Vilnius University Press

Contents lists available at Vilnius University Press

Acta Medica Lituanica
2023. Online ahead of print

ISSN 1392-0138 eISSN 2029-4174
DOI: https://doi.org/10.15388/Amed.2023.30.2.2

The Incidence of Iliopsoas Tendinopathy and Labral Tears on High Resolution MRI, An Observational Study

Ahmed Saad
Departments of Orthopedics, Royal Orthopaedic Hospital, Birmingham, UK

Roger Chan
Medical student, Royal Orthopaedic Hospital, Birmingham, UK

Aamer Iqbal
Departments of Musculoskeletal Radiology, Royal Orthopaedic Hospital, Birmingham, UK
https://orcid.org/0000-0002-8594-3774

Mark Davies
Departments of Musculoskeletal Radiology, Royal Orthopaedic Hospital, Birmingham, UK

Steven James
Departments of Musculoskeletal Radiology, Royal Orthopaedic Hospital, Birmingham, UK

Rajesh Botchu*
Departments of Musculoskeletal Radiology, Royal Orthopaedic Hospital, Birmingham, UK
https://orcid.org/0000-0001-7998-2980

Abstract. ***Introduction.*** Labral tears (LT) can present with hip or groin pain. Investigation of LT is typically with Magnetic Resonance Arthrography (MRA). The injection of contrast for MRA can lead to fluid signal intensity/oedema on fluid sensitive sequences within the iliopsoas muscle and tendon complex masking the diagnosis of iliopsoas tendinopathy, which may present with similar symptoms.

The aim of this study was to identify the presence of iliopsoas oedema in young adult patients being investigated for LT.

Material and methods. We performed a retrospective search of our radiology system for the word 'labral tear' in the reports of patients who had MRI between 2012 to 2018. Patients under the age of 40 years who underwent high resolution dedicated hip MRI were included in our study. From this database, we then used a keyword search 'strain and (o)edema' to identify cases of iliopsoas pathology and analysed the results.

Results. We identified 1151 consecutive cases of high resolution hip MRI with a suspected labral tear. 503 patients under the age of 40 years were included in our study with the average age of 27 years. Of the 503 patients within our cohort, searching for the word 'strain' identified 48 (9.5%) cases. Of these, 26 (5.3%) patients had iliopsoas oedema with a labral tear. 22 (4.4%) patients had iliopsoas oedema without a labral tear.

Conclusion. Our study shows that 4.4% of patients undergoing MRA have no labral tears but iliopsoas oedema. Patients should undergo MRI to exclude iliopsoas strains before MRA.

Keywords: iliopsoas, labral tear, arthrogram

* Corresponding author: Rajesh Botchu, Departments of Musculoskeletal Radiology, Royal Orthopaedic Hospital, Birmingham, UK.
E-mail: drbrajesh@yahoo.com

Received: 21/01/2023. **Revised:** 18/04/2023. **Accepted:** 18/04/2023

Klubo tendinopatijos ir labralinių plyšimų dažnis aukštos raiškos magnetinio rezonanso tyrimuose. Stebimasis tyrimas

Santrauka. ***Įvadas.*** Labralinis plyšimas gali pasireikšti klubo ar kirkšnies skausmu. Šis plyšimas įprastai tiriamas atliekant magnetinio rezonanso artrografiją, kuriai atlikti naudojama kontrastinio skysčio injekcija. Ji gali sustiprinti skysčio signalo intensyvumą ar edemos raišką, jautrumas skysčiams leidžia pamatyti sekas, kai klubo raumuo ar sausgyslės kompleksas maskuoja ir apsunkina nustatyti klubo tendinopatiją, kuri gali reikštis panašiais simptomais.

Šio tyrimo tikslas – nustatyti klubo edemos raišką tiriant jaunesniųjų suaugusiųjų amžiaus grupės pacientus, įtariant labralinius plyšimus.

Medžiagos ir metodai. Atlikome perspektyvųjį tyrimą, kuriame apžvelgėme savo radiologijos sistemos ataskaitų duomenis tirdami visus pacientus, kuriems buvo atliktas magnetinio rezonanso tyrimas nuo 2012 iki 2018 metų. Naudojome raktinį žodį „labralinis plyšimas“. Į šį tyrimą įtraukėme pacientus, jaunesnius nei 40 metų, kuriems buvo atliktas didelės raiškos klubo magnetinio rezonanso tyrimas. Iš šios duomenų bazės, naudodami raktažodžių paiešką „patempimas ir edema“, nustatėme klubo patologijų atvejus ir išanalizavome gautus rezultatus.

