

**DEPUY MITEK: BRINGING EDUCATION TO YOU
A COMPREHENSIVE APPROACH TO ARTHROSCOPIC ROTATOR CUFF REPAIR:
OPTIONS AND TECHNIQUES
RAYNHAM, MASSACHUSETTS
SEPTEMBER 19, 2007**

00:00:10

JON J.P. WARNER, MD: Good evening or good morning, depending on where you are. I'm Dr. J.P. Warner, and I'm pleased to welcome you to this live webcast, which is sponsored by Mitek here in Raynham, Massachusetts. I'm joined by my colleague, partner and friend, Dr. Laurence Higgins. Dr. Higgins is Chief of the Sports Medicine and Shoulder Service at Brigham and Women's Hospital, and I am Chief of the Shoulder Service at the Mass General Hospital. We're going to bring to you tonight a live surgery which I finished just an hour or two ago. And we're going to entertain questions from four locations. These locations are Atlanta, Minneapolis, Philadelphia, and as far away as Buenos Aires. I'd like to welcome almost 1,000 participants from the United States and 31 different countries that will be joining us tonight. We'll run through this case and entertain questions as we go. I'll try to highlight the key components of rotator cuff surgery, at least the way I think about them, and also demonstrate for you the way I use different devices to achieve what we want to achieve, which is a complete repair of the rotator cuff that allows healing.

00:01:12

So the case which we're going to bring to you is a case of a 73-year-old part-time tennis pro who injured the right shoulder when she fell and dislocated her shoulder in January. She had pain with overhead motion, she had limited flexion to only 90 degrees, and she had weakness with flexion and external rotation. Her MRI demonstrated tears of the supra- and the infraspinatus tendons. I think you're going to see an MRI in just a moment. We're inside the shoulder. We'd like to see the MRI, I think, right?

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LAURENCE D. HIGGINS, MD: Cut to the MRI if you can.

00:01:58

JON J.P. WARNER, MD: Cut to the MRI, please.

00:02:00

LAURENCE D. HIGGINS, MD: Let me just interject here for a second, J.P. The first question I have for you: if you have someone who has had an acute injury and fell, for example, in this patient, do you treat them differently than you might, say, for example for a patient who has had a chronic insidious onset of pain?

00:02:17

JON J.P. WARNER, MD: I think that's an important point to make. If you have an individual with chronic pain that's a gradual loss of function and you can anticipate they've had an attritional process where the tendon is gradually torn and they may have poor-quality tissue, that's quite different. This individual was a very active tennis player, no pain at all, who had a fall and then had weakness and pain, so it's likely she'll have a rotator cuff tear that will be repairable. By the time I saw her, it had been a number of months anyway, and at that point she had already failed physical therapy, which someone else had prescribed, and so we discussed and she had elected to have a rotator cuff repair.

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LAURENCE D. HIGGINS, MD: So from a theoretical standpoint, if she had come to see you, say, within the first week or so, her injury, and you had an MRI, would you advocate early surgery for someone with that problem or would you recommend interval course of therapy before surgery?

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JON J.P. WARNER, MD: It really depends on the individual and their activity level, their age. There are a lot of factors. We have to remember that the shoulder is connected to a person and the person has certain requirements in their life. And everybody grades their outcome differently depending on who they are. If you have a very active individual, regardless of their age, then I'm aggressive about treating them. If we have an individual who's less active and they may be elderly in their activity, even if they're chronologically younger, I'll be more conservative in treating that individual. And we'll discuss that. And we may do it in the context of an MRI, we may try a brief course of physical therapy to see if they feel better, but it's an individualized process of decision-making.

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LAURENCE D. HIGGINS, MD: But in the great context, you are more aggressive with acute traumatic tears than, say, attritional tears.

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JON J.P. WARNER, MD: That's exactly the case. Acute traumatic tears I'll be more aggressively treating, which unfortunately in my practice is not so common. I tend to see individuals that have had a chronic problem and often after they had prior surgery.

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LAURENCE D. HIGGINS, MD: How does the fact that this patient had a dislocation affect, say, your treatment in a 73-year-old patient with a dislocation who may have concomitant labral injury? What's your thoughts? Is that saying you're aggressive you're treating arthroscopically or if you see it present or is it something that you may elect to just treat the rotator cuff and address the cuff injury and not necessarily the associated labral or Bankart injury if there is one present?

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JON J.P. WARNER, MD: Well, again, many of the viewers in the audience who are senior shoulder surgeons or senior orthopedists understand that the problem of recurring instability in an older individual is less of an issue than in a younger individual. And so usually any labral pathology or ligamentous pathology is not as relevant as the rotator cuff tear. And in most instances it's not really an important issue unless they present with the current instability and they also have a rotator cuff tear, in which case you have to analyze both components of their problem and treat both of them at the same time. In those rare instances you might do a repair of their instability at the same time you repair their rotator cuff.

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LAURENCE D. HIGGINS, MD: Wonderful. Well, we're going to actually start this video here looking at the portals. And maybe you can describe the MRI appearance that this patient has. Here we can see it.

00:05:26

JON J.P. WARNER, MD: Yeah, here we go. I think we're seeing an MRI now. This is a full thickness rotator cuff tear. The tendon is retracted to the top of the humeral head, no further. The quality of the muscle is excellent. In the interest of time, we won't show all the other images, just this one image that gives you some insight into the -- what we're dealing with.

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LAURENCE D. HIGGINS, MD: So let's talk a little bit about positioning now. So we've elected that this patient is going to have surgery. I know both of us do this in a beach chair position. Tell me a little bit about -- do you think there's an advantage to beach chair versus lateral decubitus or is it a very personal preference?

00:06:00

JON J.P. WARNER, MD: I think it's a personal preference. There are many expert surgeons probably in the viewing audience that do lateral decubitus and many that do beach chair, and it really is a question of what's your most comfortable position to be in. We'll make some points about the advantages of the beach chair because that's what I do, and I'll do that during the course of surgery. And your technique will depend on the positioning and what you're most comfortable with. So I think we'll roll the video now and show the arthroscopic portals. Now, I've marked out the portals here. This is the back of the acromion, the spine here. This is a soft spot in the [visor's] portal. The point I'm making here is that that's right over the joint. The routine portal is the A portal. The B portal is the portal that I use for visualization and for instrumentation, which is a direct lateral portal. I place the A portal a little bit higher so that I can insert the scope over the rotator cuff looking down a little bit easier. The C portal is right in front of the cortical chromium ligament, which I've marked out here, and then you see the location of the B portal. The D and the E portals are accessory portals that are very helpful in placement of the anchors and in suture retrieval. And you basically move the scope around during the procedure and move your access points during the procedure to make the operation easier.

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LAURENCE D. HIGGINS, MD: Is it pretty typical for you to make all five portals or is that really dependent upon the size of the tear? Say, for smaller size tears may you just use three or four of those portals?

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JON J.P. WARNER, MD: Absolutely. It depends upon the configuration of the tear. Now, I know in this patient that this is a very large rotator cuff tear, and from experience I know that I'm going to be using these portals. I don't think there's any downside to using them. They're -- you can barely see them when they heal anyway, and you don't want to limit yourself in terms of access and visualization. As you'll see during the operation, it's very, very important that you have the flexibility and freedom to move the arthroscope into the best position to see and do likewise for the instruments that you use for the repair and suture manipulation.

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LAURENCE D. HIGGINS, MD: Well, why don't we get started and at least show the visualization. This is from a standard routine posterior portal, the initiation of the visualization. Why don't you take us through a little bit on what you've seen here. I think this is the beginning of the subacromial space here we see.

00:08:22

JON J.P. WARNER, MD: Yeah, I'm in the subacromial space, and we're looking down at the cuff. You can see here just the bursa over it. I'm usually starting inside the joint, but we're on top here now. We're going to rotate the arm. You'll see the cuff tear here. This is the edge to the left, which is a cuff tear, and you can see the greater tuberosity here very nicely. We're placing the arthroscope in now just through the A portal, and we're coming over the top of the rotator cuff. I guess we've done everything inside the joint at this point.

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LAURENCE D. HIGGINS, MD: And this is -- I think we're actually going to get into the joint. This is just a quick look outside to start that you had above the cuff, and now this should be inside the joint.

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JON J.P. WARNER, MD: So now I'm going to be inside the joint, and what you're going to see is looking upwards at the rotator cup. I really think it's really helpful to look from both directions. You're going to see here the humeral head is going to be to the right. There's a little tissue in front of us right now that we'll move out of the way. Because this is a live and really not edited -- we've clipped things out for the interest of time -- you'll see some of the things we deal with to see. In front of me is going to be the biceps tendon, and you'll see

the biceps tendon is significantly diseased in this individual. It's going to be something that I'll have to contend with. When you put the scope in, typically you have this kind of a visualization, so you'll see better once I've manipulated things a bit. I'm going to make a lateral portal as well, an instrument through that portal. Now, I'm putting a spinal needle here along the orientation where I want to insert an instrument. This is the biceps tendon in front of me. The fraying that you see, tissue hanging down into the joint, is the rotator cuff and the biceps. So I'll put a motorized shaver in here and kind of clean things up a little bit. I'm assuming that's what we're going to see next in a moment.

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LAURENCE D. HIGGINS, MD: Let me talk to you a little bit while we see this, about cannula use anteriorly, or what's your preference for cannula use in these cases?

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JON J.P. WARNER, MD: You know, I use cannulas in a very limited fashion principally to tie my sutures, because I think it's easier to manage your sutures through a cannula and tie the knots down. In Europe, in many other countries, cannulas are not used. And it's not a problem as long as you retrieve your sutures through the same portal at the same time. I use only one cannula. I move it around where I need it. Most of what I do is done without a cannula, instrumenting percutaneously, as you'll see during the course of this procedure.

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LAURENCE D. HIGGINS, MD: And it's important to note that the portals that you've demonstrated on the beach chair position are altered obviously if you're in a lateral decubitus position.

