DANISH MEDICAL JOURNAL

Original Article

Dan Med J 2022;69(7):A09210714

# Low prevalence of trochanteric bursitis in patients with refractory lateral hip pain

Jeppe Lange[1, 2], Claus Tvedesøe[3], Bent Lund[1] & Marie Bagger Bohn[1, 2]

1) H-HiP, Department of Orthopedic Surgery, Horsens Regional Hospital, 2) Department of Clinical Medicine, Health, Aarhus University, 3) Diagnostic Centre, Silkeborg Regional Hospital, Denmark

Dan Med J 2022;69(7):A09210714

## ABSTRACT

**INTRODUCTION.** Bursitis at the greater trochanter has historically been identified as a major pain generator in patients with lateral hip pain (LHP). We believe that hip abductor tendon pathology (HATP) plays an important and overlooked role in LHP. The purpose of this study was to evaluate the presence of isolated trochanteric bursitis on MRI in patients with refractory LHP.

**METHODS.** The MRIs of 120 patients with LHP (94% women, median age 54 years) performed at our orthopaedic outpatient clinic between 2017 and 2020 were evaluated by two raters for trochanter-related pathologies, including HATP and bursitis.

**RESULTS.** Two (2%) patients were registered with greater trochanteric bursitis with no relevant HATP, 30 (25%) patients had elements of inflammation (high-intensity signals) in the greater trochanteric bursa with relevant HATP. Five (4%) patients had relevant HATP with bursitis in the sub-gluteus minimus bursa with no bursitis in the greater trochanteric bursa. The remaining 83 (69%) patients had no sign of trochanter-related bursitis.

**CONCLUSION.** Isolated trochanteric bursitis as the cause of refractory LHP appears to be rare. We believe that the presence of HATP in LHP has been severely underestimated and a shift in focus towards treatment of these structures is necessary.

**FUNDING.** none.

**TRIAL REGISTRATION.** According to current national legislation, no formal ethical approval was required for this study. The National Data Protection Agency approved the study (1-16-02-124-19).

Trochanteric bursitis has historically been identified as a major pain generator in patients with lateral hip pain (LHP), and the majority of established treatments, such as corticosteroid injections or surgery, have focused on treatment of this anatomical structure [1-3]. However, a study in 1,000 non-selected hip MRI highlighted the potentially low prevalence of an inflamed trochanteric bursa [4]. This was supported by findings in an ultrasound study including 877 patients, which only rarely detected isolated bursitis of the greater trochanter [5].

In recent years, growing attention has been devoted to hip abductor tendon pathology (HATP) as an important cause of refractory LHP. HATP includes tendinopathies, tendon tears or ruptures of the gluteus medius (Gmed) and minimus (Gmin) tendons. Unfortunately, it appears that HATP is still under- or misdiagnosed. So far, MRI has been the cornerstone in diagnosing HATP [6-10], and it has been estimated that GMed and GMin tendon tears may be present in as many as 25% of middle-aged females and 10% of middle-aged males [11].

The purpose of this study was to evaluate the presence of isolated trochanteric bursitis on MRI in patients with refractory LHP who were referred to a public orthopaedic hip clinic.

## METHODS

### Study design

This was a cross-sectional study that forms part of a large prospective cohort study [12]. The study period ran from January 2017 to January 2020. The reporting of this study was done according to the STROBE guidelines.

### Study setting

Our orthopaedic outpatient clinic (OOC) is located in a public teaching hospital with a local referral population of 250,000. As the clinic comprises a specialised hip preservation surgery unit, patients from other parts of the country are also referred to our OOC.

### Participants

In the study period, 1,349 unique patients were registered at our OOC with one of two International Classification of Diseases – tenth edtion diagnosis code related to LHP (DM70.6 Trochanteric bursitis/DM76.0 Gluteal tendinitis) by seven consultant orthopedic surgeons. Only patients seen by one of two consultants (one hip joint preservation surgeon and one adult hip reconstruction surgeon) in the study period were evaluated for participation in this study. Patients were eligible for inclusion provided i) an MRI had been performed due to LHP in the study period, ii) the patient was 18 years or above and iii) provided informed consent.

