

20 Arthroscopic Rotator Cuff Repair Instruments and Equipment: Setting Yourself Up for Success

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The purpose of this chapter is to discuss the tools, instruments, and equipments that are available for arthroscopic rotator cuff repair. Once a determination has been made that the patient has a reparable rotator cuff tear, having the appropriate set up and equipment available to fix the tear is essential. The authors describe the key instruments needed and how they influence the key steps of the procedure. An improved understanding of the instruments and equipments available for arthroscopic rotator cuff repair and how to use them properly will help make the procedures easier and more efficient, and this in turn will result in improved clinical outcomes for patients.

POSITIONING

The authors prefer to use the beach-chair position as described in chapter 1. An operating table that allows good exposure to the entire shoulder and does not limit arm positioning is a must. The medial border of the scapula must be free so that there is room to pass instruments at the necessary angles. The authors also recommend the use of a mechanical arm holder, such as the Spider limb positioner (Tenet Medical Engineering; Calgary, Canada) or the McConnell arm holder (McConnell Orthopedic Manufacturing Company; Greenville, Texas, U.S.A.), in order to position the arm appropriately during different parts of the case. The arm holder is one of the most important pieces of equipment that facilitates arthroscopic rotator cuff repair—it allows the surgeon to apply traction to the arm, which opens the subacromial space and thus improves visualization; it allows the tear to be rotated into the optimal position; and it obviates the need to have an assistant for arm positioning. Surgeons may also choose to position the patient in the lateral decubitus position, which necessitates the use of lateral traction to place the arm with the appropriate amount of traction and abduction. However, in the authors' opinion, this position does not allow dynamic inspection and movement as readily as the beach chair with an arm holder.

INSTRUMENTATION

There have been great advances in the last few years in arthroscopic shoulder instrumentation. The advent of procedure-specific instruments has greatly facilitated arthroscopic rotator cuff repair.

The basic instruments should include a 30° arthroscope (a 70° can be helpful at times), a motorized shaver, a radiofrequency tissue ablation device, and basic open retractors (particularly, if the rotator cuff repair procedure is converted to open procedure or if an open biceps tenodesis is planned). The authors prefer to use an arthroscopic pump for fluid management, as this allows the surgeon to control the pressure as needed. The authors also use epinephrine in the saline, as this has been shown to decrease bleeding. It is helpful to keep the pump

Please refer to pages 215–218 for the figures in this chapter.

pressure as low as possible so that extravasation of the fluid does not occur. Standard arthroscopic instruments should include an arthroscopic probe, scissors, various graspers, switching sticks, and tissue punches.

The procedure-specific instruments for arthroscopic rotator cuff repairs include instruments, such as crochet hooks, suture retrievers, and tissue graspers (Fig. 1) designed to mobilize the rotator cuff tendons, elevators to mobilize and release tissues, knot pushers, and guillotine knot cutters (which are essential if high-strength sutures are used). Penetrating direct suture passers, such as the Penetrator and BirdBeaks (Arthrex; Naples, Florida, U.S.A.) should also be in this set (Figs. 2 and 3). Depending on the surgeon's preference, reusable suture passers may also be utilized. Examples include the Viper, Needle punch, Scorpion (Arthrex; Naples, Florida, U.S.A.), ExpresSew (Surgical Solutions; Valencia, California, U.S.A.), and Spectrum and Caspari punch suture passers (CONMED Linvatec; Largo, Florida, U.S.A.) (Figs. 4–7).

DISPOSABLES

Disposable single use items include the appropriate clear cannulae, which will be needed, disposable suture passers or shuttling devices, free sutures, and anchors. While it is possible to perform the entire procedure percutaneously without the use of cannulae, the authors always recommend tying the sutures through cannulae to avoid entangling the sutures in the soft tissues of the deltoid and its deep fascia. The cannulae can also aid in suture management by simply parking unwanted sutures outside the working cannula (Fig. 8).