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JON J.P. WARNER, MD: Yes, the arm's at the side, and so the portals are a little bit different in their location. In the beach chair position the arm is somewhat abducted. It puts the tuberosity in a different position. It also is a question if you wish to use traction or not. We use a hydraulic armholder that allows us not only traction on the arm but rotation of the arm, which brings the tuberosity underneath the portal where I'm working and makes it easier for me to place the anchors without moving the instruments around, also easier to manipulate the sutures and to tie my knots.

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LAURENCE D. HIGGINS, MD: Now, just from a philosophical standpoint, while we're getting ready to set the next video, you've moved primarily doing double-row repairs, is that accurate?

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JON J.P. WARNER, MD: Well, when feasible. Each tear has its own configuration and quality of the tissue. When you have a situation where you have an avulsion configuration tear where there's a U-shaped tear or a V-shaped tear and the tendon can be directly reinserted into the greater tuberosity, I think there's ample evidence from basic science work and from also clinical work that double-row repair is better in terms of tissue apposition and in strength and therefore more likely to lead to a structural healing of the tendon when you repair it than would single tendon repair.

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I think we're going to bring up a video clip here now that's going to show you the biceps tendon. So we've cleaned up the front of the shoulder. This band in front is a band-like middle glenohumeral ligament. Below you see the labrum and the glenoid. We're going to see up above the cannula, and there's the biceps. What you'll note about the biceps is there will be some significant fraying of the biceps tendon. You can see the subscapularis there is intact, attaching at the lesser tuberosity. If you look to the upper right-hand side of the screen, I think you'll see the fraying in the biceps tendon. There's some synovium over the biceps tendon as well. The important thing to notice is that the biceps tendon is uncovered by the cuff, and this fraying here is a result of the biceps tendon subluxating posteriorly. Lafosse's made the point that the tendon can subluxate posteriorly and when you see this,

you should treat the biceps tendon, and tendonitis will be part of this procedure, though in the interest of time I won't really show you how I'm going to do that. Now, you can see clearly the articular surface of the humeral head, and to the right is the tuberosity. And on top is the edge of the tendon, which is just over the biceps tendon. So I think you see the rotator cuff tear a little bit better now, and this is the view I get when I look from underneath upwards towards the rotator cuff. There's a little bit of tissue, a stump of the tissue remaining laterally over the greater tuberosity. I always start with this view and I always start with the lateral portal and work through that portal into the joint. So I'm putting a little spinal needle here so that I can orient my lateral portal and have the proper position to put my motorized shaver in and my other instruments. So you should see that in a moment. Again, this is live surgery and without editing, so we're sort of fussing a little here a little bit.

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LAURENCE D. HIGGINS, MD: Let me draw your attention to what we see in this patient. It's something I think we pay a lot more attention to is this lateral instability of this bicep, something that I think is probably seen -- or we probably see it a lot more -- it's seen a lot more commonly now that we're paying attention to it. Tell me, does that affect your interest in preserving the biceps? And if you see any subluxation either medially or laterally, are you more prone to do a tenodesis or a tenotomy?

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JON J.P. WARNER, MD: Well, I think it's very important to educate yourself and learn lessons, and I have. And publicly I'm very happy to thank Gilles Walch and Pascal Boileau for really being not the only ones to say this but the major proponents of the biceps as a cause of pain. And more often than not now, the biceps I find to be significantly diseased, and I think as a group shoulder surgeons are more comfortable with dealing with the biceps tendon either through tenotomy or tenodesis. Many of the revision surgeries I do, patients have not had adequate treatment of the biceps tendon. So when I see this situation, I will always tenotomize or tenodesis the biceps tendon. Now, my motorized shaver here is on the greater tuberosity. I'm going to remove some of the soft tissue off the greater tuberosity, and I do this from looking inside the joint because I have a great view of the medial part of the footprint of the rotator cuff. So I'm going to use my shaver here and peel some of that tissue away. And when I go in the subacromial space I'll have a much better orientation to where the footprint of the rotator cuff is and I'll be able to see a little bit better in terms of where I want to fix the rotator cuff. You can see this is not actual tendon tissue; this is what's left of the tendon tissue over the greater tuberosity, and you want to define exactly where you're going to reinsert the tendon. Usually I'll do this with a motorized shaver; sometimes I'll use the radiofrequency device. I'll do likewise with the rotator cuff. I look underneath up at the rotator cuff and try to determine the degree of delamination which is present, and we'll show that a little later in the video. It's very, very important to understand that the tendon does not tear as a uniform edge -- sometimes it does, but usually not -- and that you should define all elements of the tendon tear in multiple planes and address them. This is sort of an interesting case because the tuberosity is downward somewhat compared to the humeral head. There's a bit of a -- almost like a trough that no one's made here, it's just the shape of this humeral head. There might be a little osteophyte even. But certainly the patient doesn't have obvious arthrosis.

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LAURENCE D. HIGGINS, MD: Just so we can discuss now, this is a 73-year-old tennis player. Is this someone that you might be more interested in tenodesing, or tell me a little bit more about your philosophy just on the biceps tendon here.

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JON J.P. WARNER, MD: Well, this patient and I had a discussion. Normally in a 73-year-old individual I do a tenotomy. This individual is an avid tennis player and told me she had a friend who had a biceps tendon tenotomy and had pain, and for me that's enough to be

justification to doing a tenodesis, so on her I did a tenodesis. I have some feelings about tenodesis. You can do them proximally or distally. We've done a critical review of our cases and interestingly found that individuals who have pain in the front of their shoulder, about 17% of them will continue to have pain if you do a proximal tenodesis compared to 2% if you do a distal tenodesis, so I tend to do a subpectoral tenodesis at the end of the procedure after I've done the arthroscopic surgery and I release the biceps tendon and then pull it underneath the pectoralis and fix it at the completion of the arthroscopic repair.

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LAURENCE D. HIGGINS, MD: Okay. I think we're probably getting cued up. And your preference on how to do the tenodesis part. What do you use when -- do you just cut across it? What do you use to address just doing the actual tenotomy part rather, when you're cutting the tendon out of the joint? What do you do? And if you see an unstable labrum associated with a case that you're going to do a tenotomy or a tenodesis in, do you think there's any indication to fix, say for example, the superior labrum in conjunction with one of these tenotomies?

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JON J.P. WARNER, MD: Well, no. Obviously the superior labrum is not functional anymore. You tenotomize the biceps tendon, you debride the superior labrum, and then I guess beyond the scope of this demonstration here to get into it, but I use an anchor and I fix the biceps tendon adjacent to the pectoralis major using simple sutures and what Lafosse described as a lasso loop, which is very strong, and that's worked just fine for me. Can we run the clip on the subacromial space? So the next thing you're seeing is the subacromial space here. Actually you're not. The next thing you're seeing is the biceps tendon tenotomy. Um, and what I've done here is I have the radiofrequency device in, which is a --

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LAURENCE D. HIGGINS, MD: You released the biceps --

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JON J.P. WARNER, MD: I released the biceps tendon. I guess they've -- we've cut that out. But we've cut out the segment and we've also cut out the biceps tendon and we're going to go on to the subacromial space in just a moment.

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LAURENCE D. HIGGINS, MD: Now, you visualize from -- your technique, your preferred technique here is to go from posterior all the way through anterior, come out your anterior portal?

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JON J.P. WARNER, MD: Yeah, this is just a little quirk. The way I do it is I've learned when I was a fellow, and I didn't really change anything. It's very helpful because it ensures that I come underneath the coracromial ligament. It ensures that I put an anterior cannula in that allows me instrumentation and orients me because the largest blood vessels that tend to bleed are just medial to that cannula. And it lets me find my way into the space. You can see the cannula now, the bursa there. I can put my instruments in. When I hit the cannula, I don't pass point, and I'm less likely to have a problem with bleeding. So now that I've done this, I'm going to instrument from directly laterally and use the radiofrequency device, the S-90, which is a device that has suction built into it. It's a very aggressive radiofrequency device. I happen to like it for tissue ablation very much, and I use this to a large degree to remove the bursa. I use the shaver to a nominal degree, mostly to clean up what's left. So hopefully in a moment you're going to see the radiofrequency wand come in. And it's very important to have adequate visualization before you start with the rotator cuff repair. And I think the bursa is a big issue because the bursa is -- I call the bursa the vampire of the shoulder. It's very difficult to get rid of it. If it keeps coming back during your procedure you should be vigilant to remove it repeatedly. Here's the radiofrequency wand coming in. And we're going to remove the bursa out of my way now. And you'll see when I remove this it's a little like pulling the veil or a curtain out of your way and you'll be

able to see down into the subacromial space and look downward onto the rotator cuff. So I instrumented just briefly through the anterior cannula, and then I'm going to come from directly laterally through the B portal now. You may notice I'm working at 90-degree angles, which makes it much easier to triangulate. First thing I'm going to do is I'm going to use the radiofrequency device to remove soft tissue so I can see the acromion. I'm looking down on the rotator cuff tear, which you saw before. I'm using this on the undersurface of the acromion, and I will define the lateral and the medial edge of the acromion. When you do an acromioplasty is a question that people often ask, and I try to delay doing that if I'm going to do it until I've done the rotator cuff repair, principally because I don't want to make more possibilities for bleeding. And even this patient I was going to do an AC joint resection as well, which we won't be showing you, but I always do this after I've done the rotator cuff repair just in case I have bleeding because I think visualization is so important to the rotator cuff repair.