Patients were referred to MRI by the two surgeons if distinct palpable tenderness or pain of the GMed and/or GMin tendon insertions (anterior, lateral or posterosuperior facets of the greater trochanter) were detected, and this was identical to the cause of their referral. Also, one or more of the following tests were used to underpin the suspicion of HATP and needed to be positive for the patient to be referred for MRI: Trendelenburg sign/walk, the 30-second Single Leg Stance, the FADER (Hip Flexion, Adduction, External rotation), the FADER-R (Hip FADER with resisted isometric internal rotation at end range), the Internal Resistance Test, side lying hip abduction [13].

MRI was performed in 132 patients of whom 120 (94% women) provided written informed consent to participate in this study. The median age was 54 years (range: 18-77 years) at the first consultation. Distinct bilateral complaints were reported by 29 patients (24%). The history of LHP exceeded six months in all patients referred for MRI. Due to the risk of recall bias, the exact duration of symptoms was not estimated.

### MRI

The applied MRI algorithm was based on previous reports [14-17] and adapted by two of the authors (CT, JL) to a clinician-oriented concept (see **Table 1**). A preferred standard MRI approach to the lateral hip structures includes coronal and axial windows with both inflammation and anatomical protocols. The specific MRI protocols in the study were performed at the discretion of the individual radiology department. Because of national legislation, patients are entitled to have their MRI done within a miximum of 30 days as from their referral. As such, numerous centres performed the MRI. We had no direct influence on which exact MRI protocol was followed. All MRIs were transferred to our local database for evaluation. The evaluation of the MRI was performed by CT & JL, according to Table 1. CT is a consultant musculoskeletal radiologist with a special focus on MRI. CT has participated in selected surgeries in LHP patientsfocusing on the evaluation of the macroscopic findings during surgery and the associated MRI findings. JL is a consultant orthopaedic surgeon with expertise in hip joint replacement surgery and has performed more than 100 open hip abductor tendon surgeries and independently interpreted more than 200 hip MRIs since January 2017.

**TABLE 1** Applied MRI and X-ray algorithm in diagnosing hip abductor tendon pathology.

| MRI sequence | Evaluation | Interpretation |
|---|---|---|
| *Coronal* | | |
| Inflammation | Look for high-intensity signal:[a] | |
| | Superior to the greater trochanter | Active inflammation in the hip abductors as a sign of tendon pathology |
| | Lateral to the greater trochanter | Active inflammation in the hip abductor tendon-bone junction or bursae as a sign of trochanter-related pathology |
| | Intraarticular | Fluid accumulation as a sign of intraarticular pathology |
| Anatomical | Look at:[b] | |
| | Surface of lateral trochanter | This is easily visualised for osteophytes, especially in the anterolateral corner at the gluteus minimus attachment indicating longstanding irritation of the tendon-bone junction |
| | Abnormal or normal appearance of the muscle-tendon | This is based on an individual assessment<br>As it is also a binary event the number of abnormalities is of no importance in these sequences |
| | Goutallier/Fuchs Classification System on any individual section of the entire sequence with the highest fat area in relation to the total area | *The degree of muscle atrophy by*<br>Grade 0: none fat<br>Grade 1: some fat<br>Grade 2: clear fat < 25% of muscle<br>Grade 3: clear fat ≤ 50% of muscle<br>Grade 4: clear fat > 50% of muscle |
| *Axial* | | |
| Inflammation | Look for high-intensity signal:[a] | |
| | Superior to the greater trochanter | Active inflammation in the hip abductors as a sign of tendon pathology |
| | Lateral to the greater trochanter | Active inflammation in the hip abductor tendon-bone junction or bursae as a sign of trochanter-related pathology |
| | Posterior to the greater trochanter | Indicate bursa fluid as the patient lies supine during the MRI and gravity will make bursa fluid accumulate in the deep gluteal space |
| | Intraarticular | Fluid accumulation as a sign of intraarticular pathology |
| Anatomical | Look at:[b] | |
| | Surface of lateral trochanter | This is easily visualised for osteophytes, especially in the anterolateral corner at the gluteus minimus attachment indicating longstanding irritation of the tendon-bone junction |
| | Abnormal or normal appearance of the muscle-tendon | This is based on an individual assessment<br>As it is also a binary event, the number of abnormalities is of no importance in this sequence |
| | Size of tensor fascia lata: a volumetric increase is indicative of tensor fascia lata compensation in hip abductor tendon pathology | Is the size of tensor fascia lata identical yes/no if no which side is largest? |
| | Gluteus medius and minimus attachment | Is the attachment /footprint of the gluteus medius normal?<br>Is the attachment/footprint of the gluteus minimus normal? |
| X-ray | Kellgren-Lawrence classification[b] | *Grade defined binarily as*<br>0-1: no certain osteoarthrosis, normal, doubtful narrowing/ possible osteophytes<br>≥ 2: manifest osteoarthrosis, definite osteophytes/narrowing |
| | Surface of the lateral greater trochanter as a sign of longstanding enthesitis | Smooth/not clearly irregular<br>Irregular but no definite spikes or osteophytes<br>Definite spikes/osteophytes |
| | Calcification lateral to the greater trochanter as a sign of calcifying tendinitis | Yes or no |

