Surgical treatment of patellar tendinopathy in athletes. A retrospective multicentric study

T. Cucurulo, M.-L. Louis, M. Thaunat, J.-P. Franceschi

Hôpital de la Conception, 13005 Marseille, France

Summary  The purpose of this study was to evaluate the results of surgery, in particular arthroscopic procedures in the treatment of patellar tendinopathies that are refractory to conservative treatment in athletes.

Method: A retrospective multicenter study was performed in four centers. Patients were athletes who did not respond to carefully followed conservative treatment and who underwent surgery. Sixty-four patients were included, 10 who underwent arthroscopy. Patients were questioned and followed-up for an average of 22 months (6—116 months).

Results: At the final follow-up, 87% of the patients had an improved Blazina score and 63% were again practicing their sport at the same level. None of the preoperative factors influenced the final result and one surgical technique was not more effective than another (patellar tip resection versus arthroscopic approach).

Discussion: The results of this study are comparable to those in the literature which show a success rate of more than 80% whatever the surgical technique. This study limits a certain number of biases because the patient group is homogenous (athletes, unsuccessful conservative treatment) with similar functional scores, and well-defined protocols for postoperative rehabilitation. However, the study of this entity is difficult because of the limited number of subjects and its different anatomopathological forms.

Conclusion: Surgical treatment is indicated in motivated athletes if carefully followed conservative treatment is unsuccessful after more than six months, making it impossible to practice a sport (Blazina grade 3). Arthroscopic techniques seem to be as effective as open surgery with an equivalent delay for beginning sports activities.

Level of evidence: IV.

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Introduction

A lack of antatomoclinical correspondence is frequent in extensor tendinopathies. Tendons may be very painful with abnormal imaging results or, on the other hand, tendons may be abnormal on imaging but asymptomatic [1]. The therapeutic indications should not be adapted to the
Patellar tendinopathy

imaging results but to the amount of functional difficulty of the patient in relation to his/her goals and the outcome and difficulties of available treatments.

Surgery is only indicated after conservative treatment has been carefully followed for at least six months and is unsuccessful. Numerous surgical techniques are possible depending on the site of the tendinopathy (main tendon body or enthesopathy [insertional tendinopathy]) and the type of injury (nodules, cysts, calcifications or partial thickness tears). In case of injury to the main body of the tendon, all authors recommend surgery to the tendon, longitudinal tenotomy and excision of the degenerative tissue. On the other hand, there is no consensus on the ideal surgical technique for insertional patellar tip tendinopathies which is the most frequent anatomopathological form of this entity. Some, since Roels et al. [2] prefer to treat the tendon alone and Testa et al. [3] have even proposed a percutaneous ultrasound guided intervention under local anesthesia. However, most authors recommend a mixture of bone and tendon resection [4–8].

New arthroscopic techniques have been developed [9–14] to decrease the amount of time necessary to recover function and athletic form, while reducing the risk of complications.

The aim of this study by the French Society of Arthroscopy (Société française d’arthroscopie [SF A]) was to evaluate the results of surgery, in particular with arthroscopic procedures in the treatment of patellar tendinopathies that are refractory to conservative treatment in athletes.

Materials and methods

Series

A multicentric retrospective study of 64 tendinopathies in athletes treated surgically was performed by the SF A. The series included 20 cases operated on at the Hôpital de la Pitié-Salpêtrière, 20 cases at the Clinique Chirurgie in Marseille, 23 in the Centre Médicochirurgical Paris V and one case in the Polyclinique des Alpes du Sud.

This study included 64 patellar tendinopathies refractory to conservative treatment and physical therapy, treated surgically. Inclusion criteria were patients with patellar tendinitis, corresponding to "jumper’s knee" as defined by Anglo-Saxon authors [2, 4].

These 64 tendinopathies were operated on in 64 patients, aged 17 to 59 (mean: 30). The series included 88% men and 12% women.

All patients were athletes, and 45% were competitive athletes. Patients practiced an average of seven hours of sports per week, with a range of 2–20 hours. Although tendinitis is normally more frequent in jumping sports such as the high jump, basketball and volleyball, our series included a majority of soccer players (Table 1).

Patients were seen after an average of 36 months of pain, with a range of two months to 20 years. Symptoms were cyclic in 48% of cases.

Patients received conservative treatment for an average of two years and four months. In most cases, this included rest and a reduction of sports activity. Associated treatments included non-steroid anti-inflammatory drugs in 64%, peritendinous steroid injections in 26% (minimum: 1, maximum: 4), physical therapy sessions in 89% with stretching in 41%, deep transverse friction massage in 34%, eccentric training in 30%, cryotherapy in 17%, ultrasound sessions in 38%, mesotherapy in 20% and shock wave therapy in 34%.

