



The Correlation between Patellar Plica and Degeneration of the Femoral Condyle among Military Personnel*

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ABSTRACT

Objective. To determine if there is a correlation between patellar plica syndrome and presence of osteochondral defect among patients who underwent diagnostic arthroscopy.

Methodology. This is a single-center, retrospective cohort study involving patients who underwent diagnostic arthroscopy of the knee with or without primary ACL reconstruction, meniscectomy, and application of Hyalofast scaffold done between January 1, 2018, and December 31, 2020. A retrospective chart review was conducted. Inclusion criteria were: (1) patients aged 18 to 56 years who underwent diagnostic arthroscopy, (2) patients with nonspecific anterior and anteromedial knee pain, (3) patients who were diagnosed with degenerative osteoarthritis via physical exam/X-rays and (4) patients who had complaints of persistent knee pain with no improvement despite conservative management. The exclusion criteria were: (1) patients who have history of significant knee trauma causing fracture of the tibio-femoral and patello-femoral joint and (2) patients who were diagnosed with septic arthritis and post-traumatic arthritis. Patients' demographic data, history, physical examination findings were gathered and tabulated.

Results. There were a total of 70 patients who underwent diagnostic arthroscopy from January 2018 to December 2020. The prevalence rate of patellar plica syndrome was 10%. There were no significant differences noted in terms of age, gender, comorbidities, BMI, and length of military service. None of the patients with patellar plica syndrome had sports-related injuries ($n = 0$, $p = 0.007$), and most of these patients did not have other knee pathology ($n = 6$, 86%, $p < 0.001$). The most common type of patellar plica noted intraoperatively was mediopatellar plica (71%), followed by infrapatellar plica (29%). Anterior and/or anteromedial pain was the most common symptom of patellar plica syndrome (100%), followed by pain when kneeling (71%). There were significantly fewer patients presenting with clicking or catching with patellar plica syndrome ($p = 0.003$), and significantly more patients who had a positive mediopatellar test on physical examination ($p = 0.023$). An osteochondral defect was present in 86% of the cases with patellar plica as compared to 21% of patients without patellar plica ($p = 0.001$).

Conclusion. Patellar plica syndrome was present in 10% of military personnel who underwent diagnostic arthroscopy. The presence of osteochondral defects were correlated with patellar plica.

Keywords. patellar plica syndrome, degeneration of the femoral condyle, military personnel, soldier/s; knee pain, degenerative osteoarthritis

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INTRODUCTION

Knee pain is a common problem with many causes, from acute injuries to complications of medical conditions. Risk factors for knee pain include biomechanics, excess weight, and overuse during repetitive motions.¹ Overuse is common in military personnel as daily jogging and exercises are needed to maintain fitness and to pass the quarterly Physical Fitness Test.

The Armed Forces of the Philippines (AFP) represent a physically active population of male and female service members with generally high occupational demands. They participate in organized physical fitness training and undergo physical fitness testing.² Knee pain is a common cause of consult in military treatment facilities, most commonly located anteriorly and anteromedially. The usual diagnoses are knee sprain, ligamentous knee injuries, fractures/dislocations, and osteoarthritis.

Patellar plica syndrome is a rarely diagnosed condition which is sometimes incidentally found during diagnostic arthroscopy for other conditions. Diagnosis of plica syndrome is difficult since when the symptoms occur, they are not easily distinguishable from other intra-articular conditions and knee derangements of the knee joint.³

Currently, there were no data gathered as to the prevalence of patellar plica syndrome among military personnel who consulted for knee pain. The purpose of this study is to determine the correlation of osteochondral defect on the medial femoral condyle and presence of patellar plica syndrome in the military population.

METHODOLOGY

Study design

This is a single-center, retrospective cohort involving patients who underwent diagnostic arthroscopy with or without primary ACL reconstruction, meniscectomy, and application of Hyalofast scaffold done between January 1, 2018, and December 31, 2020.

A retrospective chart review was conducted on all patients admitted between 2018 and 2020 who underwent diagnostic arthroscopy of the knee. All charts that satisfied the inclusion criteria were included in the study.

