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Arthroscopic Diagnosis of Occult Posterolateral Meniscocapsular Separations: Another Hidden Lesion

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Abstract

Purpose: The purpose of this study was to describe the surgical findings and clinical outcomes in a series of patients with occult posterolateral meniscocapsular separations diagnosed arthroscopically after a negative MRI.

Methods: A retrospective analysis of prospectively collected data of consecutive patients who underwent surgical arthroscopy with repair of an occult posterolateral meniscocapsular separation by two fellowship-trained orthopaedic sports medicine surgeons at a single institution was performed. All lesions were identified arthroscopically in the posterolateral aspect of the lateral compartment as a distinct pathologic separation between the posterolatreal capsule and adjacent meniscal tissue with increased excursion upon probing. Clinical examination notes, MRI and operative reports were reviewed. Patient reported outcome measures were assessed via patient questionnaire.

Results: A total of six patients were included for analysis. MRI evaluation of the lateral meniscus was unrevealing in 4 patients, suggested a possible tear of the body of the lateral meniscus in one patient and demonstrated a parameniscal cyst abutting the anterior root of the lateral meniscus in another patient. Arthroscopic examination revealed meniscocapuslar separations of the posterolateral meniscus in all six knees with two knees demonstrating concomitant bucket-handle meniscus tears. Patient reported outcomes were determined for 67% of study patients. The average reported IKDC score was 63.8, the average KOS-ADL score was reported as 63, the SF-12 Physical score averaged 46.8 with an average SF-12 Mental score of 59.9.

Conclusions: The diagnosis of occult posterolateral MCS could be missed on advanced imaging, such as MRI, so arthroscopic diagnosis may be required. This study indicates that arthroscopic diagnosis and repair of occult posterolateral MCS results in good functional and clinical outcomes.

Level of Evidence: IV, Therapeutic Case Series

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Introduction

Meniscal tears are the most commonly treated injury of the knee joint and one of the most frequently treated injuries in orthopaedic surgery with an incidence of 61/100,000 in the United States.[1] Left untreated, meniscus tears may compromise joint integrity and have been associated with degenerative changes leading to long-term dysfunction.[2,3] Due to its rigid adherence to the medial collateral ligament (MCL) and relative lack of excursion, the medial meniscus is more commonly injured as compared to the lateral meniscus with the posterior horn most often affected. Classically described tear patterns include radial, horizontal, vertical, complex, flap-type and bucket-handle.[4]

Of the various meniscus tear types, meniscocapsular separations (MCS) are uncommon injuries characterized by detachment of the meniscus from its capsular attachment. This detachment may lead to further instability of the knee with progression of meniscal tear pattern and cartilage injury.[5] Strobel et al. first introduced the term "Ramp Lesion" in 1988 to describe tears involving the meniscocapsular junction at the posterior meniscocapsular zone.[6] Since then, there has been renewed interest in these injuries and the challenges of identifying them on MRI and arthroscopy due to their position in the anatomical "blind spot" of the knee.[7] For instance, the positive predictive values of identifying MCS with MRI has been shown to be as low as 9% for the medial meniscus, and 13% for the lateral meniscus.[8] The majority of these studies have predominantly focused on MCS of the medial meniscus and often involve concomitant injuries. However, there is only one case report in the literature describing an isolated MCS involving the lateral meniscus.[9] A single case report of a lateral MCS has been described in the setting of a rare anatomic aberration known as a double-layered lateral meniscus.[10] The authors describe improvement of clinical symptoms following resection of the upper accessory meniscus and repair of the MCS. Additionally, hypermobility of the posterior horn of the lateral meniscus has been recently identified in case reports and limited case series.[11-14] Although the pathophysiology and optimal treatment have yet to be elucidated, this entity differs from a MCS as it exists in the absence of a discrete tear or traumatic capsular separation and is thought to be due to the disruption of the popliteomeniscal fascicles.

