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Retinacular band excision improves outcome in treatment of plica syndrome

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Abstract Mild symptoms usually continue after excision of the medial patellar plica. We noticed that the palpable tender cord, located on the anteromedial aspect of the knee in patients with plica syndrome, did not disappear completely after excision of the synovial fold. Beneath all plicae, a retinacular band was visible, and only after excisions of this band did the cord become impalpable. We conducted a study to determine the role of these medial retinacular bands in the symptomatology of the disorder. Twenty-four knees of 22 patients diagnosed with medial patellar plica syndrome were divided into two groups. In the first group, arthroscopic excision of the synovial plica was performed. In the second group, retinacular bands beneath the plica were additionally excised. When Lysholm scores were compared, we found that the second group showed significantly greater improvement. We believe that the retinacular bands play a role in the symptomatology and the pathophysiology of plica syndrome and that excision improves the outcome.

Résumé Habituellement des symptômes discrets persistent après excision du plica médiopatellaire. Nous avons constaté que le cordon palpable présent dans la partie antéromédiale du genou chez les malades avec un syndrome de plica n'a pas complètement disparu après ex-

cision du repli synovial. Sous tous les plicas une bande rétinaculaire était visible et seulement après excision de cette bande le cordon est devenu impalpable. Nous avons conduit une étude pour déterminer le rôle de ces bandes rétinaculaires médiales dans la symptomatologie persistante. Vingt-quatre genoux de 22 malades présentant un syndrome du plica médio patellaire ont été divisés en 2 groupes. L'excision arthroscopique du plica synovial était faite dans le premier groupe et dans le deuxième groupe la bande rétinaculaire sous le plica a été excisée en plus. Quand les scores de Lysholm ont été comparés nous avons vu que le deuxième groupe avait une meilleure amélioration, statistiquement significative. Nous croyons que cette bande rétinaculaire joue un rôle dans la symptomatologie et la physiopathologie du syndrome du plica et que son excision améliore le résultat.

Introduction

Synovial plicae are embryological remnants of synovial tissue. Multiple cavities in the knee coalesce to form a single cavity with synovial lining at the tenth foetal week. After this coalescence, mesenchymal tissue may persist as a plica in varying sizes and extent depending on the degree of reabsorption [20]. Infrapatellar, suprapatellar, and medial patellar plicae are the most prominent. The normal plica is a thin, pliable, synovial fold containing abundant elastic and areolar tissue. The elasticity of the tissue allows the plica to glide over bony prominences [6]. However, trauma to the knee can cause inflammation, resulting in oedema, thickening, and inelasticity of the tissue, and plicae may eventually scar into fibrotic bands that bow-string over the femoral condyle [6]. The medial patellar plica is the one that is most frequently symptomatic. It originates from beneath the quadriceps tendon, coursing medial to the patella, turns around the medial femoral condyle, and inserts into the infrapatellar fat pad [19]. In symptomatic patients, the medial patellar plica can easily be palpated as a tender cord. On several thin patients, we have noticed that the palpable cord did not disappear after

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removal of the synovial plica. Others have reported similar findings [18, 25].

Material and method

Patients referred with anteromedial knee pain were evaluated for possible inclusion in the study. Inclusion criteria were presence of a tender anteromedial cord suggesting plica syndrome, lack of response to 3 months of conservative treatment with muscle strengthening exercises, and intraplica injection of a long-acting corticosteroid. Patients with point tenderness at the medial joint line, a positive McMurray test, or patellofemoral complaints were excluded. Standing antero-posterior, lateral knee, and tangential patellar radiographs were obtained in all patients. If radiographs revealed major patellar tracking abnormality or signs of osteoarthritis, those patients were excluded from the study.

Twenty-two patients with 24 knees were finally included in the study. They comprised 33% of all patients referred with knee pain in whom the diagnosis of an isolated plica syndrome was made during the 1-year period of the study. Seven patients were men and 15 were women. Average age was 44 (14–61) years. With the exception of two patients who had had complaints for 10 years the mean duration of symptoms was 10 (4–24) months. A summary of the patient-related data is shown in Table 1. A catching or locking sensation was present in 18 knees, and all patients had pain

on flexion over 90°. An adequate range of motion assessment could not be done because of pain in extremes of flexion. Intermittent swelling occurred in 14 knees, and constant swelling was present in five.

