Arthroscopic treatment of symptomatic type D medial plica

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Abstract We aimed to review the results of subtotal arthroscopic resection of symptomatic type D medial plica. We retrospectively evaluated 23 knees with symptomatic type D medial plica in 22 patients without other intra-articular pathology. All patients complained of chronic knee pain that had not been alleviated by medical treatment or physical therapy. In only three (13%) of the patients studied was the plica diagnosed pre-operatively with magnetic resonance imaging. The type D medial plicae in our series were classified as fenestrated (14 knees), torn (5 knees), or reduplicated (4 knees). Fibrotic changes in the plicae and degenerative changes on the medial femoral condyle were found in 16 knees. Patellofemoral chondromalacia was present in three knees. Arthroscopic partial resection was performed in all patients. Comparative Lysholm Knee Scale scores before and after surgery revealed a significant clinical improvement (pre-operative status, 67.19 ± 8.05 vs. post-operative status, 90.57 ± 9.80 ; $P < 0.001$). Type D medial plica should be considered as a possible cause of

chronic knee pain. Arthroscopic partial resection of the plicae in symptomatic patients gives satisfactory results.

Résumé Nous avons revu, pour cette étude, les résultats de la résection arthroscopique des plica internes symptomatiques de type D. Cette étude rétrospective a évalué 23 genoux présentant une telle pathologie dont 22 patients sans autre anomalie intra-articulaire. Tous les patients se plaignaient de douleurs chroniques du genou non améliorées par le traitement médical ou kinésithérapique. Seulement 3 patients (13%) ont bénéficié d'un diagnostic pré-opératoire par IRM. Ceux-ci étaient classés dans notre série comme « fenestré » (14 genoux), rompus (5 genoux) et redupliques (4 genoux). Des modifications fibreuses et dégénératives du condyle fémoral interne ont été trouvées dans 16 genoux de même qu'une chondromalacie fémoro patellaire (3 genoux). Une résection arthroscopique a été réalisée chez tous les patients. Ceux-ci ont été évalués selon le score de Lysholm en pré et post-opératoire. L'amélioration a été significative (en préopératoire, $67,19 \pm 8,05$, post-opératoire $90,57 \pm 9,80$, $P < 0,001$). Le plica interne de type D peut donc être considéré comme une cause possible de douleur chronique du genou, sa résection arthroscopique entraîne des résultats parfaitement satisfaisants.

Keywords Medial plica · Patellofemoral pain · Arthroscopy

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Introduction

Medial plica, a normal synovial remnant of mesenchymal tissue [3, 20], has its origin on the medial wall of the knee joint, runs obliquely, and inserts onto the synovium to cover the medial infrapatellar fat pad [5]. The existence of a medial plica is a common arthroscopic finding in adults, in which population the frequency of medial plica ranges from

19% to 60% [1, 7, 13, 14, 22], but it is rarely a cause of discomfort [20, 22]. A hypertrophic medial plica is one of the causes of the anterior knee pain [8]. Repetitive mechanical injury or direct trauma may cause chronic inflammation, fibrosis, and thickening of the plica, which may then cause symptoms [5] such as pain, crepitus, snapping, popping, or effusion. The clinical picture of medial plica mimics that of medial meniscal tears or patellar maltracking [9]. The snapping plica can sometimes be palpated at the medial edge of the patella, and local compression can cause pain [12].

Medial plicae have been classified into four types according to Sakakibara [24]. Type A is a small cord-like ridge on the medial wall. Type B has a shelf-like appearance, but does not cover the anterior surface of the medial condyle. Type C is a large shelf that covers the anterior medial femoral condyle. Type D, which has the lowest prevalence, but the greatest clinical importance, has a double insertion into the medial wall [16, 24, 25]. We included only type D medial plica, which is considered most likely to cause problems [6, 16, 21]. The goals of this study were to identify the arthroscopic findings of patients with symptomatic type D medial plica and to review the results of arthroscopic surgery.

