



Fat Pad Impingement Syndromes of Knee - Under Diagnosed Causes of Knee Pain

KEYWORDS

Fat pad impingement, Hoffa's fat pad, Extra synovial impingement, Ilio tibial band syndrome

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ABSTRACT Causes of knee pain are many and mainly include internal derangements and synovial disorders. Impingement of fat pads and related disorders are relatively under diagnosed, however they constitute an important cause of knee pain where Magnetic Resonance Imaging (MRI) plays a key role in diagnosis. There are many fat pads around knee due to which many such impingement patterns occur. These include Hoffa's disease, impingement on quadriceps, pre femoral & pericruciate fat pads. There are also few other related disorders like patello femoral friction syndrome, excessive lateral pressure syndrome and ilio-tibial band friction syndrome. In this study we describe the basic anatomical background & MRI findings required for diagnosis, incidence and distribution of cases with fat pad impingement and its related disorders. Radiologists should be familiar with these patterns & these should be included in differential diagnosis of chronic and sub acute knee pain.

INTRODUCTION

There are many causes for knee pain other than internal derangements and synovial disorders. These predominantly include impingement of the fat pads and related disorders which are relatively under diagnosed. We have reviewed our MRI reports retrospectively and searched for these syndromes and found that these are significant in number among the patients with sub acute & chronic knee pain.

These conditions include extra synovial impingement and inflammation syndromes such as Hoffa's disease, impingement on quadriceps, pre femoral & pericruciate fat pads, patello femoral friction syndrome, excessive lateral pressure syndrome and ilio-tibial band friction syndrome. High signal intensity on fluid sensitive images and low signal intensity on T1W images makes the diagnosis of fat pad impingement.

REVIEW OF LITERATURE AND ANATOMY:-

Imaging features of Fat pad impingement include high signal intensity on T2 WI and low signal intensity on T1 WI in acute phase. Fat pad may be enlarged with accompanying mass effect. Chronic phase shows hypo intense signal on both T1 WI- and T2 WI- due to fibrosis & hemorrhage. Enhancement may be seen on post contrast study.

A brief overview of various fat pads of knee:

Hoffa's disease or Infra patellar fat pad impingement: -

Majority of these patients present with anterior knee pain, in these patients infrapatellar fat pad shows edema and hypertrophy. Normal Hoffa fat pad (HFP) is shown in the fig (1). Hoffa's fat pad is bounded superiorly by patella, inferiorly by inter-condylar portion of proximal tibia, anteriorly by ligamentum patella and joint capsule, posteriorly by synovium and deep infrapatellar bursa.

Fig.1. Fat pads surrounding the anterior knee, these include smaller Quadriceps fat pad(2), posterior to it pre femoral fat pad(1) and inferiorly Hoffa's fat pad(3).



2) Quadriceps fat pad impingement :-

Impingement of Quadriceps fat pad or anterior suprapatel-

lar fat pad is one of the less common causes of antero superior knee pain. This is located posterior to the quadriceps tendon, anterior to the supra patellar bursa and superior to patella. This is the smallest of all the anterior three fat pads in the Knee joint. Fig(1).

3) Pre femoral fat pad impingement:-

Pre femoral fat pad or posterior suprapatellar fat pad is a large fat pad, located posterior to suprapatellar bursa and anterior to the antero-inferior cortex of the femur, just above the femoral articular surface. Fig(1).

4) Pericruciate fat pad impingement: -

This fat pad is noted with in inter-condylar fossa fills the gap between the anterior and posterior cruciate ligaments and is intimate with both. It is intra-capsular and extra-synovial fat pad. This is triangular-shaped, located above the posterior cruciate ligament and postero-medial to anterior cruciate ligament. Fig(2) Impingement of this fat pad is observed in individuals who do intensive sports activities, such as soccer. These patients usually present with debilitating posterior knee pain, limiting their participation in sports activities.



Fig(2). The area between PCL and posterior capsule is location for pericruciate fat pad.

5) Excessive lateral pressure syndrome: -

It is due to imbalance between medial and lateral dynamic stabilizers leading to lateral tilt of the patella without frank subluxation and dislocation (1). As time progresses, there is chronic impaction of lateral patellar facet to lateral femoral trochlea resulting in chondral damage and osteoarthritis.

6) Patellar tendon lateral femoral condyle friction syndrome :-

This is due to friction between lateral femoral condyle and patellar tendon. The fat pad in between shows edema and abnormal enhancement. This is commonly seen in patellar subluxation / dislocation or syndrome associated with patellar instability(2). Trochlear dysplasia is also commonly seen in some cases.

7) Ilio tibial band syndrome: -

ITB includes fascial components from the various pelvic muscles extend distally and inserts onto Gerdy's tubercle at the antero-lateral aspect of the tibia. These patients

present with localizing pain over distal Ilio-tibial band at the level of the lateral femoral epicondyle. If there is friction between lateral femoral condyle and Ilio tibial band, the band appears thickened and irregular with edema surrounding it, especially between lateral femoral condyle and Ilio tibial band. In severe cases, there could be edema at Gerdy's tubercle (1).

