ABSTRACT

Plica syndrome is a pathological condition secondary to inflammation. Plicae around the knee are common and generally asymptomatic. They often are misdiagnosed. The morphology of knee plicae varies; mediopatellar plicae are the most common cause of the plica syndrome. An intermittent dull pain is the most common symptom. Diagnosis is made by exclusion. Ultrasonography is useful; arthroscopy is the gold standard. Arthroscopic removal of the plica may be necessary when conservative treatment for up to 6 months fails.

Key words: disease management; patellofemoral pain syndrome; ultrasonography

EPIDEMIOLOGY

There are 2 theories regarding the embryological development of the knee and the subsequent formation of plicae. In the more popular theory, plicae are the embryological remnants of the membranes that separate the compartments. Synovial membranes divide the knee into 3 separate compartments (medial, lateral, and suprapatellar) during embryological development. After the 16th week of gestation, these synovial membranes resorb, forming a single cavity; remnants of these membranes are believed to form plica.1,2 In the other theory, at approximately the 7th week of gestation, the space between the distal femur and proximal tibial epiphysis is filled with mesenchymal tissue. Cavitations develop in this tissue as time proceeds. By week 10, the knee consists of a single cavity lined by synovial tissue. It is proposed that incomplete resorption of mesenchymal tissue and failure of cavitation lead to plica formation.2,3

CLASSIFICATION

Synovial knee plicae have 4 types of morphology: infrapatellar, mediopatellar, suprapatellar, and lateral.4 The most common is the suprapatellar plica (also known as the plica synovialis suprapatellaris),

Review article:
Plica syndrome of the knee

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which is responsible for division of the suprapatellar pouch from the knee. This plica has varying shapes, either a complete tissue plane or as a porta. It originates from either the posterior quadriceps tendon or the anterior femoral metaphysis, and passes to the medial side of the knee joint. In some cases, it may be the cause of suprapatellar bursitis and chondromalacia.5

The infrapatellar plica (also known as the ligamentum mucosum) is usually a bell-shaped synovial fold and originates from the intercondylar notch in the region of the anterior cruciate ligament and widens into the anterior joint space and attaches onto the synovial lining of the infrapatellar fat pad. According to its appearance, it is classified into 5 types: separate, split, vertical septum, fenestrated, or none of the above.6 It is the most common plica visualised during knee arthroscopy, where it represents an impediment to gaining full views of the joint interior.

The mediopatellar plica is the most common one attributed to the development of the plica syndrome. This plica is found in the coronal plane; it originates in the suprapatellar region and passes inferiorly on the medial aspect of the knee joint before inserting into the infrapatellar (Hoffa) fat pad. Based on its appearance, it is classified as type A (cord-like), type B (shelf-like, but not covering the medial femoral condyle), type C (covering the medial femoral condyle), and type D (having a double insertion).7

The lateral synovial plica is described as a band running distally along the lateral parapatellar synovium to the lateral patellar facet. Whether this is a true septal remnant remains controversial, as it seems more likely to be derived from the parapatellar adipose synovial fringe.

### PREVALENCE

The prevalence of plica syndrome varies, ranging from 11 to 87% for suprapatellar plicae and 18 to 60% for mediopatellar plicae. The most commonly reported range is 20 to 25% of the population. Infrapatellar plicae may be present in around 65% of patients.8 Lateral plicae and their rates are not well known, with most of the studies from Japan9; its range is around 1 to 2%. In an arthroscopic study of 400 knees,10 the rates are 87% for suprapatellar plica, 86% for infrapatellar plica, 72% for mediopatellar plica, and 1.3% for lateral patellar plica. Symptomatic plicae usually present in active patients undertaking repetitive knee movements. Females appear to have a higher frequency of this condition.11

