they're innumerable. But we want to preserve enough of them so that they can pick up the extra work that is needed of them as a result of the obstruction of all the veins, as well as some of the lymphatic passages. Gentle pressure and patience, the red Vessiloop is now- or the contents of the red Vessiloop are going to be further dissected separating the artery from the vein. Although it looks like just one vessel there, there's actually going to be multiple vessels there. Clearly, this could not be accomplished without the aid of the operating microscope. On the top part of the screen there, being elevated by the clamp, it looks like there's going to be a large vein. We have to be certain that that's not an artery and that the artery is not right behind it. If you simply just grab the vein, you are likely to get- to occlude an artery that's going to be hidden on the back wall of the vein. So this dissection is really quite meticulous and careful. We're listening to see if there's arterial blood flow there. There should be because it's in our red Vessiloop and we've previously identified it. If we don't identify it at this point, I would place a little bit more Propaverine on the vessels to allow them to dilate. Also want to make sure that the patient's blood pressure is in a satisfactory range, because if the blood pressure drops a little bit that may make the arterial blood flow decrease.

We're going to dissect what I said looked like a large vein and see if we can identify an artery on the back wall of that vein. And as you do this dissection, you can see that there's more than one vessel there. So we've now come through. I'm going to pass a blue Vessiloop around that and we're going to utilize that as a handle to separate it from what appears to be an artery on the back side. I'm going to pass the clamp around those other vessels which I believe are going to contain the artery. We're going to take that red Vessiloop that had previously been placed, reposition it and separate the blue and red Vessiloops.

So in a sense, we divide and conquer. We keep on dividing the vascular structures into smaller and smaller packets until we end up with what is an isolated, skeletonized artery. We're going to conform that we have the artery in the red Vessiloop at this point with a Doppler. And it hopefully was the- or hear strong arterial pulsations in the red Vessiloop, whereas in the blue Vessiloop we should hear either nothing or venous blood flow, which is a continuous whooshing sound.

When we're confident that the blue Vessiloop only contains veins, we're going to clip that, remove the blue Vessiloop, get it out of our way and here we are clipping again what I thought was going to be a vein visually and now I've confirmed is a vein by the absence of arterial blood sounds. The vein is doubly clipped and now we're going to divide it. We don't submit another specimen. That's unnecessary. Because of the size of this vein, we're going to put two clips on one side and now we're dividing that with a fine scissors. So we're left with a smaller number of vessels which contain the artery. Just simply irrigating, get rid of some of that blood. We may use a little bit more Propaverine to cause further vasodilatation, gentle pressure and we're going to continue our dissection.

And at the end of the dissection, we should have an artery that is skeletonized. And what I mean by skeletonized is that there's no other tissue or venous structures that surround it. So what appeared to be just one vessel in the beginning, especially before we used the microscope, in reality is multiple vessels. And this proves the value of using the microsurgical technique. These vessels could not be seen without the operating microscope. And the purpose of getting rid of all these vessels is to minimize one of the most common complications of varicocele surgery, and that is recurrence. Without the operating microscope, the varicocele will occur approximately ten percent of the time. With out operating microscope, our recurrence rate is less than one percent. So that increases dramatically, the success rate, in terms of the disappearance of the varicocele.

The operating microscope also minimizes the other complication that is most common, and that is hydrocele formation. Hydrocele, as I said earlier, is an accumulation of fluid around the testicle. It could be problematic in terms of discomfort or cosmetic considerations. Probably doesn't have any adverse effect on sperm production but again, it can be problematic, it can be burdensome, cosmetically unappealing and using the operating microscope, we have decreased the instance of hydroceles to less than one percent. Prior to that, hydroceles occurred approximately three percent of the time after varicocele surgery.

We demonstrating very nicely the artery. We're going to place a second small Penrose drain under that to facilitate that dissection and you can see now that we have a large artery with strong arterial pulsations, skeletonized of any surrounding tissues. We can see on the right and the left side there are lots of small vessels that have been clipped and under the operating microscope at higher power, you can actually see pulsation. You may even be able to see blood flow through that artery by changing the color of the artery. It will get dark and pale, dark and pale as the pulse forces blood through there.

We want to preserve the lymphatics so those are going to be placed now over that second Penrose drain. And we're going to place the other lymphatics over that Penrose drain. This protects the structures that we're concerned about and allows us to continue the rest of our dissection through the spermatic cord. Once these are placed over the Penrose drain, we have control of the essential structures and can proceed more rapidly through the rest of the dissection without fear of injuring the artery or the lymphatic channels, thereby avoiding the two major complications of varicocele surgery.

