

Vasectomy Reversal
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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 perform a vasectomy reversal using microsurgical techniques. Vasectomies are performed very frequently in the United States. Approximately 500,000 to 750,000 are performed each year. Two to six percent of patients undergoing vasectomies will ultimately decide that that is not the appropriate form of contraception for them and will wish to have the vasectomy reversed. Vasectomy reversal using microsurgical techniques can be quite effective. Over 90 percent of patients will have a return of sperm to their ejaculate. Fertility rates may be as high as 50 to 70 percent of patients. Therefore, using microsurgical techniques, vasectomy reversal is a realistic option for many patients. Today we are going to go to the operating room and show you microsurgical vasectomy reversal.

We start the procedure by localizing the site of the previous vasectomy. Sometimes this is palpable with a granuloma, sometimes one can feel clips from the previous vasectomy or sometimes there's just merely a gap or thinning in the vas. Locating it helps plan the site of the surgery and the incision. Occasionally, the vasectomy site will be quite high in the scrotum, and this can present some technical problems. We're going to mark the site of the incision on each hemi-scrotum and, as you can see, we stabilize the testicle in one hand and this gives us a firm surface to make the incision marking. The incision is also angled slightly towards the shoulder of the patient or the external ring. This allows us to extend the incision towards the external ring if we need to gain further vasal length during the dissection. The testicle is brought to the anterior surface of the scrotum, the skin is held taught, we open up the dartos carefully, being certain not to injure the underlying tunica vaginalis because, if possible, this will remain intact through the procedure. If we're going to be doing a simple vasectomy reversal, or vasovasostomy, the tunica vaginalis of the testicle does not have to be violated. The only time we open up the tunica vaginalis is if we feel that we are going to need to do a vasoepididymovasostomy, the connection of the vas to the epididymis. This is only necessary if there's been a blockage of the epididymis. Usually this occurs after prolonged periods of vasectomy. We're mobilizing the dartos off the spermatic chord. It's important that we obtain good hemostasis during this so that there's not bleeding later on that may adversely affect either our ability to do the procedure or the post-operative course. So careful, meticulous hemostasis is obtained.

At this point we're going to begin looking for the vasectomy site. Again, we're assuring hemostasis. I like to use a fine clamp during this procedure. We're beginning to see the vas and begin to mobilize it from the surrounding tissues although we're still using electrocautery, shortly we'll change only to bipolar forceps to make sure that there's no inadvertent injury to the vas. It's important during this procedure that we keep the vas well vascularized because ischemia will cause fibrosis and scarring and prevent the vasectomy reversal from being successful. We mobilize the vas, we keep the perivasal issues and the vasaclature of

the vas intact. We're now palpating the vas, identify the site of the vasectomy. Sometimes this is problematic and sometimes it's very difficult to actually appreciate the vasectomy site. We're always appreciative of surgeons putting clips on the vas because that helps us identify it.

I've just passed a white Vessiloop plastic loop around the vas. This gives me control of the vas without continuing to palpate it, the vas. The abdominal portion of the vas is being mobilized now. Again, it's very important that the vas is maintained, that the vascularity of the vas is maintained during this procedure. Try to use as little cautery as possible and use blunt dissection to mobilize the vas. It is important that you don't strip the vas, which can occur during this part of the procedure. Stripping the vas means that its vascularity is removed and, again, this will result in fibrosis and scar formation. The second Vessiloop is being placed now around the testicular portion of the vas. One can see that there are slight convolutions in the testicular portion of the vas and this, in fact, is the convoluted portion of the vas. This is the portion of the vas that joins with the tail of the epididymis. This is more difficult to work with because the convolutions and the tortuosity of this section. Again, the Vessiloop helps stabilize the vas and mobilize the vas and give us control of the vas without grasping it inadvertently with a forceps or a clamp or even just squeezing it forcefully between one's fingertips.

The left hand superiorly there is holding the area of the vasectomy site. This is not the vas and you can see a slight gap between the two ends of the vas. The two Vessiloops are in position, one on the testicular portion of the vas and one on the abdominal portion of the vas. We're trying to localize the exact site of the vasectomy because you don't want to sacrifice portions of vas that are healthy and usable. Occasionally as long segments will be missing and any excess sacrifice of vas will make the reconnection, or the reanastomosis more difficult. Again, as I mentioned earlier, we're using bipolar forceps. This prevents inadvertent thermal injury to healthy issues. Since electrical current is transmitted from one pole to the other, as opposed to through the body of the patient, as is the case with a standard monopolar electrocautery. It's important that adequate mobilization of the vas is accomplished.

