Arthroscopic Medial Retinacular Imbrication for the Treatment of Recurrent Patellar Instability: A Simple and All-Inside Technique

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Abstract: Proximal soft tissue realignment is the main surgical intervention for recurrent patellar instability. In recent years, all-inside arthroscopic procedures or mini-open surgeries have replaced traditional surgeries, which have more associated morbidity and poor cosmetic results. This article describes a simple and all-inside arthroscopic technique for the operative treatment of recurrent patellar instability. Using 2 epidural needles in several steps and no accessory portals required, the medial patellar retinaculum is imbricated to the desired tension. The combination of lateral release and medial retinacular plackation obviously improves the patellar tracking compared with preoperatively.

Although >100 different surgical methods have been described for the treatment of recurrent patellar instability, the best choice remains controversial. Since various procedures in a number of studies have been proved effective, no gold standard surgery has been defined yet. Most surgeries typically involve 2 basic techniques: proximal soft tissue realignment and distal bony realignment. Proximal realignment generally is addressed by a combination of lateral retinacular release and imbrications of medial retinaculum. Traditional open surgical management ordinarily leads to poor cosmetic results; therefore, total arthroscopic techniques and arthroscopy-assisted mini-open medial reefing for the medial soft tissue realignment have been reported in recent years.1,2 However, most arthroscopic methods for medial retinacular plication either require special instruments or have relatively complicated procedures.

Almazán et al3 introduced an arthroscopic technique for the repair of the shoulder rotator interval. Using 2 spinal cannular needles with several steps, the defect of the rotator cuff interval lesion could be repaired without accessory portals. Combining Almazán et al’s3 method with previously reported knee arthroscopic techniques, we developed a simple and all-inside procedure for the treatment of recurrent patellar instability.

SURGICAL TECHNIQUE

Surgery is performed with the patient under general or spinal anesthesia. The patient is positioned supine on the operating table with an inflated tourniquet applied to the operative extremity. The leg is steriley prepped and draped in routine fashion. Using the standard inferolateral and inferomedial portals, routine diagnostic arthroscopy is performed to observe the lesion of menisci and cartilage, traumatic loose bodies (chondral or osteochondral fragments), and rupture of the anterior and posterior cruciate ligaments. Corresponding treatments including partial meniscectomy, chondroplasty, and removal of loose bodies are performed.

Particular attention should be paid to check the relationship of the patellar ridge with the femoral trochlear groove through range of motion of the knee and assessing patellar tracking from both inferolateral and inferomedial portals. Lateral tilt and overhang of the lateral patellar facet can be observed. The extent of laxity of the medial patellar capsuloligamentous complex and tightness of the lateral patellar retinaculum can be evaluated.

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Two spinal needles (17F Weiss or Tuohy) are used for reefing the patellar medial retinaculum. A suture retriever is prepared by a needle and a suture loop with 1 end passed through the cannula of the needle (Figures 1A, B). A spinal needle is inserted into knee joint at the medial patellar edge, and under arthroscopic view, the needle is retreated for 1 or 2 cm to make a proper suture loop for another needle passing (Figures 1A, B). At a medial 2 or 3 cm from the first needle on the skin, another needle is pierced into the joint posteromedially to make the inner exit as far away the medial edge of patella as possible. Within the joint, under arthroscopic view, 2 suture retriever loops are crossed (Figures 1A, B) and 1 end of the suture loop is pulled by a forceps to open the loop into a free suture (Figures 1C, D). After removal of 2 needles from the joint and leaving 2 sutures, the suture loop is pulled to deliver 1 end of the free suture out of joint to complete 1 stitch (Figures 1E, F). This procedure is repeated 3 or 4 times so that the stitches evenly spread from the superior pole to the inferior pole of the patella (Figure 1G). Using a giant needle subcutaneously passing through the 2 eyelets of 1 stitch on the skin, the end of suture at patella edge is brought to the far medial eyelet (Figures 2A, B).