a) Objective findings.
b) Subjective findings

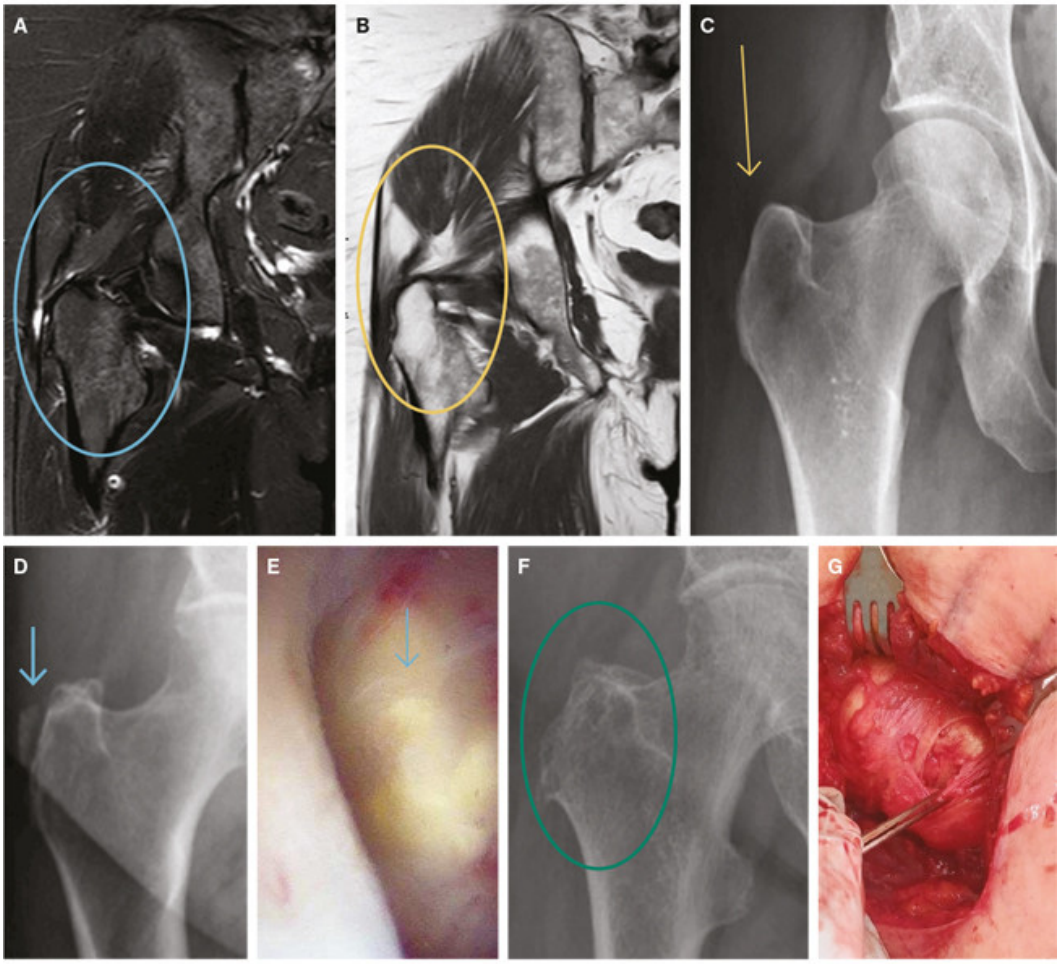
The concept of interpretation of the MRI in the study was agreed upon in consensus between CT and JL and included pre-study evaluation of five individual cases. The evaluation consisted of both "objective" findings, such as the presence of high-intensity signals, and "subjective" findings, such as the evaluators' interpretation of the "objective" findings as the presence of HATP or bursitis. Specifically in relation to the primary outcome of this study, the presence of bursitis was evaluated on inflammatory protocols. Bursitis was defined as a clearly extra-tendinous, well-defined accumulation of high-intensity signals lateral to the greater trochanter in cases of greater trochanteric bursitis or superior to the greater trochanter in cases of subgluteal bursitis, based on the work by Cvitanic et al., Kong et al. and Dwek et al. [14, 16, 18]. Tendon discontinuity with high-intensity signals replacing the tendon structure was not defined as bursitis but as a rupture (HATP) (see **Figure 1** for an example).