The following details were collected: demographic and clinical profile (age, sex, length of military service, physical fitness level, presence of comorbidities, body mass index, history of trauma to the knee, pre-existing knee conditions), signs and symptoms (anterior and/or anteriomedial pain, pain on kneeling/crouching, clicking/catching/intermittent locking, knee swelling), physical examination findings (mediopatellar plica test, Hughston plica test), types of synovial knee plica seen intraoperatively (infrapatellar, mediopatellar, suprapatellar, lateral), and other intraoperative arthroscopic findings (presence of osteochondral defect, presence of an ACL tear, presence of a meniscal tear) (Figure 1).

The surgeries were done by two consultants specializing in arthroscopy following a standard operative checklist which included the following procedures: Inspect suprapatellar pouch, Evaluate patellofemoral articulation, Evaluate patella (medial/lateral and inferior/superior), Inspect the lateral gutter, Inspect the popliteus tendon and recess, Inspect medial gutter, Inspect and probe medial femoral condyle, Inspect and probe medial tibial plateau, Inspect and probe anterior, middle and posterior medial meniscus, Inspect and probe ACL/PCL, Inspect and probe lateral femoral condyle, Inspect and probe lateral tibial plateau, Inspect and probe anterior, middle and posterior lateral meniscus, and Evaluate passive tracking of patella in trochlear groove.

Any plica seen were shaved; patients with osteochondral defect underwent application of Hyalofast scaffolding with micro fracture of the cartilage and were advised to undergo intraarticular injections of PRP and sodium hyaluronic acid post operatively (Figure 2).

Setting

The study included active military personnel in the Department of Orthopaedics and Traumatology, Armed Forces of the Philippines Health Service Command – Victoriano Luna Medical Center (VLMC).

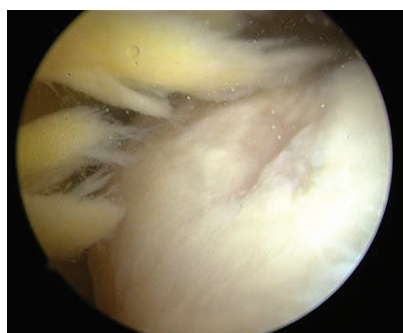


Figure 1. Intraoperative image revealing findings of patellar plica with an osteochondral defect on the femoral condyle.

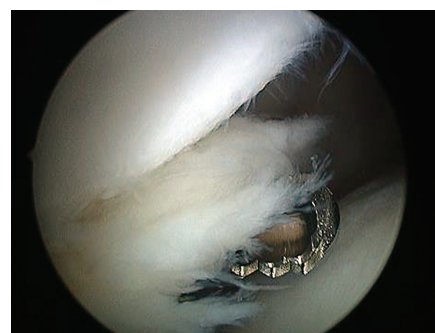


Figure 2. Intraoperative image taken during removal of the plica via arthroscopic shaving.

Table 1. Comparison of demographics between patients with and without patellar plica

Demographics	With patellar plica (N=7) n (%)	Without patellar plica (N=63) n (%)	p-value
Age (x ± SD)	35 ± 6.298	31.79 ± 8.681	0.253
Sex			0.581
Male	7 (100%)	58 (92%)	
Female	0 (0%)	5 (8%)	
Comorbids			0.698
Hypertension	1 (14%)	6 (10%)	
Diabetes Mellitus	1 (14%)	7 (11%)	
Asthma	0 (0%)	2 (3%)	
BMI (x ± SD)	28.43 ± 3.207	26.67 ± 3.797	0.615
Length of military service (in years) (x ± SD)	7.57 ± 4.237	6.68 ± 4.428	0.213
History of trauma			
None	1 (14%)	1 (2%)	0.191
Sports-related	0 (0%)	34 (54%)	0.007*
Wear and tear	6 (82%)	43 (68%)	0.317
Motor vehicular accident	0 (0%)	5 (8%)	0.581
Fall	3 (43%)	19 (30%)	0.383
Other knee pathology			
None	6 (86%)	3 (5%)	<0.001*
Meniscal tear	1 (14%)	37 (59%)	0.032
Cruciate ligament tear	0 (0%)	52 (83%)	<0.001*

Table 2. Types of patellar plica

Type	Frequency (N=7) n (%)
<i>Infrapatellar</i>	2 (29%)
<i>Mediopatellar</i>	5 (71%)
<i>Suprapatellar</i>	0 (0%)
<i>Lateral</i>	0 (0%)

Participants

The study included patients with non-specific anterior and anteromedial knee pain who underwent diagnostic arthroscopy from 2018–2020.

