The Efficacy of MPP Sign In the Diagnosis of the Medial Patellar Plica Syndrome

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Abstract

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Clinical features of the symptomatic medial patellar plica (MPP) are nonspecific and the diagnosis has been troublesome for orthopaedic surgeons. We present a diagnostic test for symptomatic medial patellar plica. It is a provocative test that elicits pain by applying thumb force to the inferomedial portion of the patellofemoral joint. The MPP sign is defined as positive when the patient experiences pain with the knee at extension and eliminated or markedly diminished with the knee at 90 degrees of flexion. 163 knees with a positive MPP sign were analyzed. 127 knees (78%) had symptomatic MPP, 30 knees (18%) had fat pad synovial fringe entrapments and 6 knees (4%) demonstrated localized synovitis. Among 127 cases of the symptomatic mediopatellar plicae, 109 knees (86%) had pathologic MPP, 10 knees (8%) had wide-width MPP, and 8 knees (6%) demonstrated pathologic MPP with fat pad hypertrophy. Arthroscopic excision of thickened fibrotic portion of the MPP and entrapped fat pad synovial fringes were conducted.

The MPP test is a new clinical test for MPP syndrome with an positive predictive value of 78%.

Key Words: Medial patellar plica syndrome, Arthroscopy, MPP sign
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I. INTRODUCTION

Synovial plica of the knee was first described in anatomic dissections by Fullerton in 1916 and Mayeda in 1918. Iino described the arthroscopic appearance of plicae and classified the different shapes of medial plica into four types in 1939. Medial synovial plica originates on the medial wall of the knee joint, runs obliquely down in a coronal plane toward, and inserts into the medial synovial lining of the infrapatellar fat pad. Iino found the shelf to be present in more than 50% of knees, and Sakakibara in 45%, Aoki in 22%, Jackson et al in 60%, and Kim in 72%. Irritation of the medial synovial shelf gives rise to mediopatellar plica(MPP) syndrome, the symptoms of which are very variable, according to the status of the pathologic plica. The principal symptom is anterior pain in the knee associated with swelling, a feeling of snapping, and occasionally a sensation of instability. A palpable and sometimes audible snap is often present during flexion and extension of the knee. However, symptoms closely resemble those of the common internal derangements of the knee and the accuracy of the diagnosis depends largely on the clinician's experience. So, the diagnosis of
MPP syndrome has been troublesome for orthopaedic surgeons. We have developed a new clinical test (MPP sign) for the diagnosis of MPP syndrome. In this study, the diagnostic accuracy of the MPP test was analyzed by comparing the results of preoperative clinical testing with arthroscopic findings.

**II. MATERIALS AND METHODS**

Between January 1996 and May 2002, 163 knees (155 patients) demonstrated positive MPP signs, that is a provocative test that elicits pain by impinging the thickened plica between the inferomedial margin of the patella and the medial femoral condyle. The 79 male and 76 female patients had an age range of 15 months to 70 years with an average of 36.7 years, and among the female patients, 46 (60%) were housewives. 51 patients (31%) had a history of blunt trauma to the knee that preceded the onset of symptoms. The duration of symptoms, between onset and seeking medical attention varied from 3 months to 5 years, with an average of 11.2 months. All patients had anterior pain in the knee and 129 patients (79%) complained of anteromedial knee pain. 31 patients (19%) had intermittent swelling and 20 patients (12%) complained of painful clicking during activities such as knee flexion, crouching, jumping, or running upstairs. 59 patients (36%) had rolling over signs. All patients underwent at least 6 months of conservative treatment, which consisted of supervised physiotherapy, activity modification, and non-steroidal anti-inflammatory medications. Operation was recommended if consecutive positive findings were found on three visits over six months. Clinical examination was performed pre- and intra-operatively by senior author as follows.