**FIGURE 1** MRI findings displaying high-intensity signals lateral to the greater trochanter, interpreted as gluteal tendon rupture. **A** + **B**. Short-TI inversion recovery MRI protocol. Tendon discontinuity with high-intensity signals interpreted as rupture (blue circles). **C**. T1-weighted MRI protocol. Tendon discontinuity and fatty infiltration interpreted as rupture (blue circle).


As the presence of isolated bursitis of the greater trochanter was the primary purpose of this study, a consensus meeting was held after finalization of the individual evaluations of the 120 MRIs. At this meeting, CT and JL evaluated 49 MRI in which one or the other had interpreted the presence of bursitis with or without the presence of concomitant HATP (see **Figure 2** for an example), and a consensus on the final evaluation was registered. We registered HATP on a binary level. HATP included tendinopathies, tendon tears or tendon ruptures without distinguishing between these.

Other conceptual findings were registered according to Table 1 (see Figure 2).

**FIGURE 2** MRI, X-ray and surgical findings in patients with lateral hip pain. **A.** Coronal short-TI inversion recovery (STIR) image of lateral hip structures. Blue circle encloses combined high-intensity signals interpreted as combined hip abductor tendon pathology (HATP) and greater trochanteric bursitis. **B.** Coronal T1 image of lateral hip structures is seen in the STIR image. The yellow circle encloses fatty degeneration in the gluteus medius and minimus muscle, interpreted as HATP (rupture). **C.** Standard anterior-posterior X-ray of the hip. The yellow arrow points to a smooth lateral trochanter surface, interpreted as normal. **D + E.** Standard anterior-posterior X-ray of the hip. The thick blue arrow points to a calcification lateral to the greater trochanter, interpreted as calcific tendinits, and later confirmed surgically, thin blue arrow. **F.** Standard anterior-posterior X-ray of the hip. Uneven surface of lateral trochanter (green circle), interpreted as a sign of longstanding HATP. **G.** Degenerative, complete tear of the gluteus medius suspected in F was confirmed during total hip arthroplasty.




**Data management and statistics**

REDCap was used as data extraction system and an a priori extraction report form was made comprising the information listed in Table 1. The two evaluators were blinded to each other's interpretation of the MRI and X-ray. Continuous and categorical data are presented as medians with interquartile ranges; binary data, as proportions. All statistical analyses were conducted with Stata 16.

**Ethics, registration, funding and conflicts of interest**

All patients included in the study provided their written consent for participation. The study was conducted

without funding. No authors had any conflicts of interest to report.

*Trial registration:* According to current national legislature, no formal ethical approval was required for this study. The National Data Protection Agency approved the study (1-16-02-124-19).