The camera is switched from the inferolateral portal to the inferomedial portal to get a better view of the lateral retinaculum. In most patients with recurrent patellar instability, after debridement of the lateral synovium of the patella by a 4.5-mm Linvatec soft tissue shaver (Largo, Florida), a radiofrequency device is inserted in the joint through the inferolateral portal to perform lateral retinaculum release.
A full-thickness retinaculum cut is made from the superior pole of the patella to the inferior pole at 1 cm lateral to the patella. The assistant manually tightens the sutures at medial side of the patella, and patellar tracking is evaluated again from full extension to 90° of flexion under arthroscope. After medial plication and lateral release, the new relationship of the patellar ridge with the femoral sulcus can be observed. Furthermore, it is found that lateral tilt and overhang of lateral patellar facet are vanished or improved. At the same time, it also can be found that the patella is pulled medially from apparent view. Based on re-evaluation of patellar congruency in the trochlea and tracking, we regulate the tension of medial retinaculum imbrication to avoid internal tilt in case of excessive medialization of the patella.

Then the fluid of the joint is drained and the sutures tightened and knotted 1 by 1 when the assistant pushes the patella medially and maintains the tension according to the re-evaluation under arthroscope (Figure 3B). After this procedure, we check the joint under arthroscope again to make sure patellar tracking is satisfied, and then bury the knots subcutaneously (Figure 3A).

Postoperatively, as a part of standard rehabilitation program, quadriceps contractions and straight-leg raises are encouraged immediately after anesthesia fades. After 2 weeks, the patient is allowed to partially bear weight with crutch support and brace protection. Full weight bearing is allowed at 4 weeks. The brace is unlocked to enable patients to begin range of motion exercises not beyond 60° and 90° every 2 weeks. At 4 weeks, the patient is allowed to increase knee flexion as tolerated.

RESULTS
To date, 17 patients with recurrent patellar instability have been treated by this all-inside arthroscopic technique. Traumatic chondral or osteochondral fragments were found in 4 cases, and 3 of them underwent chondroplasty. In 2 cases, lesion of the menisci was found and corresponding partial meniscectomy was performed. No anterior and posterior cruciate ligament rupture was found. No operational complications such as intra-articular infection or iatrogenic injury were observed. Mean operative time was 48.4±6.7 minutes (range, 39-61 minutes), whereas average time for medial imbrication was 23.2±4.9 minutes (range, 17-35 minutes). Furthermore, in the latest 5 cases performed in the past 12 months, medial reefing was performed in <20 minutes.

Postoperatively, 3 patients have been followed for >2 years, 7 patients for 1 year, and 5 patients for <1 year. Two patients were lost to follow-up. No recurrence of patellar subluxation or luxation has been found. On physical examination, all patients had a normal patella tracking and good stability in response to manual translation of the patella. One patient who failed to follow standard rehabilitation program had significant loss of range of motion (from 5° to 95°) 7 months postoperatively.

DISCUSSION
For the treatment of patellar dislocation, many open procedures, including soft tissue realignment and bony procedures such as Elmslie-Trillat, Roux-Goldthwait, Hauser, Insall proximal realignment, and combined realignment procedures, have been popularized in the past. Although these traditional operations have proven to result in successful clinical outcomes to a varying extent, they generally accompany apparent morbidity and poor cosmetic results. Nevertheless, the recent progress of knee arthroscopy provides the possibility of minimally invasive procedures for proximal realignment of the patella.

Our technique does not require special instruments, complicated surgical skills, or accessory portals. The procedure is simple and easy for surgeons to perform. Halbrecht® reported an all-inside technique for proximal patella realignment under arthroscopy. Using 1 epidural needle toward 2 different directions subcutaneously, the medial retinaculum and capsule were penetrated twice so that the suture was introduced to create a loop for knotting. Compared to our technique, the disadvantages of Halbrecht’s® method are: (1) it requires an accessory superolateral portal;
(2) the second stab through the retinaculum by epidural needle subcutaneously is difficult to precisely control the position of the outlet and the span of a stitch; and (3) it takes more time and more complicated skills to knot 4 or 5 times in the joint under arthroscopic rather than freehand knotting outside the joint.