The purpose of this study was to describe the surgical findings and clinical outcomes in a series of patients with occult posterolateral meniscocapsular separations diagnosed arthroscopically after a negative MRI. We hypothesize significantly improved functional and clinical outcomes following arthroscopic repair of occult posterolateral MCS.

Methods

A retrospective analysis of prospectively collected data of consecutive patients who underwent surgical arthroscopy with repair of an occult posterolateral meniscocapsular separation by two fellowship-trained orthopaedic sports medicine surgeons at a single institution was performed between March 2016 through March 2020. All patients had an available preoperative magnetic resonance image (MRI) using a 1.5-T MRI scanner. All MRI sequences were reviewed by one of the senior orthopaedic surgeons and a fellowship-trained musculoskeletal (MSK) radiologist. All patients underwent a period of nonoperative management consisting of physical therapy and administration of non-steroidal anti-inflammatory medication. Indications for surgical intervention included objective complaints of mechanical symptoms and persistent lateral joint line (LJL) pain despite nonsurgical management for more than 3 months duration. Exclusion criteria were as follows: ligamentous instability as determined by positive Lachman, positive pivot-shift, positive anterior-posterior drawer and increased varus-valgus laxity as well as those patients undergoing surgical arthroscopy for ligamentous reconstruction and cartilage injury. Demographic information including age, sex and body mass index (BMI) were collected. Clinical examination notes were reviewed with data collected for chief complaint, laterality, mechanism of injury (MOI), time from injury to surgery and pertinent physical exam findings. MRI and operative reports were reviewed with data collected and recorded with regards to meniscus pathology, ligamentous integrity and degree and location of associated articular cartilage damage. All lesions were identified arthroscopically in the posterolateral aspect of the lateral compartment as a distinct pathologic separation between the posterolateral capsule and adjacent meniscal tissue with increased excursion upon probing (Figure 1).

Patient reported outcome measures were assessed via patient questionnaire at greater than one-month postoperatively with evaluation of the International Knee Documentation Committee score (IKDC), Knee Outcome Survey Activities of Daily Living Scale (KOS-ADL), 12-Item Short Form Survey (SF-12) with inclusion of both the Mental Component Score (MCS-12) and Physical Component Score (PCS-12). Descriptive statistics were determined in an attempt to summarize the sample data.

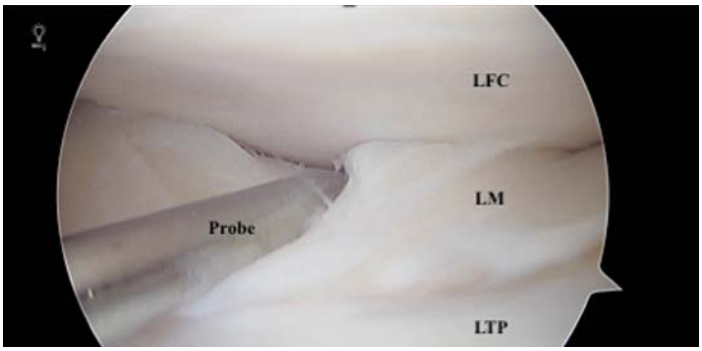

Figure 1. Pathologic Lateral MCS with Increased Meniscal Excursion. LFC = Lateral Femoral Condyle; LM = Lateral Meniscus; LTP = Lateral Tibial Plateau

Results

A total of six patients were included for analysis. Sex characteristics of the cohort are five female and one male (Table 1). The average age of the entire cohort was 44.2 years old with female age range from 31 to 63 years of age and the one male patient aged 36 years old. The average BMI for the cohort was 29.5 (range 19.1 to 39.5). There was an equal distribution of knee laterality (3 right and 3 left). All patients presented with primary complaints of intermittent mechanical locking of the knee resulting in the inability to achieve full extension with significant concomitant pain. Mechanism of injury was reported as atraumatic in 33.3% (2 of 6) of patients with the remaining patients reporting injury as the result of squatting, bus accident, exercise and getting out of bed. All patients demonstrated LJL tenderness on physical examination with an average arc of motion of 136.7° (range −5° to 135°). All other physical exam components, including ligamentous integrity, were unremarkable. The average time from onset of symptoms to arthroscopic evaluation was 45.5 months (range 3 to 144 months). MRI examination of the lateral meniscus was unrevealing in 4 patients, suggested a

