

# Plica: Pathologic or Not?

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## Abstract

*A fold that occurs within a joint is referred to as a plica synovialis. Three such plicae are seen with regularity within the human knee joint. These folds are normal structures that represent remnants of mesenchymal tissue and/or septa formed during embryonic development of the knee joint, and can be seen during arthroscopic inspection of the knee joint. Controversy exists within the orthopaedic community as to whether a plica can develop pathologic changes sufficient to cause disabling knee symptoms. The author defines the clinical syndrome, describes the arthroscopic appearance of pathologic plica, and outlines nonsurgical and surgical methods of management of this uncommon condition.*

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A plica synovialis is a membranous fold or ridge found in the synovial lining of a joint. Three such folds are found with regularity in the human knee. In the normal state, these folds are quite filmy, thin, and vascularized, and have no known function.

The most common plica, the plica synovialis patellaris, usually referred to as the ligamentum mucosum, is located in the intercondylar notch, extending from below the level of the articular surface of the femur to the tibial plateau. It covers the anterior cruciate ligament and frequently blocks its visualization during diagnostic arthroscopy.

The second most frequently found plica is the plica synovialis suprapatellaris, commonly called the suprapatellar plica. It is located in the suprapatellar space, extending from the medial wall of the knee toward the lateral wall, and sometimes creates a complete septum between the suprapatellar bursa and the knee joint proper. It may be fenestrated in its central portion by an oval opening, or porta. Wide variations in its shape and width are seen.<sup>1</sup>

The third most frequently seen plica is the plica synovialis mediopatellaris,

commonly referred to as a medial shelf or medial plica. This shelflike fold of synovial membrane extends from the infrapatellar fat pad to the medial wall of the knee, running in the coronal plane. The rarely seen plica synovialis lateropatellaris, or lateral plica, is the same type of structure as the medial plica. It extends from the fat pad laterally to end in the synovium of the lateral wall of the knee.<sup>2</sup> The medial plica may appear to be contiguous with the suprapatellar plica.

The suprapatellar plica and the ligamentum mucosum are thought to be remnants of septa dividing the suprapatellar bursa and patellofemoral cavitation and the medial and lateral femorotibial cavitations, respectively. The medial and lateral plicae most likely represent remnants of mesenchymal tissue.<sup>3</sup> The significance of these folds of synovial tissue resides in whether they can be the source of pain and impairment of knee joint function.

## Plica Syndrome

Plica syndrome is defined as a painful impairment of knee function

in which the only finding to explain the symptoms is the presence of a thickened, hypertrophic plica. Chronic anteromedial knee pain and a sense of tightness in the subpatellar region on squatting are the common complaints expressed by patients found to have a pathologic plica. The ligamentum mucosum is not a source of these types of symptoms. Additional symptoms are snapping sensations, buckling, knee pain on sitting, and pain with repetitive activity.<sup>4</sup> Recurrent effusions and locking of the knee joint are not typical in patients with this syndrome.

The usual differential diagnosis of patients with anterior knee pain includes jumper's knee, torn meniscus, patellar malalignment with or without pathologic chondromalacia of the patella, bipartite patella, and degenerative joint disease. It may be difficult to distinguish plica syndrome from other pathologic conditions that produce similar symptoms. However, the cause of the symptoms can often be determined by a careful physical examination.

## History and Physical Examination

Approximately 50% of patients with plica syndrome present with a

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history of blunt trauma to the anterior aspect of the knee. They will on many occasions have a latent period free of symptoms after the healing of the initial injury, only to have the delayed onset of anterior knee pain some weeks or months later. Most of the remaining patients with this syndrome have a history of the development of pain following a prolonged period of a strenuous repetitive physical activity, such as running, weight lifting, or step aerobics. Only a few patients will present without a history of trauma or repetitive physical activity.

Patients with plica syndrome usually present with tenderness in the medial parapatellar region. Provocative tests to elicit this tenderness have been described by Koshino and Okamoto<sup>5</sup> and are helpful in assessing patients with anterior knee pain. The first test is done by palpating the medial border of the patella while producing medial patellar displacement with one hand and simultaneously producing knee valgus and internal or external rotation of the lower leg with the other hand. The second provocative test is referred to as the holding test. The patient is asked to hold the knee in full extension while the examiner attempts to flex it against the patient's resistance. The examiner again pushes the patella medially while palpating its medial border. Pain produced with or without a click is considered a positive test in either case.

Additional findings include a painful, palpable medial parapatellar cord that can be rolled and popped beneath the examining finger. Tenderness immediately over the joint line is the exception rather than the rule. The knee should not exhibit any signs of ligamentous instability or patellar malalignment. The finding of a knee effusion is unusual; when present, causes other than the plica syndrome should be considered.