## RESULTS

Two (2%) patients had isolated greater trochanteric bursitis with no associated HATP. Thirty (25%) patients had HATP with some elements of inflammation (high-intensity signals) in the greater trochanteric bursa (as an example of this, see Figure 2). Five (4%) patients had HATP with bursitis in the sub-gluteus minimus bursa with no bursitis in the greater trochanteric bursa. The remaining patients (69%) had no high-intensity signals indicating trochanter-related bursitis.

A total of 88 (93%) patients had a Kellgren-Lawrence grade ≤ 1 on X-ray. Four patients (4%) had calcifications lateral to the greater trochanter on X-ray (see Figure 2).

## DISCUSSION

We found that isolated trochanteric bursitis on MRI was very rare in patients referred with refractory LHP to our public outpatient orthopaedic clinic. In most cases, a positive finding of some degree of trochanteric bursitis was associated with HATP. The vast majority of patients with refractory LHP in our cohort did not have MRI signs of trochanteric bursitis. This finding is important as most patients with LHP have, historically, been treated for their bursitis exclusively, primarily with corticosteroid injections. We believe that our findings reveal a need for a shift in focus towards treatment of HATP, especially in refractory LHP patients.

We also found that the majority of patients with refractory LHP do not have manifest radiological coxarthrosis. Furthermore, in a few cases, the LHP could potentially be attributed to findings of tendinitis calcaria.

### Relation of our findings to selected literature

MRI may aid substantially in diagnosing (and differentiating) HATP in refractory LHP. Other studies have reported on the appearance of the lateral hip structures relating to the greater trochanter [15, 16]. These studies are the foundation for the approach used in the evaluation of the MRI in patients with LHP seen at our outpatient clinic. In a study by Cvitanic et al. [14] on 45 patients, the authors concluded differentiation between pathologies would be supported by the presence of a high-intensity signal, defined as hyperintensity relative to fat on T2-weighted images or iso-intensity relative to the contents of the urinary bladder on fat-suppressed T2-weighted images, and the relative location of these to the greater trochanter. We also believe that using T2 hyperintensity signals superiorly compared to laterally to the greater trochanter as a criterion for tears may be important information in the preoperative assessment of the abductor tendons of the hips and in determining whether surgical repair is indicated. If a high-intensity area is present superior to the top of the greater trochanter, this is strongly indicative of a tear (see Figure 1).

Blankenbaker et al. [17] evaluated 131 patients for T2 hyperintensity around the greater trochanter. If hyperintensity was present, this was reported as localised above, below or both above and below the greater trochanter. The main findings of the study were that bursal fluid and peritrochanteric oedema and HATP can be seen in asymptomatic hips. This is important as the specific physiological cause(s) of pain in LHP have not been established. So, merely treating an inflamed bursa may relieve some parts of the pain but omits others. Furthermore, treating a rupture may not yield sufficient pain relief if other structures are involved in generating pain. A need exists to further evaluate the relationship between the duration and degree of the reported LHP to

the MRI findings and to qualify the specific "objective" MRI findings as described in Table 1 in LHP patients and in relevant matched patient groups.

Chi et al. [19] evaluated 185 patients and found that HATP appears to progress from tendinosis to tendon tears with advancing age and with associated progression in muscle atrophy. Furthermore, a positive association between greater trochanteric bursitis and tendon pathology with advancing age was found, suggesting that HATP may often be the true underlying cause of pain, as also found in our cohort.

**Limitations**

The cohort established in this study is believed to fairly represent the LHP population of the majority of orthopaedic outpatient hip clinics. However, certain limitations to the present study should be acknowledged. Like all observational studies, our study is prone to both information and selection bias and results must be interpreted accordingly. The cohort was formed during a period in which the two surgeons' knowledge of HATP increased, and MRI was performed on a case-by-case decision at the surgeon's discretion. We were unable to obtain completely uniform MRI protocols across the numerous radiologic centres involved. This is a major weakness, but we believe that all MRIs were suitable for evaluation of the primary endpoint – the presence of trochanteric bursitis. The interpretation of both objective and subjective findings may be questioned as our approach was designed to be used also by clinicians with no distinct expertise in musculoskeletal MRI. Tendon elongation or disruption was not registered as this may be very difficult to assess for clinicians/non-expert radiologists. Rather, tendon appearance was registered as a binary event; normal or abnormal. Neither the format nor the configuration of high-intensity signals was evaluated [17, 20] as the mere presence of such singals indicated pathologies [18], which was the relevant outcome in this study. The Goutallier/Fuchs classification grade was determined on the image with the highest fat area in relation to the total area. As fatty infiltration or muscle atrophy appears three-dimensional, but is only evaluated on a single slide, this may interfere with the clinical utility of this information. Interestingly, a recent systematic review and meta-analysis reported that high-grade fatty infiltration of the hip abductor muscles resulted in less improvement measured by the Harris Hip Score, but this did not influence VAS pain scores after surgery.

