

Plica Syndrome of the Knee

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Abstract: Anterior knee pain is a common complaint in the pediatric and adolescent population. Multiple etiologies can be responsible for the onset of pain in this demographic. One etiology of this pain can be a pathologic plica. Plica are synovial folds within the knee that can become inflamed/fibrotic through both acute and chronic processes. A focused physical exam with appropriate imaging can lead to this diagnosis, particularly when other pathologies have been ruled out. Conservative management in the form of rest, anti-inflammatories, and physical therapy can help to alleviate the vast majority of cases that present with pain. In selected cases, arthroscopic resection can lead to good functional results.

Key Concepts:

- Anterior knee pain is a common chief complaint in pediatric and adolescent patients.
- Plica are synovial folds within most knees that can become problematic for individuals when they become inflamed/fibrotic.
- Other etiologies of anterior knee pain should be ruled out via history, physical examination, and imaging prior to diagnosing plica syndrome of the knee.
- Patellar cartilage damage can be seen in association with this entity.
- Conservative treatment is the mainstay of treatment with arthroscopic resection reserved for selected recalcitrant cases.

Introduction

Anterior knee pain is a common complaint in the pediatric and adolescent population.¹ The etiology of anterior knee pain is multifactorial and can be related to various different diagnoses. With the onset of sports specialization, knee pain is an increasing complaint due to overuse.² Although complaints of knee pain in the peri-patellar region are common, the accompanying symptoms can be variable. The spectrum of symptoms (i.e., decreased motion, swelling, instability, and mechanical symptoms) combined with physical examination and imaging if indicated, can lead to a

diagnosis. An understanding of the various intra- and extraarticular pathologies that can cause knee pain in this age group is essential for the clinician to prescribe the appropriate treatment.

A common, yet not well understood, cause of anterior knee pain is synovial plica syndrome.^{3,4} For the clinician treating pediatric and adolescent patients with knee pain, an understanding of the pertinent anatomy, presentation, physical exam, and imaging is essential so treatment decisions can be made.

Anatomy/Embryology

The plica are a series of synovial folds present within most knees. There are generally thought to be four main plica within the knee including the suprapatellar, medial, lateral, and infrapatellar.⁵ The development of the knee joint is thought to occur during the 7th–10th week of fetal life with the knee being divided into separate cavities.^{6–8} These cavities then begin to form more distinctly into the knee joint with remnant mesenchymal tissue forming into synovium. If these folds of synovium become large enough, they can be considered plicae.

The presence of a plica does not necessarily indicate that they are or will become pathologic. Many individuals will have a plica visualized arthroscopically that does not cause discomfort due to the fact they are thin, pliable, and transparent.⁵ This tissue can become problematic for individuals when the plica tissue becomes inflamed and fibrotic. This then leads to a tight band of tissue that can impinge on the patella and trochlea with knee flexion leading to pain and, at times, cartilage damage in the absence of other etiologies.^{9,10} The plica can become fibrotic through one of two pathologic pathways: the plica can become inflamed due to an acute or chronic repetitive event to the tissue itself (i.e., blunt trauma or repetitive overuse) or due to inflammation stemming from other traumatic events within the knee joint.^{10,11} Periods of rapid growth can also lead to this tissue becoming pathologic and symptomatic.

Clinical Presentation

The clinical challenge in the diagnoses of a symptomatic plica is that the presentation can be varied. Patients may present with complaints of knee pain that stems from both traumatic and atraumatic etiologies. The common complaint is the presence of pain in the anterior aspect of the knee.¹² Patients will also complain of a snapping sensation along the medial patella with flexion, clicking/grinding, a tender band along the peripatellar region, swelling, mechanical symptoms, and decreased range of motion.^{5,13–14} As these complaints may overlap with other diagnoses that can present in a young, active patient population, ruling other pathologies such as meniscal tears, osteochondral



Figure 1. Location of typical pain in the peripatellar region (inferomedial) of patients with medial plica syndrome.

lesions, and cartilage injuries are critical prior to attributing anterior knee pain to a pathologic plica.

Other systemic conditions which can cause synovial pathology including rheumatoid arthritis, PVNS, diabetes, hemophilia, and Lyme disease must be considered and ruled out as well.

Physical Examination

The physical exam is critical in the diagnosis of this pathology.¹⁵ Comparison to the contralateral, normal knee is essential, although bilateral pathology can exist. Examination for other pathologies as part of a standard knee exam is important as well as examination for other factors that may contribute to plica inflammation including hamstring tightness, core weakness (single leg squat), patellar mal-tracking, IT band tightness, and quadriceps atrophy.

With the patient in the supine position, tenderness is typically elicited (Figure 1) over a bandlike tissue fold in the inferomedial patella.

Kim et al. described a mediopatellar plica (MPP) test.¹⁶ While in the supine position, the examiner applies a manual force to the inferomedial patellofemoral joint over the area of tenderness. If the tenderness improves at 90 degree of flexion, the test is positive (Video 1). This

is due to the fact that the medial plica is thought to slip away from the medial condyle at 90 degrees of flexion. In their study of 172 knees, the authors found the test to have a sensitivity of 89.5%, specificity of 88.7%, positive predictive value of 78.7%, and negative predictive value of 94.4%. Additional tests include the Hughston's plica test and the Stutter test.⁵ In the Hughston's test, the examiner places one hand on the heel and the other on the lateral patella with the fingers over the medial femoral condyle. The knee is flexed/extended with the tibia internally rotated and the patella medially translated. Pain/popping of the knee between 30–60 degrees of flexion is considered positive (Video 2). In the Stutter test, the patient sits on the side of the examining table with knee at 90 degrees. The examiner places their fingers on the center of the patella and asks the patient to extend the knee slowly. If there is patellar “stuttering” or movement between 45–70 degrees of motion it is felt to be a positive test (Video 3).