### PATHOLOGY

Patients with plica syndrome differ from the asymptomatic population. In predisposed patients with structurally abnormal plicae, symptoms were
triggered by some stimulating events. The normal appearance of plicae is of a thin, soft, flexible, vascularised structure covered in synovium. In pathological specimens, the plica appears hypertrophied with elasticity loss, calcification, hyalinisation, and fibrosis.\textsuperscript{12–14}

Development of symptomatic plicae is associated with an inflammatory process secondary to acute trauma, repetitive stress injury, meniscal tears or loose bodies, or osteochondritis dissecans. Inflammation may be related to anatomic change within the knee and the plica itself (as the plica becomes bowstringed on the medial femoral condyle).\textsuperscript{15} This results in abrasion on the condyle during knee flexion. Inflammation can also result in oedema and damage to tissue integrity and eventually lead to friable plicae that damage nearby structures (femoral condyles) and go on to cause condromalacia or secondary synovitis.\textsuperscript{16,17} A less complicated cause may be natural loss of elasticity in increasing age.

Occasionally the plica may be torn, ranging from a partial tear to a bucket-handle or complete tear. Torn plicae are usually secondary to direct trauma or twisting. They can be found in the patellofemoral joint during arthroscopy.\textsuperscript{18,19}

**SYMPTOMS AND DIAGNOSIS**

Symptomatic plicae may cause considerable dull pain in the anteromedial aspect of the knee; the pain may be intermittent or aggravated by physical activity,
and can be associated with locking, giving way, and clicking within the joint. These symptoms are not usually associated with knee effusions or swelling.

In cases of torn plicae, locking and reduced knee flexion are the common complaints.

There may be localised tenderness at the medial and inferior patellar border, and on palpation rarely a tender membrane may be discerned as a cord-like structure. The patella itself is not unstable, but a false-positive patellar apprehension test may be elicited, owing to localised pain. A diagnostic test known as ‘taut articular band reproduces pain’ entails palpation of the medial peripatellar region to feel the thickened plical band. The mediopaterllar plicae test entails forced flexion of the knee to 90° while maintaining a manual force to the inferomedial part of the patellofemoral joint. The test is positive when pain occurs in extension but is relieved at 90° flexion. The test had 90% sensitivity and 89% specificity in 172 knees.

Haematological and biochemical investigations are invariably normal. Abnormal results should lead to consideration of an alternative diagnosis. Radiographs of the knee do not demonstrate plicae, but are helpful in excluding other pathology.

Dynamic ultrasonography is highly effective at detecting abnormalities of medial plicae in the knee, and have good sensitivity (90%) and specificity (83%). As a staging tool, magnetic resonance imaging also has good sensitivity (95%) and specificity (72%), depending on how far the plicae extending onto the medial facet (Fig. 1). Contrast arthrography and pneumoarthrography are of little use. Arthroscopy of the joint for visualisation and treatment remains the gold standard (Fig. 2).

The diagnosis of the plica syndrome is made by exclusion of clinical and radiological findings (Fig. 3). Its validity is often debated by those who do not believe plicae to be of any relevance.

TREATMENT

Initial treatment for the plica syndrome involves pain relief and anti-inflammatory drugs, combined with limitation of the aggravating activities. Conservative therapies include stretching of the quadriceps, hamstrings, and gastrocnemius in combination with cryotherapy and anti-inflammatory agents. Up to 60% of patients attain resolution of symptoms after one year of conservative therapy, whereas 40% have no benefit and eventually undergo surgery. Another pharmacological intervention entails intraplical steroid injection, after which 73% of 30 patients achieved complete relief.

Surgical intervention may be considered when conservative therapy fails for at least 6 months. Arthroscopic removal of the symptomatic plica (usually the medial plica) through the superolateral or direct medial portal is usually successful. Up to 34% of patients can expect to be pain-free following this procedure, whereas 65% were able to resume sporting activities.

In cases of torn plicae, arthroscopic resection is particularly effective. In 2 cases of a bucket-handle tear following twisting injuries, symptoms resolved completely after arthroscopic debridement. Resection remains the only treatment for torn plicae.

REFERENCES