The institutional ethical committee approved the study, and informed consent was taken from all patients. Patients were divided into two groups of 12 knees alternately in order of entrance to the operating room. In the first group, standard antero-lateral and antero-medial portals were used. Before distending the joint, the plica was identified at the medial gutter of the knee. The disorder was confirmed by chondral erosion on the medial femoral condyle against the plica, where it impinged (Fig. 1). The plica was excised completely with the help of a motorized shaver instrument and a basket forceps, as required. After complete excision, the retinacular bands of the medial retinaculum and the patellofemoral ligament were visible below the excised tissue. Finally, the portals were sutured over a suction drain.

In the second group, in addition to the previous procedure, the retinacular bands were also excised completely until the subcutaneous fat tissue was visible (Fig. 2).

The suction drains were removed 24 h after the procedure, and full weight bearing was allowed. Active and passive range of motion and quadriceps and hamstring stretching and strengthening exercises were started on the first postoperative day. Elastic bandaging was continued for 3 weeks.

Table 1 Patient summary data

Patient no.	Age	Gender	Duration of symptoms (months)	Excised tissue	Preoperative Lysholm score	Postoperative Lysholm score
1	24	Male	120	Plica	30	30
2	57	Female	4	Plica	30	67
3	47	Female	7	Plica	24	70
4	28	Male	15	Plica	19	90
5	26	Female	4	Plica	15	45
5	26	Female	4	Plica	30	67
6	52	Male	4	Plica	46	90
7	34	Male	24	Plica	70	99
8	48	Female	24	Plica	11	67
9	50	Female	5	Plica	48	70
10	54	Male	5	Plica	48	90
11	55	Female	13	Plica	30	67
12	41	Female	10	Plica + band	24	94
13	61	Female	11	Plica + band	48	98
14	14	Female	7	Plica + band	37	98
15	26	Male	4	Plica + band	50	98
16	54	Female	7	Plica + band	31	80
17	49	Female	14	Plica + band	48	94
18	50	Female	12	Plica + band	24	80
18	50	Female	12	Plica + band	61	100
19	34	Female	12	Plica + band	37	88
20	51	Female	120	Plica + band	61	90
21	45	Female	12	Plica + band	57	92
22	61	Male	6	Plica + band	48	98

Fig. 1 Arthroscopic view of a medial patellar plica and the corresponding chondral injury. 1 medial femoral condyle, 2 patella, 3 mediopatellar plica

The patients were followed up for pain, range of motion, quadriceps atrophy, and patellar stability and were also evaluated using preoperative and latest follow-up Lysholm scores. Lysholm scores between 95 and 100 were considered as excellent results, between 90 and 94 as very good, between 80 and 89 as good, between 70 and 79 as fair, and below 70 as poor, using the system recommended by Pidioriano et al [22]. The scores were analysed statistically using the Mann–Whitney test.

Results

In all knees, a chondral erosion on the medial femoral condyle was seen. In ten knees, the chondral erosion was graded as Outerbridge grade 1; in eight, grade 2; in five, grade 3; and in one, grade 4.

Fig. 2 Retinacular bands visualized after complete excision of the plica. 1 medial femoral condyle, 2 retinacular bands

Patients were followed up for a mean of 30 (24–36) months, and preoperative and latest follow-up Lysholm scores were compared. Antero-posterior, lateral, and patello-femoral knee radiographs were also reviewed at the latest follow-up. In the first group, one patient did not improve at all and another was referred with bilateral recurrence after 10 months. Steroid injection and exercise programmes did not help this patient, and she was relieved only after a second arthroscopic procedure in which both the synovial plica and the retinacular bands were removed. She remained symptom free 24 months after the index operation, after which she was lost to follow-up. Except for these two patients, all knees were free of symptoms. Effusion developed in 20 of the 24 knees but resolved again in 3–4 weeks. Severity and the duration of effusion did not differ between the groups. At the last follow-up, control patients were examined for patellar instability that might have been caused by the resection of the retinacular bands, and tangential patellar radiographs at 20° of knee flexion were obtained. None of the patients had complaints of patellar instability, none had abnormal lateral or medial transposition, and no abnormal patellofemoral tracking was seen. On all radiographs, the patella was congruent with the femoral patellar groove, and there was no patellar tilt or lateral displacement. Two patients from group 1 had slight quadriceps atrophy. Five patients in group 1 had restricted flexion over 90° due to pain. In group 2, all patients had a full range of motion and none had atrophy.

In group 1, the mean preoperative Lysholm score was 33 (range 11–70), and the mean postoperative score was 71 (range 30–99). In group 2, the mean preoperative score was 44 (range 24–61), and the mean postoperative score was 93 (range 80–100). In group 1, there were four good/excellent, four fair, and four poor results; in group 2, all scored between good and excellent. Preoperative Lysholm scores did not differ significantly between the two groups. Postoperatively, patients in group 2 showed a significantly better improvement.