Patients and methods

Medical records of 3,138 arthroscopies were accessed from March 2000 to August 2004. Arthroscopic treatment was performed by six surgeons in two medical centres. Medical records were investigated by two examiners. Twenty-three knees in 22 patients (8 women and 14 men) with a symptomatic type D medial plica were selected for this study and evaluated retrospectively according to medical records. Plicae that were accompanied with other intra-articular pathologies such as meniscal tear and ligamentous injury were excluded from the study. All patients complained of chronic knee pain that had not been relieved by nonsteroidal anti-inflammatory medications and quadriceps exercises for at least 3 months before operation.

In all patients, clinical symptoms and physical, radiological and intra-operative findings were evaluated. Pre-operative and post-operative Lysholm Knee Scale scores were assessed from the information in medical records. Post-operative scores were calculated on the third week follow-up (18–29 days). Every patient was scaled (0–100) related with their complaints during activities. After the first day of operation, patients are allowed mobilisation and physical therapy was begun. MRI graphics of type D plica were carried out, reviewed retrospectively and searched for findings of pathological plica. The average follow-up period was 21 months (range 13–24 months). No clinical deterioration was encountered during the follow-up period.

All patients were treated with arthroscopic surgery under tourniquet. Anteromedial, anterolateral, and superolateral portals were used. The arthroscope was placed through the anterolateral portal, and each plica was partially resected with punch and shaved through the anteromedial and superolateral portals. There was no need to control bleeding. Early post-operative range of motion and weight-bearing was allowed in all patients.

Photographic documentation of plicae was evaluated retrospectively for subtyping. Type D medial plicae were further classified into three subgroups according to Matsusue's classification as fenestrated, reduplicated, or torn [16]. The degeneration on the contact surface of the medial femoral condyle cartilage with the plica was evaluated according to the modified Outerbridge classification [21]. Statistical evaluation of Lysholm knee scores was made by using paired *t* test.

Results

The mean age of the patients was 42.4 years (range, 23–60 years). Fifteen right knees and eight left knees were studied. One patient exhibited bilateral involvement. Six patients had a history of trauma, and the remaining patients described an insidious onset of symptoms. During the pre-operative physical examination, all patients reported chronic knee pain. The localisation of that pain was anterior in 5 knees, medial in 11, lateral in 2, and both anterior and medial in 5. The minimum time interval from the onset of symptoms to surgery was 3 months. The results of the patellar grinding test (manual patellofemoral compression against quadriceps contraction) were positive in seven knees. In addition to pain, one patient complained of swelling in the knee and restricted range of motion, and another reported a “giving way” sensation.

Magnetic resonance imaging (MRI) studies were conducted in 20 (87%) patients, and medial plica was demonstrated pre-operatively in only 3 (15%) of those individuals. A hypointense band anterior to the medial condyle was defined as medial plica on T1-weighted and T2-weighted magnetic resonance images. Grade II degeneration of the medial meniscus was found in eight patients during evaluation by MRI.

All medial plicae were identified via arthroscopic examination and were classified as torn (5 knees) (Fig. 1), reduplicated (4 knees) (Fig. 2), or fenestrated (14 knees) (Fig. 3). Hypertrophic changes of the plica, such as thickening or loss of elasticity, were found in 16 knees that exhibited degenerative changes on the medial femoral condyle. Those degenerative changes were noted on the cartilage surface of the medial femoral condyle that was in contact with the medial plica. According to the Outerbridge

