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Case Report

Deep MCL injury cases with arthroscopic findings of hypermobile medial meniscus: A report of six cases of arthroscopic meniscal suture repair

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ABSTRACT

MRI did not detect any abnormality in the medial meniscus besides high-intensity changes at the meniscofemoral portion of the deep medial collateral ligament. Although pure valgus stress test proved no medial joint widening at 0° and 30°, when an examiner applied knee valgus and tibial external rotation force, the patient experienced pain in the anteromedial knee joint that coincided with their refractory symptoms in individual specific activity. Arthroscopy investigation confirmed that the anterior to middle segment of the medial meniscus had excessively slid into the central direction by a probe-drawing manoeuvre; synchronous meniscal movement in the valgus and external rotation test was also observed. After arthroscopic meniscal suture to the lesion had suppressed the abnormal meniscal movement, the patients' refractory anteromedial symptoms disappeared immediately. From their common history of medial collateral injury and the high intensity at the deep medial collateral ligament, we assumed that chronic deep medial collateral ligament impairment sustained the hypermobility of the medial meniscus. Arthroscopic confirmation of hypermobility led to definitive treatment of a simple meniscal suture. Painful deep MCL injuries with hypermobile medial arthroscopic findings are not a rare phenomenon as previously assumed; however, surgeons often fail to recognize its latent clinical features.

Introduction

Medial collateral ligament (MCL) injury is the most common ligamentous injury of the knee.[1] The deep MCL functions as a secondary restraint to valgus load[2] and rotational stability in early flex.[3] The structure of the ligament consists of a thickened medial joint capsule attached to the medial meniscus and is composed of meniscofemoral and meniscotibial portions.[4] Rupture of these structures leads to medial meniscal excessive mobility.[5]

On the other hand, a hypermobile meniscus is one of the kinematics that recognizes meniscal instability. It manifests as abnormal mobility of the meniscus that can cause knee joint pain without substantial meniscus tear.[6] Most cases of hypermobility occur in the lateral meniscus. However, cases of medial meniscal hypermobility are less reported.[7–9] Some are traumatic and some are non-traumatic[8] and most reports of anterior medial knee pain caused by hypermobility of the medial meniscus were accompanied by substantial meniscal tears[10] or by normal variants of the anterior horn detachment from the tibia.[11] A case of hypermobile medial meniscus without meniscal structural tear was reported by Sanada et al.[9] They stated that the pure medical meniscal hypermobility without tear that causes anteromedial knee pain was even rarer because there was no previous report that mentioned the same pathokinematics as their report. However, from August 2015 to February 2019, we encountered six patients who experienced persistent anteromedial knee joint pain with arthroscopic findings indicating hypermobile medial meniscus. Their symptom was assumed to be associated with chronic deep MCL injuries. All patients were treated successfully by arthroscopic meniscal suture. Here, we present the characteristic symptoms, examination, and MRI findings of deep MCL injury with hypermobility of medial meniscus to diagnose its unique pathology. Furthermore, we present the clinical outcomes of the six patients after effective surgical treatments.

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Case report

Six patients diagnosed with hypermobile medial meniscus were treated in our hospital from August 2015 to February 2019. Patient characteristics and clinical history were reviewed. There were one male and five females with a mean age of 23.7 (range 19–41) years. The mean follow-up was 17.2 (range 7–24) months. The preoperative evaluations included the Lysholm score and Tegner activity score (Table 1).

Five patients were injured during sports activity, and one patient twisted the knee during heavy labour work. All of them sustained anterior medial knee pain in their specific sports or labour work, but the pain was insignificant in daily life. Noteworthy, all had a history of MCL injury. Five had been treated conservatively, while the other one underwent MCL reconstruction with an autograft of a semitendinosus tendon.

Examinations and diagnosis

Physical examination

Physical examinations showed no medial joint tenderness and secured normal range of motion of the knee. There were no notable positive findings in the examinations of the valgus stress test at 0° and 30° or McMurray test. In all cases, valgus and external rotation tests (Fig. 1) elicited pain on the anterior medial site of the knee.

Images

Radiographic findings were normal, including that on the valgus stress radiograph, without any side-to-side instability difference. MRI revealed high-intensity changes at the meniscofemoral portion or anterior structure subjacent to the deep medial collateral ligament in all cases, while normal superficial medial collateral ligament was seen in five cases and preservation of the linear alignment with low intensity of the graft was seen in one case of post-MCL reconstruction (Fig. 2A–F). There was no intensity change to the substance of the medial meniscus.