The Blazina classification [4] modified by Roels et al. [2] can be used to determine the functional severity of the patellar tendinopathy. Thirty-five percent of the patients in our series who underwent open surgery and 30% of patients who underwent arthroscopy had stage 3 disease, corresponding to permanent pain during sports activity resulting in a reduction in training time. Sixty-five percent of the patients who underwent open surgery and 80% of the patients who underwent arthroscopy had stage 3bis disease, corresponding to pain requiring stopping all athletic activity.

Patients’ medical histories included one patellar fracture, one patellar instability, two Osgood-Schlatter disease. Four patients presented with risk factors of patellar tendinopathy with two cases of patella alta, and two cases of hamstring retraction.

Preoperative clinical examination

Pain was located in the tip of the patella in 92% of the cases, in the main tendon body in 77%, and in the lower attachment on the anterior tibial tuberosity (ATI) in 47%. Pain during tendon stretching was found in 89.5% of patients. The test of eccentric lowering and raising while standing on one foot was always positive.

Paraclinical tests

Plain films did not show any anomalies in 52% of the cases. Calcification of the inferior pole of the patella was found in 44% of cases. Twelve ultrasound results were provided, half showing hypervascularisation at the tendon insertion, 25% presenting a nodule, and 12% a cyst. The 55 MRI’s performed revealed hypervascularisation in 18% of cases, a nodule in 46% of cases, a cyst in 9%. Moreover, there was a partial thickness tear in 18% of cases and bursitis in 9%.

Surgical techniques

Surgical treatment was only indicated after at least six months of conservative treatment had failed. Numerous techniques were proposed depending on the site of the tendinopathy (body of the tendon or enthesopathy [insertional]) and the type of injuries determined on imaging (nodules, cysts, calcifications or partial thickness tears). If the injury is in the tendon body only, all authors recommend

<table>
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<tr>
<th>Table 1</th>
<th>Distribution in percentage by sports activity.</th>
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<tr>
<td>Soccer</td>
<td>30%</td>
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<tr>
<td>Track and field</td>
<td>28%</td>
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<tr>
<td>Tennis</td>
<td>11%</td>
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<tr>
<td>Basketball</td>
<td>11%</td>
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<tr>
<td>Volleyball</td>
<td>7%</td>
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<tr>
<td>Handball</td>
<td>7%</td>
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<tr>
<td>Other</td>
<td>6%</td>
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treating the tendon alone with longitudinal tenotomy (carding) and excision of the degenerative tendinous tissue. On the other hand, there is no consensus on the ideal surgical treatment of insertional patellar tip tendinopathy which is the most frequent anatomopathological form of this entity. Since the study by Roels et al.[2], some prefer to treat the tendon alone. However, most authors recommend treating both bone and tendinous tissue with numerous variants. Thus, in 1962, Smillie published one of the first surgical interventions of insertional patellar tendonitis, by making multiple holes in the patellar tip. Later, Blazina et al. [4] proposed excision of the extraarticular patella by opening the tendon along its axis and ablating abnormal tendinous tissue. Since 1980, Saillant et al. have described a derivative technique[15]. Using an anterior incision, the synovial sheath is excised then the degenerative areas are explored with longitudinal tenotomy by cutting four vertical strips along the tendon. The two median edges of the lower quarter of the patella are detached sub-periostally and the tip is exposed. The tendon can then be carefully explored. All the degenerative areas (nodules, calcifications, cysts, partial thickness tears) should be excised while limiting excision as much as possible. The lower extraarticular quarter of the patella, which was previously freed by scraping the two median strips, is resected with a scissors or a liston’s knife. The resected edges are rounded to avoid any future conflict with the tendon. If one of the strips has been weakened because of excision of a nodule, an overlapping of the two median strips provides reinforcement and limits the risk of secondary rupture. It is closed with a drain, and the different fibrous strips are sutured with resorbable sutures. (Fig. 1).

Other authors prefer to create tendinoperiostal scars in the inferior pole of the patella [5,7] or numerous holes [6] or associate both [16]. Based on patellar tendon repairs after harvesting for Kenneth-Jones type ligamentoplasties, Fritschy and Wallensten [17] suggest a large resection of a fragment of bone from the superior base of the triangular patella and the central third of the tendon. Some authors

Figure 1  Open surgery. A. Axial incision by scalpel along the fibres. B. Longitudinal tenotomy and creation of four strips of tendon with a Halsted clamp. C. Resection of cysts and diseased nodules. D. Connection of tissue with a possible overlap to strengthen strips weakened by resection.

Figure 2  Arthroscopic technique. A. Identification of the tip of the patella with a needle. B. Bursectomy with a shaver. C. Debridement of the deep tendon with a shaver. D. Resection of the tip of the patella with a motorized drill.