A common source of anterior knee pain, particularly in the active younger age group, is infrapatellar tendinitis, or jumper's knee. Jumper's knee can be ruled out by careful examination of the infrapatellar tendon prior to an arthroscopic examination. This is done by depressing the superior pole of the patella in the relaxed fully extended knee, to elevate the inferior pole of the patella. The examiner then palpates the insertion of the infrapatellar tendon with the index finger by directing pressure superiorly, along the long axis of the leg. Extreme tenderness can be elicited in the patient suffering from tendinitis. By establishing the diagnosis of jumper's knee in this fashion, many arthroscopic plica excisions can be avoided.

Continued postoperative complaints of knee pain, aggravated by attempts to strengthen the quadriceps mechanisms by resistive exercises, suggest infrapatellar tendinitis either as a primary or an associated cause of anterior knee pain. A proper preoperative diagnosis can prevent significant postoperative anxieties.

### **Diagnostic Tests**

Routine radiographs of the affected knee with plica syndrome are normal. Double-contrast arthrograms may show the presence of a suprapatellar plica, but cannot aid in determining whether the plica is producing symptoms. Magnetic resonance imaging has not been helpful to date in establishing the diagnosis of plica syndrome. Routine laboratory tests, including the standard chemistry panels ordered for establishing a diagnosis of inflammatory joint disease, are normal.

### **Nonsurgical Treatment**

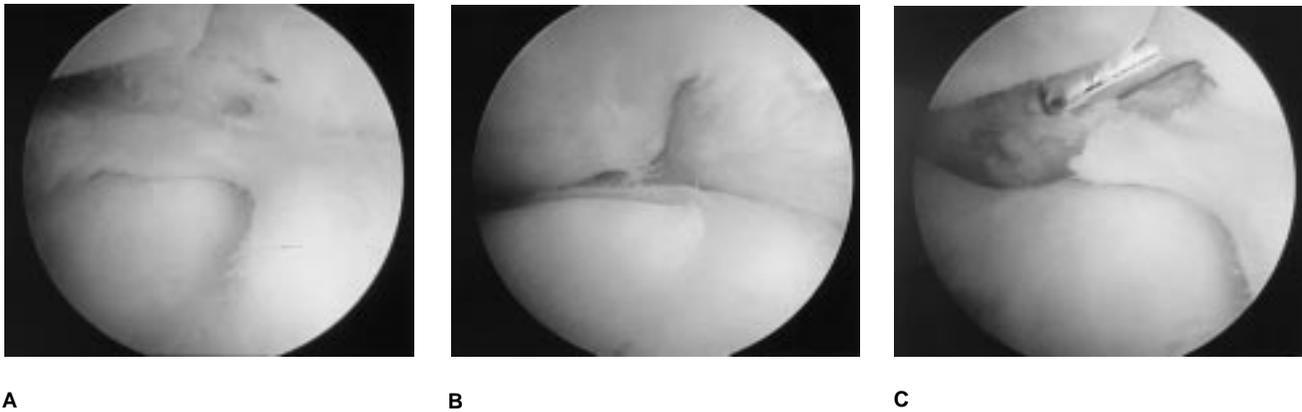
If a tentative diagnosis of plica syndrome has been made, it is appropri-

ate to institute a course of nonsurgical treatment.<sup>6</sup> This treatment includes rest from all strenuous physical activities, a course of nonsteroidal anti-inflammatory medication, moist heat applications, and hamstring stretching. Resistive strengthening exercises should be avoided because they will aggravate the symptoms, particularly in the early phases of treatment. If there is relief of symptoms, the patient can gradually be brought back to his or her former activity level with the usual counsel regarding alteration of level of participation in order to prevent a recurrence. Intraplacial injection of local corticosteroids has been advocated by some as a treatment alternative,<sup>7</sup> but I have no experience with this method of management. Failure to respond to nonsurgical management leaves arthroscopic excision of the pathologic plica as the treatment of choice.

### **Arthroscopic Findings**

Arthroscopically, the pathologic medial plica appears as a thickened, avascular, wide (greater than 12 mm), membranous band of tissue (Fig. 1). It is best seen with the arthroscope placed in the suprapatellar lateral portal.<sup>5,8</sup> When palpated with a blunt probe, the pathologic medial plica has the feel of a taut bowstring. The medial plica may be seen to impinge between the medial facet of the patella and the medial surface of the trochlea when the knee is slowly flexed. The plica does not have to impinge between the patella and the trochlea to be considered pathologic. The characteristic thickened, bowstring appearance of the plica is indicative of its pathologic nature.