Other items that should be readily available include a burr that can be used to perform the acromioplasty, a full radius shaver, and the appropriate radiofrequency ablation wand (Figs. 9–11). The authors prefer to use 4.5 mm shavers and burrs, as this diameter decreases the turbulence seen with larger diameter shavers. The authors also prefer variable intensity bipolar radiofrequency ablation, as this effectively removes unwanted soft tissue and cauterizes tissues as needed. Suture passers and the surgeon's preferred anchors should also be available.

Once the surgeon has the appropriate items available, the surgery becomes more efficient since the circulating nurse and surgeon will spend less time looking for the desired tools and more time focusing on the procedure at hand.

Surgical Steps

The surgery can be divided into five steps and a review of the steps with the instruments needed at each step will make it easier for the surgeons to make sure that they have the equipment they desire. The stages are exposing the rotator cuff, mobilizing the cuff, placement of suture anchors, passing the sutures, and tying the sutures.

EXPOSURE

Exposure requires a thorough subacromial decompression. This typically takes place after the glenohumeral arthroscopy, during which the cuff is visualized from its articular side. While some surgeons have described waiting until the rotator cuff is repaired to perform the acromioplasty, in most instances, the authors prefer to perform the acromioplasty first, as this creates more room to work and prevents inadvertent damage to any sutures or repaired tendons. Inferior traction is applied with the arm holder, and visualization is initially achieved by placing the arthroscope directly behind the coracoacromial (CA) ligament. For resection of the bursa, the authors use a combination of the 4.5 mm shaver and an ablation device in the subacromial space.

The authors prefer to make the skin portals small so that fluid does not leak out and there is less turbulence. Four portals, widely spaced, are used for all routine cuff repairs. The authors resect all bursa from the lateral gutter and posterior recess of the subacromial space. Failure to do so will result in problems with visualization at later stages of the repair. The deep deltoid fascia should be preserved to prevent the deltoid muscle from imbibing water and swelling, as this will encroach upon visualization. The authors' preference is to use one 6 mm clear screw-in cannula through which the authors pass the anchors and tie the sutures. Smooth push-in cannulae are also available. These are useful for intra-articular work, as they will slide with the shaver as it is passed into deeper areas of the joint; however, smooth cannulae

in the subacromial space may fall out with frequent instrument passing. The authors typically place a single cannula anterolaterally, while the remainder of the portals is used for percutaneous instrument passage. This set up minimizes incision size and trauma to the deltoid muscle, yet allows excellent visualization and permits flexible angles for instrument passage.

For debridement of the soft tissue, there are various types of shavers. The authors prefer a full radius shaver with suction. A less aggressive full-radius resector is preferred so that only bursal tissue is resected without harming the underlying rotator cuff or the overlying deltoid fascia. A burr (oval, round, or tapered) should be available to perform the acromioplasty. There are also devices that cut both soft tissue and bone, and the authors prefer this type of resector, as it is more efficient than switching back and forth between shaver and burr as one alternates between bone and soft tissue resection (Fig. 9). Again, the 4.5 mm size is quite effective because the pump can keep up with the outflow generated through the shaver, with subsequently less turbulence and less bone debris. Better visualization once again means better efficiency.

The radiofrequency ablation devices are helpful because they debride tissue without causing much bleeding. The authors prefer a bipolar device with suction in the head. The bipolar devices may generate more heat than the monopolar devices, but seem to allow for more efficient tissue ablation with clear visualization. The authors also prefer variable intensity energy and try to use the ablation device at low power, only when needed for cauterization. The mechanical shaver is the authors' preferred method of tissue resection. Indiscriminant use of radiofrequency may lead to thermal injury to nerves, chondral surfaces, bones, and tendons.