Fig. 3 Cadaver dissection. Retinacular bands run from the medial edge of the patella and the distal edge of the vastus medialis posteriorly and inferiorly. Transparent arrows show the retinacular bands of the medial retinaculum. 1 patella, 2 vastus medialis, 3 tibia

Discussion

The frequency with which the presence of a plica has been reported varies between 14% and 100% in arthroscopic procedures and between 25% and 33% in cadaver dissections [3, 7, 9, 17].

Although some authors believe that it rarely is symptomatic, is being diagnosed too often, and is confused with meniscal injuries [15, 26], there are reports stating that a symptomatic plica is found in 4% of all arthroscopies and constitutes 28% of all internal derangement cases [8, 24]. Our finding mirror that of Koshino and Okamoto who reported a symptomatic medial plica to be found in 13% of all arthroscopic procedures [18]. The cases in this report made up 14% of the arthroscopic procedures during the study period. Misdiagnosis of the syndrome is frequent. Farkas et al. claim that only three of the 14 cases they have treated for medial plica syndrome received a correct diagnosis prior to the procedure [10]. In another series, 32% of the plica cases were preoperatively misdiagnosed as meniscal lesions [5].

Surgical treatment is indicated if conservative therapy fails [9, 16]. Arthroscopic complete excision of the plica is the preferred method of surgical treatment. The reported results of surgery vary between 65% and 100% good or excellent [8, 10, 12, 14, 18, 23]. Good or excellent results decrease to as low as 40% when a cartilage lesion is present [14]. The impingement lesion is defined as the localized femoral condylar ridge or groove of the articular surface that impinges upon the plica with increasing flexion, and its incidence is reported as 14% [8]. Frequency of the secondary chondromalacia or impingement lesion varies between 13% and 49% [14, 23]. Although some authors believe that the presence of the chondral lesion does not change the surgical outcome [10, 12, 23], other emphasise its influence on long-term results [14]. We observed a cartilage lesion of varying severity in all knees. This may explain why we obtained only 33% good/excellent results in the first, excision of plica only, group, and encountered recurrence in two knees and continuation of symptoms in one knee. When the retinacular band was excised in addition to simple removal of the synovial fold, the success rate increased to 100%.

The femoral condylar chondropathy is thought by some authors to be mechanical damage caused by direct contact from the bowstringing plica [4, 21]. Other authors believe that the erosion of the chondral surface of the medial femoral condyle is caused by local synovitis secondary to irritation by the synovial fold rather than a mechanical injury [2, 13]. History of blunt trauma or, more often, overuse of the knee is usual in the plica syndrome and has been reported in 50% of patients [12]. Sometimes, no special condition is necessary [9]. Trauma or overuse injury probably initiates the synovitis. An increased number of nerve elements has been demonstrated in the substance of the plica, contributing to the symptoms of pain [11]. We believe that retinacular bands may have a role in both the development of local synovitis and the mechanical irritation of the femoral condyle.

Despite improvement, mild symptoms may persist after excision of the plica alone [3]. Inferior results of treatment of plica syndrome compared with other arthroscopic procedures have been reported [8, 16]. We made diagnoses based on the palpable tender band medial to the medial edge of the patella. We noticed that in some patients, the band was still palpable after complete excision of the medial patellar plica and disappeared only after resection of the thick retinacular band beneath. It is known that the plica does not always correspond to the palpated cord [25]. In a case series, the cord-like mass, palpable in 30 knees, disappeared in 25 postoperatively [18].

We dissected the medial side of the knee in five embalmed cadavers. The medial side of the knee is comprised of a three-layered tissue-plane system as described by Warren and Marshall [28]. The medial patello-femoral and patello-meniscal ligaments rest on the second layer, which is superficial to the joint capsule and deep to the deep fascia [27]. We found that the retinacular bands that we excised lie inferior and deep to the medial patellofemoral ligament and deep to the patellomeniscal ligament (Fig. 3).

The medial patello-femoral and patello-meniscal ligaments are the major restraints preventing lateral patellar instability [1]. The retinacular bands that come into view after excision of the medial patellar plica, lie a safe distance from the medial patello-femoral ligament and thus excision of these bands does not affect the restraining function of the ligaments. We believe this procedure does not affect patellar stability, improves treatment outcome, and decreases the recurrence rate of medial synovial plica syndrome.