The pathologic suprapatellar plica is usually somewhat thickened, but never quite assumes the meniscoid appearance of the abnormal medial plica, which acts like a bow-



**Fig. 1** Pathologic medial plica. **A**, The arthroscope was placed in the superolateral portal, and a 70-degree fore-oblique lens was used for this image obtained with the knee in full extension. The patella is seen above the plica, which exhibits a dense, meniscoid appearance. **B**, The knee is flexed to 40 degrees. Note the impingement of the plica between the medial facet of the patella and the medial portion of the trochlea. **C**, After partial resection of the plica, the taut bowstring effect can be appreciated.

string in flexion and impinges on the femur rather dramatically. In contrast, the normal plica easily yields and folds away from structures with which it comes into contact.

Plicae that have a silky, areolar feel when probed are not likely to produce symptoms. On those rare occasions when a lateral band is encountered, the same identifying criteria for pathologic characterization should be used. It is important that the entire knee be carefully visualized in an organized fashion.

The diagnosis of plica syndrome is often one of exclusion. When the diagnosis of a ruptured meniscus is not confirmed by arthroscopy and the characteristic signs of a pathologic plica are seen, the correct diagnosis of plica syndrome can be assumed. Conversely, if a plica is seen to be pathologically thickened in the presence of a torn meniscus, it should not be classified as evidence of plica syndrome, but rather as a secondary finding. A simple excision of the plica, as a part of the meniscectomy or meniscus repair, is appropriate. The plica in this instance is an incidental finding. Any primary disorder of the knee that can produce chronic swelling

and inflammation is capable of producing changes of a pathologic nature within a plica.<sup>6</sup>

### Surgical Technique

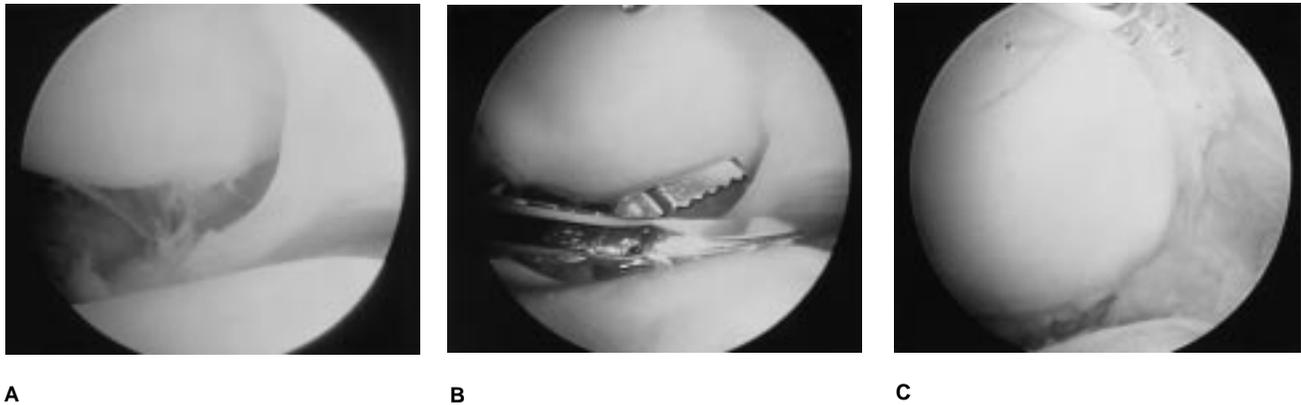
The patient is placed supine on the operating table, with a tourniquet and leg-holding device in place. General or regional anesthesia is preferred. The lower end of the table is flexed. A superomedial portal is created along the medial patellofemoral joint line approximately two finger breadths above the superior pole of the patella of the fully extended leg, and an automated inflow system is utilized to distend the knee with sterile saline solution. A distention pressure of approximately 50 mm Hg is used.

A complete arthroscopic inspection of the femorotibial joint is carried out through standard anteromedial and anterolateral portals. This includes probing of both menisci, visualization of the intercondylar notch, inspection of both sulci, and posteromedial and posterolateral compartment visualization. The posterior compartment inspections are carried out with the use of a 70-

degree fore-oblique lens placed into the posterior compartments through the intercondylar notch.

Inspection of the patellofemoral joint is carried out by bringing the leg into full extension, and maintaining this position by resting the patient's foot on a padded sterile-draped instrument stand. A superolateral portal is then used for placement of the arthroscopic cannula. This portal is created at a point three finger breadths above the superior pole of the patella of the extended knee, along the lateral patellofemoral joint line. Placement of the arthroscope in this portal provides an excellent view of the entire patellofemoral joint (Fig. 2). (If the inflow cannula creates an obstruction to visualization, it can be transferred to the already created anterolateral portal.) The medial plica is clearly seen from this position. The suprapatellar plica can be seen by rotating the fore-obliquity of the lens or by using an accessory portal placed laterally near the superior pole of the patella.