Rezultatai. Nustatėme 1 151 atvejį, kai, įtariant labralinį plyšimą, buvo atliktas magnetinio rezonanso tyrimas. Iš to skaičiaus pacientų 503 pacientai, jaunesni nei 40 metų, įtraukti į mūsų tyrimą; jų vidutinis amžius –27 metai. Iš mūsų 503 pacientų imties, ieškodami žodžio „patempimas“, nustatėme 48 atvejus (9,5 proc.). Iš to skaičiaus 26 pacientams (5,3 proc. bendro skaičiaus) buvo nustatyta klubo edema su labraliniu plyšimu; 22 pacientams (4,4 proc.) – klubo edema be labralinio plyšimo.

Išvada. Mūsų tyrimo imties 4,4 proc. pacientų, kuriems buvo atliktas magnetinio rezonanso tyrimas, nustatyta klubo edema be labralinio plyšimo. Todėl darytina išvada, kad pacientams prieš atliekant magnetinio rezonanso artrografiją reikėtų atlikti magnetinio rezonanso tyrimą, tai leistų atmesti klubo patempimo atvejus.

Raktažodžiai: dubens raumenys, labralinis plyšimas, artrograma

Introduction

Labral tears are the most common form of labral injuries and have the potential to cause significant debilitating mechanical hip and groin symptoms. They have a prevalence of 22–55% in patients presenting with hip pain [1-5]. They typically occur in association within the anterosuperior region of the hip joint (1'o clock, 2'o clock position) [20,21], or less commonly in an atypical fashion deep to the iliopsoas tendon without any bony abnormalities (3'oclock position) [22]. Patients usually present with hip or groin pain, however, there is overlap in the clinical presentation with similar symptoms seen in femoro-acetabular impingement (FAI), hip dysplasia, iliopsoas tendinopathy and degenerative osteoarthritis [6-8].

Investigation of LT is typically with Magnetic Resonance Arthrography (MRA) or high resolution nonarthrographic 3T MRI (HR MRI) (Figures 1, 2). There are numerous studies which report higher sensitivity of MRA in comparison to noncontrast MRI [9 - 11]. Consequently, many centres in the world, including the UK, perform MRA to diagnose LT, often without an initial MRI. One of the differential diagnoses of groin pain when patients are investigated for LT is iliopsoas tendinopathy (IT).

The iliopsoas is formed of two muscles: the psoas major, typically arising from T12 and L1-L3, and the iliacus muscle, originating from the iliac fossa of the pelvis [26]. Together, both muscles unite at the level of the inguinal ligament passing directly below it. The muscular complex then passes anteriorly within a close anatomic relationship to the capsule-labral complex of the hip joint, before attaching onto the lesser trochanter of the femur [27]. It is at this region where the psoas tendon has been recognised to play a role in the pathophysiology of acetabular labral impingement and iliopsoas tendinopathy [28,29]. The iliopsoas is the strongest flexor of the hip joint, important in standing, walking, and running, but also possesses dynamic functions during postural change [30].