MATERIAL AND METHODS

A total number of about 500 cases from 4 yrs period (2012 to 2016) were reviewed retrospectively from two hospitals. We have used all the above mentioned seven conditions as search words in the data systems of two hospitals and collected the cases. All these cases were reported by one of the two radiologists (first and second authors) who have an experience more than a decade in MRI musculo- skeletal reporting. Both radiologists are well versed with these conditions, and they have these conditions in their reporting check list.

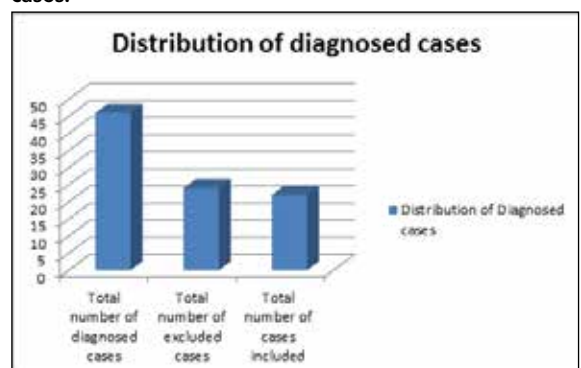
A total number of 46 cases were found which showed edema at these locations. From these cases we have excluded the cases who had recent history of trauma to knee (< 6 weeks) where extra synovial edema may be non specific and could indicate direct trauma or secondary injury to the knee than chronic impingement or inflammatory diseases. Overlapping, nonspecific fat edema patterns are also excluded from this study. We have collected cases of sub acute or chronic cases that predominantly presented with anterior knee pain. Statistical analysis was done by descriptive analysis and results were calculated using rates, ratios and percentages.

RESULTS

In our series, the incidence of diagnosed cases is 9.2% of the total studies, (46 out of 500 cases), hence these pose significant diagnostic importance. We have reviewed these 46 patients and excluded the acute traumatic patients and analyzed findings in 22 chronic knee pain patients. 22 out of 46 patients (47.8%) are chronic patients where these conditions represent predominant diagnosis. In all the categories together we found 22 cases.

These are distributed as follows: 4 patients had Hoffa's fat pad impingement, 3 had quadriceps fat pad impingement, 1 had pre femoral fat pad impingement, 1 had pericruciate fat pad impingement, 3 patients had excessive lateral pressure friction syndrome, 5 had Ilio-tibial band syndrome and 5 had patellar tendon lateral femoral condyle friction syndrome.

Fig 3: Column chart showing distribution of diagnosed cases.



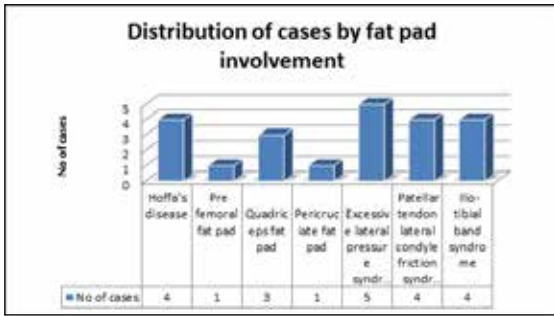


Fig 4: Column chart showing distribution of cases by fat pad involvement.

Total no. of cases searched	500
Total number of diagnosed cases	46
Total number of cases excluded (acute traumatic)	24
Total number of cases included	22
Hoffa's disease	4
Pre femoral fat pad	1
Quadriceps fat pad	3
Pericruciate fat pad	1
Excessive lateral pressure syndrome	5
Patellar tendon lateral condyle friction syndrome	4
Ilio-tibial band syndrome	4

Table 1: Shows distribution of cases by fat pad involvement.

DISCUSSION

There are many known causes of knee pain of which pain due to fat pad impingement constitutes an important cause. There is less awareness of this condition as it is thought to be rare.

The discussion of individual types of fat pad impingement is as follows.

1. Hoffa's disease or Infra patellar fat pad impingement:-

This is richly innervated and, therefore, a source of anterior knee pain. HFP disorders are related to traumas, involvement from adjacent disorders and masses. Patients with abnormalities of the HFP on MRI are often but not always symptomatic. (3).

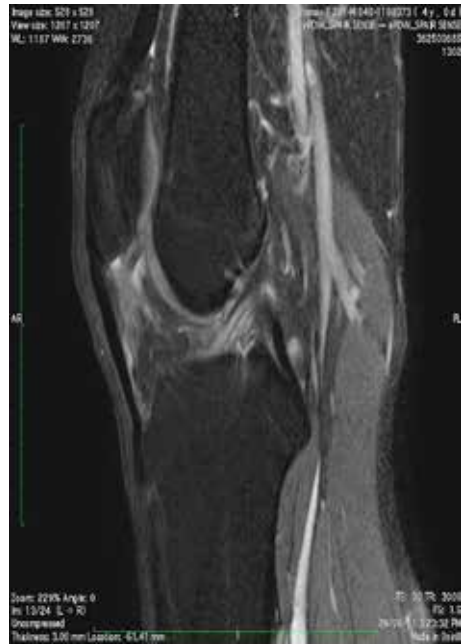


Fig-5. PD-FAT SAT shows significant edema in the infra-patellar fat pad.