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Now I'm at the anterior lateral edge of the acromion. You'll see that I'm removing this tissue. The acromion is a very important landmark. It defines the ceiling of where you're working. You may notice it has a bit of a hook or a curved shape to it, and my cannula is a little bit impeded by this. So at this -- in this particular individual, I'm going to back the cannula up a bit and I'm going to remove some of the soft tissue. The CA ligament is underneath the cannula, so I won't cut the CA ligament, I'll just recess it. It leads to less bleeding if I do that anyway. And then what I'm going to do is I'm going to use the burr and I'm going to do a very minimal acromioplasty just to open up the front of the shoulder, which will make it easier for me to retrieve sutures and manipulate my sutures during the rotator cuff repair. I think this is very important. It's a little bit like improving your lie in gold, even though that's not legal. Here it's legal in arthroscopy, and it does help you to make things easier for yourself. Medially here is where the AC joint is. I'm not going to go over there, I'm just going to finish up here the preparation of the anterior acromion.

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LAURENCE D. HIGGINS, MD: One thing that I can add just from personal experience if I've -- I actually do often do the decompression first, and that's just been a matter of personal preference. And what has helped or facilitated that for me is having the duo -- the new FMS pump -- and if there's a little bit of bleeding we've been pretty happy with the ability for us to increase the pump pressure and the ability of that pump to control inflow and outflow has been really facilitated visualization. If we could keep that tape running where it was, I just want to discuss a little bit about the technique of the decompression that you do. I see here you're working from lateral to medial using a standard portal -- is this your preferred way? Do you do cutting block technique?

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JON J.P. WARNER, MD: Yeah. I think that this for me is a very simple thing to do. The main part of the acromion, if you believe in impingement, happens at the anterior edge. I'm just working anteriorly. There's a very little amount of bone I'm removing. I'm just flattening from lateral towards medial, and then I'm going to move on. I think we used to be much more aggressive about the degree of acromioplasty we do, and that's just not necessary. And again, this is as much for visualization as it is for decompression of this joint. So you see, I have a flat surface here now. I've got a very big space to work with. I'll rotate and look downward, and you have a beautiful view of the rotator cuff tear. You see where I've prepared a little bit, the tuberosity, and it gives you some perspective. It's very important to understand that you need to see from a bird's eye view, from laterally. But if I put the radiofrequency device in here I'm going to remove a little bit of the remaining bursa. You get the sense that the best rotator cuff is more medial and that there's a tapered edge. Hold on to that idea. As we go a little further along, you'll see that that is indeed the case. And even though we may have a tendon tear that measures a certain number of millimeters, there's a zone of injury where the tissue is poor, and tissue that tears is never normal, so

we want to remove the poor quality tissue and find a good edge to repair, and that's something that we're going to be paying attention to during the course of this procedure. Now, I'm fiddling a little bit more to remove some more of the bursa because I want to be very particular about being able to see. I believe we're going to put a grasper in here and then pull on the tendon, so I've placed the grasper in here. I have more soft tissue to remove. But the point of this is I define the configuration of the tear and I now want to look at the mobility of the tendon. So if I pull the tendon from posterior toward anterior, I think you'll be able to see how the mobility is greatest from posterior toward anterior, and that's the direction that I want to repair this. And you can see its mobility there. And if I pull from anterior in a moment, you can see the tendon's degenerated, or torn, there. You'll also see that from lateral in a moment. That's not good tissue, and that tissue will not be part of the repair. If you look here as I pull this way, that's most mobile, and if I were to pull the other direction from anterior, that's not quite as mobile. So that'll be the configuration of the tear and how I'm going to fix it. I think that's the best tissue there. You'll appreciate this much more when we look from directly laterally.

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LAURENCE D. HIGGINS, MD: Now, is that your preferred technique? And tell me about delamination of these tears. Is this something that you think is prevalent in 10% of the tears, in half the tears that you see, or in more than half the tears?

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JON J.P. WARNER, MD: Well, it depends. My age population or older individuals, people who have had prior surgery and bigger tears. And in those individuals, delamination in my experience has been very common. I always check for it. You'll see the value of this in a moment. It's really critically important, because if you do not appreciate this, you really run the risk of doing a partial repair, and that certainly is probably one of the reasons why the literature has suggested re-tear rates are higher with arthroscopic repair than with open repair. Now here's a bird's eye view from directly laterally. You see we have a beautiful perspective on the shoulder. The humeral head is in the center, anterior is to the right. Posterior is to the left. We'll be able to drive underneath and look underneath the tendon, and you'll see the extent of the delamination. Now, there's a little bit of bursa in the back as well. I'm looking here to appreciate that. I placed the radiofrequency device in to remove some of that bursa. I'm moving towards the back of the shoulder towards the infraspinatus. I think this tear principally involves the supraspinatus. Whether or not some of the infraspinatus is involved is a little difficult to say. Maybe a very superior portion of the infraspinatus is involved. I'm doing this -- removing this tissue -- because I'm going to be passing a number of my instruments here and I don't want to get caught in the bursa. The deltoid you'll see just underneath this bursa here, and I think it's very important to visualize. Now I'll lift up the rotator cuff in a moment and I think we'll be able to see underneath it.

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LAURENCE D. HIGGINS, MD: This is -- here you can see you've got a grasper here. Now tell me, you know, this looks like an avulsion-type tear; it doesn't look like there's a V-component, this looks like a tear that we're going to be able to repair from posterior to anterior but more of an avulsion-type tear. Now you can see here as you look into the joint, you're going to see a large area of delamination of the tendon.

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JON J.P. WARNER, MD: And very important. You've just got a glimpse of what may be a deeper layer. When I go underneath I'm going to take this grasper and I'm going to grab this layer. It's not the labrum. You see it comes out, it's the rotator cuff. It would be very easy to miss this with your suture-passing devices if you didn't notice this and pull it laterally so that it is at a similar position to the more superficial part. I think that's a very good illustration that is not uncommon and I think very important to recognize.

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LAURENCE D. HIGGINS, MD: We can pause here for a second and we can discuss a little bit. We have a question from Mark [Albrecht] in Atlanta discussing large spurs and your belief, are they associated with rotator cuff tears? Why don't we speak just a moment about the pathogenesis of rotator cuff pathology? Do you think most tears are intrinsic in nature or tears are extrinsic in nature, i.e., are they senescent changes that cause this?

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JON J.P. WARNER, MD: Well, I think we owe a debt of gratitude to Dr. Charles Neer, who really was the first person to define and illustrate impingement, and his feeling was that about 98% of all rotator cuff tears were extrinsic from impingement by the coracromial arch. I think it's much more appreciated now that that probably is the minority of tears, or at least that it's multifactorial. We know from basic science for people like Christian Gerber and many others that intrinsic degeneration of the tendon is a big factor here and that once that happens, the associated abrasion against the coracromial arch is probably playing a secondary role. And again, tendons which tear are never normal. And if we understand that, we treat both elements of the rotator cuff disease.

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LAURENCE D. HIGGINS, MD: If we can maybe cut back to the video here, and we're going to talk a little bit about visualization. And this is an inside view here of the posterolateral portal that you're making. Maybe you can -- do you usually do inside-out visual-- technique for finding out where you want to put these with the spinal needle?

00:30:04

JON J.P. WARNER, MD: Well, I always use a spinal needle. It's a little bit like a practice swing in golf. It orients me to where I want to be. I then place a little blunt trocar here. And I know that that's going to give me the right orientation for my anchor, for my instrument, whatever I'm using that for. It's just a little teeny hole; it takes one suture to close it. My radiofrequency wand is here, and I'm going to use this to remove some of the bursa, which again is kind of in my way. I'm doing this because I'm going to be instrumenting through this portal, and every time I put the instrument back and forth I don't want to pull the bursa in front of my view. The theme throughout this procedure is going to be whether or not you're going to be able to see and see to effectively do a good job with your repair.

00:30:45

LAURENCE D. HIGGINS, MD: Now that we have this delamination, we can probably pause here and move forward to addressing the delamination. Tell me -- share with me your thoughts about the techniques that you use to address the delamination. Clearly, we need to grab this undersurface layer. Is this a layer that you're going to try to repair obviously at the articular margin and your techniques to facilitate that.

00:31:09

JON J.P. WARNER, MD: I think it really depends on the configuration of the tear. In this particular instance, you're going to see that the deeper layer is relatively mobile. In some individuals, there is a differential retraction where the deeper layer is retracted more medially and it's not as mobile as the more superficial layer. In that instance, the deeper layer is repaired only medially on the medial edge of the footprint of the rotator cuff, or the footprint of the greater tuberosity, and the more superficial layer is repaired laterally. In this instance, I'm going to put a suture through both layers, bring them about to the same level, and then make sure that my sutures traverse both layers. So I'll check the degree of mobility of each component and in some instances I'll resuture the tendon together before I even pass the sutures to ensure that I capture both layers.

00:31:57

LAURENCE D. HIGGINS, MD: If we can go to the video here, I think what we're going to see is you've created an accessory anterolateral portal. You're still viewing laterally, and now you've grasped a cuff. And share with us what you're doing now.

00:32:08

JON J.P. WARNER, MD: Well, this is a spinal needle. This is one of many ways to do this. This is allowing me to use a percutaneous device. Now you'll notice I've missed the deeper layer so I'm going to back up the spinal needle, grasp the deeper layer, and then come through so that I go through both the deeper and the superficial layer with a spinal needle. This is not the definitive suture. This is going to make sure that when I pull on the rotator cuff I can put my other sutures through the tendon. The device we're using here is a CHIA passer. It's a suture shuttling device. It's a percutaneous suture shuttling device that's somewhat unique. And it's very simple because all you need is a spinal needle and this one device. It has a little opening in it that allows you to shuttle sutures. That opening collapses when you pass it through an 18-gauge spinal needle, and you'll see here we're going to do so. So we're going to push it down the spinal needle and then I'm going to instrument through the anterolateral portal. Then I'm going to retrieve and then use it to shuttle a number two Orthocord suture through both components of the rotator cuff. And we do this - we work through the rotator cuff tear into the joint to go back and forth on either side of the tendon tear, being careful to assess each step as we go. So my assistant is going to pull out the spinal needle now and we're going to load the suture onto this CHIA passer.