One of the critical aspects of this mobilization is to prevent undue tension on the anastomosis. Undue tension will result in technical failure. It may also- this may occur because of scar tissue or even occasionally disruption of the anastomosis and the difficult anastomosis. We're continuing to mobilize the testicular portion of the vas, which is controlled with the Vessiloop. We'd like to find the actual site of the vasectomy and it looks like we're coming to that at this point with the dissecting clamp identifying the most (inaudible) portion of the testicular portion of the vas. And I think you can appreciate now more clearly the convolutions or the tortuosity of that segment. That's particularly apparent when the traction is released from the Vessiloop.

Now grasping the vas at the vasectomy site, this is tissue that is going to be sacrificed. It's scar. There's no lumen inside of that vas. And that has to be sacrificed because in order for the anastomosis to be successful, the tissue has to be well vascularized, to have a normal healthy lumen, the mucosa of the vas needs to be healthy. This tissue has been injured as a result of the vasectomy process. Many times surgeons will use electrocautery to cauterize the lumen of the vas during the vasectomy and that is of no value to us during reconstruction. Pointing out the area of cicatrix, we preparing a window now which will allow us to pass a tongue blade underneath the vas so that we can try and sect it and identify the vassal lumen. By spreading, we avoid transecting vessels and, again, maintain the blood supply to the vas. A tongue blade is being passed beneath the vas now. This will stabilize the vas and allow us to transect the vas.

The transection of the vas is important. It should be a clean cut through the vas. It's important that it's perpendicular to the long axis of the vas so that the lumen of the vas will be in the center of the cut surface of the vas. If the lumen is eccentric, or not round, it will make for much more difficult anastomosis and one that is technically less likely to be successful. The tongue blade creates a firm platform for this transection to occur. We will be utilizing a beaver ophthalmologic ultra-sharp blade with an 11-degree angle. This ultra-sharp scalpel will be placed through the vas as a guillotine. It is not drawn through the vas but really guillotines the vas. This prevents spiraling of the vas as we transect it.

As soon as we transect it, we aspirate fluid that will efflux from the cut end of the vas and that will be examined under the operating- under the microscope to see if there's sperm within the vassal lumen. Obviously, this will only occur on the testicular portion of the vas. We're aspirating some sperm here for fluid, which hopefully will contain sperm. Obviously, it contains some blood as well. We're not meticulous about obtaining hemostasis at this point because we want to, again, be certain that we don't injure the vassal wall of devascularize it in any way.

Once we've obtained the fluid, again with the bipolar forceps, we meticulously but carefully assure hemostasis, try not to use the bipolar on the cut surface of the vas directly because this will inadvertently injure the vas and maybe the vassal lumen and the mucosa. With my right hand I'm gently milking or squeezing the epididymis, trying to force fluid through the cut end of the vas. Occasionally we will have patients cryo-preserve this sperm-containing fluid to assure that sperm are have for in vitro fertilization if the vasectomy reversal is not technically successful. Our experience is that patients who store sperm generally do not need to utilize them. So we do not encourage people to do that, but we certainly make them aware of it. That being said, if a patient has failed previous vasectomy reversal, we're more inclined to urge them to freeze that sperm and especially if the partner is a little bit older.

We're now looking under the microscope at the fluid to see if there are sperm there. We do this in the operating room immediately so that we can determine if we can accede with a vasovasostomy. And we see in this particular situation that there is a motile sperm, actually it looks like two sperm there that are stuck together or a double-headed sperm. But the important point here is there is sperm and the sperm are motile. That portends very well in terms of the success of the procedure. The quality of the vassal fluid has been clearly documented to e important in terms of predicting success of the procedure. If there is pasty fluid that is like toothpaste, that's an indication that there is epididymil obstruction and in most surgeon's hands, we will not do a reconstructive procedure there but will proceed to a vasal epididymostomy. If there was fluid that contains sperm pieces, heads or tails, it is generally thought that that indicates that there is patency of the epididymis and we will proceed with a vasovasostomy. The absence of any fluid in my surgeon's hands will indicate the need for a vasal epididymostomy. We see a little bleeding here, want to get control over that, again, using bipolar forceps.