The following were the inclusion criteria:

- Patients aged 18 to 56 years who underwent diagnostic arthroscopy of the knee
- Patients with nonspecific anterior and anteromedial knee pain
- Patients who were diagnosed with degenerative osteoarthritis via physical exam and x-rays
- Patients who had complaints of persistent knee pain with no improvement despite conservative management

The following are the exclusion criteria:

- Patients who have history of significant knee trauma causing fracture of the tibio-femoral and patello-femoral joint
- Patients who were diagnosed with septic arthritis and post-traumatic arthritis.

Patients' demographic data, history, physical examination findings were gathered and tabulated.

This study was approved by the Bioethics Review Board of the Department of Research of the Armed Forces of the Philippines Medical Center prior to subject gathering.

RESULTS

There were a total of 70 patients who underwent diagnostic arthroscopy from January 1, 2018, to December 31, 2020. Overall, the prevalence rate of patellar plica syndrome was 10% ($n = 7$). There were no significant differences noted in terms of age, gender, comorbidities, BMI, and length of military service (Table 1). None of the patients with patellar plica syndrome had sports-related injuries ($n = 0$, $p = 0.007$), and most of these patients did not have other knee pathology ($n = 6$, 86%, $p < 0.001$).

The most common type of patellar plica noted intraoperatively was mediopatellar plica ($n = 5$, 71%), followed by infrapatellar plica ($n = 2$, 29%) (Table 2).

Anterior and/or anteromedial pain was the most common symptom of patellar plica syndrome ($n = 7$, 100%), followed by pain upon kneeling ($n = 5$, 71%) (Table 3). There were significantly fewer patients with patellar plica syndrome who presented with clicking or catching ($n = 1$, 14%, $p = 0.003$), and significantly more patients who had a positive mediopatellar test on physical examination ($n = 7$, 100%, $p = 0.023$).

Osteochondral defects were associated with patellar plica syndrome, being present in 86% of the cases as compared to 21% of patients without patellar plica ($p = 0.001$) (Table 4). Post-hoc analysis shows that only osteochondral defect was directly correlated with patellar plica syndrome (Table 5). Intraoperatively, it was directly observed that the plica grinds on the area of the defect during knee flexion and extension.

Table 3. Comparison of signs and symptoms in patients with or without patellar plica

Signs and symptoms	With patellar plica (N=7) n (%)	Without patellar plica (N=63) n (%)	p
<i>Anterior / Anteromedial pain</i>	7 (100%)	52 (83%)	0.285
<i>Pain upon kneeling or crouching</i>	5 (71%)	47 (75%)	0.583
<i>Clicking or catching</i>	1 (14%)	47 (75%)	0.003*
<i>Swelling</i>	1 (14%)	4 (6%)	0.419
<i>Positive Mediopatellar test</i>	7 (100%)	35 (56%)	0.023*
<i>Hughston plica test</i>	7 (100%)	46 (73%)	0.129

Table 4. Comparison of arthroscopic findings in patients with or without patellar plica

Arthroscopic findings	With patellar plica (N=7) n (%)	Without patellar plica (N=63) n (%)	p
<i>Osteochondral defect</i>	6 (86%)	13 (21%)	0.001*

Table 5. Post-hoc analysis on the factors affecting patellar plica syndrome

	B	S.E.	Wald	df	Sig.	Exp(B)
<i>Positive mediopatellar test</i>	-18.112	7595.757	0.000	1	0.998	0.000
<i>Osteochondral defect</i>	-2.318	1.135	4.168	1	0.041*	0.098
<i>Constant</i>	-0.773	0.494	2.454	1	0.117	0.462