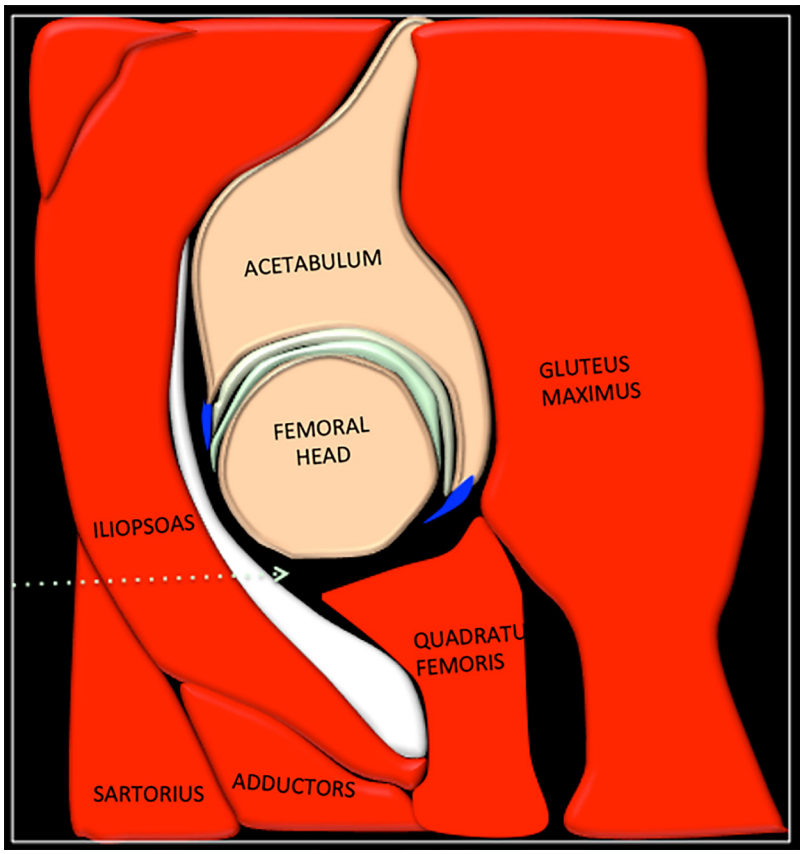

Figure 1. Sagittal animation of the hip showing direction of arthrogram (arrow)

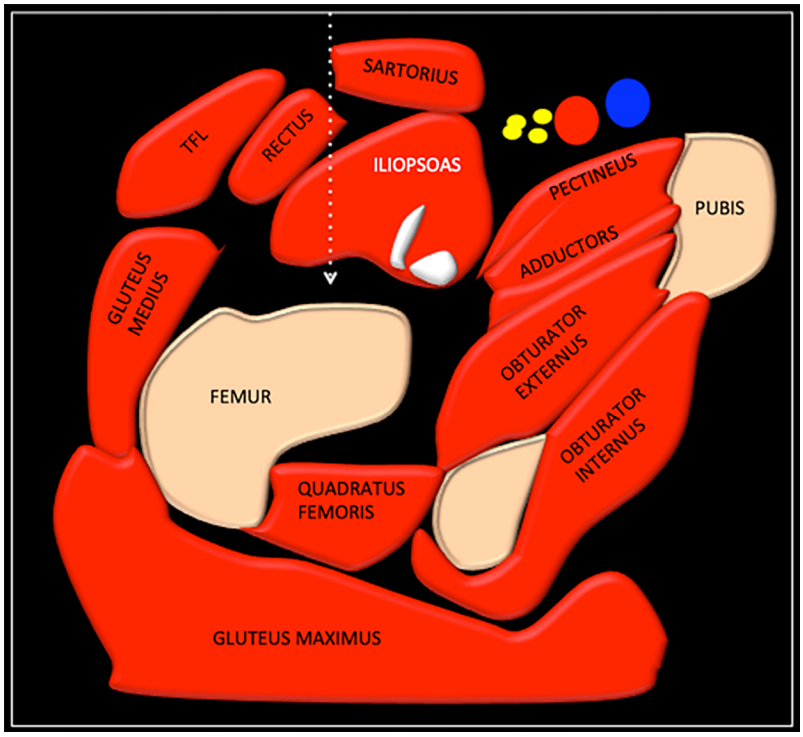

Figure 2. Axial animation of the hip showing direction of arthrogram (arrow)

Generally, in suspected cases of iliopsoas tendinopathy, high signal intensity on T2WI is often seen accompanied by iliopsoas edema surrounding the iliopsoas tendon as it passes over the anterior aspect of the hip joint (Figure 3). Local anaesthetic administration during MRA can mask true edema/pathology in relation to iliopsoas tendon complex.