00:33:28

LAURENCE D. HIGGINS, MD: And you'll use this suture more or less as a traction stitch to manage the delaminated tear.

00:33:33

JON J.P. WARNER, MD: Yes, in this instance, though certainly this technique could be used for margin convergence closure when you have a triangular shape tear. Margin convergence is not the way we're going to close this, but the same techniques are applicable in that setting. So I've got my one suture in the back, I put a clamp on it. Then I'm going to retrieve the other suture also from the back so I can pull on the rotator cuff, and I believe you'll see that both components of the tendon are pulled laterally. So we've got that limb out there, and you can see how the deeper layer is being pulled laterally here with the rest of the rotator cuff, the superficial layer. Very, very important step before I pass my sutures.

00:34:16

LAURENCE D. HIGGINS, MD: Great. No, that's perfect. We can pause that there. That's the end of that clip there for us. And let me talk to you a little about a question that Matt Ramsey from Philadelphia has posed to us about partial tears. Tell -- you know, one of -- that's a very challenging issue, whether or not you can accurately assess how thick a partial tear is, and Gary Gartsman and others have looked at outcomes of tears that were say 50% in thickness and greater and their poor outcomes versus tears that were less than 50%. Do you have any tips or techniques that you prefer to use to look at tendon thickness in partial thickness tears?

00:34:52

JON J.P. WARNER, MD: Well, I think you get a lot of information from the MRI. The MRI quality is excellent. Now we know that we can see many of these tears very nicely, although sometimes we miss them. I think it is important where the tendon tear is. If it's bursal side tear, in my experience, it tends to be more symptomatic than an articular side tear. That's just anecdotal. We know that the footprint of the attachment of the rotator cuff on the greater tuberosity is around 1.4 cm, so you can measure the exposed bone in the glenohumeral joint at the medial part of the footprint and then calculate what percent of the tendon is left. It's a little harder with the bursal side, but you can do likewise there. I don't have an absolute number. I think that if you can put a blunt instrument through the tendon, the quality of what's there is poor and should be removed and you should repair the tendon. I don't think anybody has real science to tell us one way or the other except that uncontrolled prospective studies have shown that with significant partial thickness tears, resection and repair leads to a better outcome than simple debridement when you follow these individuals over time.

00:36:00

LAURENCE D. HIGGINS, MD: We're going to cue up a video here about the EXPRESSEW II, and I want to talk to you a little about this. If we can go to outside -- if we go to the view here, tell -- share with me some of the things that you've seen using this device. This is the EXPRESSEW II and some of the advantages. We can probably even freeze the screen right there so that --

00:36:20

JON J.P. WARNER, MD: Well, this is another method for suture passing. It allows you to pass and retrieve your suture, if you wish, through the same portal or through another portal. It allows you to work using a device that's like a grasper but also almost like a little sewing needle on the end of an instrument. It's very low-profile. It'll fit through a 6 mm cannula. It'll fit through the tissue, as you see here. When you open it, you can grasp the tissue, you can manipulate the tissue, you can deploy your suture, and in this way put sutures through the tendon. It's just one more way to do things. I think that a lot of people like to use this viewing from posteriorly. You see the problem here. It's very important that while this is an excellent device, that we only have the superficial part of the tear, not the deep layer, and it's important to be aware that if you don't see and appreciate this, you might only repair that layer. You see here how we've placed the suture through the tendon? In this instance I'm going to grasp it through the posterolateral portal in order to retrieve it, although sometimes you are actually able to disengage and retrieve it on the superior surface and then extract it, and it can be very quick working through one portal to bring your sutures through the tissue and retrieve them in this fashion. This is just simply a grasper being placed over the rotator cuff here, and my instrument is going to grab the suture here and then I'm going to open up the end of the EXPRESSEW device and he's going to retrieve the suture through the rotator cuff and then the EXPRESSEW will be removed.

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LAURENCE D. HIGGINS, MD: And that's a very nice way to pass suture. But again, I think it's important to see the some limitation if you're using a viewing just from a posterior portal, as you mentioned. We can pause here. And I think in this case you elected not to use this as too much of a traction suture because you already had used the CHIA and passed one. That was more for grabbing the anterior aspect just to -- for later preparation.

00:38:16

JON J.P. WARNER, MD: That's exactly. I think you can take your choice. I could have easily done likewise with the EXPRESSEW, but the CHIA allowed me to go through both layers a little bit easier.

00:38:25

LAURENCE D. HIGGINS, MD: If we can go to the video here, this is an important point here, and I want you to address this here. This is an area of the cuff that has marginal attachment, and maybe you can share with me your thoughts on these areas here, where sometimes we see small strands of tendon still just holding on.

00:38:40

JON J.P. WARNER, MD: Yeah. Again, I have a bird's eye view, so I can attest the quality of what's left of removing a little bit of this little flimsy tissue that really isn't any worthwhile attachment anymore. I'm actually going to debride the footprint a little bit more to make sure that the entire tuberosity is exposed so that there is tissue receptive to soft tissue healing. And I do this -- I'm pretty aggressive about doing this so that I can see exactly where I want to put the anchors. Now I'm going to make sure -- especially I can see posteriorly. I think the posterior and medial anchor is a critical anchor because it repairs the junction of the supra- and the infraspinatus, and that's the attachment point of the most powerful part of the rotator cuff, that is, the posterior and superior part of the rotator cuff.

00:39:20

LAURENCE D. HIGGINS, MD: Now here we are. You're about to place your first anchor using that accessory posterolateral portal. And this is -- you're going to use -- tell me about the anchor that you're using here.

00:39:29

JON J.P. WARNER, MD: Well, this is the SPIRALOCK anchor. It's an absorbable anchor. I think it's up to you whether you want metal or absorbable. I happen to like absorbable. We can probably discuss that a little bit as we go along, but in the interest of illustration I want to talk about the technique. You use an awl to perforate the bone. It's important to understand that the medial anchor is not just for tissue apposition but it is the strongest part of the greater tuberosity because it is subchondral. And in work from Gerber and our own work, we looked at what happens -- and I think Roger Emery is another individual who did work that shows that there's disused osteopenia of the greater tuberosity and the quality of the bone deteriorates except in this location, which is the strongest point. And so the medial anchors not only repair the rotator cuff, but they protect the lateral anchors in a footprint repair technique. And so my first anchor is going to really go up under the subchondral bone, and then the sutures from that anchor will be used with the lateral anchor to bring the tissue against the bone. So we tap this --

00:40:27

LAURENCE D. HIGGINS, MD: Now, do you tap every anchor that you put in. And tell me, this is the 5-5 SPIRALOCK that you're putting in?

00:40:35

JON J.P. WARNER, MD: Exactly. I tend to tap. It depends upon how good the bone is. If the bone is relatively strong, then I definitely tap because if you're pushing against resistance you can break the anchor, which you wouldn't want to do because it's PLA. And I have not had a problem. One thing you can't see here and hear and feel is that you hear a click and you feel the purchase in the bone and you know that this is a good anchor, it's a good, quality purchase in the bone. I always pull on the sutures relatively --

00:41:02

LAURENCE D. HIGGINS, MD: And that's what you're doing.

00:41:03

JON J.P. WARNER, MD: With a significant amount of force so that I absolutely make sure that the anchor is set. If that anchor backs up even a little bit, I will remove it and put a large anchor in.

00:41:09

LAURENCE D. HIGGINS, MD: And will you go to a metal anchor or just put a larger SPIRALOCK in?

00:41:13

JON J.P. WARNER, MD: I usually put a larger SPIRALOCK anchor in, but you certainly could change to a metal anchor if you wished. Now what I'm doing now is I'm taking the retriever and I'm pulling all four strands of the sutures through the anterolateral portal. The reason I'm doing that is because I'm going to be retrieving my sutures from a posterolateral portal and I want to retrieve from the direction opposite of where the sutures are going. It's going to be a lot easier for me if I do that. Now what I do is I take two sutures of different color that belong to different pairs and push them into the joint, parking them there so that I can retrieve them when they go through the rotator cuff. I'm going to use a Clever Hook device, which is an excellent device. It's one of my favorite devices. Laurent Lafosse developed this. It's clever because it opens on the bottom and it's basically a needle on a stick. And in the same way you pass sutures when you do open surgery, you do that arthroscopically through supination of your hand. And so you have tactile feedback when you do this that's very similar to what you do when you put sutures in open on a needle holder. So I have different portals I can go through. I'm going to look here and I've already rehearsed this and know I want to go through this portal. I'm going to come behind the suture that you see here, which is a suture that I've used to bring the lateral -- to bring the deep and the superficial

part of the rotator cuff together. I'm going to push through the rotator cuff and I'm going to ensure by pulling on the sutures that are traction sutures that this device traverses both the deep and the superficial layer, and you're going to see that in a moment. I actually feel the instrument go through the rotator cuff and then I drive into the joint underneath the rotator cuff and look up and you can see my instrument here. And when I back up you're going to see that it's gone through both parts of the rotator cuff, and I think you'll just see the traction suture just to the upper part here. Very, very important that I've got both parts -- both the deep and the superficial part, so when I retrieve these two sutures they're going to traverse both parts of the rotator cuff, the same thing you would want to do open. And the interesting thing is you see much better than what you would see open because I can rotate the scope, which magnifies, and see all components of the rotator cuff. So I'm retrieving the suture now and I have to be careful when I retrieve it that I pull it out of the tissue and not out of the anchor, which most of the arthroscopists that are experienced in the audience know but is not so difficult to do if you're not careful. So you see the sutures are remaining in the anchor and coming through the rotator cuff. And this is really a series of repeated steps doing this, making sure that each time you do this that you're spacing your sutures through good, quality tissue and you're constantly assessing where you're going. So I'm going to go again and push the next suture, an individual strand, down into the joint, parking it once again so that I can retrieve it with the Clever Hook device. Now, many other instruments can be used, I just prefer to look from laterally an instrument from my accessory posterolateral portals so that I can use this Clever Hook just like I were to use a needle if I were doing this open. I drive on either side of the rotator cuff to see. Sometimes I'll have someone push the rotator cuff down for me or I'll push it down with the instrument to see where I'm going, and then once I push through the tendon I'll supinate and pop through the undersurface and you'll see I'll drive underneath one more time and just retrieve my suture again.