At this point we would take an operative photograph so that we can demonstrate this to the patient. I think we nicely see three bundles here, two of them the lymphatic, one is an artery and on the right hand side of the screen here we see the large veins that represent the varicocele. We have a skeletonized artery, almost completely skeletonized. We're going to continue to do some work here. Looks like there may be another small vein right there and we're going to go after that, again to minimize the recurrence rate. So again, this would not be visible without the operating microscope. Even with it, I was fooled there for a moment. And you can see here another vein being teased off the artery. The artery is being skeletonized. We want to be sure that we don't injure the artery so we're placing a blue Vessiloop around the vein to confirm our impression that the artery is on the upper hand side of this image and the vein is on the lower half. The red Vessiloop is grasped, brought through, again dividing and conquering the vessels. The red Vessiloop contains the artery, the blue the vein. We'll confirm that. We can confirm that visually. The arterial sounds are even stronger now because there's no venous interference. We listen to what we think is the vein to make sure there's no arterial sounds. We make sure that they're separated from one another to avoid transmission of sound from one vessel to the other. We're convinced and we clip, again, this venous channel. The Vessiloop is removed. We misfired that clip. We

removed that from the field and we try again. The clip is securely placed and the vessel will be divided only after we confirm that the artery has not been inadvertently injured in any way.

Hearing strong arterial sounds, we now divide what hopefully will be the last major vein around the artery. You can see very nicely the lymphatics above the artery. They're clear, they have no blood in them. The area is being irrigated. And we have a beautiful dissection demonstrating the benefit of microsurgical varicocelectomy. The Vessiloops are being removed. With gentle traction we can elevate the artery and the lymphatics, and explore the rest of the cord. We do this again under the operating microscope. Generally we'll see some more lymphatic channels that will be preserved, some additional veins that need to be clipped and occasionally we see an external cremasteric artery, or accessory kind of artery, that we'll preserve if identified. And here it looks like we found one. A red Vessiloop is encircling that artery. We are going to dissect through that just like we did the major internal spermatic artery. We'll divide any veins. And we're using bipolar here to divide these vessels. The smaller vessels don't need to be clipped. The clipping just adds a little more time, a little bit more money to the procedure since we're using titanium clips and are unnecessary especially after we've done the tedious dissection of the testicular artery.

Once we secure the testicular artery, we're a little bit more confident and there's less potential for adverse consequences. Again, we've identified another vein that we're going to separate from the artery that's in this bundle. So we go through the same process of encircling what we believe are the veins with the blue Vessiloop, encircling what we believe are the arteries with the red Vessiloops. We separate the structures, identify the arterial sounds, identify the absence of the arterial sounds as well, and then divide the veins. We're actually passing both Vessiloops through the same window at this time. And that allows us to separate the structures a little bit more quickly. You can see they both go through the same window. And we pull the blue superiorly and the red inferiorly, so with one maneuver we can separate the two different structures. The Doppler was again utilized to confirm arterial blood sounds as well as the absence in the veins. I like to elevate the Vessiloops to form almost a hammock to prevent transmission of blood flow from one structure to another. We're confident that that's a vein, we'll clip that and divide it as before. And now we're going to divide that with a fine scissors.

A little Propaverine to cause vasal dilatation to help us identify the artery since this is a smaller artery. This is not the main internal spermatic artery or testicular artery. It's still critically important that it's skeletonized and all the veins are divided or interrupted. This looks small. We're got the artery, we're clipping off the little vein. We still hear arterial sound. And with a bipolar, we're just going to divide this small venous channel. The vessel is sealed and divided all at the same time with a bipolar. We continue to skeletonize the artery. And we'll zoom in at a little bit higher power. I think you can actually see pulsations there. There's still some small venules alongside the artery. The artery is becoming more apparent. You can see it as more glistening. Made a little hole on a vein there. Not concerned about it because we have the artery and we have control over that vein. Although it looks like significant bleeding, this is under the operating microscope and that's trivial. Again, a little pressure is applied so we've isolated the second artery, which is being elevated by this clamp at this point. Just going to irrigate some of that blood away, make sure that we have good hemostasis. We're going to zoom in a little bit. You can see- in a second you can see the arterial pulsations I'm pointing to that with the clamp. And you can see the whole upper part of this image pulsate.

We continue to explore the remainder of the cord to be certain that there's not any other vessels that need to be divided. I'm not concerned about arteries at this point bc we're got two arteries - one the testicular artery as well as the external cremasteric artery. But we want to make sure that there's no there veins that are hidden in these structures, as we can see here, because those veins will result in recurrence of the varicocele. That we're generally dissecting these out, have a little oozing from that vessel. That's not problematic. We're going to get hemostasis in just a moment with the bipolar forceps. Then we divide anything that looks like a vein in this structure. There will be sometimes some large lymphatic channels that we'll leave, but again here's nothing that that needs to be taken. And without this meticulous dissection, we will have a recurrence. Now actually that looks like a small artery. You can see some pulsations there so we're going to leave that but we're going to divide everything else. And at this point, the division is usual just done with bipolar. The vessels are usually relatively small.

