Technical Note

Ariadne's Thread: An Easy Way to Find Your Way Back to the Glenohumeral Joint Through the Posterior Portal Once You Have Left

Samy Bouaicha, M.D., Karl Wieser, M.D., and Florian Grubhofer, M.D.

Abstract: Finding the way back into the glenohumeral space after a time-consuming rotator cuff reconstruction is not always easy because of swelling of the surrounding soft tissues. We present a safe and quick technical tip on how to reintroduce the arthroscope by means of a transarticular suture. After primary work in the glenohumeral space is performed and before the arthroscope is withdrawn from the joint, a monofilament suture is channeled from the anterior working portal through the glenohumeral joint to exit from the posterior portal. Once the subacromial reconstruction of the posterosuperior cuff tear is finished and the surgeon wants to re-establish the posterior portal to the glenohumeral space to assess the reconstruction intra-articularly, the channeled suture limb can be used to re-enter the posterior portal and to find the way back into the glenohumeral joint without harming the reconstruction. This fast and easy tip might be helpful for any arthroscopic shoulder surgeon who wants to reassess the glenohumeral space at the end of a procedure on a regular basis without losing time or his or her nerve and who wants to prevent additional damage to the posterior soft tissues.

Almost every shoulder arthroscopy starts with the establishment of a dorsal viewing portal for glenohumeral joint inspection. Further usually anterior or anterolateral working portals are then added depending on the surgical procedure the surgeon intends to perform. Once the glenohumeral work is completed and the camera position is changed to the subacromial space, the posterior access to the glenohumeral joint is temporarily abandoned. This is particularly the case in superior and posterosuperior rotator cuff reconstructions, in which the most time-consuming part of the surgical procedure is performed in the subacromial compartment. In many cases after successful reconstruction, the surgeon wants to scrutinize the proper reattachment of the tendons from the glenohumeral space. Because of swelling and/or shifting of the different soft-tissue layers, the reinsertion of the arthroscope through the initial posterior channel back into the glenohumeral joint might be difficult or even potentially harmful to the reconstructed posterior cuff. The following technical tip using a transarticular suture allowing for easy reinsertion of the arthroscope into the glenohumeral space was invented to reduce unnecessary additional soft-tissue damage and to spare the surgeon's nerves. We call it "Ariadne's thread" according to the Greek mythology saga in which Princess Ariadne from Crete, daughter of King Minos, helped Theseus to find his way out of the Minotaur's labyrinth by providing him with a ball of thread.[1]

Technique

After primary work in the glenohumeral space is performed and before the arthroscope is withdrawn from the joint, a monofilament suture (e.g. No. 2 polydioxanone [PDS]) is inserted with a suture grasper through an anterior or anterolateral working portal (usually through the rotator interval) (Fig 1). The tip of the grasper is then advanced to the opening of the arthroscopic cannula while the arthroscope itself is slightly pulled out of the cannula, allowing for entering of the grasper tip into the cannula under a direct view.

From the Department of Orthopedics, University of Zurich, Balgrist University Hospital, Zurich, Switzerland.

The authors report that they have no conflicts of interest in the authorship and publication of this article. Full ICMJE author disclosure forms are available for this article online, as supplementary material.

Received July 2, 2018; accepted August 2, 2018.

Address correspondence to Florian Grubhofer, M.D., Department of Orthopedics, Shoulder and Elbow Team, Balgrist University Hospital, Forchstrasse 340; 8008 Zurich, Switzerland E-mail: florian.grubhofer@balgrist.ch

2212-6287/18826

https://doi.org/10.1016/j.eats.2018.08.008

Fig 1. Intra-articular arthroscopic view from posterior viewing portal. The suture grasper is loaded with a monofilament polydioxanone (PDS) suture and inserted through the anterior working portal.