In cases in which concern persists for this diagnosis (particularly in older patients), corticosteroid and/or anesthetic injection can be used to determine if the plica is the source of pain. Intraplival injection has been described,¹⁷ but the ability to predictably inject the tissue is variable. Rather, intraarticular injection can be utilized as the plica is an intraarticular structure. Relief of pain can indicate an intraarticular source of pain¹⁸ (versus an extraarticular source), particularly when other intraarticular pathologies have been ruled out.

Imaging

The importance of imaging in establishing the diagnosis of plica syndrome—particularly as plica syndrome is a diagnosis of exclusion—is critically important. A standard 3–4 view series of the knee can rule out bony pathology.

Ultrasound has been described to assist with the diagnosis of this condition as well. Paczensky evaluated a series of patients with dynamic sonography for medial plicae who subsequently underwent arthroscopy.¹⁹ The accuracy was found to be 88% with a sensitivity of 90% and



Figure 2. T2 axial MRI image of an MRI of the knee in a 17-year-old patient with a pathologic medial plica (red arrow).

a specificity of 83%. Derks et al. also examined ultrasound in a series of 39 knees and found a sensitivity of 92% and specificity of 73% for plicae.²⁰

MRI is a useful diagnostic technique for many of these patients, particularly to rule out other intraarticular pathology (Figure 2).

On MRI, plica appear as low-signal intensity structures with variable thickness/size, particularly on fluid-sensitive sequences.²¹ In a systematic review, Stubbings et al. found that MRI had a sensitivity of 77% and specificity of 58%.²² In addition to confirmation of the diagnosis of a medial plica, MRI can also be useful in determining cartilage damage in patients stemming from the plica. Hayashi et al. examined 163 knees with medial plicae and found that the presence of a plica on MRI was associated with medial patellar cartilage (not femoral) chondral wear.²³

Nonoperative Management

Conservative management is the mainstay of treatment for this condition in the pediatric and adolescent population. Initial management concentrates on reduction of



Figure 3. Two taping techniques for the treatment of medial plica syndrome.

pain and inflammation. Rest from high-impact activity such as running and jumping combined with ice and anti-inflammatories are the critical components of treatment. For many patients, particularly those who do not have the acute pathology, a physical therapy program can be essential which concentrates on core strengthening, flexibility, and assessment of mechanics. Decreased participation in hyper-specialized activities can help as well.²⁴ Amatuzzi et al. examined 136 cases of patients with synovial plica and found 60% of patients had either good or average results with nonoperative management.²⁵ The treatment of this pathology can utilize many of the principles for treating pediatric and adolescent anterior knee pain.²⁶

Other modalities that can be utilized include kinesiology taping as well as intraarticular injections. Genc et al. performed a prospective randomized controlled trial on taping for plica syndrome.²⁷ They found that taping improved symptoms and decreased impairment more than physical therapy alone in patients with plica syndrome (Figure 3).

In recalcitrant cases prior to undergoing surgical intervention, intraarticular and/or intraplica injection can be

performed. Rovere et al. found that 73% of patients had complete relief of pain and return to full activity after injection.¹⁷

If concomitant pathology has been ruled out and patients have failed at least 3–6 months of conservative treatment, operative intervention can be considered.

Operative Management

In patients who have failed treatment, arthroscopy can be considered as a treatment option. It can not only confirm the diagnosis but also rule out other pathologies as well. It is critical at the time of arthroscopy that the plica appears pathologic, inflamed, and fibrotic (Figure 4).

Normal synovial tissue should not be resected as this can cause additional pain to a very sensitive structure. Chondral injury from the plica can be treated as well during the arthroscopic plica resection. After resection (Figure 5), the impinging tissue should no longer be present in the patellofemoral joint.

The short-term results of surgical treatment in appropriately selected patients have been generally good. Gerrard et al. performed a meta-analysis and found that the



Figure 4. Large medial plica (red arrow) impinging on the medial femoral condyle at the time of arthroscopy in an 18-year-old male.



Figure 5. Arthroscopic imaging demonstrating resection of the tissue seen in Figure 4.

overall good and excellent outcomes following surgery was 84.2%.²⁸ Schindler et al. in an analysis of 23 studies found that 64% of patients were symptom-free and 26% had improved.¹² Yet, care must be taken to temper expectations regarding long-term postoperative outcomes. Paczesny et al. examined 52 knees at 10-year follow-up who had arthroscopic plica resection, and found clinical outcomes were better in patients who did not have concurrent cartilage lesions.²⁹ Furthermore, Kramer et al. examined 135 patients at a mean of 4.4 years after arthroscopic plica resection with/without lateral release and found that only 36% of patients were pain-free.³⁰

Because of the guarded long-term prognosis of surgical treatment, exhaustive conservative management is critical in the treatment of this condition.

Summary

Medial plica syndrome is a diagnosis that must be considered in the treatment of pediatric and adolescent patients with anterior knee pain. The diagnosis can be challenging to make, and a careful history, physical exam, and pertinent imaging is important to rule out other causes of knee pain. Conservative modalities are the foundation of treatment of this condition. In selected cases, surgical intervention can be undertaken with good results.

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