Our next task is to identify the upper aspect of the vasectomy and identify that abdominal portion of the vas. So similarly, we are going to mobilize the abdominal portion of the vas, preserving the vascular blood supply to the vas. We'll make a window underneath the vas, pass a tongue blade through that window to provide a firm platform for the transection of the vas. This is easier on the abdominal portion of the vas, especially when it's the straight portion of the vas that is being transected. On the testicular side, this can be very difficult especially in a convoluted portion where it's difficult to get the vasal lumen to be in the middle of the vasectomy of the vas and the concentric. So again, using the guillotine type technique, we transect the vas by just pushing through it rather than drawing the knife back, as I'm doing this remaining tissue. That's not important. This guillotine approach is just critical to make sure that the vas is divided perpendicular to the long access to make sure that the vasal lumen is in the middle of the vas and there is- it is round and the vas wall is the same thickness circumferentially around the vasal lumen.

With a dilating forceps, the vasal lumen is being dilated. This is important on the abdominal portion of the vas because the abdominal portion of the vas, the lumen becomes very small since there's no fluid that is going through it. On the testicular portion, the vasal lumen tends to be dilated because the pressure of the fluid that is constantly being exposed to the vas. That will dilate it, whereas on the abdominal side, the vas is not exposed to these pressures and therefore the vasal lumen will be much thinner. That's why we need to utilize the vasal dilating forceps.

We've done that and now the vas will readily accept a 24 angiocath. It is important when that angiocath is being placed in the vasal lumen that the mucosa is not telescoped into the vas. So it has to be adequately dilated before that angiocath is placed. The angiocath is placed so that we can demonstrate patency of the abdominal portion of the vas to make sure that the vas has not been injured elsewhere as a result of the vasectomy. So we are now performing what is called a colorimetric vasogram. Methylene blue stained saline is being instilled into the abdominal portion of the vas. This installation process should not meet any resistance. When there is an additional point of obstruction, one is unable to even instill a few

milliliters of fluid. When there's no obstruction, the vas, the seminal vesicles easily accepts fluid without any pressure. And by passing a red rubber catheter into the bladder, we retrieve methylene blue stained urine. This demonstrates patency of the vas, the ejaculatory ducts, the methylene stained saline enters into the bladder and we end up retrieving greenish urine, demonstrating patency of the entire system. This can be also achieved just by instilling saline. The absence of any pressure or resistance demonstrates patency of the structures. However, this is a nice way to demonstrate this clearly. We do that only on one side. On the other side, if the saline is instilled without difficulty, we use that as presumptive evidence of patency. The basin is passed off the table, my gloves are changed after the catheterization just to prevent any chance of infection. It should be noted now that we do not use perioperative antibiotics for this procedure and have not has patients develop infections.

So at this time we have now mobilized the testicular portion of the vas, we've confirmed that there is sperm so we've confirmed that there is not epididymil obstruction. We've mobilized the abdominal portion of the vas. We've instilled fluid and have demonstrated patency of the abdominal portion of the vas. So we're essential ready to do our microsurgical reconstruction. I do like to remove the intervening segment of vas that has been damaged from the previous vasectomy and I'm elevating that now. The two ends of the vas are being held, we're continuing the dissection. We continue the dissection just alongside the vas. And we do this to make sure that we don't inadvertently cause any vascular to the vas or even to the testicle. The dissection is limited. Hemostasis is important. I like to get rid of this segment of the vas so that there is no additional issues in the scrotum in the post-operative period, making examination of understanding of what one is feeling any more difficult. This segment is going to be passed off. It is not sent for any histologic evaluation or confirmation sine there is no pathology that one would anticipate in this and that decreases the cost of the procedure. So the intervening segment of the vas is removed. We're going to measure that and that will be part of our operative dictation so that we can see the gap that is necessary to traverse. Sometimes that gap is quite long. That requires more mobilization and, as I indicated earlier, that can require extension of the incision towards the external ring to adequately mobilize the abdominal portion of the vas.

Since we're working in the convoluted portion of the vas, it is sometimes difficult to identify a site where the lumen of the vas is located perfectly within the transected portion. And what I mean by perfectly, I want the lumen to be in the middle of the vas with the vasal wall being the same thickness in a concentric fashion. So we're trimming a small amount of vas back to achieve this. Although this does sacrifice a small amount of vas, it's critical to achieving a successful watertight anastomosis. And what we see here is a nicely transected convoluted portion of the vas.

Historically we used to try to mobilize the convoluted portion of the vas and actually get rid of the convolutions. What we found was that this resulted in devascularization and a higher likelihood of having a technical failure. So we don't do that now. But we do, again, try to get the vas transected in an appropriate fashion to facilitate the anastomosis. You will see when we go under the operating microscope that the lumen of the vas is going got now be directly in the middle of the transected portion of the vas. Want to make sure that there is no tension on the anastomosis., so we'll mobilize both the abdominal and testicular portion of the vas slightly, at all times being cognizant of the risk of devascularization and making sure to prevent that. Again, bipolar forceps is begin utilized. We use Heparin, Heparinized saline. This does not cause problems with bleeding but does prevent clot formation in the vasal lumen and this sometimes can be problematic.