Fig. 1 Torn medial plica with multiple perforations in a 45-year-old female patient

classification, seven knees had no degeneration, one knee had grade I degeneration, eight knees had grade II degeneration, and seven knees had grade III degeneration on the medial femoral condyle (Table 1). Four knees had softening of the patellar cartilage, which could be confirmed by palpation with probe. Three knees had no intra-articular degenerative findings and were completely normal except their hypertrophic plica. Additional intra-articular lesions that could have been a source of symptoms were not identified in any of the patients studied; all medial menisci were intact. In the early post-operative period, two patients had restriction in the range of motion because of effusion, but they resolved after 2 weeks. The patients' complaints cleared up in the follow-up period. The functional outcome was satisfactory in 20 patients. Three knees of two patients who had a score below 75 complained of pain. One of them was the oldest patient in our group who had advanced degenerative changes in the medial femoral compartment (G2 and G3). The other patient defaulted on physical therapy. All of the patients regained a full range of motion. The paired samples *t* test indicated a statistically significant difference ($P < 0.01$) between pre-operative (67.19 ± 8.05) and post-operative (90.57 ± 9.80) Lysholm Knee Scale scores.

Discussion

The plicae are remnants of mesenchymal tissue [3, 20]. The medial plica was described by Iino in 1939 [10] and was later classified into four types by Sakakibara [24]. Type D

is a large shelf that covers the anteromedial femoral condylar surface and has a double insertion on the medial wall. Matsusue and colleagues found that the rate of the symptomatic plica was 1.9% in their series and divided the type D classification into three subgroups (fenestrated, reduplicated, or torn) [16]. Our prevalence of symptomatic plica (0.73%) was not as high as their result. The discrepancy can be explained by the exclusion criteria of our study. We did not include the patient with intra-articular pathologies other than the symptomatic plica. The fenestrated plicae had the highest prevalence (70%) in their study [16]. We had similar results. Most of our patients (57%) who required surgery had a fenestrated plica.

Medial plicae usually cause no symptoms. Type D plica is less common, but is more likely to cause symptoms because it may impinge on the medial femoral condyle and the medial patellar facet [5, 22]. Type D plicae are believed to cause symptoms after acute or repetitive trauma stimulates an inflammatory reaction. Local synovitis and irritation of the nerve endings induce the subsequent knee pain [18]. All of our patients complained pre-operatively of chronic knee pain lasting more than 3 months. A history of acute knee trauma was reported by only five of our patients. We postulated that chronic repetitive injuries were probably responsible for the symptoms in our other patients, but we do not have specific data to support this conclusion.

Fibrotic changes occur in the plicae as a result of chronic inflammation [8]. A medial plica in close contact with the medial femoral condyle abrades the chondral surface during flexion of the knee [19]. This type of mechanical irritation results in degenerative changes [15]. The combination of chondral and inflammatory changes may be responsible for

Fig. 2 Arthroscopic view of a reduplicated plica in the left knee of a 54-year-old male patient

Fig. 3 Right knee of a 40-year-old male patient. Note the fenestrated medial plica during the extension (A) and flexion (B) of the knee, the impingement between the plica and the femoral condyle (white

arrow), and the degeneration of the cartilage on the medial condyle (black arrow) after resection of the plica (C)

knee pain. Barber found that the symptoms caused by a medial plica were relieved by resection in 80% of his patients, although the noticeable articular cartilage disruptions on the medial femoral condyle were present in only one-third of the knees of those patients [1]. Chow and colleagues found no

relationship between symptoms and cartilage lesions caused by a hypertrophic synovium [4]. We noted that medial femoral condyle degeneration correlated with hypertrophic changes such as thickening and stiffness in the plica. Although the chondral lesions remained in 16 patients whose

Table 1 Demographics, arthroscopic findings and pre-operative and post-operative Lysholm Knee Scale scores of the study subjects

