

# Suprapatellar plica syndrome of the knee: literature review and case report

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## Abstract

**Introduction:** The plica is a residual septum that divides the knee into three compartments: supra, medial, and lateral. Although anatomically suprapatellar plica of the knee is common, it rarely causes symptoms. Thickening of suprapatellar plica may present as anterior knee pain with or without mechanical symptoms. The suprapatellar plica may be a cause to be missed as a cause to look for anterior knee pain. **Case Presentation:** 33-years-old woman presented with recurring anterior knee pain. A non-specific patellofemoral pain was concluded as initial diagnosis, but conservative treatment failed to relieve the pain. During exploratory arthroscopic examination, a shallow suprapatellar cavity with folded synovium with central perforation was found. Plica excision was done with no complication. After 10 days, the patient has significant improvement and after one month the patient walked uneventfully. **Conclusion:** Suprapatellar plica is the most common arthroscopic findings compared to other type of plica. Because the presence of suprapatellar plica does not always depict suprapatellar plica syndrome, it is a cause to be looked for during arthroscopy on anterior knee pain. The complete type of it, especially without perforation, appears only as shallow suprapatellar cavity, that the surgeon should be aware of.

**Key words:** anterior knee pain – knee – plica – plica syndrome – suprapatellar plica

## Introduction

The plica is a residual septum that divides the knee into three compartments: supra, medial, and lateral during intrauterine eight weeks of life. Suprapatellar plica is the most common remnant, followed by medial and inferior plica, while the rarest is lateral plica [1–3]. Although suprapatellar plica is the most common, it has minor clinical manifestation compared to the more frequent symptomatic medial plica. Suprapatellar plica syndrome mainly presents as anterior knee pain and suprapatellar tenderness, with or without mechanical symptoms. As to inferior and lateral plica, clinical symptoms are rarely reported [2,4].

## Embryology

In the eighth week of embryogenesis, the knee joint starts developing a membrane that divides the knee into three compartments: medial, lateral, and superior, which will be reabsorbed in the next several weeks, creating a single knee cavity. Sometimes the remnant of these mem-

branes is still identified after birth as synovial plica. Embryologically, the superior membrane disappears starting laterally, creating an opening that communicates the bursa and the true knee joint. In 20 % of adults the medial part of suprapatellar septum remains. It is found to arise from the under surface of the quadriceps tendon and insert at the knee medial wall [1,5,6].

## Morphology

The morphology of the plica is variable, it could be smooth, rounded, transparent, sharp or perforated [7]. Pathologic or symptomatic plica take years to present as the plica qualities need to change. Changes in synovial tissue pliability caused by inflammation is the established pathophysiology [2,8]. However, there are more to it, primary disorders of the knee could produce transient or chronic synovitis which could cause development of pathologic plica. Synovial hematoma after trauma and mechanical activities with repetitive flexion are the most common

cause. In addition, intra-articular hemorrhage or synovitis could also be caused by torn meniscus, loose body, osteochondritis, patella subluxation or previous surgical intervention. Through prolonged progress the inflammatory synovitis would lead to a thick and oedema plica fold and with ongoing progress, it would become fibrotic. As a result, the plica become thick, white, and fibrotic which was elastic now inelastic [2,8–11].

## Classification

There are many classifications proposed by surgeons [6,12–14]. Zidorn's embryologic classification differs into four types of suprapatellar plica, Type I Septum completum, Type II Septum Perforatum, Type III Septum Residuali, and Type IV Septum Extinctum [6].

## Incidences

Incidences of suprapatellar plica are widely reported [5–7,12,15]. The most recent arthroscopic evaluation study found suprapatellar plica to be identified in 184 knees out of 318 knees (57.8 %) and cadaveric study 6 (42 %) suprapatellar plica [15].

## Pathophysiology

Previous reports have suggested that a pathological plica is caused by thickened fibrous plica that is less elastic to hard patellar chondral or chondral surface, or become in contact with the medial femoral condyle or rarely with the patella [16]. However, the pathophysiology remains unclear. This fibrous plica or pathological plica are impinged in between the quadriceps tendon and femoral trochlea on knee flexion more than 70°. There may be association between recurrent effusions in suprapatellar pouches and the findings of complete suprapatellar plica or plicas with a small porta. Because of the small porta, an increased hydraulic pressure in the suprapatellar porta is believed to have a valve-like phenomenon in this case [17]. Synovial hematoma due to trauma, repetitive flexion is common, in addition, Intra-articular hemorrhages and synovitis caused by torn meniscus, loose body, osteoarthritis, patella subluxation, and surgical intervention have been found to be the cause of symptomatic plica in some cases [2].