We spend the necessary time to make sure we have meticulous hemostasis because bleeding after the anastomosis. can result in disruption of anastomosis. This dissection is all being performed using optical magnification although it's not under the operating microscope. We use optical loops of 4.5 magnification. So my vision at this time is better that yours, but shortly we're going to be under the operating microscope and a new world will open up to you. Having some problematic bleeding from the vasal vessels it's important to note the location of the vasal vessels because this will help orient the anastomosis. The vasal vessels should be on the same side of the anastomosis both on the abdominal and testicular portion of the vas. So this is a marker to prevent torsion of the vas. We're making sure that these can align easily without any tension. Often times I will use a proline suture to keep these two ends proximate to each other. It seems that we have good length here without too much difficult and without tension.

We're getting prepared now to make another window and I'm pointing out here the convolutions that I think you can clearly see in this area. We're going to make a small window here that's going to accommodate the vas approximating clamp. The vas approximating clamp will stabilize the vas during the anastomosis. Not all surgeons utilize this but I think most do. Some simply will place a suture in the periovasal issues of both the abdominal and testicular portions of the vas to reapproximate it and not utilize a stabilizing clamp. We find it's very helpful. It secures the issues in place. It gives us the ability to move the anastomosis. during the performance of the anastomosis. and gains control. This measures the length of the disrupted or respected portion of the vas. Although there is vas tissue there, it's scarred and not utilizable. That measures about a centimeter and a half, which is a fairly standard amount of resection. We're going to pass that off and again, that's not submitted for histologic evaluation.

This demonstrates the vas approximating clamp. The vas approximating clamp is folded and this allows the two ends of the vas to be facing upwards toward the operative surgeon. As the anastomosis progresses, the vas approximating clamp will be unfolded so the two ends of the vas will then be directly pointing at one another. But when you begin the anastomosis., you want the two ends looking straight up at you almost like a double-barreled colostomy, if you will, looking straight up at you so that you can place your posterior sutures initially and your mucosal sutures. Again, irrigation with Heparinized saline. You can see on the abdominal portion of the vas that there's a little bluish tinge and that's from the colorimetric vasogram that we utilized. The mucosa of the vas does not stain with methylene blue because it's healthy normal tissue. Only the transected muscular segment of the vas will stain. So this helps identify the mucosa and we'll see that more clearly under the operating microscope. The vas approximating clamp is positioned. I place an umbilical tape around it so that I can stabilize it and keep it in the appropriate position. That's clamped away from the operating surgeon, again, to stabilize it. We place Kelly clamps on the wings of the vas approximating clamp. As you can see here, again this gives me a handle to allow me to manipulate the vas or move the vas during the anastomosis. to facilitate the placement of the sutures, which it sometimes can be difficult. We're being certain that there's enough redundancy of the vas here. So you like tissue above the vas approximating clamp. Sometimes it's difficult to put the vas approximating clamp on the testicular portion if it's in the convoluted vas, as you can see here.

We're now going under the operative microscope. On the left hand side of your screen is the abdominal portion of the vas. The vas approximating forceps is now going to be placed inside the lumen, again to gently stretch the vasal lumen which has been not dilated over this period of time because there's been no fluid traversing it. When the vas dilating forceps is placed in the lumen it's important not to lacerate the lumen. We let the vas dilating forceps open up gently under control so that they don't snap out of the lumen and inadvertently injure it. You can see the vas dilating forceps there just gently stretching the vasal lumen. I think you can see clearly the white appearance of the lumen as opposed to the cut surface which is stained blue. We just allow the forceps to gently stretch, or dilate, the vasal lumen, being sure not to injure it, tear it, puncture it in any way because any of those events will cause scarring and failure. There you can clearly see the lumen. You can see that the muscular wall of the vas is symmetric around the lumen, indicating that the transection wasn't that perpendicular to the long axis of the vas.