If the medial plica is determined to be pathologic, it is removed by utilizing a lateral portal, best located with the use of a probing 18-gauge spinal needle used for portal-site selection.



**Fig. 2** Wide, dense pathologic medial plica. **A**, Patella is seen above the plica in this superolateral view. **B**, There is only the suggestion of impingement in this instance. A basket forceps is inserted through an accessory lateral portal to begin the removal of the pathologic plica. **C**, Completed resection of the medial plica.

The plica should be removed entirely by resecting it to its base throughout its length. If the diseased plica is simply divided to remove its bowstring effect, it may heal itself, with recurrence of the patient's symptoms.<sup>6,9</sup>

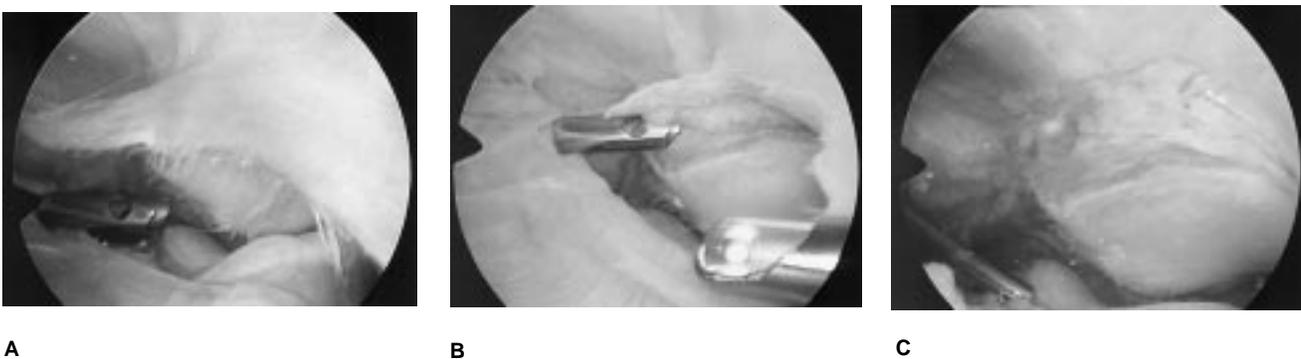
The same approach is used to resect a pathologic suprapatellar plica (Fig. 3). In this instance, it is occasionally prudent to use the anterior inferolateral portal for placement of the operating instruments. Care should be taken not to carry the resection into

the overlying soft tissue, in order to avoid excessive bleeding. If bleeding is noticed, arthroscopic electro-surgical instrumentation may be used to coagulate the bleeding points, thus avoiding postoperative hemarthrosis, which is one of the complications of plica surgery. When the surgical procedure has been completed, a soft-tissue bandage is used. Weight-bearing as tolerated with crutches is allowed on the day of surgery. Routine postoperative management is carried out,

with return to full activities in 4 to 6 weeks.

### Prevalence

Published papers in the refereed literature report a prevalence of plica syndrome of 3.8% to 5.5%, as assessed by arthroscopic examination of the knee.<sup>4,10-12</sup> In my personal experience, a retrospective review of 564 consecutive cases of knee arthroscopy disclosed 13 patients



**Fig. 3** Pathologic suprapatellar plica. **A**, A fringe of synovitis is present on the edge of the plica, which has a fibrous texture. **B**, Partial resection of the suprapatellar plica renders the patella easier to identify. A proximal lateral portal was used for surgical instrument placement. **C**, View of the patellofemoral joint illustrates complete resection of the pathologic plica.

with plica syndrome, a prevalence of 2.3%. The average patient age in this series was 23.8 years.

## Surgical Results

The results of surgical treatment of plica syndrome in carefully selected patients have been reported to be good, excellent, or satisfactory in 75% to 91% of cases.<sup>4,9-12</sup> Ten (77%) of 13 patients had satisfactory results in my personal series.

## Summary

A pathologic plica synovialis can be the sole cause of disabling painful symptoms in the knee. This syndrome accounts for 5% or fewer of pathologic conditions that serve as indications for arthroscopic surgery. The syndrome usually presents with a history of blunt trauma that precedes the onset of chronic anteromedial knee pain. In the absence of a history of blunt trauma, a history of

repetitive strenuous knee exercise is present. In patients with persistent symptoms following nonsurgical care, arthroscopic resection of the pathologic plica is curative in 75% to 91% of cases. Understanding that plica syndrome is uncommon and exercising closer attention to detail in the evaluation of the patient should lead to a reduction in the number of arthroscopic procedures being performed for the removal of normal plical tissue.

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