MOBILIZATION

Once the subacromial bursa has been debrided and the tear is identified, the cuff may need to be mobilized. Soft tissues are removed from the tuberosity, but the cortical bone is preserved. Again, the arm holder can be used to rotate the arm so that the tear is in perfect view. Because mobilization of the tear is frequently required, it is imperative that the shoulder repair set includes rotator cuff graspers, basket punches, and soft tissue elevators. The graspers are used like forceps in open surgery—to put traction on the cuff while releases are performed, and to determine tear morphology, the punches are used to freshen the tear edges and the elevators are used to mobilize retracted tendons by developing the necessary anatomic intervals. The shaver and ablation devices will also be used to mobilize the cuff, if the tear is chronic.

ANCHOR PLACEMENT

Next, the suture anchors are placed. If bioabsorbable anchors are to be used, then the appropriate drills, punches, and taps must be available. Either metal anchors or resorbable anchors are acceptable, and there are different designs with fully threaded or partially threaded screws. Screw-in absorbable anchors that are double-loaded are the authors' preference for most tears when bone quality is good. The surgeon should choose an anchor with an eyelet that maximizes sliding and minimizes abrading, as this has been shown to be a weak link in some earlier designs. Under cyclic loading, some sutures may fail at the eyelet due to abrasion. Most modern anchors have good resistance to bone pull-out. The new fully threaded designs may offer better purchase in the dense cortical rim of the tuberosity, and these designs may have some advantages in osteopenic bone. The authors prefer using high-strength sutures, as these are more resistant to breakage and damage during suture retrieval and tying. Most anchors come preloaded with sutures, although it is possible to reload anchors if desired. Suture type depends on surgeon preference, and there are many different commercially available and acceptable types. Most surgeons prefer high-strength sutures [Fiberwire by Arthrex, Herculine by CONMED Linvatec, Orthocord by DePuy Mitek (Raynadam, Massachusetts, U.S.A.), and others] (Fig. 12).

SUTURE PASSAGE

For passing the sutures through the rotator cuff tendon, there are many different techniques that can be used. Passing can be divided into direct and indirect (shuttling) techniques. With

direct suture passage, a sharp device is passed directly through the tendon and then one limb of suture from the anchor is retrieved and passed through the tendon in one step. With indirect techniques, two steps are required. In the first step, a device is passed through the tendon and then a "shuttle" made of wire or suture is passed through the tendon. The shuttle is then retrieved and the final suture is connected to the shuttle. In the second step, the final suture is passed or "shuttled" through the tendon. Direct passage is faster, but sometimes is not practical due to the angles that are needed. Shuttling, although requiring a second step, allows more flexibility in the angles needed and, in some instances, may permit smaller instruments to be passed through the cuff tissue with less damage to the tendon.

The devices for suture passage can also be classified into direct-passing devices or indirect-passing devices. The direct devices include such products as BirdBeaks and Penetrators, which are reusable. There are also needle-based devices, such as the ExpressSew, Needle Punch, Viper, and Scorpion, which allow suture passage through the cuff tendon directly from a lateral portal. These devices allow for a fixed bite of tissue (usually around 12–15 mm of tissue).

The indirect suture-passing devices that require two steps to shuttle the sutures include simple spinal needles that can be used with a polydioxanone suture (PDS) (Ethicon Inc., Somerville, New Jersey, U.S.A.) as the shuttle, Suture Lassos (Arthrex; Naples, Florida, U.S.A.), which uses a wire as the shuttle, the Caspari punches/Spectrum curved passers, which use PDS or a specially designed shuttle known as the "shuttle relay" to shuttle sutures, and the Accupass disposable passers, which come in various angles (Smith and Nephew; Andover, Massachusetts, U.S.A.) and use a loop of monofilament to act as the shuttle.

The proficient arthroscopic surgeon should become familiar with both direct and indirect suture-passing techniques and should be facile with one or two of these devices, in order to increase one's skill and ability to repair complex tears. Sometimes, one technique or device may allow a better angle or more efficient way of passing the suture. Understanding the different techniques will improve efficiency and efficacy of the repairs.

For the vast majority of cases, the authors prefer to use an indirect shuttling technique with a disposable passer, as this allows the most flexibility in positioning of the sutures and in the size of suture bite, permits the most reliability in instrument function, and creates the least damage to the tissue with a very small perforation.