After this step, the suture grasper is loaded with suture, connected to the arthroscopic cannula, and slowly pushed to the back of the shoulder directed by the cannula, which is slowly pulled backwards (Fig 2). Once the grasper tip appears on the skin surface, the

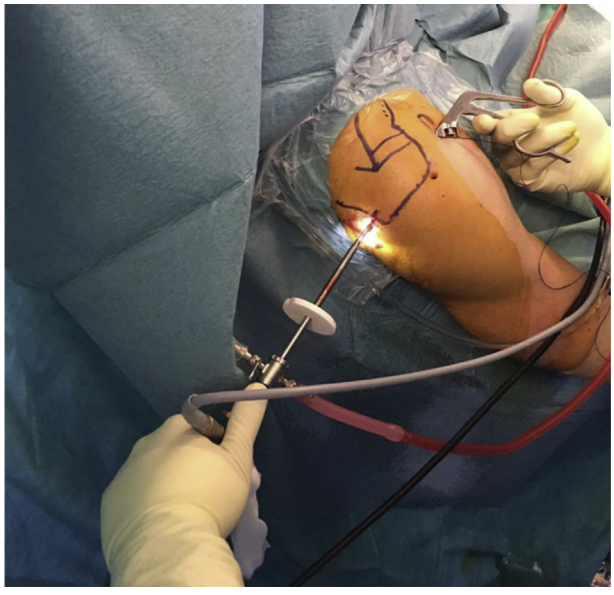

Fig 2. Right shoulder in a 52-year-old female patient in the beach-chair position. The suture grasper, which is inserted through the anterior portal, is connected and herewith channeled by the cannula, which is inserted through the posterior portal. The grasper is pushed posteriorly by the surgeon's right hand and the cannula is pulled posteriorly by the surgeon's left hand so that the grasper is led through the posterior portal.

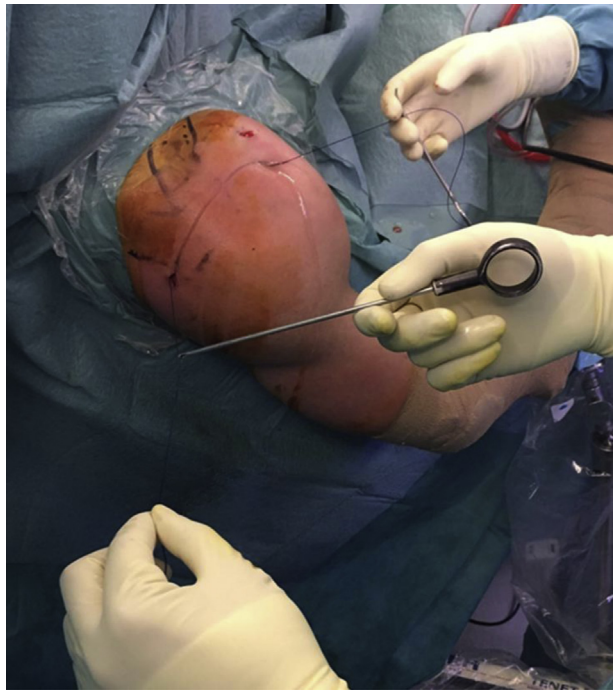

Fig 3. Right shoulder in a 52-year-old female patient in the beach-chair position. A knot pusher is mounted on the posterior polydioxanone (PDS) limb by the surgeon. The anterior limb is pulled by the assistant's right hand so that the knot pusher is guided by the tensioned PDS suture into the glenohumeral joint.

suture is secured to the anterior limb with a hemostat. Once the surgeon wants to re-establish the posterior portal to the glenohumeral space, a knot pusher is mounted on the posterior suture limb and gently

Fig 4. Right shoulder in a 52-year-old female patient in the beach-chair position. The half-pipe instrument is inserted into the glenohumeral joint along the knot pusher by the surgeon's left hand. The transarticular suture is kept under tension by the assistant's hand for additional leading support of the knot pusher.