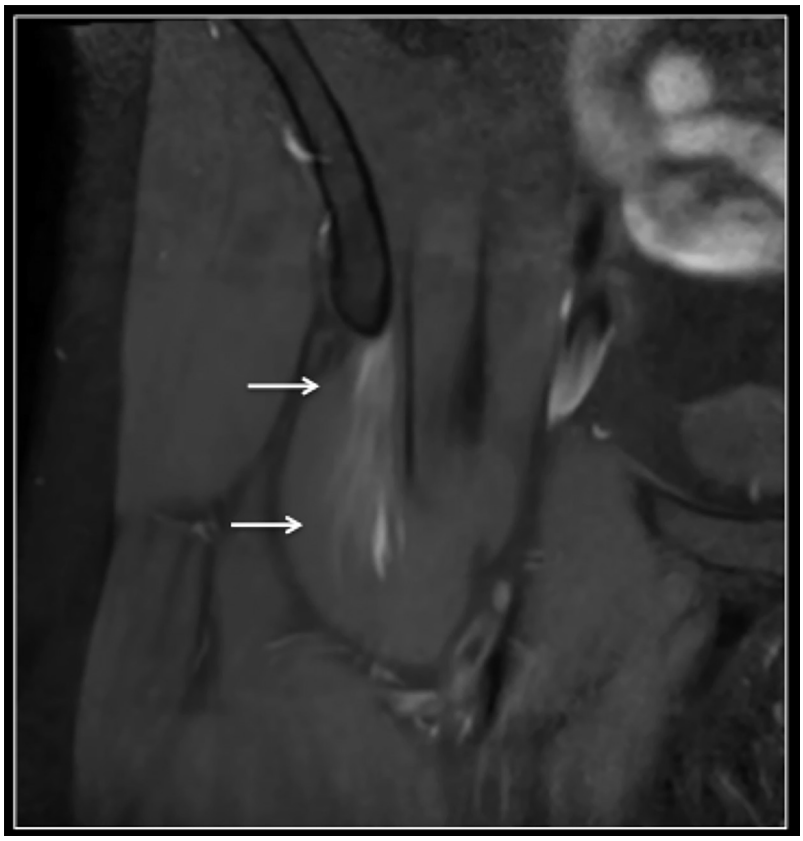

Figure 3. Coronal PDFS demonstrating edema involving the iliopsoas (arrow)

In our tertiary orthopedic centre, LT are investigated with high resolution noncontrast 3T MRI (HR MRI). A proportion of these patients had MRA in other centres and were referred to our young adult hip team for management. The aim of this study was to identify the incidence of iliopsoas edema in relation to the anterior aspect of the hip joint in young adult patients being investigated for LT using HR MRI, and identify the rates of false positive results that may present with iliopsoas tendinopathy using MRA.

Material and methods

We performed a retrospective search of our department's radiology system for the word 'labral tear' in the reports of patients who had MRI over the past six years (between 2012 to 2018). Our inclusion criteria included all patients under the age of 40 years who underwent HR MRI of hip at our institution, for clinical suspicion of labral tears. The sequences include intermediate weighted sequences with and without fat suppression in coronal oblique, sagittal oblique and axial oblique (matrix – 512x358, FOV – 16–18 cm, 3 mm slice thickness, 0.3 mm interslice gap, TR 3000-4000, TE – 3-40). All radiologists in our centre use the terminology 'strain and edema' to report cases of iliopsoas pathology. We therefore used a keyword search 'strain and edema' to identify cases of iliopsoas pathology from this database. Furthermore, all images were reviewed by a consultant musculoskeletal radiologist. Institutional review board approval was obtained for this retrospective study.

Results

We identified 1151 consecutive cases of HR MRI of hip in our radiology database with a suspected labral tear. 503 (43.7%) patients were under the age of 40 years and were therefore included in our