We're going to do a little bit of trimming here to get the perivasal issues out of the operative field or out of the area of the anastomosis. But again, it's important that we don't trim this back too far or strip it because that will devascularize the vas. We want to have it well vascularized and healthy to promote healing. We do this by pulling the perivasal issues in the direction of the vas, away from the cut surface. So by pulling and then trimming, it does not devascularize the vas but does expose the cut surface, making the anastomosis. easier. You can see creamy fluid efluxing from the cut surface on the convoluted portion of the vas. At times this continuous drainage will be problematic during the procedure. On the other hand, we're happy to see that because it shows that the epididymis is not obstructed and, as we demonstrated previously, there is sperm in this fluid. And if we were going to try to cryo-preserve this, we would sit here for a while aspirating that fluid. Again, you can see we're pulling the perivasal issues in the axis in the long axis of the vas so that we can expose the vas without devascularizing it. It's important that you don't take a small divot out of the vasal wall. This is particularly likely to occur in the convoluted portion of the vas when you're clearing the perivasal issues off because the convolutions of the vas are unpredictable

and one may inadvertently injure the vas. So we're not aggressive about this on the testicular portion of the vas, especially in a convoluted area.

What I'm doing now is placing marking dots on the vas wall. These dots will help orient the vas and divide it into quadrants to enable us to plan the placement of our sutures. This is particularly important when you do operate in the convoluted portion of the vas, when there's a disparity between the thickness or the circumference of the vas as well as a disparity between the lumen of the vas. If you do not place these marking dots, you will have greater difficulty being certain that you appropriately align the lumen of the vas on the abdominal and testicular portion. An inappropriately aligned lumen will result in leakage, granuloma formation and failure. Now because of the wetness of the testicular portion of the vas and the continuous leakage of fluid, we're having some difficulty making a nice dot. And you can see there's been some leakage or bleeding, if you will, of the methylene blue. So we're going to try to keep that driver. We also trimmed the marking pencil so that we can get a nicer dot. And you can see that the last one was cleaner than the first one. And there's the fluid that's leaking, which makes it likely to bleed or run. We're trying to put the fourth dot now.

So you can see the dots divide the vas wall into quadrants: 12:00, 6:00, 9:00, 3:00. We're going to demonstrate the vasal lumen by gently placing the vas, the dilating forceps into the lumen. And we're going to do the same thing now on the abdominal portion of the vas. You can see the lumen very clearly there. Using a wick pledget, we're going to try to dry that up a little bit to make it easier to place the dots. We're stabilizing the vas, so our forceps are at the 3:00 and 9:00 position. We're going to start by placing a dot at the 6:00 position. So this dot will line up with the 6:00 position dot on the opposite side. So we have a nice dot there. We're now putting a dot at the 3:00 position, a dot at the 9:00 position and a dot in just a moment at the 12:00 position. We're just admiring the vas at this point. And now we're about to put the last of the four dots at the 12:00 position. And if you look straight down the barrel, if you will, you see the four dots dividing it into quadrants and you see the lumen in the middle of those four dots. You can see how we'll use those dots to align the two ends of the vas. It's important that they're aligned appropriately to prevent torsion or undue tension on the anastomosis. and also to make sure that the vasal lumens are appropriately aligned so that there's not a dog-ear or an area where the sperm containing fluid, the seminal fluid, can leak. It's actually not true seminal fluid, it's epididymal fluid with sperm.

We're getting ready to put our first sutures in. These are 9-0 ethilon nylon sutures. The first sutures to go into place are going to be purely muscular sutures. We're going to be placing these at the 6:00 position and these will form the posterior wall of the anastomosis. This suture will be placed on either side of the 6:00 suture. I like to place these sutures initially because, one, they stabilize the vas wall and they complete the posterior aspect of the anastomosis., which is going to be more difficult to see later on after we've completed the rest of the anastomosis. So we're holding the vas up. I'm getting ready to place the suture. It's going to be on either side of the 6:00 suture. This is purely a muscular suture. It does not enter into the vasal lumen, as you can see. And that's exactly where we like to place it.

We're now going to go to the abdominal portion of the vas. We're going to identify the 6:00 dot. As you can see, we don't handle the needles. They're too small to handle. We handle the suture material, let the needle dangle and then pick it up immediately with our needle holder. If you tried to do this by picking up the needle with your fingers, you won't be successful. This suture is placed in the same position on the testicular portion of the vas. It's being guided through the tissue carefully. Obviously, these sutures are tied under the operating microscope. One could not do this without the operating microscope. One of the great difficulties of this procedure is working with your team. The nurses who don't have access to the operating microscope and are handing you sutures that they can barely see without some form of optical magnification.

So we're tying this down. The assistant is guiding the two ends together to make sure that they align nicely and that there's no tension on them. As we tie this first suture down, we want to make sure that the muscular walls are approximated nicely. You're going to see, as we zoom down, that the vasal lumen line up very nicely as well. So the 6:00 dots are right next to each other and if we release the vas they will actually overlap one another and disappear. So you will not see the 6:00 dots once the two posterior wall sutures are placed. This is the first one and you're going to see the second one in just a moment.