DISCUSSION

Plica syndrome of the knee is a constellation of signs and symptoms that occur secondary to injury or overuse. *Plica* is a Latin word meaning "fold." This term is simply descriptive; there is no empiric evidence that true folding of the synovial lining ever occurs.³ The synovial plica of the knee is formed during the embryogenic phase of development and begins to involute during the 12th week of fetal life. This involution is incomplete in many individuals, and plica persist in 50% of the population, varying in shape and size. When the synovial plica of the knee persists, it transforms into an embryonic relic.³ Four types of synovial plica of the knee have been described: infrapatellar, mediopatellar, suprapatellar, and lateral.⁴⁻⁶ Kim and Choe found suprapatellar plica in 87%, mediopatellar plica in 72%, infrapatellar plica in 86%, and lateral plica in 1.3%, in a study of over 400 knees.⁴

In normal conditions, synovial plica are thin, pink, and flexible. Under the microscope, they are visible as a lining of single or reduplicated synovial cells lying on a stroma of connective tissue which contains numerous small blood vessels and collagen fibres, but no elastic fibres. This allows the plica to change size and shape during knee movement. When pathologic, inflammation turns the plica hypertrophic, more vascular, edematous, more hyalinized, tight, thickened, fibrotic, and non-elastic. With overuse or trauma, these plica can become irritated and inflamed leading to the disorder or syndrome.⁷

Diagnosis of plica syndrome is made by physical examination or arthroscopy. Plica syndrome presents similarly to meniscal tears and patellar tendonitis, and is common among active

individuals. Symptoms include knee pain on the inner side of the joint, tenderness directly over the medial plica, swelling and warmth around the plica, and snapping and clicking on knee flexion. In some cases, there is an associated degeneration of the femoral condyle among these population. Thus, diagnosis is difficult.⁵

There are a few physical examination maneuvers that aid in the diagnosis of patellar plica syndrome. The mediopatellar plica test is done by having the patient lie supine while the examiner flexes the affected knee to 30 degrees and presses the patella medially; this pinches the edge of the plica between the medial femoral condyle and the patellar facet. The test is positive if the patient complains of typical anteromedial pain. The Hughston plica test is done by having the patient lie supine position. The examiner grasps around the knee anterolaterally with one hand and presses the patella medially with the heel of the hand palpating the medial femoral condyle with the fingers of the same hand. The examiner then grasps the patient's heel with the other hand then internally rotates the lower leg and then repeatedly flexes and extends the knee. If a painful, audible, or palpable "popping" is noted, the test is positive suggesting a mediopatellar plica syndrome.⁷

As the symptoms experienced with pathological plica are not specific, the diagnostic procedure should keep a high level of suspicion and ideally work through exclusion, to differentiate from any other knee derangement. Physical examination does not give exclusive results due to possible tenderness of the antero-medial capsule or the area around the suprapatellar pouch on direct palpation.⁶ Non-invasive modalities such as X-rays, ultrasound, computed tomography and magnetic

resonance imaging today allow precise assessment of diseased and injured structures in the knee.^{5,7} X-rays of the knee are typically normal in a patient with plica syndrome.

While synovitis can be a source of possible knee pain, it is relatively uncommon and should be diagnosed only through exclusion. Diagnostic arthroscopy and surgical treatment should only be considered in exceptional cases that do not respond to conservative treatment.³

CONCLUSION

Ten percent of our patients with knee pain who underwent diagnostic arthroscopy had patellar plica. This may be because patellar plica syndrome presents similarly to other knee pathologies. Anterior and/anteromedial knee pain and a positive mediopatellar test were present in all our patients with patellar plica. Osteochondral defects were also seen in 86% of patients with patellar plica, as compared to 21% of patients without patellar plica ($p = 0.001$). The osteochondral defect and pain may be caused by grinding of the plica on the area of the defect during flexion and extension, as seen on diagnostic arthroscopy.

LIMITATIONS

The study was limited only to a single institution. The main investigator was not present during all the surgeries. Post-operative or long-term follow-up was not in the scope of the study.

RECOMMENDATIONS

It is recommended to perform the study including the other station hospitals/institutions which also cater to military personnel. Proper documentation of intraoperative findings (type of plica, location of osteochondral defect) as well as the history and physical exam of the patients should be done.

STATEMENT OF AUTHORSHIP

All authors certified fulfillment of ICMJE authorship criteria.

AUTHORS DISCLOSURE

The authors declared no conflict of interest.

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