00:44:32

LAURENCE D. HIGGINS, MD: Now, tell me a little bit about mobilizing the cuff. In this patient here it seemed like you were able to see relatively easy and were able to mobilize the cuff without too much work. Is that something you spend a lot of time in? And tell me a little bit about your techniques for mobilization while we're continuing to pass the sutures with the Clever Hook.

00:44:52

JON J.P. WARNER, MD: Yes. There are a sequence of steps that one follows and you determine the need for each step. One of the important steps is a release of the rotator cuff when it's retracted. Here the rotator cuff, especially the deep layer, is very mobile. It's really not an issue to pull it laterally. Had I had a problem with this, I would have used the radiofrequency device here, the hook tip or the S-90 and released along the labrum, the deep part that is the intraarticular release, same thing that is done open and which Neer, Biliiani, and others have described. And I will also release on the external surface of the rotator cuff, and there are many, many steps you can do, including interval slides, the same as you would do open, releasing from the base of the coracoid process, releasing at the coracohumeral ligament. None of that was really necessary in this individual.

00:45:42

LAURENCE D. HIGGINS, MD: So here is your last suture that you're passing, and all of your anchors on the medial row are all mattress anchors, three passes of the Clever Hook.

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JON J.P. WARNER, MD: Yeah. I think you mean mattress sutures.

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LAURENCE D. HIGGINS, MD: Mattress sutures.

00:45:55

JON J.P. WARNER, MD: Yeah. One anchor, four strands. Yes. They're all horizontal mattress so that when I tie the sutures down, I'm going to attach the medial -- the rotator cuff to the medial part of the footprint of the greater tuberosity.

00:46:12

LAURENCE D. HIGGINS, MD: Now you've passed your first anchor and you've determined likely that you're going to put two medial row anchors in. Tell me a little bit about passing sutures to facilitate this. You have your traction stitch in, the rotator cuff, and you're going to pass that to the front of the shoulders. And you're going to continue to work from the back or do you work from the front at this point for the anterior based anchor?

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JON J.P. WARNER, MD: Yes, I think one of the things you may see here is that this tendon tear, the configuration changes a little bit based on the quality of the tissue. We -- I found when I was doing this that there was a tear in the anterior part of the tendon tissue and the quality of that tissue was very poor. So I actually make a split in the tendon.

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LAURENCE D. HIGGINS, MD: Why don't we go ahead and show that now, because I think it's an important part, and maybe you can address this question that's come from Singapore: How do you determine what is the healthy and unhealthy portion of this cuff here and how do you -- how much of the degenerative tissue are you going to resect?

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JON J.P. WARNER, MD: Well, I think you can see this is poor tissue. It bites out very easily. What you didn't see is there was a little hole. You can barely see it here. It was a little bridge of tissue here, and so I'm removing that poor-quality tissue. And some of it is tactile feel, some of it is visualization. You saw that the cuff is mostly mobile from posterior. You'll see this when I pull on it how it comes from this direction, and that's going to be the direction of the repair. And the tissue in the front is actually not so great, and we're actually -- see the tear right there? So I'm going to resect that to that point and then I'm going to close in a side-side fashion at the completion of the reinsertion of the posterior part of the rotator cuff, which is really the business part, the most important part here. So we will have a little bit of a margin convergence closure here. When I say a little, I mean relatively limited. But certainly you should be constantly assessing the quality of what you're repairing as you go along. And you can see now that we have more of a complex tear, but the posterior part is what I'm going to be repairing.

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LAURENCE D. HIGGINS, MD: I think that's a very important point there, and if we just continue to let this video roll for a second, because you would really end up having a hole in the center of the cuff and be repairing very unhealthy, nonviable cuff had you brought that edge over to the tuberosity. And this is where you need to be creative when you're doing your repairs. Here we see the second anchor, all for the second anchor going in.

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JON J.P. WARNER, MD: Yeah. Let me just comment on this. I've changed my portals. I'm through the anterolateral portal. One thing that you may see here is that I'm going to externally rotate the arm or internally rotate -- I can't remember which. Here, internally rotate. And it's going to bring the tuberosity a little bit more in line with where I want to place the anchor, and I can see that I'm not going to interfere with the other anchor and that it's going to space out the anchors just where I want them. Now, I suppose you could put more anchors here if you wanted. I don't think that more than two medial anchors are necessary in this particular tear. That's pretty common. If I have a really big tear I might use three. The key is that I want to seal the tuberosity area off from the synovial fluid and have the cuff directly attached to the medial part of the tuberosity. We're going to tap just like we did before and put the anterior anchor in as well. And this is really the most tedious part of the operation because once we've done the medial anchors it's very quick to put the lateral anchors in, as you'll see towards the end of this procedure.

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LAURENCE D. HIGGINS, MD: So this is really just repeating the same steps and the same techniques that you used for the first anchor here. We can see that, again, another SPIRALOCK anchor going in. And alternate ways of passing sutures that you use here. Certainly the Clever Hook can be used from an anterior-based portal, but I think it's important that you demonstrated where the cuff was mobilized most freely, that you're going to actually work from posterior to anterior to try and bring the cuff from the posterior aspect to the anterior aspect on the tuberosity.

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JON J.P. WARNER, MD: Yes, and it's just adapting to the configuration of the tear. We're going to pull the sutures -- the traction sutures -- through the anterior portal, which will pull the cuff forward. And then it's logical that I work from behind, pushing my retriever, my -- in this instance, the Clever Hook -- through the Clever Hook, through the rotator cuff and bringing the sutures from an anterior position towards posterior. Where I -- dealing with a more semicircular-shaped tear, I might work from the anterior portal in that instance. So I'm now going to be retrieving the traction suture, and that's going to allow me to pull the rotator cuff almost really down over the tuberosity so that it's very easy to pass my sutures through the rotator cuff. It's very important to do that as well so I know exactly where I want my Clever Hook to pass through the tissue because if I go too far medially I'll have a tension mismatch in the tissue and I won't really bring it down to the tuberosity and if I go too far laterally I won't have the proper tension set and I won't have sufficient tissue left to repair through the lateral anchor over the lateral part of the footprint of the greater tuberosity.

00:51:16

LAURENCE D. HIGGINS, MD: I think one of the key things that you're demonstrating here is setting yourself up for success which is by taking sutures and passing them into the joint, and that is something that really makes this procedure much more fluid and much simpler. It's sometimes difficult to use the devices like Clever Hook and reach all the way out to the tuberosity, and some tears are not mobile. And I think that's a critical step, that if you could add something to an individual's technique, it really can facilitate doing these repairs.

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JON J.P. WARNER, MD: Well, I think you'll see as we do this that if I pull on the traction suture, the rotator cuff is pulled downward. You have a better view, I can see on top of the rotator cuff, I can decide where my instrument should go so I know that's where I want my sutures to go. Sometimes I'll have an assistant push the rotator cuff down. Whatever I need to do to see better to make sure that I perform the individual step in a way that brings the rotator cuff back as close to anatomical as possible. So once again, it's very simple to just go and retrieve each suture. The Clever Hook is really clever because it opens on the bottom, which puts it in a perfect position to retrieve the sutures. Retrievers that open on the top are a little bit more of a fiddle to retrieve your sutures with.

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So we've got our first set here. We're going to kind of clamp these, see where they're going. I'm pulling my suture through, just like I did before, making sure that I'm not going to unload suture from the anchor. And then it's just simply a matter of passing the other two suture through adjacent to the first set but spaced far enough apart that I have good quality tissue between the sutures to pull the rotator cuff down and have a secure repair. So again, we have this nice bird's eye view.

00:53:03

LAURENCE D. HIGGINS, MD: You can really see how the lateral view shows you that delaminated area and how important that visualization is from a lateral side, and I think that's certainly the impetus for why I changed and work -- from a visualization standpoint almost entirely from the lateral aspect. And sometimes in small tears that can be a challenge when you're working from the lateral side and it's hard to get in and see the

sutures. A small trick that I've learned from Laurent Lafosse was to actually leave the inserter on the anchor and to use that to manipulate the rotator cuff without having to have another instrument in there and use that to hold the suture up and then use that to pass sutures directly into the Clever Hook.

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JON J.P. WARNER, MD: Um, yeah. I just want to make a comment about that. It is the case actually that small lateral tears can actually be more difficult than larger tears. You have a less good view. It's sometimes a relatively tight space to work in. And at least in my experience, these tears are pretty straightforward and the lateral ones are a little bit more difficult technically to deal with. Not always the case, but certainly sometimes the case.

00:54:16

LAURENCE D. HIGGINS, MD: We have a question from Mark Albrecht, and I think it raises an interesting point here. He's talking about open versus arthroscopic repairs and tensioning of the rotator cuff. There is some real concern that overtensioning the cuff may cause fatty infiltration, fatty -- or muscle atrophy, and perhaps doing these arthroscopically may actually be a safer technique. Maybe you could share some of the basic research.

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JON J.P. WARNER, MD: Yeah. Let me comment on that but also just comment on what you're seeing here. My assistant's pulling the tendon so that I have a good view where I'm going to put my instrument. I think this is a very important. Christian Gerber is the only person that I know of who has demonstrated that there is an advantage, a scientific advantage to arthroscopic rotator cuff repair versus open, and that is that he compared two groups of supraspinatus repairs, one open and one arthroscopic, and demonstrated that fatty replacement, which is degeneration of the muscle as you've described, occurred more in the individuals undergoing open repair than arthroscopic repair. And I think a logical assumption is that overtensioning of the tendon resulted in the fatty replacement. So I think that that point is borne out in some science now. Certainly more future studies are going to clarify if that is indeed the case, but it does make some sense.