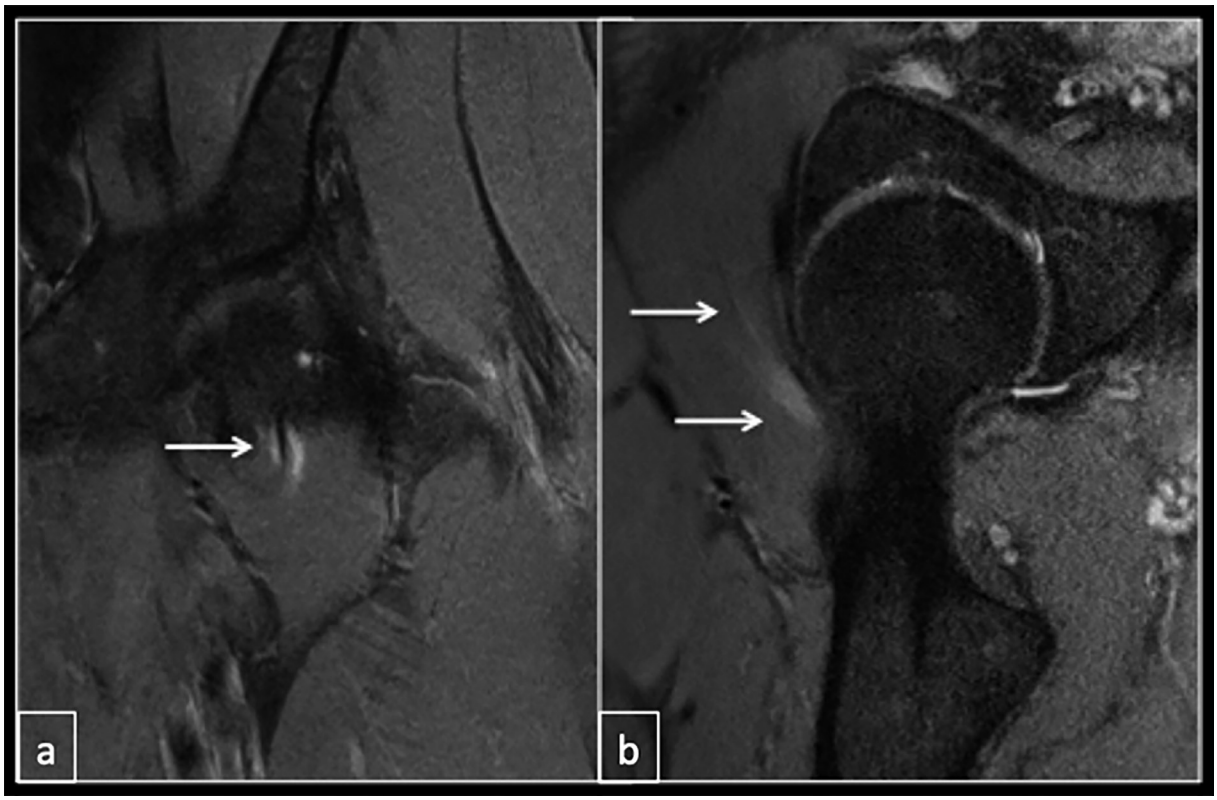

Figure 4. Coronal PDFS (a) and sagittal oblique (b) demonstrating edema involving the iliopsoas (arrow)

Figure 5. Coronal PDFS (a) and sagittal oblique (b) demonstrating edema involving the iliopsoas (arrow)

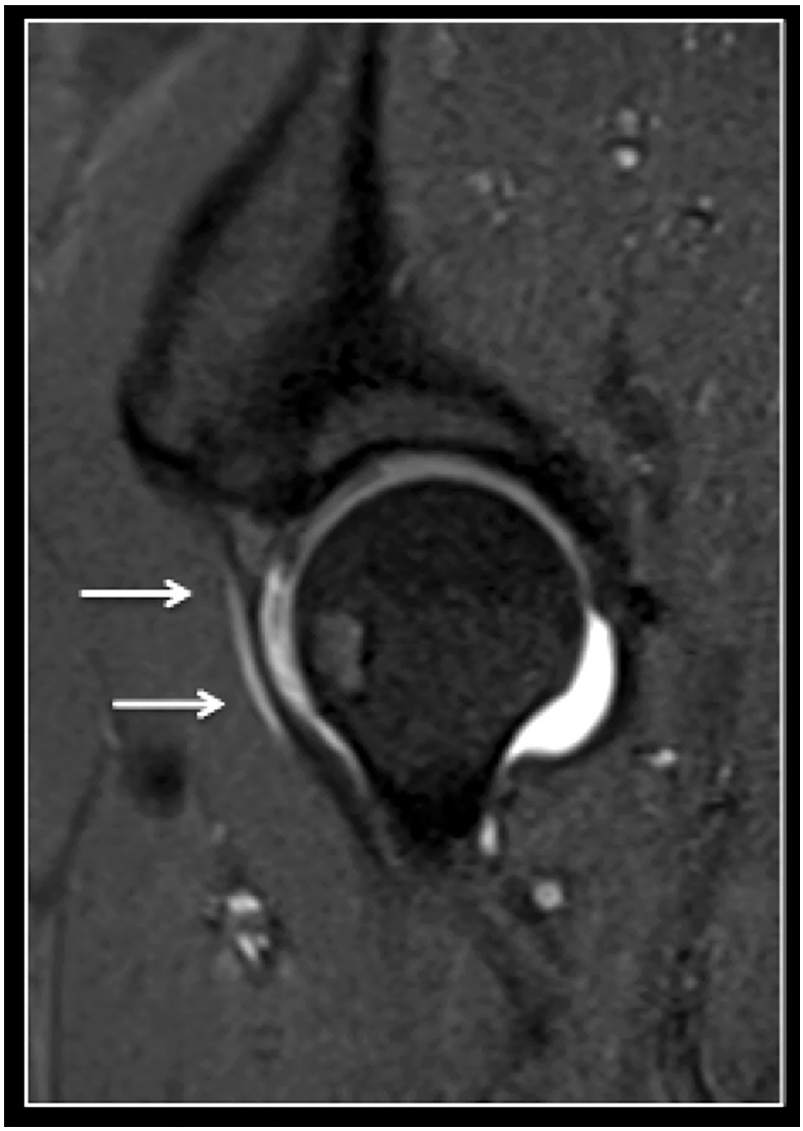

Figure 6. Sagittal oblique T1FS (b) demonstrating fluid involving the deep iliopsoas, anterior to the hip joint (arrow)

study. The mean age of our patients was 27 years (7–40 years). There was a female predominance of 273 to 230 males (ratio of 1.2:1). All patients had an MRI due to ongoing groin pain.