TYING THE SUTURES

For retrieving the sutures, suture retrievers and crochet hooks are essential. Several manufacturers have these available. Sutures should be handled gently, and instruments that retrieve them should be smooth so as not to damage or fray them. A crochet hook is easy to use because it does not require space to open the jaws. It is better to use a crochet hook through a cannula to avoid getting its hook caught in the soft tissues of a percutaneous incision. A suture retriever, because of its tapered design, can be used percutaneously, although sometimes in tight spaces or inside of a cannula it may be difficult to open the jaws of the device. Some new types of retrievers have teeth at the tip, and thus they can be used to grasp tissues or sutures using the teeth or they can be used to retrieve sutures in an atraumatic way by grasping more proximally in the jaws so that the suture can slide as it is retrieved.

For tying and cutting the sutures, the surgeon must be well practiced at arthroscopic tying techniques and should have a knot pusher (either open or closed) and arthroscopic suture cutter in the repair set (Fig. 13).

Arthroscopic rotator cuff repair techniques may seem complex at first. However, having the appropriate equipment and tools is the first step toward increasing the efficiency of the procedure and optimizing the outcome for our patients.

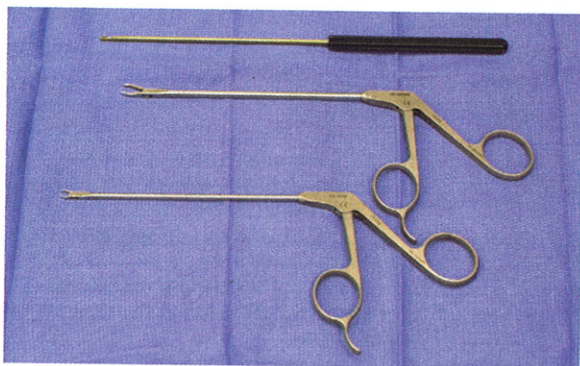


FIGURE 1 Various types of suture retrievers. (Top): Crochet hook (Linvatec). (Middle): Kingfisher (Arthrex) allows for grasping tissue/suture and atraumatic suture retrieval. (Bottom): Crab claw (Arthrex) atraumatic suture retriever. Atraumatic suture handling prevents damage to the suture that could compromise the repair strength.

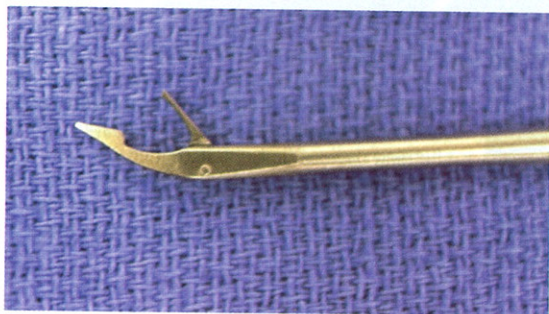


FIGURE 2 Close-up of tip of BirdBeak (Arthrex) suture retriever. This is a direct-passing device.

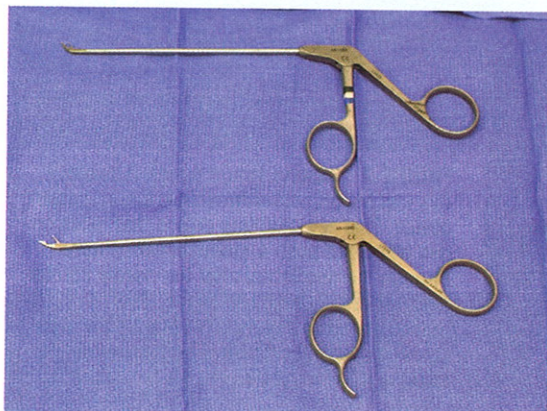


FIGURE 3 Variable angles of BirdBeak (Arthrex) suture retrievers. These devices are passed directly through the tissue, and then the sutures are grasped in the mouth of the instrument and pulled through the tissue.