00:55:33

LAURENCE D. HIGGINS, MD: Okay. You can see here we're about to pass our last stitch. It came out of the joint and I think just show about another 15 seconds of this here you can see grabbing the last medial suture here of our anterior medial anchor. And again, pulling this out through the back. And I think one of the things that not working through cannulas has facilitated for me is -- has aided in suture management, because now I can have sutures that are not through cannulas and I can park them through different portals, and that can really facilitate things. We can come back to the studio here, and we're going to get ready to tie our sutures and we're going to show that relatively quickly so we can get to the lateral row and your discussion about the lateral row. Tell me a little bit about the variety of techniques that you've used for lateral row repair.

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JON J.P. WARNER, MD: Well, I think there are many different methods. I used to tie knots, and now there are a number of devices out there that you can use. I prefer to use the knotless devices. The problem with the knotless has been their holding power in the bone and the tensioning of the tissue. And the device you'll see here is the VERSALOCK anchor, which has a number of advantages. It'll be very apparent. One, it's trocar-driven, so you don't need to drill a hole; you simply place it where you wish it to go. Two, it expands so that it expands into the relatively porous lateral greater tuberosity and has a stronger fixation. Three, it has a reproducible tensioning mechanism so you can actually tension the sutures in a fashion where you kind of toggle them down. And four, it grasps the sutures when the anchor is delivered so that it locks the sutures in place in one step. And it's actually very fast, it's quite reproducible, and it's really intuitive. It's a little like a tent peg pulling a tent down against the ground so that the tent stays taught, and you'll see that I think when we illustrate that in a moment.

00:57:28

LAURENCE D. HIGGINS, MD: Let's go inside back to the arthroscopic component. One thing that we're seeing now is we're seeing you tying your anchors and tying the sutures. Tell me, do you use sliding knots? Is that pretty much your routine? Here we can see we're kind of in the midst of tying one of the anchors. Here I believe you're tying the anterior medial anchor first.

00:57:47

JON J.P. WARNER, MD: I think when you talk about tying knots it's a little bit like asking a golfer how they swing a club. It doesn't matter how he does it, it just matters what the score is. And so my preference is to tie a sliding locking knot, which happens to be a buntline half hitch, but there are probably 100 different knots that you can use, from SMC to Revo to you name it. I back it up with a number of half hitches, and in this instance I'm going to bring the sutures out another portal and save them because I'm going to load them onto the lateral anchor. So when the suture slides, I do a sliding knot. It's important to be aware that modern suture anchors, especially nonabsorbable anchors, don't have rough eyelets. If you do have a metal anchor, you run some risk to abrade the suture, although these sutures are very resistant to breakage. And some individuals prefer to tie half hitches without sliding in order to avoid that. I do tie half hitches when the sutures don't slide, and sometimes they get tangled or they crisscross through the tissue and you have to be able to do that. And I believe the next suture here actually was a half hitch because the suture didn't glide so easily, it didn't slide easily. And so --

00:58:56

LAURENCE D. HIGGINS, MD: And that's not so uncommon after you've tied down one of the medial rows. On occasion, sometimes that does happen that one of them doesn't slide.

00:59:04

JON J.P. WARNER, MD: Yes, not at all. And an important point to understand is that you're looking down on the tissue, so the way you know you get good compression against the bone is you watch the tissue be indented or pucker when you tie the knot down and you're sure that you really take all of the laxity out of the suture. This is sort of knot security and what Burkhart's called loop security. You make sure that each time you tie you really pass point the way you would with your fingers and that you really tighten the knot down, securing it down. You can see how I'm buckling the tissue down and it's securely against the tuberosity. Very, very important point in knot-tying.

00:59:44

LAURENCE D. HIGGINS, MD: And one other important point here with this technique is that when we're using the VERSALOCK, you do tie down your medial row first, and that's the technique. If you were going to use, say, two anchors in a construct where you had a medial row and a lateral row, do you tie your medial anchor first or do you tie your lateral anchor first? Just share with me your thoughts on that.

01:00:05

JON J.P. WARNER, MD: Well, it depends on what anchors I'm using. And not long ago when I didn't have the VERSALOCK anchor, I would put in the medial and lateral row, abduct the arm, and then tie the lateral row first and then the medial row. Because of the geometry of the repair, one ties the medial row now and then loads the sutures onto the VERSALOCK anchor. It's important that you properly tension the tissue so you have lateral tissue left that you can bring down over the tuberosity when you load the sutures onto the VERSALOCK anchor.

01:00:40

LAURENCE D. HIGGINS, MD: All right. Here we are. Now, you've tied your anterior anchor and you're about to start tying your posterior anchor. And this is a little bit of the tedious part of this, but one of the things that you need to do, and here again, important. You've decided to tie your posterior anchor from a posterior portal. Is it your preference to tie anchors through the portal that you put them in? Is that your preference or is it?

01:01:05

JON J.P. WARNER, MD: Well, no, it depends, and the configuration of this tear lends it to this sequence. One, by tying it anteriorly I bring the tissue down against the tuberosity so it's not floating up in the way. And I have space into which I can instrument and tie my sutures. Two, when I'm tying from the back I'm pushing the knot down in line with where the anchor was placed so that there's little friction because of the lack of an acute angle, and I can be certain that I get very secure suture knot against the bone compressing the tissue. It's logical that if you tie in the line with the anchor you're going to have more compression of the tissue than if you tie oblique to where you placed the anchor. In some instances I'll abduct the arm to facilitate this or rotate the arm, and that's a very nice feature of having an articulated armholder such as the one we use. We're really not making that point here, but I do move the arm frequently during the procedure in order to be able to take advantage of this kind of geometry and make sure that I give myself the best orientation for knot-tying and for secure knot-tying.

01:02:14

LAURENCE D. HIGGINS, MD: Again, this is live surgery -- or a surgery that was done earlier today, so we don't have a lot of editing. So there's some repetition here, but I think it's important that you -- what you see here is you're watching each knot go down on the scope. And I can tell you that that's a critical step because if you do not see the knot go down on occasion, the knot may be a free knot tied within the cannula and then tying a second knot on top may create a problem. So this -- although it's a tedious part, you do need to pay attention and you do need to concentrate here. We have a question from Dr. Albrecht and talking about dog ears. And I think that we're going to actually hold off on that just for a little bit because you had a very creative way of dealing with that, one that we're going to see in the interior aspect of the tear and how you were able to tie it down, and I think that's going to address that question. Again, here more tying the sutures and then saving one pair of the sutures.

01:03:05

JON J.P. WARNER, MD: Yeah, what I'm doing now is I'm putting a retriever here through the posterior portal. I'm going to pull the purple suture out of the way, parking it through the posterior portal so I can retrieve it when I wish to load it onto the VERSALOCK anchor, and then I'm going to take my last suture from the posterior anchor, which is the green one here, and just tie that down. And once I've done that then I can concentrate on the final steps, which are the lateral -- placement of the lateral anchor.

01:03:38

LAURENCE D. HIGGINS, MD: Just in -- while we're going through these stages, and we'll certainly let the audience watch this, share with me a little bit about your post-op rehab in these patients. Do you judge their therapy -- is it very individualized or is pretty much everyone on the same paradigm?

01:03:54

JON J.P. WARNER, MD: Well, there are some principles, I think. One of the biggest things we worry about and we've seen examples of it is excessive and inappropriate loading of the tendon repair prior to the time when it's able to withstand force. So I've gotten much more conservative in the treatment of my patients. Understanding that a re-tear is worse than a stiff shoulder. And stiffness generally responds very well to excellent physical therapy and a motivated patient. So most of these patients will have their arm in a shoulder mobilizer for four to six weeks depending on the tension in the repair, the quality of the tissue. I may or may not allow them to do pendulum exercises. They certainly can go in the shower after a few days. But active range of motion is delayed until that time, either four or six weeks, and generally passive range of motion by the therapist is also delayed. And I want to emphasize that being unable to control the quality and the extent of the therapy is one of the reasons why I'm very conservative because these patients go to see therapists in different places

and certainly they're not all familiar with our protocols, even if we try to educate them and make sure that they are.

01:04:58

LAURENCE D. HIGGINS, MD: Now we're at the stage on the video that we've tied down our two pairs of medial anchors, our two pairs of sutures from our medial anchors, and you're starting to look laterally. It's important here -- I think you can share a little bit about removing the bursa here, because the VERSALOCK anchor really does occupy a relatively lateral position here. You do need to have good visualization when you put this in, and so tell me a little bit about just the preparation for this anchor.

01:05:28

JON J.P. WARNER, MD: Yeah. You can see periodically during this procedure I use the S90 radiofrequency device and I'm pulling out the bursa. I said before the bursa is constantly coming back. I have to push it out of the way to see. And I pause at instances when I can't see well and make sure that I can. So that's what I've done. I've placed a 7-mm cannula here. You can instrument without the cannula, but I prefer to use this cannula to insert the VERSALOCK anchor. It requires a cannula of this dimension. You see again -- what you're seeing is not the bursa, it's the edge of the rotator cuff sort of flipping up in the way. We're coming on top of it. What I'm doing now is I'm retrieving one color suture from the anterior anchor and one from the posterior anchor so that I'm going to create a crisscross type repair laterally. I can actually load two suture through each limb of the VERSALOCK device if I want, but in this instance I'm just going to limit it to one.. It makes it a little bit easier for tensioning. Again, this is sort of live. We didn't edit this out. You can see a little bit of the struggles and how we solved them: changed the scope position a little bit, moved the arm, moved the cannula, and get a better orientation to what we're trying to do, which is retrieve the sutures. I like to retrieve a different color suture from each anchor so I know which anchor I'm dealing with. Again, this is guess what, more bursa, which is in my way that I'm momentarily going to get caught up in and then get out of and then be able to retrieve my suture.