Of the 503 patients within our cohort, searching for the word 'strain and oedema' identified 48 (9.5%) cases. Of these, 26 (5.3%) patients had iliopsoas oedema with a labral tear. 22 (4.4%) patients had iliopsoas oedema without a labral tear (Figures 4, 5, 6).

Discussion

Groin pain is a debilitating condition that may be caused by a cocktail of overlapping conditions that often make their diagnosis quite challenging [12]. The groin area exhibits a complex anatomical position, where groin pain can arise from a multitude of sources that may be intra-articular, extra-articular or radiating from elsewhere [13]. These include tendinopathies, bone injuries, acute muscular injuries of from an overuse mechanism [13]. More precisely, extra-articular causes include muscle strains or tears (iliopsoas tendinopathy) [14], nerve entrapment, usually presenting with a classical burning pain [15] and stress fractures, which are often exercise induced and seen in young active athletes [16] (Table 1). Intra-articular causes of groin pain are more complex and even more

difficult to diagnose, comprising of femero-acitabular impingement [17,18], ligamentum teres injuries [19], loose bodies and labral injuries.

Table 1. Differential Diagnoses of Other Causes of Abnormal Signal Intensity on MRA in patients with Iliopsoas strain:

Ischiofemoral impingement
Femoral head avascular necrosis
Hip tendinitis – Gluteus Muscle tendinitis, Rectus Femoris Injury
Hip Bursitis- Trochanteric Bursitis **Ischial Bursitis**
Osteitis pubis
Pubic ramus stress fracture
Femoral neck stress fracture

Studies have shown a close relationship between the iliopsoas tendon and labrum, and clinical manifestations of labral tears are usually similar to that of iliopsoas tendinopathy (IT); both exhibiting hip pain and occasionally a painful click (snapping hip) [23,24]. IT represents a group of different pathological conditions that can be categorised as tendinosis, muscular strains, iliopsoas bursitis, and partial or complete tendon ruptures. It is defined as inflammation of the iliopsoas tendon and characteristically occur in the area where the tendon drapes over the front of the hip joint. Due to the deep anatomical location of the IP, it is often challenging to distinguish between IT and labral tears. Therefore, it is essential to understand the cross-sectional anatomy of the iliopsoas tendon and its relationship to the acetabular labrum to aid in the diagnosis and management of such conditions. [25]

The gold standard diagnostic imaging modality for labral tears is magnetic resonance arthrography (MRA) or nonarthrographic HR MRI [9, 31]. Studies have established that MRA, when infused with gadolinium, has a sensitivity of approximately 90% [32,33]. It retains an advantage over conventional magnetic resonance imaging (MRI, the sensitivity of 83%) for the diagnosis of acetabular and cartilage defects [34]. The principle of MRA relies on the theory of capsular distention. Following contrast infusion, the substance extends into the labrum or within the acetabular-labral boundaries, leading to distension of the hip capsule, thereby outlining the labrum and filling any tears that may be present [35,36].

MRA, though, is not without its limitations and in some cases can pose a potential pitfall in the diagnoses of labral tears. Although many centres use PDFS/T2FS sequences with MRA to identify the potential causes of iliopsoas edema, injection of the contrast while doing hip arthrogram may produce high signal that can obscure the iliopsoas edema and produce false positive results. Moreover, some pathological conditions, such as labral or cartilaginous lesions, FAI, or hip dysplasia, have also previously been reported to obscure the diagnosis [29, 37]. As far as we are aware, no previous reports have looked at iliopsoas tendinopathy producing false positive results with MRA. In our study, we identified 4.4% of patients, presenting with groin pain, that had iliopsoas oedema on MRA, devoid of any labral tears. These were identified on HR MR. Iliopsoas tendinopathy is best diagnosed using conventional MR imaging [38,39]. On the axial plane, MR images display the muscle-tendon complex and their relationship to adjacent structures. The sagittal plane helps to evaluate the IP tendon and muscle in the area surrounding the pelvic brim at the level of the femoral head. When iliopsoas strain is present, it is classically seen as high signal intensity muscle oedema on T2 weighted images [36, 40-42]. Due to this, we suggest that patients should undergo HRMRI

imaging or noncontrast MR prior to MRA, to exclude iliopsoas strains and prevent misdiagnosis in patients with iliopsoas tendinopathy.

Limitations

Limitations to this study include the fact that this is a retrospective study focussed mainly on radiological diagnosis and MRA were performed at different referring hospitals, therefore, there was no clinical correlation done.

Conclusions

Labral tears are common injuries that are best diagnosed using MRA or HR MRI. Iliopsoas tendinopathy presents with similar symptoms as that of labral tears.