1. **MPP testing**

The MPP test was conducted with the patient supine and knee extended. Manual force was applied to press the inferomedial portion of the patello-
femoral joint by thumb, inserting the medial plica between the medial femoral condyle and the patella. While maintaining this force, the knee was flexed at 90 degrees. The MPP sign was defined to be positive when the patient experienced pain with the knee in extension and eliminated or markedly diminished pain with the knee in 90 degrees of flexion. The symptom was compared with the opposite side.

2. Arthroscopic technique

A thorough inspection of the joint was carried out using a unique anterolateral portal, so-called a lateral patellofemoral axillary portal. If we choose only one portal to inspect the knee joint, it is the best. It is located in a small triangular area formed with an anterolateral edge of the femoral condyle and inferolateral edge of the patella. It provides a better view of the mediopatellar plica than the conventional anterolateral portal. When an abnormal mediopatellar plica existed, a superolateral portal was made. Then, examination through a superolateral portal included palpation of the plica with a probe through the anterolateral portal to assess its tension, rigidity, and the dimensions. The morphologic description should embrace its width, thickness, color, vascularity, tension, and the status of the free edge. The status of the articular cartilage of the medial femoral condyle and medial facet of the patella were also checked. In order to simulate the clinical situation, we drained the irrigation fluid to clear up visualization. Localized entrapment of the plica between the medial femoral condyle and the patella was confirmed. On refilling the fluid, a dynamic examination from 0 to 90 degrees of knee flexion was performed, to assess the contact and gliding of the plica on the medial femoral condyle (e.g., like a bowstring or a windshield effect), and the MPP test was then repeated while maintaining the superolateral portal view to confirm the phenomenon of the test.
Figure 1. When the affected knee was extended, a fibrotic plica was apart from the medial femoral condyle and did not show the bowstring phenomenon.

Figure 2. MPP test: when manual force was applied to the inferomedial portion of the patellofemoral joint with the examiner's thumb, the fibrotic plica was impinged between the patella and medial femoral condyle.
Figure 3. While flexing the knee by 90 degrees, the fibrotic plica slipped away from the medial femoral condyle.

Any other possible pathologic conditions were assessed, including medial patellar or trochlear chondromalacia, and synovitis. Excision of the thickened fibrotic portion of the pathologic plica was conducted using a motorized shaver inserted through the anterolateral portal.

III. RESULTS

Among the 163 knees that demonstrated positive MPP signs preoperatively, 127 knees(78%) had symptomatic mediopatellar plicae, 30 knees(18%) had fat pad synovial fringe entrapments without evidence of pathologic plicae and 6 knees(4%) had localized synovitis on medial peripatellar region. Of the 127 symptomatic mediopatellar plicae, 109 knees(86%) had pathologic mediopatellar plicae, which had avascular fibrotic edges that impinge on the medial femoral condyle during flexion of the knees, 10 knees(8%) had wide-width MPP, and 8 knees(6%) demonstrated pathological MPP combined with fat pad hypertrophy. 46 knees(28%) had chondromalacia of the medial femoral
condyle and 29 knees (18%) had chondromalacia on both the medial femoral condyle and the medial patellar facet. 18 knees (11%) had chondromalacia of the medial patellar facets. Arthroscopic excision of the thickened fibrotic portion of the MPP and of the entrapped fat pad synovial fringes was performed. One year postoperatively, 125 knees (76.7%) had no pain and an excellent result and 38 knees (23.3%) had mild pain or discomfort and a good result. There were no complications that affect the results, though five patients had a postoperative hemarthrosis that required aspiration.