01:06:59

LAURENCE D. HIGGINS, MD: Now, is it your preference to use just one suture from each one? And that's what I've been doing. I haven't been double-loading them. I've been happy with the single suture technique.

01:07:07

JON J.P. WARNER, MD: Typically I do that. It gives me more freedom to decide if I want to - and I can put a number of VERSALOCK anchors in as long as I have enough sutures left. And the more you put in, the more points of fixation you have, the more compression of the tendon laterally. Typically, it's two. It just has to do with how much room you have in the greater tuberosity for the holes you might make, so I pull the purple one from the anterior and I'll pull the green one from the posterior and we'll pull these down and you can see how nicely this comes over the lateral part of the tuberosity. What you may see here in a moment is I'm going to abduct the arm with the armholder, which is going to bring the shaft of the humerus more in line with the way I want to place the anchor. I really want that to be as close as perpendicular to the anchor insertion as possible. I've now abducted the arm. I'm well lateral to the lateral part of the footprint of the greater tuberosity, and so this is the sort of tent peg effect I mentioned. Now, you see this tissue hanging down? You could easily just sort of try to work around it, but I'm going to take a moment and put a radiofrequency device in one more time and kind of tease this out of my way to make absolutely certain I have the best view when I'm putting the anchor in so I can watch the deployment of the anchor and manipulate the sutures without a problem.

01:08:15

LAURENCE D. HIGGINS, MD: Some -- and I think that's an important point you're making is that I think it's really critical to improve your visualization, and doing this, this is a great step, using the vapor intermittently during the procedure. Also, if you do have blood and

you are using a pump, you certainly can increase pump pressure, and that's one of the things I've found, particularly with the Duo device has been very effective for me. They have a 160-second -- or 60 to 120 second period where the pump pressure will go up and then revert back to normal. And if you have a little bit of bleeding, that's the nice thing. This is important. Why don't you share with us what you're doing here?

01:08:49

JON J.P. WARNER, MD: Yeah, let me interrupt for a minute. This is the VERSALOCK anchor. You see -- you can see these sort of little loops or wings that are sort of wire, and they basically load the sutures through the VERSALOCK anchor. Again, this is trocar driven. I haven't had to drill a hole. I put a clamp here so I don't lose these sutures, I just simply slide the anchor down the cannula. My assistant is keeping it oriented so that I'm exactly perpendicular to the bone, and now I'm just going to impact this. And the trocar tip is going to drive the anchor into the bone, and you'll see as this happens now, and I'm going to pause when I get to the point where you see the eyelet through which the sutures run. And I can rotate the anchor to make sure that I have a direct line so I can pull on the sutures. Now pulling on each individual suture so that you can see them tensioned through the eyelet of the anchor. I'll kind of keep some tension on this so when I impact this anchor down, I've already sort of preloaded the anchor with the sutures. So there's a stop on the end of the anchor. I know that I'm against the bone here. I can confirm that by backing up the cannula if I want, but I see it very nicely here. And now I'm going to load the insertion device, this little gun device on. There's a little toggle wheel that you rotate the sutures around, and so when you turn that wheel you'll tighten the sutures and you'll be able to see that inside the shoulder. And the gun is set at the locked position. There's an unlocked position as well when you extract it. So once I've done this we'll tighten the wheel, or turn the wheel in a clockwise direction, and I think you'll see inside the joint hopefully that we're tensioning the sutures. Here I'm delivering the anchor. So the anchor's been delivered now, so I'm going to unwrap the sutures, I'm going to unlock the gun and extract it, and then turn counterclockwise to remove the inserter. When we do so, we'll see the sutures that are left there, which we'll cut, and you'll also see how nicely we brought the lateral part of the rotator cuff against the greater tuberosity.

01:01:53

LAURENCE D. HIGGINS, MD: Now here you simply just cut the sutures, and you just used a regular knot-cutter. There's no -- it's a very important point. You don't need to tie any knots here. This is secure and this is -- that's the end of the fixation point for here.

01:11:05

JON J.P. WARNER, MD: Exactly. That's why it's knotless and simple and relatively quick, and it really is sort of a quick ending to all of the rest of the work that we did. Now, it's very important to understand you can make errors here, and I'm rotating the arm and looking at the orientation of the cannula to decide where the next anchor is going to go. And what I realize here is that with external rotation, I bring the tuberosity more posterior, I have a much better orientation for the way I want to pull the sutures, I'm away from the other anchor so I won't interfere with that anchor, and I'll get a much nicer suture bridge here when I do this. You can see anteriorly how it's a little bit open there, and when I retrieve the sutures and deliver this anchor, it's going to pull that part of the tendon down. Again, we deal with the bursa one more time, which we have to sort of get out of our way. I think we may see the radiofrequency device again to do that. And each step I want to make sure that I can see as I go through this procedure.

01:11:58

LAURENCE D. HIGGINS, MD: And I left -- we left this part again completely unedited here so you can see just the importance of improving visualization and the steps necessary so that you can put this in in an anatomic and facile way. So you're about to retrieve the next set of sutures, so one suture again from the anterior and one suture from the posterior anchor.

01:12:20

JON J.P. WARNER, MD: Yeah, you can decide. I mean, if it was better for the configuration of the tear, I could retrieve both from posterior. In this instance I think we'll get a very nice crossing pattern if I retrieve one from anterior and one from posterior. The arm's a little bit in flexion now so I'm going to bring it down because my sutures were more posterior, and that brings my sutures into view. And now it's a little bit easier to retrieve them. If you don't remember to move the arm, you can sort of struggle a little bit. So here's the purple suture from the back, and next time I'm going to bring the green suture from the front. The ones you see left there are extra, and I could either load them on another anchor if I want, or in this particular case I'm going to get rid of those except for the anterior sutures, which you'll see how I use those in a minute. Now, you see the sutures are sort of twisted here. I kind of pushed them out of my way, sort of fiddle a little bit here, back the cannula up a bit. But what I want is not that suture there, I want the one more anterior, which is coming up there at the top of the screen. And I'm going to rotate the camera a little bit, and then I see it and I want the green one, which I've got here, and I'm going to pull that down. And when I bring the cannula down, you're going to see very nicely how it pulls the tendon down against the bone.

01:13:29

LAURENCE D. HIGGINS, MD: And now just simply repeating that same step here, we're going to use the second VERSALOCK and end up with two medial and two lateral based anchors.

01:13:38

JON J.P. WARNER, MD: Exactly, and I'm going to abduct the arm again a little bit so that I have a good orientation. I'm going to externally rotate a bit as well so that I move the other anchor posterior out of my way and put my cannula right there. My assistant is going to hold that orientation so it doesn't move, and I'm just going to load the sutures onto the VERSALOCK one more time and deploy it as you saw it a moment ago. Again, here's the VERSALOCK anchor: two limbs, two wings, two sutures, although there can be two in each if you wish. Two different colors make it easier for me to understand which is coming from which direction and I'm less likely to twist the sutures around the anchor if I do that. Clamp the end of it, because if I drop the inserter it doesn't fall to the floor off of the sutures. Slide it down the cannula here, orient it exactly where I want. I can check with the other anchors one more time and make sure that I'm in a good position and then simply deliver the anchor.

01:14:40

LAURENCE D. HIGGINS, MD: Is there a minimum distance that you like having between those two anchors?

01:14:46

JON J.P. WARNER, MD: Yeah, I mean I don't really know the minimum distance. I'd say probably about 5 mm would be good. You want a reasonable bridge between the two. You don't want a break between the two. The sutures are twisted here. It really doesn't matter as long as I can tension them, and then I'm going to impact this down and deliver the anchor as I did before.

01:15:08

LAURENCE D. HIGGINS, MD: We're going to keep this going for just a little bit longer and you'll see the inserter going on, and this is what drives the -- or actually secures the sutures and the anchor. And you have the tension -- any concerns about overtensioning?

01:15:24

JON J.P. WARNER, MD: Yeah, you could overtension, I just haven't done it. I haven't broken any of these. I mean, they're very reliable. You see how the sutures tightened as I fire the anchor in. This is a very reproducible step, and I can't tell you how many I've done, but it's been enough to tell you there have been no technical problems inherent to the anchor. Problems that have been -- that have occurred have been my own making, and that had to

do with not seeing well, not placing the anchor in the right position, things that are surgeon-controlled factors. Now you look here you see very nicely how it's down. You can see our little crisscross pattern here with the posterior part of the rotator cuff across the footprint. Very important, secure repair, and that's what you want to achieve however you do this. Now we'll probe it a it, and I think we'll also be able to see what I'm going to do here. Now, you see the split that I had made, you have a little bit of a dog ear, right, and that was the question that was raised before, how to deal with that. Well, you have a little margin convergence closure to do, and in this instance I have two sutures left which I can use for that, and those sutures come from the anterior anchor. And all I'm going to do is take the sutures in the front, these sutures here, and bring them through the anterior rotator cuff tissue. So when I tie them down they're going to pull this dog ear down underneath the more anterior rotator cuff. The sutures in the back I'm going to cut.

01:16:45

LAURENCE D. HIGGINS, MD: Okay. We can show that now. Why don't we come to the studio for a minute here and we can -- we're just removing those posterior sutures. Now, we're talking about dog ears and we're talking about the management here. Margin convergence -- you're just tying this part of the suture down, tying down the anterior part of this cuff. Obviously there's a lot of different ways of doing this. You could have simply just used a margin convergence, but you elected to use the sutures from the anchor. Any concerns about using those sutures, about pulling at a different angle, or do you think the fixation's going to be strong enough for that?

01:17:20

JON J.P. WARNER, MD: Well, I think the strongest part of the fixation has already occurred between the two anchors. I've got an extra suture tail that I'm just pulling a dog ear down tissue to tissue, so it's not really that structural to repair and I think it's fine to do that. It's not something that I do all the time, and if I need to I can put extra sutures in and just simply do a simple side-to-side closure the way you would do typical margin convergence using either the CHIA passer or the Clever Hook or a variety of other devices, however you wish to do it.