References

1. Amis AA, Firer P, Mountney J, Senavongse W, Thomas NP (2003) Anatomy and biomechanics of the medial patellofemoral ligament. *Knee* 10:215–220
2. Barber FA (1987) Fenestrated medial patella plica. *Arthroscopy* 3:253–257
3. Broom MJ, Fulkerson JP (1986) The plica syndrome: a new perspective. *Orthop Clin North Am* 7:279–281
4. Calpur OU, Tan L, Gurbuz H et al (2002) Arthroscopic mediopatellar plicaectomy and lateral retinacular release in mechanical patellofemoral disorders. *Knee Surg Sports Traumatol Arthrosc* 10:177–183
5. Chen Y, Sun C, Wang W, Zhang W (1997) The mediopatellar plica syndrome of knee in 61 cases. *Hunan YiKe DaXue XueBao* 22:330–332
6. Cothran RL, McGuire PM, Helms CA, Major NM, Attarian DE (2003) MR imaging of infrapatellar plica injury. *AJR Am J Roentgenol* 180:1443–1447
7. Dandy DJ (1990) Anatomy of the medial suprapatellar plica and medial synovial shelf. *Arthroscopy* 6:79–85
8. Dorchak JD, Barrack RL, Kneisl JS, Alexander AH (1991) Arthroscopic treatment of symptomatic synovial plica of the knee. Long-term follow-up. *Am J Sports Med* 19:503–507
9. Dupont JY (1997) Synovial plicae of the knee. Controversies and review. *Clin Sports Med* 16:87–122
10. Farkas C, Gaspar L, Jonas Z (1997) The pathological plica in the knee. *Acta Chir Hung* 36:83–85
11. Farkas C, Hargitai Z, Gaspar L et al (2004) Histological changes in the symptomatic mediopatellar plica. *Knee* 11:103–108

12. Hansen H, Boe S (1989) The pathological plica in the knee. Results after arthroscopic resection. *Arch Orthop Trauma Surg* 108:282–284
13. Hardaker W Jr, Whipple TL, Bassett FH III (1980) Diagnosis and treatment of the plica syndrome of the knee. *J Bone Joint Surg Am* 62:221–225
14. Harrewyn JM, Aignan M, Renoux M, Delbarre F (1982) Synovial folds of the knee (plica synoviales). Treatment under arthroscopy. *Rev Rhum Mal Osteoartic* 49:3–9
15. Irha E, Vrdoljak J (2003) Medial synovial plica syndrome of the knee: a diagnostic pitfall in adolescent athletes. *J Pediatr Orthop B* 12:44–48
16. Johnson DP, Eastwood DM, Witherow PJ (1993) Symptomatic synovial plicae of the knee. *J Bone Joint Surg Am* 75:1485–1496
17. Klein W (1983) The medial shelf of the knee. A follow-up study. *Arch Orthop Trauma Surg* 102:67–72
18. Koshino T, Okamoto R (1985) Resection of painful shelf (plica synovialis mediopatellaris) under arthroscopy. *Arthroscopy* 1:136–141
19. Munzinger U, Ruckstuhl J, Scherrer H (1981) Internal derangement of the knee joint due to pathologic synovial folds: the mediopatellar plica syndrome. *Clin Orthop* 155:59–64
20. Ogata S, Uthoff H (1990) The development of synovial plicae in human knee joints: an embryologic study. *Arthroscopy* 6:315–321
21. Patel D (1986) Plica as a cause of anterior knee pain. *Orthop Clin North Am* 17:273–277
22. Pidorian AJ, Weinstein RN, Buuck DA, Fulkerson JP (1997) Correlation of patellar articular lesions with results from anteromedial tibial tubercle transfer. *Am J Sports Med* 25:533–537
23. Richmond JC, McGinty JB (1983) Segmental arthroscopic resection of the hypertrophic mediopatellar plica. *Clin Orthop* 178:185–189
24. Saengnipanthkul S, Sirichativapee W, Kowsuwon W, Rojviroj S (1992) The effects of medial patellar plica on clinical diagnosis of medial meniscal lesion. *J Med Assoc Thai* 75:704–708
25. Strobel MJ (2002) Synovial Plicae. In: *Manual of Arthroscopic Surgery*. Springer, Berlin Heidelberg New York pp 253–266
26. Tindel NL, Nisonson B (1992) The plica syndrome. *Orthop Clin North Am* 23:613–618
27. Tuxoe JI, Teir M, Winge S, Nielsen PL (2002) The medial patellofemoral ligament: a dissection study. *Knee Surg Sports Traumatol Arthrosc* 10:138–140
28. Warren LF, Marshall JL (1979) The supporting structures and layers on the medial side of the knee. *J Bone Joint Surg Am* 61:56–62