IV. DISCUSSION

A pathologic mediopatellar plica is one of the causes of anterior pain in the knee; however, clinical diagnosis is frequently difficult. Although diagnostic accuracy is improving with the use of MR imaging, a carefully documented history and physical examination remain the most important methods for the MPP syndrome. Blunt trauma to the knee preceding the onset of symptoms is frequently present. Muntzinger et al had 74%, Kinnard and Levesque had 70%, Broom and Fulkerson had 59%, Matsusue et al had 25%, Andersen and Poulsen had 22%, and Dorchak et al had 20%, though Johnson et al had only 13%. In our series, 31% of the patients had a history of blunt trauma to the knee during ADL and sports activities. The principal symptoms of the pathologic MPP is intermittent anterior knee pain, which increases with physical activity, particularly stair-climbing and descending. Hardaker et al found this in 100% of 73 cases and Muse et al in 92% of 52 cases. In the majority of reported series of symptomatic medial plicae, pain was localized medial to the patella, one finger breadth proximal to its inferior pole, and along the medial fat pad at the insertion of the plica. The incidence of anteromedial pain was 74% of 51 cases by Muse et al, 65% of 78 cases by Nottage et al, and 42% of cases by O'Dwyer
and Peace. In our series, all patients complained of anterior knee pain. 129 patients (79%) had anteromedial pain in the knee. 20 patients (12%) complained of a sensation of snapping and clicking within the knee, usually following heavy exercise, and noticed that the patella seemed to catch momentarily during flexion and extension. On physical examination, a symptomatic MPP can often be palpated as a tender, band-like structure paralleling the medial border of the patella at 30 degrees of flexion. A palpable and sometimes an audible snap are often present during flexion and extension. Hardaker et al reported this sign in 71% of the patients, Muse et al in 67%, Glasgow et al in 50%, and Muntzinger et al in 45%. Richmond and McGinty estimated that the plica was palpable in only 10(15%) of 65 cases. In our series, we found it in 81(64%) of 127 cases. By gentle palpation during flexion and extension, the examiner may notice crepitation of the patella as it rides eccentrically in the intercondylar groove. However, these findings are not always present. Even for experienced orthopaedic surgeons, correct diagnosis has often proved to be elusive. Some clinical tests have been introduced to improve the diagnostic accuracy, such as the knee extension test, the flexion test, and two provocation tests. The knee extension test, as described by Pipkin in 1971, is performed by extending the knee from 90 degrees of flexion, while internally rotating the leg and pushing the patella medially. The knee typically popped as a consequence of the presence of a pathologic plica between 60 degrees and 45 degrees of flexion. However, the popping disappears during the day because of the synovitis that is present and the formation of effusion in the knee. For this reason, this is regarded as a “morning test”. Using these tests, it is sometimes difficult to differentiate pathologic MPP from other internal derangements of the knee, and the efficacies of these tests have not been reported upon. From the beginning of the 1990s, we have considered the gliding pattern of the pathologic MPP on the medial femoral condyle during the range of motion. It has been
reported that clinical manifestations of pathologic MPP are due to the so-called bowstring or windshield phenomenon.\textsuperscript{10,13,33-35} When the knee flexion has reached approximately 30 degrees, the plica begins to bowstring and makes contact with the medial femoral condyle. This persists during further flexion to about 60 degrees.\textsuperscript{7,22,33} This phenomenon, the 'rolling-over' sign, can be confirmed easily using an arthroscope (Fig. 1). We have noticed that further flexion beyond 60 degrees results in slippage of the plica from the condylar ridge and used this phenomenon to develop the MPP test for the more accurate diagnosis of the MPP syndrome. The MPP test was conducted arthroscopically through a superolateral portal view. When the affected knee was extended, a fibrotic plica was apart from the medial femoral condyle and did not show the bowstring phenomenon. As manual force was applied to the inferomedial portion of the patellofemoral joint with the examiner's thumb, the fibrotic plica was impinged between the patella and medial femoral condyle (Fig. 2). While flexing the knee by 90 degrees, the fibrotic plica slipped away from the medial femoral condyle (Fig. 3). These findings coincide with the changing patterns of the existence of tenderness during the MPP test. Despite maintaining digital force, pain is eliminated or markedly diminished by flexing the knee at 90 degrees, which is a positive MPP sign.