## Clinical presentation, physical examination and workup

Plica syndrome usually manifested as anterior knee pain, frequently diffused, especially after prolonged standing or sitting, sometimes accompanied by mechanical symptoms such as locking, snapping, catching, clicking, with or without knee effusion. The common patient complaint is dull anterior knee pain which is often aggravated by going upstairs. There is tenderness on upper edge of patella, with or without effusion and mechanical symp-

toms Plica syndrome usually affects people regardless of gender in their first through third decade. However, it is less common in children below 10 years old. History of knee injury may present [1–3].

Physical examination is not specific. The plica can be palpated like a roll of ribbon at suprapatellar region with some tenderness [3]. To our knowledge, no special examination proposed to address the superior patella plica syndrome.

Standard knee radiographs are unable to depict plica. Ultrasound, Computed Tomography (CT) scan, and Magnetic Resonance Imaging (MRI) are the better option. MRI is the best option because it can exclude other conditions that are responsible for pain such as cartilage defect, osteochondral lesion, meniscus tear and ligament disruption. However, all the investigation above lacks the ability to differentiate symptomatic and asymptomatic plica [3,18].

There is no specific ultrasound investigation yet to determine suprapatellar plica. On ultrasound investigation of the patella plica, the patient is in supine position with full extension of the knee. Normally an empty space is found within the patellofemoral space. A study found a strong echoic zone that originates from the synovial alignment of the knee joint capsule is seen when patella plica is present. Furthermore, the shape of the echoic zone is visualized to be elongated when the patient knee is bent from full extension to 30° flexion. The sensitivity and specificity of ultrasound finding was 92 % and 73 % respectively [19]. Another study was done with dynamic sonography technique. The patella was moved medially and laterally, a continuous echo sliding over the medial femoral condyle was visualized. In addition, the entry of the echo was under the patella which helps visualization of contact between the plica and the patella cartilage. The sensitivity and specificity of this study was 90 % and 83 % respectively. However, this study specifically studies medial patella plica [20,21].

On CT scan, suprapatellar plica is visualized as a fine parallel line to the medial wall of the joint, infrapatellar plica is often fan-shaped, the plica widens as it descends to infrapatellar pad. Medio patellar plica is visualized as a thin line inserting into synovium covering infrapatellar fat pad that originates from the medial wall. However, double-contrast standard was injected to get the visualization required. Thus, due to invasiveness of the method, the use of CT Scan in plica syndrome is considered almost obsolete [2,22].

MRI detects the plica as a band of low-intensity signal within the joint fluid. Fat suppressed T2-weighted, or proton density-weighted image and gradient-echo T2 weighted are suggested to be the best at visualizing the plica. MR arthrography could be an option when there is a suspected plica during examination and there is not enough

fluid inside the joint. The best visualization of suprapatellar plica is on sagittal view which visualized as a bandlike low signal-intensity located posterior of the patella. In addition, MRI also helps to exclude other pathologies that may mimic suprapatellar plica syndrome such as medial patellar plica, quadriceps tendinitis, meniscus injury, cartilage injury and osteochondral lesions [18].

The gold standard is arthroscopy, where normal plica that is thin, reddish, elastic, with smooth edge become thick, white, with sometimes evidence of cartilage erosion below it [3]. Suprapatellar plica is easily viewed during arthroscopy as an arch structure on the medial or lateral side of suprapatellar, but complete plica without perforation hole presents only as shallow suprapatellar cavity, and it could be missed if the surgeon not to look for it.

## Treatment

In managing suprapatellar plica syndrome, conservative treatment is the first option. This includes rest, physiotherapy, and anti-inflammatory topical agents. The main goal of conservative therapy is to reduce the aggravating factor while waiting for the irritation and inflammation to subside. High loading activities such as jumping, or squatting should be avoided. To help with the pain and inflammation, non-steroidal anti-inflammatory drugs (NSAIDs) or paracetamol can be given. The duration or ideal exercise have not been studied; however, exercise therapy has been found to reduce symptoms, increase function, and improve recovery. Some muscles that could be focused for strength and flexibility are medial oblique vastus muscle, the rest of quadriceps muscle and gluteus muscle [3].

Suprapatellar excision shows a high rate of success in pain relief and improved function if other possible sources such as meniscus and chondral erosion has been excluded. The procedure is relatively easy, and plica can be perforated and excised with radiofrequency, shaver or punch [2,23].

## Arthroscopy technique

Standard antero-lateral and antero-medial portals are usually sufficient to identify plica, but often do not allow appropriate panoramic views. Sometimes an additional supero-lateral portal is done to view the dynamic of the plica during joint movement [9,24,25]. Arthroscopy exploration and management of other concomitant intra-articular pathology such as chondral injury, osteochondritis, meniscus tear, should be done first before plica excision to avoid visual problem due to bleeding.

Symptomatic plica should always be completely excised to their base [9,10,26]. Incomplete excision will induce fibrosis and recurrence of the bands, but over-

zealous resection might result in excessive intra-articular bleeding. The plica excision was done by scissors, or basket punch or by intra-articular electrocautery or radiofrequency devices. The latter will add benefit of simultaneous plica resection and bleeding control. Hemarthrosis is the main complication of plica surgery, hence, meticulous haemostasis at the end of surgery is a must.