Figure 3  Distribution by percentage of patients according to the Blazina score three months and six months postoperatively and during the last follow-up, according to surgical treatment. A. Arthroscopy. B. Open surgery.
associate this with extensor realignment \[18,19\] or a bone-tendon quadriceps graft.

New arthroscopic techniques have been developed \[9,10,13,20\]. Because damaged tissue is in fact always found in the deep part of the tendon under the inferior patellar pole, the principal of these procedures is to perform arthroscopically controlled shaving of retrotendinous tissue, and excision of the damaged tendon associated with treatment of the patella if necessary. The most recent publications \[9,20,21\] describe a superficial retrotendinous debridement procedure with no bone resection, based on the idea that treatment is limited to excising the neovascularisation and innervation of the degenerative area (Fig. 2).

Statistical tests

We looked for a significant difference between patients who underwent open surgery and those who underwent arthroscopy. The presence of a correlation between surgical results and the age, sex, duration of symptoms, athletic level, preoperative Blazina stage, type of injury, type of treatment, duration of postoperative immobilisation and the delay to rehabilitation were analysed. The statistical tests were performed using SPSS software version 11.3.5 for Windows. \( P < 0.01 \) was considered to be significant.

Results

Surgical treatment

The choice of surgical technique differed from one center to another. Most surgeons had a different therapeutic approach depending on the clinical and paraclinical results or the degenerative areas discovered during surgery. This explains the differences in distribution for the types of procedure, with a majority of longitudinal tenotomies (51 out of 54 cases of open surgery). There was surgery to the bone in 39 cases, bursectomy in 23 and synovectomy in 33. Nodules, cysts or calcifications were systematically resected when they were discovered during surgery. Ten patients underwent arthroscopy. A bursectomy was always performed associated with tendon debridement in four cases, and patellar tip resection in two.

Postoperative immobilisation in extension with a splint was prescribed in most cases (80%). Immobilisation lasted an average of 23 days, with a range of 0—45 days. Full weight was applied an average of four days after surgery. Rehabilitation began an average of 15 days after surgery with a range of 0—30 days.

Clinical evaluation during the last follow-up

All patients progressively improved on the Blazina scale at three months, six months and at the last follow-up (Fig. 3). There was no significant difference between patients who underwent open or arthroscopic surgery. At the last follow-up, there were 20% stage 2, 40% stage 1 and 40% asymptomatic patients in those who underwent arthroscopy and 6% stage 3, 6% stage 2, 18% stage 1 and 70% asymptomatic patients in those who underwent open surgery. At the last follow-up, an improvement in Blazina stage was observed in 96% of patients compared to their preoperative stage.

At the last follow-up, patellar pain had improved in 93% of cases compared to the preoperative stage, with 92% improvement in patients who underwent open surgery and 100% in those who underwent arthroscopy.

At the last follow-up, tendon body pain had improved in 83% of patients compared to the preoperative stage with 77% improvement in patients who underwent open surgery and 100% in those who underwent arthroscopy.

At the last follow-up, improvement in pain during stretching and eccentric raising and lowering during a monopodal stance was observed in 94% of patients compared to the preoperative stage, with 92% improvement in those who underwent open surgery and 100% in those who underwent arthroscopy.

Renewal of sports activity

Patients were able to begin running an average of 5.5 months after surgery for the entire series with a range of 1—12 months. This delay was 5.5 months in patients who underwent open surgery with a range of 2—12 months and four months in those who underwent arthroscopy with a range of 1—12 months.

The average delay before beginning training was six months after surgery for the entire series with a range of 3—18 months. This delay was seven months with a range of 3—18 months in patients who underwent open surgery and five months with a range of 3—18 months in those who underwent arthroscopy.

At the last follow-up, 88% of patients were able to perform the same sport they had before surgery and had recovered an average of 76% of their athletic level with a range of 0—200%. Sixty-three percent of patients reached the same athletic level as before the development of symptoms. For the entire series, the average number of hours of sports practiced per week was five hours at the last follow-up with a range of 0—18 hours.

The 45% of competitive athletes in the study began competing again within six months after surgery. This delay was six months with a range of 4—18 months in patients who underwent open surgery and six months with a range of 6—15 months in those who underwent arthroscopy. Sixty-seven percent of patients who were competitive athletes had begun competing again at the last follow-up. Ninety-six percent had recovered their former level, and 45% had reached a higher level than initially.

Complications

Complications occurred in two patients. One patient presented with an unhealed wound requiring a second intervention, and another patient presented with algodystrophy.

Statistics

We did not find any significant difference between the results of patients who underwent open surgery and those who underwent arthroscopy. We did not find any correlation
between the results obtained and the age, sex, duration of symptoms, athletic level, preoperative Blazina stage, type of lesion, type of treatment, length of postoperative immobilisation or delay before rehabilitation.