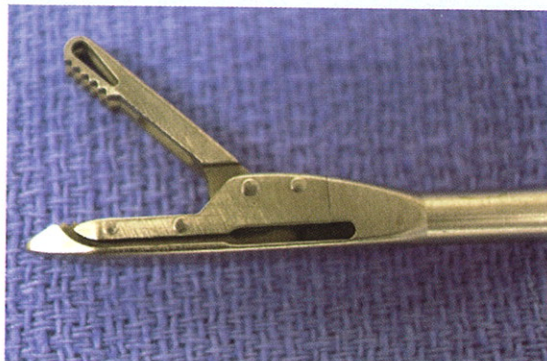


FIGURE 4 Needle punch tip (close-up) (Arthrex). This device requires a special needle, which is loaded into the tip. The tissue is grasped and then the needle with attached suture is passed through the tendon and retrieved on the opposite side.

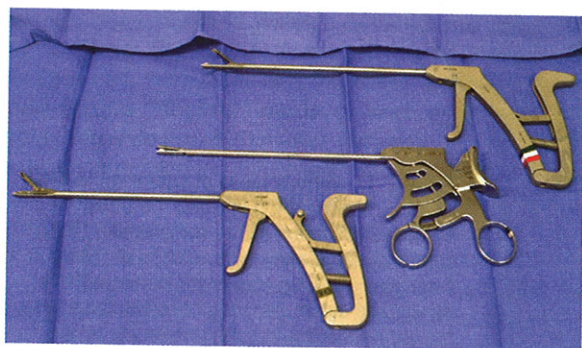


FIGURE 5 Direct suture-passing devices. (Top): Scorpion (Arthrex). (Middle): ExpressSew (Surgical Solutions). (Bottom) Needle punch (Arthrex). These devices rely on specially designed needles, which are passed through the rotator cuff tissue. They are also designed to allow for adequate bites of tissue, usually around 15 mm of tissue.

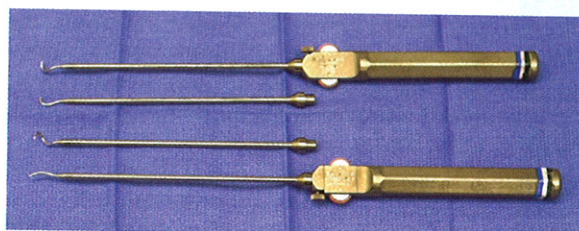


FIGURE 6 Spectrum suture passers with various angled tips (Linvatec). These are shuttling devices that require either monofilament suture or a "shuttle relay" (Linvatec) to pass sutures through tissue. The small diameter and variable angles make these devices very useful.

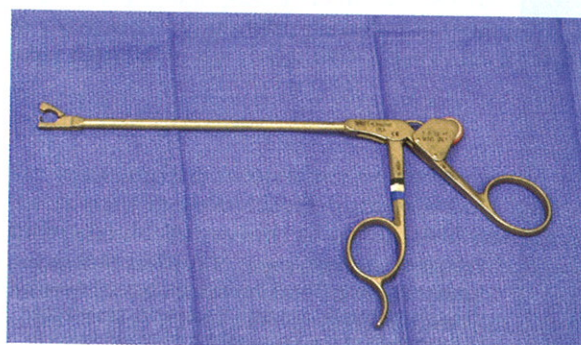


FIGURE 7 Caspari suture punch (Linvatec); this was the original arthroscopic suture-passing device. This is a shuttling device that relies on two wheels to push a monofilament suture through the needle tip, after the needle tip has been passed through the tissue. The monofilament is then used to shuttle the final suture through the tissue. There are modified designs with longer needles for the rotator cuff.