Arthroscopy investigation

Arthroscopy showed no ligament or cartilage damage in any patient. The medial meniscal surface was smooth; however, the middle to anterior segment of the medial meniscus excessively glided in the intercondylar direction when it was drawn by an arthroscopic probe. Similar abnormal movement of the medial meniscus was observed in the valgus and external rotated position (Video 1), as the patients had complained of anteromedial pain at the examination booth.

Supplementary video related to this article can be found at https://doi.org/10.1016/j.asmart.2020.05.002

Table 1
Preoperative demographic data.

Case	Age	Sex	Injury	Score		Treatment of
			situation	Tegner	Lysholm	MCL injuries
1	41	F	Volleyball	6	90	conservative
2	20	F	Ice hockey	9	80	conservative
3	20	F	Ice hockey	9	85	conservative
4	21	M	Japan Kenpo	9	95	reconstruction
5	19	F	Life saving	7	–	conservative
6	21	F	Heavy labor	7	70	conservative

Fig. 1. Valgus external rotation tests.
Valgus external rotation tests elicited pain on the anterior articular aspect of the knee.

Treatment and rehabilitation

Treatment

Arthroscopic surgery was performed to stabilize the medial meniscus. After rasping at the meniscocapsular lesion, we performed meniscal suture repair with the mean of 5.5 (range 5–6) stiches by inside-out or outside-in suture technique with #2-0 braid from the middle to anterior segment of the medial meniscus. The meniscal hypermobility was diminished by either a probing manoeuvre or valgus and external rotation stress test (Video 2).

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Rehabilitation

Immediate partial weight-bearing with double crutches and a range of motion exercise between 0° and 120° flexion angle were started the day after surgery. Full weight-bearing was initiated 2 weeks after surgery. Four weeks after surgery, free range of motion exercise was permitted. The patients started jogging 2 months after surgery and returned to sports activities at 3 months post-operation.

Postoperative course

Immediately after surgery, the preoperative positive valgus and external rotation tests turned negative. There were no complications or re-damage, and all patients returned to sports without anterior medial knee pain on mean 4.5 (range 3–7) months after surgery.

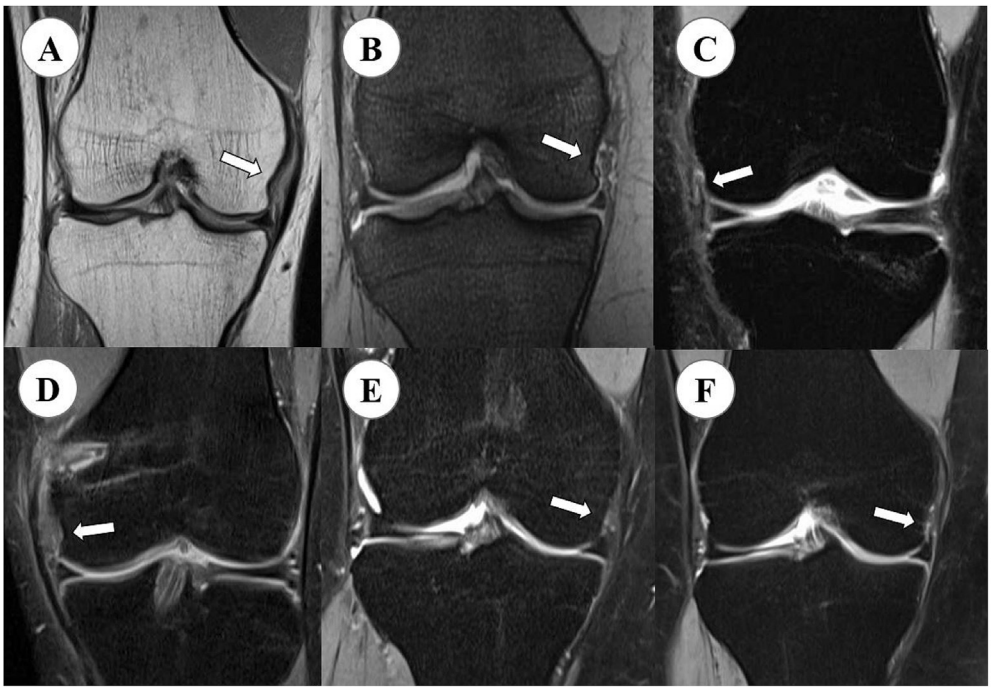

Fig. 2. A–F: Preoperative MRI. 2A: Case 1; 2B: Case 2; 2C: Case 3; 2D: Case 4; 2E: Case 5; 2F: Case 6.
MRI revealed high-intensity changes at the meniscofemoral portion of the deep medial collateral ligament in all cases (White arrows). However, there were no damage to the substance of the medial meniscus and superficial medial collateral ligament.(Fig. 2A–C,E,F/case 1-3,5,6.), except for the case of reconstruction with semitendinosus tendon was low-intensity in Case 4 (Fig. 2D/case 4).