Discussion

The literature on the surgical treatment of patellar tendinopathies is fairly limited. One of the aims of this symposium was to better understand the available technical options to optimize the results of this surgery, in particular by emphasizing the role of arthroscopy in this treatment.

To help our study, a search on Medline was performed for articles between 1978 and 2008 using the following keywords "patellar tendinopathy", "jumper's knee", "tendonitis". The study group on tendinopathies led by Coleman et al. [12] performed a meta-analysis of 21 clinical studies published between 1978 and 2000, and analysed the methodology of each study. Thus, the authors were able to define a methodological score ("Coleman Methodology Score" or CMS) of 100 points based on an analysis of the following criteria: the number of subjects, the average follow-up, the number of types of procedures included, the type of study, the preoperative radiological tests, the description of the postoperative rehabilitation protocol, results criteria, follow-up data criteria, and patient selection criteria. Of the 21 studies analysed, the average CMS was 37.3/100 (minimum: 15, maximum: 66). The conclusion of this study was that a low score was associated with an allegedly higher success rate. The CMS of our study was 55/100, which was negatively affected by the multicentric and retrospective nature of the symposium study, and which showed that the methodology of our study was satisfactory.

Our analysis of the series in the literature between 1990 and 2008 was based on an analysis of referenced series of surgical treatment of tendinopathies, with a follow-up of at least one year, in cohorts of at least 10 patients, excluding all complete thickness tears. The results analysed were the success rate, the delay before beginning athletic activities, and the athletic level reached after surgery. Twelve studies were analysed and compared to the SFA series (Tables 2–4) [5,7,9,10,13,16–18,22–24].

Only three prospective studies have been performed [12] and most studies have been retrospective like the symposium's. Most studies are small cohorts of less than 30 patients. Only the studies by Karlsson et al. [7] and Coleman et al. [12] present cohorts of more than 50 patients as well as the present study which includes 64 patients.

The average age of patients in the different series was between 25 and 31 years old, comparable to that of the present study.

Moreover, there are clearly more men who undergo surgery than women in all the series analysed including that of the SFA.

Our analysis of the surgical techniques in the series in the literature is mainly focused upon whether or not surgery was performed on the patellar tip. When it is performed, it involves either resecting the patellar tip or drilling holes in the inferior pole of the patella. The meta-analysis seems to favour surgery to the bone because the success rate when there was no patellar surgery was 71% all series combined, compared to 92% if there was patellar tip resection or drilling. We did not find any significant difference in the results of our study based on these criteria.

For the rehabilitation protocol, the results of studies with postoperative immobilisation [12] were slightly poorer (82.4% success rate) than if rehabilitation was begun quickly without immobilisation (93% success rate). We did not find any statistically significant difference in relation to the criteria of postoperative immobilisation in our series.

Only six articles were found describing arthroscopic treatment of patellar tip tendinopathies. It should be noted that no complications due to full thickness tendon tears from excess resection were reported in the three published retrospective and prospective studies.

Johnson [25] was the first to describe arthroscopic patellar tip resection with 90% good and excellent results, athletic activities begun nine weeks postoperatively and competitive sports, 13 weeks postoperatively.

Coleman et al. are the only authors who have published a retrospective study comparing open surgery (26 patients) and the arthroscopic procedure [13]. There was no surgery to the bone in any of these operations; the deep part of the patellar ligament at the patellar tip was debrided. They report an 81% success rate with open surgery compared to

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<th>Author</th>
<th>Year</th>
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<td>8/1</td>
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<td>29</td>
<td>27/2</td>
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<td>29</td>
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<td>30</td>
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96% in the arthroscopic series. Only 60% of patients reached the same athletic form as before surgery in both groups. The time necessary to reach the same athletic form was shorter in the arthroscopic series (six months) than in the open surgery series (10 months).

Ogon et al. [9] published a retrospective series of 15 subjects who underwent simple arthroscopic debride-ment and cauterisation of the deep part of the tendon and the tip of the patella with no bone or tendon excision. They report 86% excellent results and insist upon the importance of denervation of the patellar tip by a bipolar cautery system.

Lorbach et al. [10] are the only authors to have recently published a prospective study on radioscopically controlled arthroscopic resection of the tip of the patella in 20 patients. They report a success rate of 90%, with 95% beginning sports within six months after surgery.

**Conclusion**

In this symposium, arthroscopic and conventional surgical techniques were compared showing similar results to those in the literature with a success rate of more than 85%. Like other published arthroscopic series, the SFA study shows a tendency towards faster recovery in patients who undergo arthroscopy, with patients beginning sports activities sooner, often within less than six months after surgery. Nevertheless, arthroscopy was not found to be more successful than open surgery for this entity.

**References**