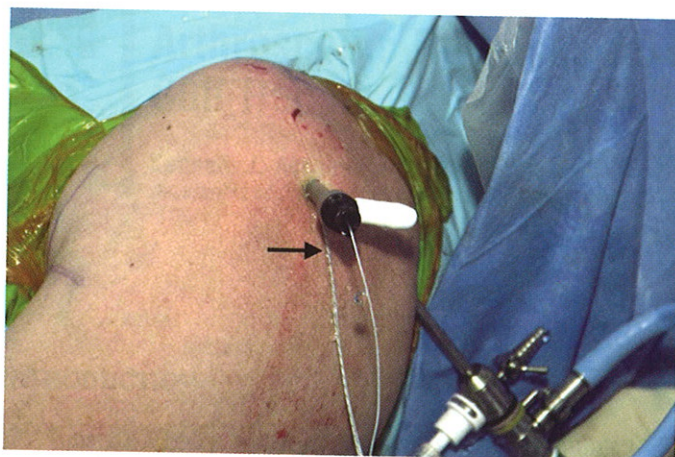


FIGURE 8 Technique for suture management using one portal: an anchor can be placed through the cannula. This prevents the anchor from getting caught in the soft tissues. Once the anchor is securely placed, the cannula can be removed. The sutures will now be exiting through the skin portal. The cannula is then replaced in the same skin portal. In this way, the sutures are now outside the cannula. The desired suture can then be retrieved in the cannula and either shuttled or tied. The steps can then be repeated for each suture coming from the anchor as needed. This simple sequence of steps helps tremendously with suture management and obviates the need for accessory portals and minimizes the risk of tangling.



FIGURE 9 Helicut shaver (Smith and Nephew). Allows removal of both soft tissue and bone with same device. Flutes help prevent clogging.

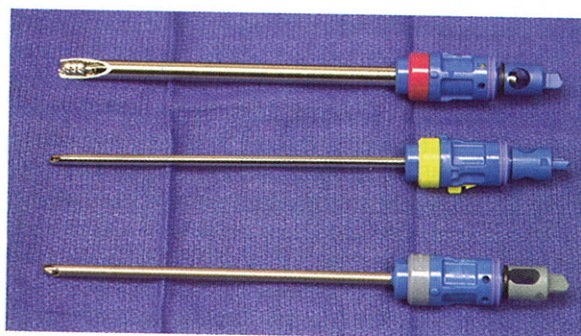


FIGURE 10 Various types of shavers and burrs. (Top): Acromionizer high-speed burr for bone resection (Smith and Nephew). (Middle): A 4.5 mm full radius shaver for soft tissue resection (Smith and Nephew). (Bottom): Helicut 4.5 mm high-speed resector for bone and soft tissue resection (Smith and Nephew).



FIGURE 11 Close-up views of shaver tips. (Top): A 5.5 mm acromionizer (Smith and Nephew). (Bottom): A 4.5 mm helicut burr (Smith and Nephew).



FIGURE 12 Fiberwire (Arthrex) #2 size—high-strength suture material. High-strength sutures have become the standard in arthroscopic rotator cuff repair.

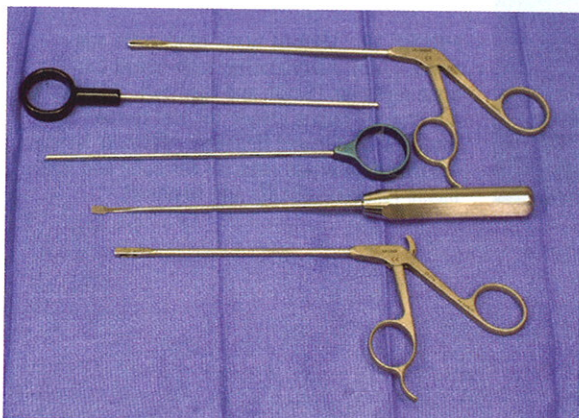


FIGURE 13 Miscellaneous arthroscopic instruments (from Top): Tissue grasper (Arthrex), closed-loop knot pusher (Linvatec), closed-loop knot pusher (Arthrex), knife rasp 15° angled elevator (Arthrex), and closed guillotine knot cutter (Arthrex).