In 2002, Haspl et al developed another all-inside method with some instruments including a working cannula and Transporter Suture Retriever (Acufex, Mansfield, Massachusetts). In their method, an accessory superomedial portal was needed, and 4 or 5 arthroscopic knots were formed and slid down through the extra-articular cannula. Compared to our technique, their procedure is relatively complicated, and the span of the stitch is limited since the inlet and the outlet are perforated from a cannula through the same superomedial portal.

In 2007, Ali and Bhatti reported a technique to reef the medial retinaculum with a long and prebent 16-gauge Tuohy needle, meniscal suture needle, and artery forceps, which created a subcutaneous plane to retrieve sutures. Their method is not simpler than Haspl et al’s since 4 portals (inferolateral, inferomedial, superolateral, and midmedial parapatellar) are needed. According to Ali and Bhatti, the inlets of the stitches are not close to the medial edge of the patella, mainly as a result of the difficulty of bending a metal 16-gauge Tuohy needle precisely for perforating the capsule twice in aimed positions.

In 2006, Schöttle et al reported a similar technique, with 2 differences compared to our method: (1) the first needle is pierced through the periosteum of the medial patellar facet, which may lead to avulsion of the insertion on the periosteum as a result of the high tension of knotting in medial imbrication; and (2) an eyelet is advanced through the subcutaneous tissue and is pressed against the skin, where a second epidural needle is inserted through the eyelet into the joint. It may be not easy for a needle to pass through the subcutaneous eyelet precisely.

Although some studies show the clinical success of isolated lateral retinacular release for the treatment of recurrent patellar dislocation, recent systematic review combining the results of 14 studies concludes that compared with lateral release and medial soft tissue realignment, lateral release alone yields significantly inferior long-term results with respect to symptoms of recurrent lateral patellar instability. In our technique, we performed both lateral release and medial retinacular imbrication for patients, and no recurrence of patellar subluxation or luxation has been found. After full-thickness lateral release, the patella could be pushed medially by an assistant and medial plication performed. In 2010, Dodson et al performed plication first and then released the lateral retinaculum. However, based on clinical experience, we believe that the initial lateral release would provide suitable conditions to further medial plication and knotting the sutures with desired tension. Furthermore, it is incorrect to knot the sutures as tightly as possible in medial reefing. An in vitro study has implied that proximal soft tissue realignment may result in significantly medialized and internally tilted patellar movement. We suggest that the knotting should be adjusted to appropriate tension according to our method: (1) the first stab is made on the patellar side, ligament reattachment is performed first and then released the medial patellofemoral ligament body (Figures 1D, 1F, 3B), since imbrication provides a tension-free condition for ligament healing. Indications for our technique include recurrent patellar instability resulting from laxity of the medial retinaculum, injury of the medial patellofemoral ligament body, and cases without serious trochlear dysplasia, patella alta, and a considerably high Q angle. However, for the treatment of most severe osseous abnormalities, such as significantly high Q angle, serious patella alta, or trochlear dysplasia, distal bony realignment procedures should be initially considered rather than our technique. Moreover, theoretically our technique is unsuitable for some special types of patellar instability even with a normal Q angle. For example, in cases of avulsion of the medial patellofemoral ligament from the patellar side, ligament reattachment on the medial patellar facet or the reconstruction of the medial patellofemoral ligament is a better choice.

CONCLUSION
The advantages of our technique include simple steps, no special instruments, no accessory portals, and ease of manipulation for arthroscopists. The pitfalls include the limitation that it cannot be performed when the medial patellofemoral ligament has been avulsed off the femoral or patellar side, and that the sharp tip of the spinal needles may cut off the sutures when they pierce into the joint.

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