We have 4 patients who show Hoffa fat pad edema, (Fig-5) in chronic disorders. One of them shows thickened infrapatellar plica.

2. Quadriceps fat pad or Anterior suprapatellar fat pad edema/impingement:-

According to Nikolaos et al, it is not uncommon to have supra patellar fat pad edema and it is rarely associated with anterior knee pain. (4)

But all our 3 patients with Quadriceps fat pad edema had anterior knee pain. One patient solely presented with pain in the supra patellar region which is showing mass effect and abnormal enhancement on post contrast study.(Fig-6)



Fig-6. Shows significant oedema in quadriceps fat pad which is swollen . It is posteriorly surrounded by supra patellar bursa.

3.Pre femoral fat pad impingement:-

A study done by Nicolaos Tsavalas et al (4) shows suprapatellar fat pad swelling was present in 13.8% of their population . In our study population one patient shows this specific type of edema, which is involving inferior half of the fat pad. (Fig-7)



Fig-7. Swelling and edema of the pre femoral fat pad.

4. Pericruciate fat pad impingement: -

This is less commonly involved impingement syndrome. Inflammatory changes in this fat pad is found in athletes. Unlike the other syndromes, these patients present with posterior knee pain(5). We have one case of this type of impingements which is also showing mild anterior subluxation of the femur (fig-8).



Fig - 8. Edema noted diffusely in the pericruciate fat pad posterior to the PCL

5. Excessive lateral pressure syndrome: -

Abnormal tilt without lateral translation of patella has been referred as excessive lateral pressure syndrome (ELPS). In fact, some cases of ELPS may be associated with medial subluxation. ELPS is usually caused by a tight lateral reti-

naculum, which may need to be released if there is failure of conservative treatment (6). We have observed 5 cases in our study. These cases show thick lateral patellar retinaculum and patello-femoral ligament, often there is edema in the lateral Hoffa's fat pad and more characteristically edema between lateral femoral condyle and patellar retinaculum (fig -9).

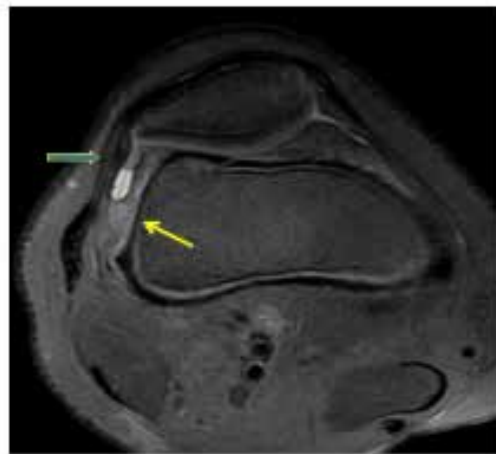


Fig: 9. PD FATSAT axial image shows edema between lateral femoral condyle and patellar retinaculum with significant thickening of this lateral patellar retinaculum. There is lateral tilt of the patella.

Patellar tendon lateral femoral condyle friction syndrome :-

Chung et al, described edema in the superolateral portion of the infrapatellar fat pad as a secondary sign of the patellar tendon-lateral femoral condyle friction syndrome (PFS) (7).We have 4 cases in our study, 2 of them are associated with patella alta. (fig.10,11).Though this is mentioned as a separate entity, but it is the supero-lateral part of the Hoffa's fat pad. Unlike the Hoffa's fat pad, which is generalized edema, this is more focal edema. In severe cases we may see edema in the adjacent bone also. Trochlear dysplasia is an important contributor for subluxation as well as this friction syndrome. The distance between TT (tibial tuberosity) - TG (Trochlear groove) is useful for the assessment of dysplasia and anterior instability (1).



Fig:10- Supero lateral part of the Hoffa's fat pad shows diffuse edema in a patient with complaint of antero lateral knee pain. This patient also has patella alta (high

riding patella).



Fig: 11-Shows potential decrease in the space between lateral femoral condyle & patellar tendon in this young boy who presented with antero lateral knee pain.

7. Ilio-Tibial band friction syndrome: -

MRI shows poorly defined edema or fluid collection in the space between lateral collateral ligament, Ilio tibial band & lateral femoral condyle (8). We have 4 cases of this syndrome in our series. One patient presented only with focal pain and tenderness over this region with out any other symptoms. (Fig.12). Mere edema surrounding ITB without other findings does not categorise into this entity.



Fig(12) .Coronal PD fat sat image taken from the anterior scan of the knee shows grossly thickened ITB showing intrasubstance edema, decreased space between it and femoral condyle. The edema is extending into Hoffa's fat pad.

CONCLUSION:

Extra synovial impingement & inflammation syndromes of the knee are under diagnosed. They should be looked for in patients presenting with sub acute and chronic knee pain. Radiologists should be familiar with these edema patterns. MR imaging is the best modality to diagnose.

These findings are very important and should be given importance especially when there are no internal knee derangements.

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