Table 1. Patient Characteristics

Case	Age	Sex	BMI	Laterality	MOI	Subjective	Joint Line	ROM	Symptoms to Surgery
1	31	F	24.2	R	Atraumatic	Locking Pain	LJLT	0 to 120	8 months
2	55	F	19.1	L	Atraumatic	Locking Pain	LJLT	-5 to 135	4 years
3	39	F	37.1	L	Squatting	Locking Pain	LJLT	-5 to 135	12 years
4	36	M	23.6	L	Bus Accident	Locking Pain	LJLT	-5 to 135	10 months
5	41	F	33.5	R	Exercise	Locking Pain	LJLT	-5 to 135	5 years
6	63	F	39.5	R	Getting out of bed	Locking Pain	LJLT	-5 to 135	3 months

MOI = Mechanism of Injury; LJLT = Lateral Joint Line Tenderness; ROM = Range of Motion

possible tear of the body of the lateral meniscus in one patient and demonstrated a parameniscal cyst abutting the anterior root of the lateral meniscus in another patient (Table 2). No evidence of MCS was noted on MRI (Figure 2). However, MRI did reveal lateral compartment articular cartilage pathology in 50% of affected knees. Arthroscopic examination revealed MCS of the posterolateral meniscus in all six knees with two knees demonstrating concomitant bucket-handle meniscus tears (Table 3). All MCS lesions and both bucket handle tears were addressed via arthroscopic repair. Concomitant arthroscopic findings included International Cartilage Regeneration and Joint Preservation Society (ICRS) Grade-I pathology of the LFC in three knees, ICRS Grade-II in one knee with two knees sans articular pathology of the LFC. Similarly, diffuse Grade-I articular lesions were arthroscopically identified on the lateral tibial plateau (LTP) in two knees. One knee demonstrated a focal Grade-II articular defect, one knee revealed diffuse Grade-III articular changes and the remaining two knees were without articular abnormality.

Patient reported outcomes were determined for 67% (4 of 6) of study patients (Table 4). The average reported IKDC score was 63.8 (range 50 to 81) with 87 representing the maximum possible score. The average KOS-ADL score was reported as 63 (range 55 to 68). The SF-12 Physical score averaged 46.8 (range 42.7 to 54.2) with an average SF-12 Mental score of 59.9 (range 58.8 to 60.3).

Discussion

Six consecutive patients underwent arthroscopic repair of an occult posterolateral MCS at an average time of 45.5 months from the initial onset of symptoms. Preoperative MRI revealed varying degrees of articular cartilage damage to the LFC and tibial plateau without evidence of posterolateral MCS. Following repair, all patients reported good clinical outcomes with satisfactory IKDC, KOS-ADL, SF-12 Physical and SF-12 Mental scores. Many studies have designated medial MCS as an occult injury, citing anatomic location and limitations with MRI as the cause for missed diagnosis.[7,8,15,16] Greif et al. reviewed anatomic variants of medial MCS with associated MRI findings in an attempt to simplify and standardize the diagnosis.[17] However, the modified classification relies on mechanism of injury, associated ACL injury and associated MRI findings for diagnosis. To our knowledge there is only a single case report involving a patient with an isolated lateral MCS, which was diagnosed via ultrasound following a negative MRI.[9]

Much of the literature regarding medial MCS focuses on younger athletes sustaining a twisting injury, however, our patients were middle aged with varied mechanisms of injury.[16, 18] All six of our patients presented with lateral knee pain and locking symptoms that persisted despite months to years of conservative therapy. Additionally, our patients had normal exams aside from LJL tenderness. Persistent joint line