Patient no.	Sex	Age (years)	Knee	Type of plica	Lysholm Knee Scale scores		Pain site	Knee trauma history	MFCD (Outerbridge classification)
					Pre-operative	Post-operative			
1	F	38	R	Torn	73	95	LAT	No	G2
2	F	50	R	Fenestrated	73	95	PF	No	G0
3	F	51	L	Torn	75	95	PF + MED	No	G3
4	M	59	L	Reduplicated	65	85	PF	No	G3
5	F	52	L	Reduplicated	70	95	MED	No	G3
6	M	52	L	Reduplicated	73	100	PF + MED	No	G2
7	M	25	R	Torn	80	100	MED	Yes	G2
8	M	34	L	Fenestrated	73	100	MED	Yes	G0
9	M	52	R	Torn	78	100	MED	No	G0
10	F	55	R	Fenestrated	75	95	PF	No	G0
11	M	35	R	Fenestrated	70	100	MED	No	G0
12	F	60	R	Fenestrated	58	74	PF + MED	No	G3
13*	F	60	L	Fenestrated	60	74	PF + MED	No	G3
14	M	49	R	Reduplicated	51	95	PF	No	G2
15	M	47	R	Fenestrated	64	100	MED	No	G2
16	M	46	R	Fenestrated	60	94	MED	No	G3
17	F	25	R	Fenestrated	62	80	MED	Yes	G2
18	M	45	L	Fenestrated	64	70	PF + MED	Yes	G1
19	M	18	R	Fenestrated	52	80	LAT	Yes	G0
20	M	23	R	Fenestrated	65	85	MED	Yes	G0
21	M	28	R	Fenestrated	70	90	PF	No	G2
22	F	40	L	Fenestrated	69	95	MED	No	G2
23	M	32	R	Torn	65	85	MED	Yes	G3

F: female, M: male, R: right, L: left, MED: medial, LAT: lateral, PF: patello-femoral, G: grade, MFCD = medial femoral condyle degeneration

lesions varied between grade 1 and grade 2, the pain was relieved in all of our patients who underwent medial plica resection. We concluded that the pain was generated by inflammatory changes caused by the medial plica and that the cartilaginous lesions did not contribute significantly to the patient's symptoms.

Physical examination is an important diagnostic tool for medial plica. However, medial plica can mimic other intrarticular disorders such as meniscal tears, patellar chondromalacia, or patellar maltracking [7, 25]. Pain caused by medial plica is usually localised to the anteromedial part of the knee. However, Matsusue and colleagues have shown that pain was localised on the lateral side of the knees in 50% of the patients with type D plica in their series [16]. Only two patients had lateral knee pain in our series, although the cause of that pain was not clear. The pain may have been due to the effect of traction on the lateral side of capsule through the infrapatellar fat pad and plica alaris lateralis [6].

MRI may be useful in the diagnosis of plica. Jee and colleagues have reported a sensitivity of 95% and a specificity of 72% for the diagnosis of plica by MRI [11]. On MRI, the medial plica is seen as a hypointense medial synovial band between the medial border of the patella and the synovium. However, the decision to operate should not be made solely on the basis of MRI findings, because most plicae cause no symptoms. No imaging studies can reliably differentiate a normal plica from an abnormal plica. Furthermore, it is not possible to identify the subtypes of type D medial plica with MRI [2].

Pre-operative MRI findings were not diagnostic in 87% of our patients. However, the results of MRI were useful in excluding other intra-articular lesions, such as meniscal tears, that may have caused symptoms. We were not able to diagnose pathological plica in most of our patients before the operation. The precise diagnosis was made during the arthroscopic operation. The decision to operate was based on clinical criteria and made after the patient had undergone a minimum of 3 months of medical and physical therapy. Some authors have advocated intraplica steroid injection as the initial step of treatment [23]. We did not perform the steroid injection because we are not able to have a precise diagnosis before arthroscopic surgery. We also believe that empirical treatment with a steroid injection that is administered before the diagnosis can be confirmed via arthroscopy is unnecessary.

Excellent results have been reported after the excision of symptomatic medial plica in most of the series published in the literature [9, 12, 17]. Equally good clinical results have been achieved after total or partial resection [12]. Subtotal resection was performed in all of our patients. We retained a peripheral rim of plicae to avoid irritating the capsule and to prevent scarring. Partial resection yielded satisfactory

results according to post-operative Lysholm Knee Scale scores. No revision was needed for the additional resection of the remaining crest.

We concluded that type D medial plica should be considered as a possible cause of chronic knee pain. Arthroscopic partial resection of the plica in symptomatic patients produces excellent results.

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