Our study shows that 4.4% of patients have no labral tears but iliopsoas oedema, suggesting the presence of iliopsoas tendinopathy. We recommend that patients should undergo HR MRI or MRI prior to MRA to exclude iliopsoas strains.

References

1. McCarthy JC, Noble PC, Schuck MR, et al. The Otto E Aufranc Award the role of labral lesions to development of early degenerative hip disease. *Clin Orthop*. 2001;(393):25–37. doi: 10.1097/00003086-200112000-00004.
2. Groh MM, Herrera J. A comprehensive review of hip labral tears. *Curr Rev Musculoskelet Med*. 2009;2(2):105–117. doi:10.1007/s12178-009-9052-9
3. Harris JD. Hip labral repair: options and outcomes. *Curr Rev Musculoskelet Med*. 2016;9(4):361–367. doi:10.1007/s12178-016-9360-9
4. Kang C, Hwang DS, Cha SM. Acetabular labral tears in patients with sports injury. *Clin Orthop Surg*. 2009;1(4):230–235. doi:10.4055/cios.2009.1.4.230
5. Herickhoff PK, Safran MR. Surgical Decision Making for Acetabular Labral Tears: An International Perspective. *Orthop J Sports Med*. 2018;6(9):2325967118797324. Published 2018 Sep 20. doi:10.1177/2325967118797324
6. Lewis CL, Sahrmann SA. Acetabular labral tears. *Phys Ther*. 2006;86(1):110–121. doi:10.1093/ptj/86.1.110
7. McCarthy JC, Busconi B. The role of hip arthroscopy in the diagnosis and of hip disease. *Orthopedics*. 1995;18(8):753–756.
8. Narvani AA, Tsiridis E, Kendall S, Chaudhuri R, Thomas P. A preliminary report on prevalence of acetabular labrum tears in sports patients with groin pain. *Knee Surg Sports Traumatol Arthrosc*. 2003;11(6):403–408. doi: 10.1007/s00167-003-0390-7
9. Fitzgerald RH Jr. Acetabular labrum tears: diagnosis and treatment. *Clin Orthop Relat Res*. 1995;(311):60–68.
10. Wenger DE, Kendell KR, Miner MR, Trousdale RT. Acetabular labral tears rarely occur in the absence of bony abnormalities. *Clin Orthop Relat Res*. 2004;(426):145–150. doi: 10.1097/01.blo.0000136903.01368.20
11. Blankenbaker DG, Tuite MJ, Keene JS, del Rio AM. Labral injuries due to iliopsoas impingement: can they be diagnosed on MR arthrography? *AJR Am J Roentgenol*. 2012;199(4):894–900. doi: 10.2214/AJR.11.8211
12. Adib F, Johnson AJ, Hennrikus WL, Nasreddine A, Kocher M, Yen YM. Iliopsoas tendonitis after hip arthroscopy: prevalence, risk factors and treatment algorithm. *J Hip Preserv Surg*. 2018;5(4):362–369. doi: 10.1093/jhps/hny049
13. Nicholson J, Scott M. Conjoint tendon disruption: redifining and recognizing "Golmore's groin" a review of 1200 cases. *Hernia*. 2012;16:143–240.
14. Harmon KG. Evaluation of groin pain in athletes. *Curr Sports Med Rep*. 2007;6:354–361. https://doi.org/10.1007/s11932-007-0051-6
15. Akermark C, Johansson C. Tenotomy of the adductor longus tendon in the treatment of chronic groin pain in athletes. *Am J Sports Med*. 1992;20(6):640–643.
16. Robinson P, White LM. The biomechanics and imaging of soccer injuries. *Semin Musculoskelet Radiol*. 2005;9(4):397–420. doi:10.1055/s-2005-923382