Table 1. Pearls and Pitfalls

Pearls	Pitfalls
The transarticular passage of the monofilament polydioxanone (PDS) suture is best performed after the glenohumeral work is completed and before switching of the viewing cannula into the subacromial space is performed.	Neglecting the transarticular suture passage before removing the viewing cannula is a common mistake. Re-entry of the viewing cannula is necessary. Blind anteroposterior passage of the suture with the grasper should be avoided because there is a risk of incorrectly leading the suture through the subacromial space.
The tip of the suture-loaded grasper is connected to the opening of the viewing cannula under direct camera vision.	Blind transarticular suture passage from the anterior portal to the posterior portal has the potential for an incorrectly led subacromial suture passage and should therefore be avoided.
When the monofilament-loaded grasper is connected to the viewing cannula, the grasper should be pushed against the cannula heading toward the posterior portal.	Pulling of the viewing cannula during the passage of the cannula-grasper connection leads to a loosening of the grasper, which can cause incorrect leading of the grasper and the suture.
During the subacromial work, the free limbs of the transarticular suture should be secured with a hemostat. By applying tension on the 2 limbs, the suture is moved out of the working field during rotator cuff reconstruction.	The transarticular suture can be entangled in the cuff repair knot. The smooth surface of the monofilament suture allows withdrawal of the suture from the knot. If it is not possible, the resorbable monofilament can be cut at the level of the knot.
When re-entering the glenohumeral joint after the rotator cuff reconstruction has been performed, the knot pusher is pushed along the transarticular suture. It is essential that the assistant give the leading suture a sufficient pull so that the knot pusher is led by the suture into the glenohumeral joint.	If the pull on the leading transarticular suture is too loose, the knot pusher can be incorrectly led.

advanced along the suture into the glenohumeral space. During this maneuver, it is essential that the assistant give the anterior suture limb a sufficient pull to keep the suture under tension until the knot pusher reaches the joint (Fig 3). The last step before bringing the camera back is the insertion of a half-pipe instrument along the knot pusher (Fig 4). The reconstruction can then be reassessed intra-articularly (Video 1). Table 1 shows pearls and pitfalls, and Table 2 presents advantages and disadvantages.

Discussion

With Ariadne's thread securing the posterior glenohumeral portal, the arthroscope can be reinserted as many times as necessary without further harming the soft tissue. The installation of the transarticular suture is a safe procedure and not time-consuming at all. Using a monofilament suture allows pulling of the suture at the end of the procedure without harming the articular surface or the reconstructed tendon even when it is accidentally caught by one of the anchor suture limbs in rotator cuff reconstruction. Even though the reconstruction can be reassessed by entering from the anterior portal after reconstruction, the posterior intra-articular view is the view from which the tear is usually assessed in the beginning of the diagnostic arthroscopy and therefore the posterior view is desired for comparability reasons.

The installation of the transarticular suture takes extra surgical time of approximately 60 to 120 seconds. Nevertheless, the surgeon benefits at the end of the procedure because the time-consuming re-entry of the joint is easier such that the time lost for installation can be regained at the end of the procedure. There is a risk of incorrectly leading the suture when passing it blindly through the anterior and posterior portals without visional control of the camera. Therefore, the camera-controlled transarticular passage of the suture is essential to prevent this mistake. The transarticular suture can become entangled in the suture knot during posterosuperior rotator cuff repair. Because the monofilament sutures are usually a different color, it is easy to distinguish them from the sutures used for reconstructive work. In addition, the smooth texture of the monofilament allows the suture to be pulled out without too much effort. In the case of severe

Table 2. Advantages and Disadvantages

Advantages	Disadvantages
Safer posterior re-entry of viewing cannula into glenohumeral joint after rotator cuff reconstruction	Extra expenditure of time (60-120 seconds)
Faster re-entry of viewing cannula after posterosuperior rotator cuff reconstruction	Possibility of entangled monofilament suture into rotator cuff suture knot
Technique is easy, reproducible, and inexpensive	

entangling of the monofilament suture within the knot and therefore the risk of anchor or knot dislocation, the resorbable monofilament suture can be cut at the level of the knot. This fast and low-cost technical tip might be helpful for any arthroscopic shoulder surgeon who wants to reassess the glenohumeral space at the end of a procedure on a regular basis without losing time or his or her nerve and who wants to prevent additional damage to the posterior soft tissues.

Reference

1. Hansen W. *Classical mythology: A guide to the mythical world of the Greeks and Romans*. Oxford: Oxford University Press, 2005.