Arthroscopic plica resection surgery usually has minimal morbidity and rapid rehabilitation. Range of motion exercise should be initiated as early as 3–4 days after surgery to prevent subsequent stiffness and intra-articular scarring [10]. The patient usually could go back to normal sporting activities in 3–6 weeks postoperatively [2].

## Case

A 33-year-old woman presented to the orthopedic clinic with worsening chronic right anterior knee pain for one week. The pain had been felt relapsing since years ago. The patient had a history of falling from the bus eight years ago. The pain was felt especially during squatting, and prolonged walking while rest may alleviate the pain. The patient also experienced catching and sometimes locking sensations. On physical examination, bilateral patellar squinting was noted. There was no deformity, scar, or patellar effusion. Tender on medial joint line and patellar grind test were noted. Knee range of motion was 0–120°. There were no signs of infection. McMurray test, drawer test, and dial test were unremarkable. MRI examination showed superior and medial plica with the normal meniscus, cartilage, and ligaments, with a bone island at the proximal tibia.

A non-specific patellofemoral pain syndrome of the right knee was concluded as an initial working diagnosis. The patient underwent physical therapy, strengthening the gluteal and quadriceps muscle, avoid squat and stairs. However, the non-operative management failed to relieve the pain.

The patient underwent knee arthroscopy. A normal medial plica, cartilage, meniscus, and ligament were noted during exploration. A complete thickened suprapatellar plica was found (Fig. 1.1). A complete suprapatellar plica excision was performed.

At one month's follow-up, the patient was able to walk uneventfully with KOOS Score 83 %. The pain was significantly relieved. Four months after surgery, the patient did not have any mechanical symptoms left, except of anterior knee discomfort after long flexion activities.

## Discussion

Suprapatellar synovial plica is usually asymptomatic but is responsible for pain and mechanical symptoms in this patient. Suprapatellar plica is the most common arthroscopic findings, however symptomatic cases are

rare. In one arthroscopic study, Dupont found only three symptomatic out of 12,000 suprapatellar plica. Suprapatellar plica syndrome should be suspected on patient with anterior knee pain, suprapatellar tenderness and mechanical symptoms [27]. Thus, the presence of suprapatellar plica on arthroscopic examination does not always depict suprapatellar plica syndrome. Tenderness location on flexed knee and the thickening of the plica on arthroscopic examination must be examined to diagnose suprapatellar plica syndrome.

On arthroscopic examination, the much more common internal derangement of the knee such as meniscus tear or thickened medial plica are expected at first. However, everything was unremarkable. Furthermore, we found a shallow suprapatellar cavity with folded synovium with small central perforation (Fig. 1.1), Based on Zidorn's classification, this case was classified as Type II Suprapatellar Plica Septum Perforatum [6]. We decided to excise the plica with conventional shaver and did not encounter any bleeding issue. The presence of the port or perforation of septum creates a valve-like phenomenon that would elaborate to the inflammation which results in thickening and fibrosis of the plica [17]. In addition, previous trauma could also triggered the problem in this patient, previous trauma eight years prior could lead to synovial hematoma which leads to inflammatory synovitis and causing the plica thickening and edema. Thus, because of the injury, the elastic tissue of plica are likely to be replaced by fibrous elements [28].

Retrospectively, we examined the MRI and look for suprapatellar plica (Fig. 2). However, the author found it to be more visualized at the T1-weighted sequence. The result of plica excision is generally good, especially in patients with no chondromalacia. Meta-analysis studied studies shows on a mean follow up period of 27.5 months,

64 % were free of symptoms and have no limit in activities; 26 % had occasional symptoms that did not affect activity, and 10 % that failed to improve following surgery [2]. Our patient had significant improvement in just 10 days following surgery and walked uneventfully in one month.

The findings of shallow suprapatellar cavity are important, since should other causes of derangement found in this case, the author might miss to treat superior suprapatellar plica and it might contribute to some residual symptoms.

## Conclusion

Suprapatellar plica is the most common arthroscopic findings compared to other type of plica. Because the

**Fig. 2 | MRI T-1 Sagittal view. Folded synovium of suprapatellar plica (white arrow). Author's archive**



**Fig. 1 | Arthroscopic view of patellar plica. 1.1 White arrow: small perforation at suprapatellar plica 1.2 Shallow cavity of suprapatellar cavity showing thickening of suprapatellar plica. Author's archive**





presence of suprapatellar plica does not always depict suprapatellar plica syndrome, it is a cause to be looked for during arthroscopy on anterior knee pain. The complete type of it, especially without perforation, appears only as shallow suprapatellar cavity, that the surgeon should be aware of.

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