17. Kopell H, Thompson WAL, Postel AH. Entrapment neuropathy of the ilio-inguinal nerve. *New Engl J Med*. 1962;266:16–19.
18. Spitz D, Newberg A. Imaging of stress fractures in the athlete. *Radiol Clin N Am*. 2002;40(2):313–331. doi:10.1016/s0033-8389(02)00010-6
19. Byrd JW. Hip arthroscopy. *J Am Acad Orthop Surg*. 2006;14(7):433–444. doi:10.5435/00124635-200607000-00006
20. Hack K, Di Primio G, Rakhra K, Beaule PE. Prevalence of cam-type femoroacetabular impingement morphology in asymptomatic volunteers. *J Bone Joint Surg Am*. 2010;92(14):2436–2444. doi:10.2106/JBJS.J.01280
21. Byrd JWT, Jones KS. Traumatic rupture of the ligamentum teres as a source of hip pain. *Arthroscopy*. 2004;20(4):385–391. doi:10.1016/j.arthro.2004.01.025
22. Domb BG, Shindle MK, McArthur B, Voos JE, Magennis EM, Kelly BT. Iliopsoas impingement: a newly identified cause of labral pathology in the hip. *HSS J*. 2011;7(2):145–150. doi:10.1007/s11420-011-9198-z
23. Hunt D, Clohisy J, Prather H. Acetabular labral tears of the hip in women. *Phys Med Rehabil Clin N Am*. 2007;18(3):497–520. doi:10.1016/j.pmr.2007.05.007
24. Kim YT, Azuma H. The nerve endings of the acetabular labrum. *Clin Orthop Relat Res*. 1995;(320):176–181.
25. Alpert JM, Kozanek M, Li G, Kelly BT, Asnis PD. Cross-sectional analysis of the iliopsoas tendon and its relationship to the acetabular labrum: an anatomic study. *Am J Sports Med*. 2009;37(8):1594–1598. doi: 10.1177/0363546509332817
26. Schünke M, Ross LM, Schulte E, Lamperti ED, Schumacher U. *Thieme Atlas of Anatomy*. Thieme; 2006.
27. Anderson CN. Iliopsoas: Pathology, Diagnosis, and Treatment. *Clin Sports Med*. 2016;35(3):419–433. doi:10.1016/j.csm.2016.02.009
28. Taylor GR, Clarke NM. Surgical release of the 'snapping iliopsoas tendon.' *J Bone Joint Surg Br*. 1995;77(6):881–883.
29. Byrd JWT, Jones K. Diagnostic accuracy of clinical assessment, magnetic resonance imaging, magnetic resonance arthrography, and intra-articular injection in hip arthroscopy patients. *Am J Sports Med*. 2004;32(7):1668–1674. doi: 10.1177/0363546504266480
30. Czerny C, Hoffman S, Neuhold A, et al. Lesions of the acetabular labrum: accuracy of MR imaging and MR arthrography in detection and staging. *Radiology*. 1996;200(1):225–230. doi:10.1148/radiology.200.1.8657916
31. Philippon MJ, Wolff AB, Briggs KK, Zehms CT, Kuppersmith DA. Acetabular rim reduction for the treatment of femoroacetabular impingement correlates with preoperative and postoperative center-edge angle. *Arthroscopy*. 2010;26(6):757–761. doi:10.1016/j.arthro.2009.11.003
32. Aubry S, Bélanger D, Giguère C, Lavigne M. Magnetic resonance arthrography of the hip: technique and spectrum of findings in younger patients. *Insights Imaging*. 2010;1(2):72–82. doi:10.1007/s13244-010-0023-x
33. Kaddah RO, Elsayed Khalil M. MR Arthrography versus conventional MRI in evaluation of labral and chondral lesions in different types of femoroacetabular impingement. *The Egyptian Journal of Radiology and Nuclear Medicine*. 2017;48(1):169–178. https://doi.org/10.1016/j.ejrnm.2017.01.002
34. McCarthy JC, Noble P, Schuck M, Alusio FV, Wright J, Lee J. Acetabular and labral pathology. In: McCarthy JC, ed. *Early hip disorders: Advances in Detection and Minimally Invasive Treatment*. Springer Verlag; 2003:113–133.
35. Bharam S. Labral tears, extra-articular injuries, and hip arthroscopy in the athlete. *Clin Sports Med*. 2006;25(2):279–292. doi: 10.1016/j.csm.2006.01.003
36. Newberg A, Newman J. Imaging the painful hip. *Clin Orthop Relat Res*. 2003;(406):19–28. doi:10.1097/01.blo.0000043040.84315.85
37. Bergman G. Iliopsoas Tendinopathy, MRI Web Clinic — October 2015. http://radsource.us/iliopsoas-tendinopathy
38. Bancroft LW, Blankenbaker DG. Imaging of the Tendons About the Pelvis. *AJR Am J Roentgenol*. 2010;195(3):605–617. doi:10.2214/AJR.10.4682
39. Polster JM, Elgabaly M, Lee H, et al. MRI and gross anatomy of the iliopsoas tendon complex. *Skeletal Radiol*. 2008;37(1):55–58. doi:10.1007/s00256-007-0393-4
40. Verbeeten KM, Hermann KL, Hasselqvist M, et al. The advantages of MRI in the detection of occult hip fractures. *Eur Radiol*. 2005;15(1):165–169. doi:10.1007/s00330-004-2421-2