Table 2. MRI Findings

Case	Meniscus	Collateral Ligament	Cartilage
1	Normal	Normal	Normal
2	Normal	Normal	Chondrosis, LTP
3	Cyst abutting anterior root, LM	Normal	Normal
4	Possible small tear, LM body	Normal	Normal
5	Normal	Normal	Full thickness cartilage defect, LFC
6	Normal	Normal	Subchondral cyst formation

LTP = Lateral Tibial Plateau; LM = Lateral Meniscus; LFC = Lateral Femoral Condyle

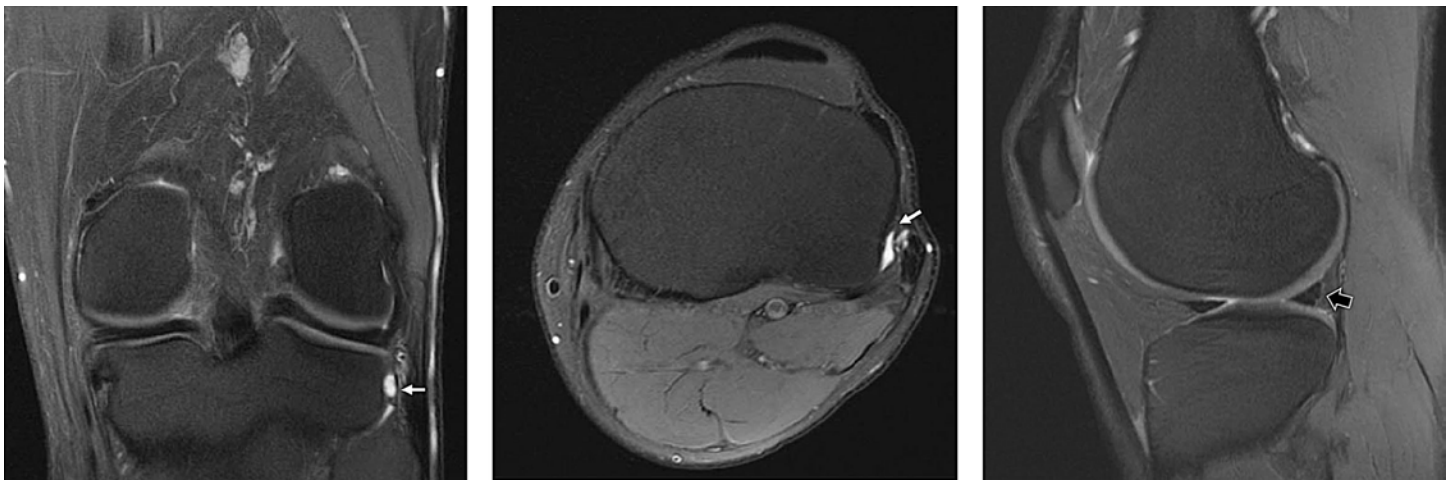

Figure 2. Coronal, Axial and Sagittal MRI Sequences Without Contrast. Images demonstrate a cystic structure along the periphery of the lateral tibial plateau (white arrow, coronal and axial images). This was called a ganglion cyst arising from the proximal tibiofibular joint on initial review. Examination of the posterior horn of the lateral meniscus does not reveal a MCS or adjacent fluid signal (black arrow, sagittal image).

Table 3. Arthroscopic Findings of Lateral Compartment

Case	Meniscus	ICRS Grade, LFC	ICRS Grade, LTP
1	MCS	Normal	Normal
2	MCS	Grade 1	Grade 3, Diffuse
3	MCS and bucket handle tear	Grade 1	Grade 2, Diffuse
4	MCS and bucket handle tear	Grade 2	Grade 2, Diffuse
5	MCS	Grade 1	Grade 2, Focal
6	MCS	Normal	Normal

MCS = Meniscocapsular Separation; ICRS = International Cartilage Regeneration and Joint Preservation Society; LFC = Lateral Femoral Condyle; LTP = Lateral Tibial Plateau