In this study, we evaluated the accuracy and benefits of the test with the aid of arthroscopic findings. Of the 163 knees (155 patients) that demonstrated positive MPP signs preoperatively, 109 knees (68%) had pathologic mediopatellar plicae as defined by Sherman and Jackson \textsuperscript{36}, which specifies avascular fibrotic edges that impinge on the medial femoral condyle during flexion of the knees. 8 knees (5%) had pathologic MPP with fat pad hypertrophy and the other 10 knees (6%) had wide-width MPP, which was inserted between the medial femoral condyle and the patella in extension. Of the 10 widewidth MPPs, three plicae appeared to be completely normal but had positive MPP signs. The wide-width types did not belong to the true MPP syndrome. They
did not show fibrotic changes or chondromalacia of the medial femoral condyle. Because of the corresponding symptoms, we regarded this condition as an impending type of the pathologic MPP. After arthroscopic removal of the wide-width MPP, symptoms improved in all cases. From the viewpoint of diagnostic value, the efficacy of the MPP test is up to 78% (pathologic MPP and wide-width MPP). False positive results of the MPP test were demonstrated in 36 knees (22%), which had fat pad synovial fringe entrapments without evidence of pathologic plicae. Hypertrophied fat pad synovium is another cause of anterior knee pain and has similar clinical findings. It is not easy to differentiate it from true pathologic MPP even with the MPP test. Arthroscopic excision of the thickened fibrotic portion of the MPP and the entrapped fat pad synovial fringes was carried out. Postoperatively, 125 knees (76.7%) were free of symptoms and 38 knees (23.3%) improved but had mild pain or discomfort. So, clinically, the MPP test also contributed to the detection another cause of anterior knee pain, namely fat pad synovial fringe entrapment.

V. CONCLUSION

The MPP test is a new clinical test for MPP syndrome with an positive predictive value of 78%. Clinically, positive test results always contributed to the diagnosis and treatment of anterior knee pain.
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국문요약

슬개 내측 병적 추벽 증후군의 진단시 medial pathologic plica(MPP) 검사의 유용성

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슬부 내측 병적 추벽 증후군은 임상적으로는 비특이적이며, 정형외과 영역에서 진단을 하는데 어려움이 있다. MPP검사는 슬관절 신진 상태에서 내측 추벽을 엎지를 통해 슬개골과 대퇴골 관절 사이로 삽입하여 동증을 유발하는 방법이다. 슬관절 신진시 동증을 경험하고, 슬관절을 90도 굽은하여 다시 검사할 때 동증이 소실되거나, 현저히 감소할 때 MPP검사 양성으로 하였으며, 양성 반응을 보인 환자들을 대상으로 관절경으로 확인하였다. MPP 검사에서 양성 소견을 보인 116슬관절(108환자)을 대상으로 하였으며, 92예(79%)에 있어서 증상이 있는 내측 병적 추벽이 관찰되었으며, 20예(17%)는 병적인 내측 추벽 소견이 관찰되지 않고 지방대 합입 소견을, 4예(4%)는 내측 슬개골주위의 국소적인 활액막염을 갖고 있었 다. 92예의 증상이 있던 환자 중에서 79예(85%)는 병적 슬개 내측 추벽을 7예(8%)는 wide-width MPP를 6예(7%)는 병적 슬개 내측추벽과 비후된 지방대가 관찰되었다. 관절경을 이용하여 슬개 내측 추벽의 비후된 섬유 조직부분과 깊이있는 지방대와 활액막 변연부를 절제하였다. MPP검사는 슬개 내측 병적 추벽 증후군에서 진단적 타당도가 79%에 이르는 새로운 임상적 검사 방법이며, 임상적으로도 이 검사가 양성일 때, 슬개 내측 병적 추벽 증후군의 진단과 치료에 도움이 될 것으로 사료된다.

핵심되는 말: 슬개골, 추벽, 관절경, MPP 검사