You can see the vessel in the middle of the screen takes like an “S” shaped configuration. That's what we often see with an artery, so as soon as we see that we suspect that it might be an artery. The other small vessels are then either divided between clips or cauterized. We keep in view the small artery. I actually put it under my finger to protect it. Some other veins here, again these are the recurrences that will occur if they are not identified. So although the challenging part of the operation is still identify the artery that this a spermatic artery and preserve the lymphatics, careful attention to all aspects of this procedure are necessary to assure success. Now success means removal of the varicocele and preventing reoccurrence as well as the side effects. Unfortunately, that does not mean get we are technically successful that patients will have improvement in their sperm production. Improvement in sperm production occurs approximately 50 to 70 percent of the time, so it's a very effective form of treatment for infertility. And again, separate any veins from that. See if we can see which is the artery and which is the vein. In order to help us, we're going to pass the second blue Vessiloop and again divide and conquer.

Now earlier I said that- I used the word “external cremasteric artery.” And what we had had earlier was not really an external cremasteric vessel but a second testicular artery. The external cremasteric vessels are located much more peripherally in the cord and that's what we're dealing with right here and now, as a third artery, which is the external cremasteric artery. Again, we're going to be assiduous about the detail. The artery is going to be confirmed with Doppler. The vein will be confirmed by the absence of arterial blood flow. It will be clipped and removed.

We're about to complete the dissection of the cord and we find another under the vessel all the way behind the cord. This is just to emphasize the importance of fully exploring the cord under optimal magnification. Again, there's no arterial sounds there, so we're just going to clip those vessels and divide them.

At this point we should have completed the exploration of the cord, preserving lymphatics, dividing all the veins, preserving the arteries. So we've repositioned the vas over the Penrose drain and the white Vessiloop as been removed. So there's the vas. You can see the testicular artery and the lymphatics all being encircled with the second Penrose drain. And actually you can visualize clearly the arterial pulsations now. We have a nice healthy artery. I'm placing a little Surgicil, which is a haemostatic agent, around the cord structures to just assure that there's no bleeding post-operatively from those little venules that are sometimes oozing. It's being gently placed around the structures and will be utilized to wrap the cord. As you can see, that just aids in the hemostasis. There's no signs of any active bleeding. We're going to now elevate the Penrose drain from the canal or from our incision. And I place another retractor, we're going to be looking at the floor of the canal to see if there's any perforating vessels from the pelvis that will sometimes enter into the cord structures and be another cause of recurrence. This has been reported to be a cause of recurrence as many as ten percent of the time. You can see the cord is to the right. I'm now putting a peanut, my dissecting instrument down to the floor, being certain that there's no other vessels that are entering into the cord and cause a recurrence. You want to get deep into that hole and you can see just normal fat back there with no vessels being visualized.

We've explored the floor and have not seen any perforating vessels. However, as you can see on the right side there are some vessels that appear to be perforating and entering into the spermatic cord. However, what I believe this represents is simply folding of the spermatic cord by the retractor. So we're going to replace the initial retractor and elevate the spermatic cord out of the field so we get a clear picture of the floor of the canal. Obviously, we don't want to start exploring the cord again because that's just going to result in advertent injury. And as we elevate the cord, we can see that the floor actually has no vessels and, in fact, what I was concerned about was correct. The cord was merely being folded upon itself, giving the appearance of additional vessels.

So the floor looks nice and clean, there is no perforating vessels and we're ready begin the closure. We're going to irrigate the wound carefully, make sure that we have hemostasis. Okay, after we've assured hemostasis we're going to be placing some Surgicil on the floor of the canal just like we did around the cord. We remove our retractor. We look again at the area of dissection. The Surgicil is dry

and haemostatic. There's no evidence of any bleeding. We place another piece of Surgicil around the cord and the Penrose drain is removed. The cord is then repositioned into its normal anatomical position and we begin the closure.

The closure begins with subcutaneous closure with an absorbable suture and the skin is closed with a subcuticular closure of an absorbable suture. This provides an excellent cosmetic result and obviates the need for early post-operative visit. After the closure is completed, we place Steri-Strips and a Tagaderm and the patient leaves the operating room with a small bandage. The patient is allowed to shower within three days of the operation and resumes activities usually within four or five days.

Thank you for watching this broadcast from the Beth Israel Medical Center in New York City. I hope you've learned something about varicoceles, varicocelectomy and its value in the treatment of the infertile couple.

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