It's important when you're tying that the vas is not pulled or disrupted. Obviously not as important as when you're first starting, but as the anastomosis goes on, this becomes of critical importance. We're going to leave a tail on this stitch and that will be helpful later on because I can utilize that to manipulate and move the vas. And you can see, as I pull on the suture, the lumen are nicely juxtaposed. I placed a background material, that green plastic sheet behind. That's helpful because it provides some greater contrast, it allows us to see the suture more easily. It also prevents the suture from getting caught in the perivasal issues. Since these sutures are so small, they are difficult to pick up from the tissues and this just helps avoid that. I also have a wick behind the vas. This gives me little bit firmer foundation and absorbs some of the bleeding that may come from the cut ends of the vas and precludes the need to utilize bipolar on the cut ends of the vas. Don't always utilize that pledget but at times it's very helpful. Again you can see how we pick up this suture or the needle without touching it, just by letting it dangle on its nose or tip, by picking up on the suture material itself.

So this is the second posterior wall muscular stitch. It's going to be on the opposite side of the 6:00 microdots. And you can see that pledget does absorb some blood, which is helpful. I'm removing it because it's now getting in my way. That's the downside of having that there. We're going to tie this suture down. And when we tie this suture down, that 6:00 dot should no longer be visible. And not only should it no longer be visible, but we should see that the mucosal edges of the vas line up nicely. If that's the case, that shows us that we've really gotten off to a good start on the anastomosis., we've lined up the muscular walls appropriately, we've lined up the mucosa appropriately and that will facilitate the anastomosis and ensure success.

So, as we zoom in, you can see that dot has really disappeared and we can see that the cut edges of the mucosa have lined up nicely. We're going to tie this suture down and again I'm going to leave a little bit of a tail on that because that's going to give me a handle that I will be able to utilize and be able to manipulate the vas later on. That little bit of a manipulation that we're able to gain by pulling on that tail will facilitate the placement of some of the more difficult sutures that are yet to come. So I'm tying the second posterior suture down at this point. And as that suture is tied down, the 6:00 dot should disappear and the mucosal areas should approximate one another. It's critical that these first two sutures are placed appropriately to avoid torsion of the anastomosis., which will result ultimately in failure.

And as we zoom in, you can see very clearly the two lumen of the vas, the abdominal and testicular portion. It almost looks like a figure of 8 because they meet at the 6:00 position. I'm placing a little bit of methylene blue on the vas now. This helps give me some contrast and I think you can see more clearly now that figure of 8 appearance of the two lumen as they kiss at the 6:00 position. Now they're not sutured together yet, they're just held together by the posterior muscular sutures. I'm going to dilate the vas lumen again on the abdominal side because, again, that's the side that is always much smaller. And, depending on the degree of disparity, that can be sometimes problematic. In this situation, they're not that different, although as you can see, I keep on working on that abdominal portion because it is smaller.

I'm getting prepared now and I'm demonstrating there the abdominal portion and then you can see that dilates up a little bit more easily. But both are nice and healthy, well vascularized. So we're preparing now for the second layer, or the interlayer more correctly, of our anastomosis. For this we use a 10-0 ethilon with a needle on each side. And the reason we use two needles here is to allow us to place this suture inside out on both the abdominal and testicular portions. We want the knot to be tied outside the lumen because any suture material within the lumen will reduce the luminal size and result in failure. We're going to be placing approximately six sutures, which would occupy a significant portion of the vasal lumen if the knots were tied on the inside. So this is going inside out at the 6:00 position basically through the dot that had been previously placed. This is the first mucosal suture of the two-layer microsurgical vasovasostomy. And you can see the suture and we're going to tie this now. I'm going to indicate to my colleague that I want him to cut one of the needles, first making sure which one it is, and when I identify that I'm going to just give it a little shake, which will indicate to him that I want the needle cut off. There it is. "Cut me," it's saying.

He cuts the needle off and I'm ready to tie this down now. It's wonderful when he passes me the end of the suture so I don't have to go look for it. We're going to irrigate again with saline that's Heparinized. And you can see how nicely the mucosa now is approximated. That figure of 8 appearance really becomes obviously. We tie it down. As you can see, there's no movement on the vas during this. We don't want to disrupt it. It stays stationary during the tying procedure. This knot is outside the lumen so we're going to want our sutures to be very short in terms of the tails. There should be essentially no tail here. You could see there's continuing efflux of sperm containing fluid from the testicular portion of the vas. We're going to zoom in there and make sure that these tails are very short so they don't protrude inside the vasal lumen. We cut one at a time to make sure there's no inadvertent cutting of the stitch and removing the stitch and also to make sure that they're as close and as short a tail as possible. We could see, I think, very clearly the figure of 8 appearance of the two lumen that are now juxtaposed to one another. We're going to place the wick there to absorb some of the fluid again and get prepared for our subsequent sutures.