01:17:57

LAURENCE D. HIGGINS, MD: Early motion with these patients. I know you said you control them in therapy for a couple of weeks. Tell me, do you actually preclude them from going to therapy for a few weeks or do you tell them to do anything on their own? What do you have them do as far as self-care?

01:18:13

JON J.P. WARNER, MD: Well, as I said, I let them go in the shower after two days. They can generally let their arm dangle and do pendulum exercises, which allows them to wash underneath their arm. They -- I usually advise them to put a button-down shirt on so that they don't have to raise their arm and they can simply put their shirt on and then put their sling on. They're instructed they can use their arm below the elbow for simple work like office work but no active use of the arm at all. And as I indicated before, I determine when physical therapy starts based on the size and quality of the tendon tear in the tissue, which I have repaired.

01:18:52

LAURENCE D. HIGGINS, MD: We're going to take a look here back inside the joint for a minute. I think we're getting close to where you're passing the sutures. I think you may just be cleaning up a little bit of soft tissue.

01:19:01

JON J.P. WARNER, MD: Yeah, I'm at that little bit of split in the tendon here. You can see my sutures here. You can see the anterior rotator cuff and the posterior rotator cuff. What I'm doing is I believe I'm going to retrieve these sutures out the anterolateral portal because I'm going to instrument through the anterior portal, so I want to pull them out a separate portal. So here comes the purple one and then the green one is going to come as

well. And all I'm going to do is use the Clever Hook device again, and in this instance it's a left-angled Clever Hook device. We have a right and a left one. Left one is red-handled; the right one is green-handled. And I'm going to retrieve them that way. So I'm going to push this suture down, parking it in a position where I can easily retrieve it with a Clever Hook device. Clever Hook is going to come through the anterior portal now, just like I would with a needle. I'm going to go through the anterior rotator cuff, drive with my scope down underneath. You'll see the Clever Hook device here, and I'm going to find my suture and pull it back through the anterior rotator cuff. So here's the suture and I'm retrieving that back through the anterior rotator cuff. And I'm going to do the same with the green suture and then simply tie the sutures down and that will be the end of the dog ear here and closure of that little opening that I made. Again, this is live surgery, so we'll fiddle around. Where's my suture? It backed out a little bit, so I'm going to push it down to my Clever Hook device with another instrument and then simply retrieve it. If you use these techniques, you do have to sometimes manipulate your sutures with two instruments, so you need an assistant to hold the camera. So here my sutures are through the tissue, I'm going to put a cannula in, pull them through the cannula. So I'm instrumenting through a cannula just to tie my knots. As I said before, I like to tie my knots through a cannula, although it's not imperative. You certainly can tie through the tissues. Retrieve both of them on the external surface of the anterior rotator cuff here and there and then I'm going to tie these down and you'll see the closure of the split in the tendon tissue.

01:21:17

LAURENCE D. HIGGINS, MD: And this is obviously a suture here that's not going to slide because it's already tied down and you're just going to do --

01:21:21

JON J.P. WARNER, MD: Exactly. This is just simple alternative half hitches just to neaten up things and make them look a little nicer.

01:21:30

LAURENCE D. HIGGINS, MD: We have a question from Mark Albrecht, and again from Atlanta and the group there talking about the use and the application of a knotless medial device. Tell me how -- I have not personally done that, but have you used that, and your thoughts on it?

01:21:44

JON J.P. WARNER, MD: Yeah, I think there are some devices out there that are not widely used at the current time for knotless repair medially. I haven't used them as a practical matter routinely. I've tried different ones. I would say their uses are evolving. But my problem with these is the accuracy of placement, the tensioning of the tissue. I think that as we get more skilled with these, ultimately we're going to have knotless repairs probably on both sides and ultimately potentially even repairs without anchors when polymers are developed that allow for direct fixation of sutures.

01:22:22

LAURENCE D. HIGGINS, MD: Just one quick -- interrupt you there. You can see now you've really tied down that little dog ear anteriorly, and it looks great. That really looks -- that looks very nice. We're going to come back live and we're going to cue up an internal view, a medial -- a view of the medial footprint from inside the joint in just a minute. But one question that has come up several times is the importance of releases. For example, releases of the coracohumeral ligament. Tell me, is that something that you routinely have to do when you have to mobilize these cuffs that may be medially retracted?

01:22:56

JON J.P. WARNER, MD: Well, I think it's something you should consider. If you noticed, in this particular tear the configuration was from posterior to anterior. Now in some cases, especially when the configuration is the opposite, the supraspinatus tendon is torn. There may be a split so that the anterior part of the supraspinatus is pulled to the base of the coracoid process. This is beautifully illustrated not only in Neer's book for open surgery but

in work by Biliiani and others. And the same way you would do an open release of the coracohumeral ligament -- you do it arthroscopically, I prefer to do it with the radiofrequency device and I release right to the base of the coracoid process. You will see the tendon become significantly more mobile to the degree that you can repair it to the tuberosity when you do that. The configuration we dealt with here was not one where that was required.

01:23:40

LAURENCE D. HIGGINS, MD: How about in a particular tight shoulder where you've got a patient that may have a significant amount of, say, adhesive components and capsulitis? Do you like doing releases in those patients?

01:23:55

JON J.P. WARNER, MD: Well, stiffness associated with rotator cuff disease is something that in the literature is generally thought to be relatively rare, but it isn't. Neer made the point in his book that one should always manipulate the shoulder if it's stiff before doing a rotator cuff repair. In individuals with a moderate amount of stiffness, I will always do a capsular release, at least the adhesions that are there, and that's typically the case in revision rotator cuff repairs, and then I'll do a repair. In those individuals who have really significant stiffness, to the degree that they are profoundly stiff, I will stage the procedures and then I'll do a capsular release, aggressive physical therapy range of motion, and come back at a later time and do the rotator cuff repair because the protocol for postoperative treatment is different with a stiff shoulder than it is with a rotator cuff repair, and if you mix the two I think you have a real risk of disrupting your repair or winding up with a stiff shoulder in favor of protecting the repair that you just completed.

01:24:48

LAURENCE D. HIGGINS, MD: We're going to take a look now inside. And how often do you do this? I personally do this on every case. You can see you've got the scope back inside at the end of this and --

01:24:59

JON J.P. WARNER, MD: Well, I don't do it on every case. I think it's an extra step. But if you look here we're looking up to the right will be the medial part of the rotator cuff footprint. You see that there is no bone exposed. The rotator cuff is down against the tuberosity. I don't push really hard because I don't want to disrupt anything, but this is what you want to achieve with the repair. I don't do it routinely because I know I achieved that. I did it here to just illustrate for you all what we've accomplished.

01:25:27

LAURENCE D. HIGGINS, MD: That looks great. That's a great inside view. We can stop and come back out to the studio and come to any more questions. Thoughts about how this technique or these techniques have changed, you know, your approach to doing these double row repairs? I know my preference is to do double row repairs on most tears. What about for very, very large tears? Do you think it makes a difference, and what do you think about -- is there an indication for doing an open repair on large rotator cuff tears?

01:26:02

JON J.P. WARNER, MD: Well, there are two questions you addressed, that you asked, and one had to do with double row repairs and one had to do with open repair and indications. Let me deal with the last question first. I think it's very much based on skill set, and surgeons should do what's best for their patient, and those surgeons that are comfortable with open repairs and big tears, they should do that. That said, the evolution of my skills through teaching -- from colleagues and friends has been that I'm much more comfortable with arthroscopic repairs, and frankly, I think it's better for massive rotator cuff tears. It's better for several reasons. One, you're less likely to disrupt their function, what they have. You do nothing to the deltoid of significance and there have been clear cases of my own where I did open surgery and the patient was worse, and I think it probably had to do with what I did to the deltoid. Furthermore, there is evidence in the literature that this can

happen, so you protect the deltoid, which I think is important. Two, we're very careful about not doing a big acromioplasty. This is very important because we want to maintain what we have left for the coracromial arch as a fulcrum for rotation. And then three, we can see very, very well the rotator cuff that we're trying to fix and sometimes we're able to accomplish a partial repair, particularly posteriorly. That's very important. It's very important because there's no evidence that the suprascapular nerve can be under tension because of the retraction of the posterior rotator cuff and they can actually have a concomitant suprascapular neuropathy. And if you do a partial repair, you can reverse this. This is a really important concept that's a new branch on the algorithm for rotator cuff treatment. Furthermore, we understand now that some individuals will have suprascapular nerve problems and we do a concomitant arthroscopic suprascapular nerve decompression, which is certainly something much more difficult to do if you're doing an open rotator cuff repair.

01:27:55

LAURENCE D. HIGGINS, MD: Well, I'd like to thank Mitek and thank you for this excellent demonstration here. We will have within one month at www.mitek.com this surgery and one additional surgery for visualization and for education purposes. It is important for those people that are learning this process that the evolution to doing these fully arthroscopically is truly that, an evolution, and that there is an appropriate stepwise fashion that I think Dr. Warner demonstrated very elegantly today. Visualization is key. It is also important to look at the type of tear, identify the type of tear that you have, and then to use a variety of techniques to affect an anatomic, and in this case, a double row repair. Any further thoughts on closing?

01:28:42

JON J.P. WARNER, MD: Yeah, I just want to thank everybody for tuning in. I know that in parts of the world it's very early and in other parts this is relatively late. I hope that some of you are watching this and taking away some points that you can use tomorrow. That's after all the most important thing that I can do. And this, I think, is a very important thing that we do for all of you because we can hopefully influence the care that you give to your patients and on a much broader scale improve the quality of the treatment of rotator cuff disease. So thank you all for tuning in.

01:29:31

[end of webcast]