Discussion

We assumed that chronic, deep MCL injury was the primary reason for patients' impairment. In the series, we found that the manoeuvre that applied knee valgus and tibial external rotation force evoked anterior knee pain in the patients. Narvani et al.[12] reported a case series of the same symptoms in patients with deep MCL injuries. A small subgroup after MCL injury was unable to return to high-level sports. Patients did not experience pain in daily life, and symptoms appeared only when participating in sports. The patients also experienced pain when the valgus and external rotation force was applied to the knee at the physical examination. Impairment of the deep MCL provoked anterior medial knee pain by stretching the deep MCL in the valgus in a slightly flexed knee position. Meniscofemoral deep MCL injury without superficial MCL injury was proved by MRI findings of their series. So as their report, our cases supported the prudent MRI findings of intensity change from the meniscofemoral portion of the deep MCL to the adjacent anterior capsule site linking to the anterior medial meniscus rim. Nevertheless, we confirmed anteromedial meniscal excessive movement by confirmative arthroscopy. Concerning meniscal hypermobility, various symptoms and physical examination findings that predict hypermobility of the medial meniscus have been mentioned. Common symptoms in previous reports include tenderness of the medial joint space, including locking, pain at rest, and range of motion restrictions.[8] Other studies reported that the anterior horn of the snapping medial meniscus was anteriorly subluxed during extension with reduction during flexion; only 11% of patients with meniscal hypermobility complained of pain on the anterior articular surface of the knee.[7,13] However, our cases were different from the previous reports. Our patients experience no range of motion loss or tenderness at the anteromedial joint space. They had no obstacles to activities of daily living, and their symptoms were mainly limited to the anteromedial knee pain during sports or heavy work while pivoting.

There was only one case report on deep MCL impairment linked with hypermobility of the medial meniscus.[9] They reported that a patient of hypermobile medial meniscus had a history of MCL injury. After conservative treatment, he continued to experience medial knee pain when planting his foot or kicking a ball but did not suffer when performing activities of daily living. Arthroscopy observation detected that the anterior segment of his medial meniscus was easily drawn to the centre of the tibial plateau with an arthroscopic hook probe. They also assumed that the pathology for sustained abnormal mobility of the meniscus was caused by irregular healing at the meniscocapsular lesion following deep MCL injury.

This case is quite similar to our cases regarding mechanism of injury, appearance of symptoms, and imaging findings.

According to the pathology, direct repair of the deep MCL could be chosen as one of the optimal surgical treatments. In fact, Narvani et al.[12] reported that deep MCL repair was an effective treatment. In our cases, stabilizing the meniscus by the simple meniscus suture technique without deep meniscofemoral ligament repair could generate satisfactory outcomes. Actually, our suture technique noted that the suture site was not directly located in the meniscofemoral portion of the deep MCL, but rather at the anterior site of the deep MCL where the medial meniscus slid by a hook probe. Aydıngoz et al.[14] reported the existence of a capsulofemoral band located subjacent to the deep MCL. The fibrous band attaches proximal to the deep MCL origin to the anteromedial medial meniscus rim, though there was no distinct structure widely investigated. In our cases, the MRI findings indicated that the abnormal intensity change from the meniscofemoral portion of the deep MCL to the possible capsulofemoral band was anteriorly adjacent; therefore, our surgical procedure stabilized the capsulofemoral band and deep MCL complex through meniscal sutures.

We believe that the two different procedures namely, the open

deep MCL repair by Narvani et al.[12] and our arthroscopic meniscal suture shared a common concept for effective treatment of deep MCL and adjacent fibrous band stabilization.

Conclusion

Deep MCL injury with medial meniscal hypermobility should be suspected in patients presenting with anterior medial knee pain, history of MCL injury, positive valgus and external rotation test, and high-intensity changes of deep MCL or adjacent structure by MRI. In an arthroscopic investigation, the excessive mobility of the meniscus linked to deep MCL impairment can be confirmed when the valgus external rotation position is applied. Meniscus suturing is an effective treatment that suppresses abnormal mobility by simultaneously stabilizing the deep MCL ligament and fibrous band. When the valgus and external rotation test evokes anteromedial knee pain, surgeons should assume that the chronic injury at the meniscofemoral portion of the deep MCL is related to anteromedial meniscal hypermobility of the medial meniscus via a confirming arthroscopy.

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Declaration of competing interest

All authors have no conflicts of interest relevant to this article.

Appendix A. Supplementary data

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