The next suture is between the 6:00 position and the 3:00 and 9:00 positions. So again, we use those marking dots to help divide these lumen equally on both the abdominal and testicular portion. And this is difficult when there is great disparity between the two sides. And that's why these dots really are so helpful in creating this anastomosis. Again, sutures are placed from inside out with a double-ended suture so that the knots are on the outside. We're going to tie this suture down. When this suture is placed, there will be a mirror image suture placed on the opposite side. So this one is at the 3:00 position or between the 3:00 and 6:00 position more accurately. And then there will be one on the other side between the 6:00 and 9:00 position. This will then be followed by another suture between this 6:00- excuse me, between the 9:00 and 12:00 position and then another suture between the 3:00 and 12:00 position, again dividing the lumen in a systematic fashion. You could see very clearly how nicely the lumen is lined up here. We're tying those sutures down. I don't worry about the little oozing from the cut ends of the vas. That's a sign of a well-vascularized anastomosis. and that's critical to success.

The instruments need to be wiped of blood. Even a small amount of blood, as you can see there, will interfere with the ability to gasp these sutures as they are so fine. We're going to cut these tails very short once again, to prevent them from protruding into the vasal lumen. This is going to be followed by a suture on the opposite side, again between the 6:00 and 9:00 positions, which have been placed there. You can see the suture at the 6:00 position, you can see that the vasal lumen are nicely juxtaposed. We're now putting a suture between the 3:00 and 12:00 position on the abdominal side. And that's going to be followed by that same suture being placed between the 3:00 and 12:00 position on the testicular side. These last sutures are not tied down until all the sutures are placed. Because if you tie these down now. You not be able to put the last suture in at the 12:00 position. So we leave these united with the needles in place. Now if you remember, that dot was a little bit bigger than we like in the other dots. So this captures just the uppermost edge of the dot, which really is the position we like. You can see we're testing to see if it's bringing the vas lumen together nicely. .

We now jump to the 12:00 position. And the last suture on the mucosa has been placed on the 12:00 position. Again you can see the two dots lined up perfectly. So we've now completed the entire inner layer of the anastomosis. Again, this is a two-layer microsurgical vasovasostomy. So we started with two posterior sutures, we have then placed six mucosal sutures. The inner layer is watertight. You no longer see sperm containing fluid efluxing, as we did earlier in the procedure. And that demonstrates that we have achieved our watertight inner layer of the anastomosis.

That is now going to be followed by a muscular layer of the anastomosis. and this will be back to the 9-0 suture. We're just going to get the muscular wall. . you have to be careful here, certainly the first stitch or so because the only thing that's holding this together is the mucosal sutures. We want to be outside of the mucosal sutures -- in other words not incorporate the mucosa or the vasal lumen in this at all. This buries, if you will, the inner layer of the anastomosis. This first stitch is generally a little bit harder, because again there's some mobility there and we want to make sure that we're not in any way putting undue tension or traction on our anastomosis. So we're just going to stabilize the vas with our forceps not squeeze it but just stabilize it. We're going to tie that down and you could see the blue from the cut surface of the vas and you could actually see just the edges of the 10-0 sutures down below. And you could see I'm picking up superficial to that with the needle. And you could see the 10-0 suture down below the mucosal layer.

And that's going to now be buried by approximating the cut ends of the muscular vas. You're going to see those blue dots. The blue stained issues will disappear, as will the dots because we're going to bring the muscular edge to the muscular edge.

So this, we do this sequentially all around the vas, completing the outer layer of the two-layer microsurgical vasovasostomy. This is the strength layer and it helps ensure a watertight tension-free anastomosis. And as we tie that down, again, you see the disappearance of the methylene blue stained wall of the vas and the disappearance of our dots.

Throughout the procedure, you can see that the vas is well vascularized. There's some oozing from the cut surfaces. You can actually see vessels right up to the cut surface and this is critically important to a healing of an alpha anastomosis. We're just going to zoom in here again so you can see how the muscular edges are reapproximated now. And the inner anastomosis, with the mucosal layer is no longer visible. Then I trim that suture just a bit so it doesn't get in our way. We're going to leave one tail long because that, again, gives me a handle to control the vas. Simply muscle, no mucosa, not picking up the needle with our hands but just manipulating it by its suture. You're going to see that we just have the cut wall of the vas, we're superficial to the mucosal sutures that you can see there. When we tie this down, you're going to see that all that blue and the microdots will disappear. My assistant hands me the tail of the suture to make it easier. And you could see very nicely now how that second layer brings the muscular wall of the vas together burying or hiding the inner anastomosis, of the mucosal layer of the anastomosis. It almost looks like the vas was never transected there.