Table 4. Patient Reported Outcomes

Case	Follow-up (mos)	IKDC	KOS-ADL	SF-12 Physical	SF-12 Mental
1*	3	-	-	-	-
2	7	71/87	67/70	54.2	58.8
3	39	81/87	68/70	44.2	60.5
4*	26	-	-	-	-
5	1	50/87	55/70	45.9	60.1
6	18	53/87	62/70	42.7	60.3

IKDC = International Knee Documentation Score; KOS-ADL = Knee Outcome Survey-Activities of Daily Living; SF-12 United States Average = 50
*Patients unable to be contacted to administer questionnaires

tenderness is consistent with previous reports of medial MCS and should raise clinical concern despite the presence of unrevealing imaging.[18-19] Although subtle findings of cartilage defects and small cysts were identified on MRI in this series, no definitive lateral meniscus tears or MCS were identified on preoperative imaging. One patient's report noted a possible small tear of the body of the lateral meniscus, but there was no evidence of MCS or posterior horn involvement. Despite a fellowship trained MSK radiologist scrutinizing the images, 100% of the MCS were missed on imaging in this study. Although a 1.5T scanner was utilized for image analysis, the literature has demonstrated no benefit of 3T as compared to 1.5T scanners in the ability to diagnose MCS.[18,19]

Arthroscopy provided the definitive diagnosis of lateral MCS for all six patients in this study and should be considered the gold standard for diagnosis of this occult lesion. The lengthy average time of 45.5 months (range 3-144 months) from symptom onset to arthroscopic intervention was secondary to the absence of positive advanced MR imaging resulting in extended conservative nonoperative management. Additionally, degenerative changes to the cartilage of both the LFC and the LTP were found in 4/6 (66%) of patients. Two of those patients also had associated bucket-handle tears suggesting that a classification system similar to that for medial MCS may be warranted.[20] Understanding the intricate anatomy of the posterior horn of the lateral meniscus further explains why this pathology is persistently symptomatic and difficult to diagnose on imaging. Cadaveric analysis has demonstrated attachment of the posterolateral capsule to the superior 11% of the posterior horn of the lateral meniscus with a length of 16.7mm, which is a smaller area than the attachment of the medial meniscocapsular junction.[15]

A secondary goal of this study was to report on initial outcomes following arthroscopic repair of occult lateral MCS. Although post-operative subjective outcomes data were unavailable for two of the six patients, progress notes from their last office visits reported that one patient was improving well and the other had no residual symptoms or limitations, indicating positive response to surgical repair of the lateral MCS. Outcomes for the remaining four patients were recorded postoperatively at the time of the study. IKDC scores averaged 63.8 (range 50 to 81), which is slightly less than that reported by younger patients following repair of ramp lesions but is consistent with age and gender based normative data.[18,21,22] The SF-12 physical scores in this series were just below average, however, the mental scores were above average based on the population average of 50 by inherent design of the scoring system.[23] Additionally, the KOS-ADL scores were excellent with an average of 60.8, indicating minimal disruption in ADLs. These subjective outcomes indicate that patients with occult posterolateral MCS do very well following surgical repair, with overall above average quality of life when compared to norms.

Limitations

This study is not without limitations. As a small retrospective case series there is inherent selection bias, however, this was minimized by the consecutive nature of patient inclusion. Comparing the results of surgery at different time points

introduces bias. Also, one month follow-up may be too short a time period to fully evaluate the clinical results of surgery. The prospective collection of PRO data would have strengthened the study findings and allowed us to quantitatively analyze the degree of subjective improvement in patient outcomes. This would have also allowed for increased homogeneity in reporting, thus aiding the interpretation of these findings. However, we did not attempt to collect PRO data retrospectively at all time points as this would have contributed to significant re-call bias in patients further removed from their index arthroscopic procedure.

Conclusion

The diagnosis of occult posterolateral MCS could be missed on advanced imaging, such as MRI, so arthroscopic diagnosis may be required. This study indicates that arthroscopic diagnosis and repair of occult posterolateral MCS results in good functional and clinical outcomes.

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