We're going to zoom in to demonstrate that and also to do our cutting. Let's see if we can focus that a bit. And you can see no blue, no dot, well vascularized. You see the blood vessels right up to the cut surface. You could almost see individual blood cells flowing through them. Okay, we're going to leave this one a little bit long as a handle. It's one of the important parts of the procedure now is to make sure that our muscular layer is closed all the way around. That's the 3:00 position. It needs a stitch there. We're going to keep on going all the way around the vas until we hit our first two sutures that have been placed before we started the mucosal part of the anastomosis. So it's important that there's a 360 degree closure of the muscular layer as well as the mucosal layer. The mucosal layer, we could see because we're doing it from the front. It's harder to do the muscular layer because we don't see that and we have to turn the vas. And you could see that it right now I'm bringing the vas approximating clamp over, flipping it 180 degrees. It strained out now because the vas doesn't need to be pointing to me.

I really want to be able to see the posterior aspect of the vas to make sure that we've gotten- gone around circumferentially. I'm using those preciously placed sutures as a handle. We're picking up on that. That helps us rotate the vas which sometimes can be problematic, rotating the vas, and that's particularly true when we're in the convoluted portion of the vas. And that's because the convoluted portion of the vas doesn't have that linear axial direction that the straight portion does. It's like rotating a piece of spaghetti versus rotating a piece of macaroni. It's easier to rotate the piece of spaghetti than it is the piece of macaroni and see it all the way around. So we're putting these muscular sutures now on the posterior aspect. And you can tell it's the posterior aspect, one, because I've flipped it over and you've seen that. But as you recall, the vas approximating clamp had been on the upper side of your image and now it's on the lower side. It had been rotated 180 degrees, so we're now looking at what had been our 6:00 position when previously we had been looking at what was out 12:00 position. You could see the knuckle of the convolution to the right hand side. And the difference between the right and left hand sides in terms of the appearance is the convoluted versus the straight portion of the vas.

Interesting when you finish the mucosal part of the anastomosis., which is technically more challenging because it's more delicate, you feel like you're essentially through with the operation. But sometimes this muscular layer, especially posteriorly, can be even more challenging. And it's just critical that you assure that you've gone around 360 degrees to prevent leakage. You could see those two sutures beneath the one that I've just placed. Those are those first two sutures that we placed in the beginning of the operation at the 6:00 position on either side of the initial marking dot. Again, tie that down and irrigate away the blood clot so we have good healing. We don't want blood in the anastomosis., we don't want it

in the lumen. And there's a little bit of oozing there. We'll keep an eye on that and see if we need to deal with that.

Well we're just about through with this anastomosis. We've utilized the same technique to perform a reconstruction on the opposite side. It's important that this technique be followed in a very careful assiduous fashion, depending on what the operative findings are. But the reconstruction procedure needs to be planned carefully to assure that we have a tension-free anastomosis., to assure that it's well vascularized, to assure that it's watertight. And those are essential elements to successful microsurgical reconstruction. We've now cut the posterior sutures. We're going to bring the vas back over, flip it 180 degrees, asses all the vas at 360 degrees around. You can see now that we've gone all the way around to those 12:00 sutures that we had placed after completing the mucosal anastomosis. We're inspecting the anastomosis., making sure that there's hemostasis. We're getting ready to cut these last holding sutures. Some thought is we'll place an additional layer of sutures in the perivasal tissues, again to take tension off the anastomosis. This one looks like there's no tension, it's well vascularized, it will not be placing any other sutures. The vas approximating clamp will be removed. Now we're just checking our hemostasis. You can see very nicely that anterior layer of sutures. Let's see if we can focus on it. There you go. One last look and you can see very clearly the blood vessels right up to the edge of the anastomosis. as I cut that last suture. You can see a blood vessel right underneath it. Excellent. All right, making sure we haven't left any tags along. We're going to be performing a vasal vasectomy on the other side now. And hopefully that's going to go as smoothly as this one did, with a high confidence of success that this patient will be able to have sperm return to his ejaculate and impregnate his partner.

I attempted to demonstrate the principles involved in successful microsurgical reconstructing. This is a very technically demanding operation but one which is associated with a high degree of success. Hopefully, you enjoyed your visit with us and thank you for your attention.

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