## CONCLUSION

Isolated trochanteric bursitis as the cause of refractory LHP appears to be rare. We believe that the presence of HATP in LHP has been severely underestimated, and a shift in focus towards treatment of these structures is necessary.

**Correspondence** *Marie Bagger Bohn*. E-mail: Mabohn@rm.dk

**Accepted** 11 may 2022

**Conflicts of interest** Potential conflicts of interest have been declared. Disclosure forms provided by the authors are available with the article at ugeskriftet.dk/dmj

**Cite this as** Dan Med J 2022;69(7):A09210714

*A list of all references can be provided by the corresponding author.*

## REFERENCES

1. Lustenberger DP, Ng VY, Best TM et al. Efficacy of treatment of trochanteric bursitis: a systematic review. Clin J Sport Med.

2011;21(5):447-53.

2. Mallow M, Nazarian LN. Greater trochanteric pain syndrome diagnosis and treatment. Phys Med Rehabil Clin N Am. 2014;25(2):279-89.
3. Craig, RA, Jones DGG, Oakley AP et al. Iliotibial band Z-lengthening for refractory trochanteric bursitis (greater trochanteric pain syndrome). ANZ J Surg. 2007;77(11):996-8.
4. Oehler N, Tuby JK, Strahl A et al. Hip abductor tendon pathology visualized by 1.5 versus 3. 0 Tesla MRIs. Arch Orthop Trauma Surg. 2020;140(2):145-53.
5. Long SS, Surrey DE, Nazarian LN. Sonography of greater trochanteric pain syndrome and the rarity of primary bursitis. AJR Am J Roentgenol. 2013;201(5):1083-6.
6. Lequesne M, Djian P, Vuillemin V et al. Prospective study of refractory greater trochanter pain syndrome. MRI findings of gluteal tendon tears seen at surgery. Clinical and MRI results of tendon repair. Joint Bone Spine. 2008;75(4):458-64.
7. Nho SJ, Grzybowski JS, Bogunovic L et al. Diagnosis, evaluation, and endoscopic repair of partial articular gluteus tendon avulsion. Arthrosc Tech. 2016;5(3):e425-e431.
8. McGonagle L, Haebich S, Breidahl W et al. MRI and clinical analysis of hip abductor repair. Hip Int. 2015;25(1):24-7.
9. Lindner D, Shohat N, Botser I et al. Clinical presentation and imaging results of patients with symptomatic gluteus medius tears. J Hip Preserv Surg. 2015;2(3):310-5.
10. Makridis KG, Lequesne M, Bard H et al. Clinical and MRI results in 67 patients operated for gluteus medius and minimus tendon tears with a median follow-up of 4.6 years. Orthop Traumatol Surg Res. 2014;100(8):849-53.
11. Domb BG, Nasser BM, Botser IB. Partial-thickness tears of the gluteus medius: rationale and technique for trans-tendinous endoscopic repair. Arthroscopy. 2010;26(12):1697-705.
12. Bohn MB, Lund B, Spoorendonk K et al. Gluteal-related lateral hip pain. Dan Med J. 2021;68(6):A01210027.
13. Grimaldi A, Mellor R, Nicolson P et al. Utility of clinical tests to diagnose MRI-confirmed gluteal tendinopathy in patients presenting with lateral hip pain. Br J Sports Med. 2017;51(6):519-24.
14. Cvitanic O, Henzie G, Skezas N et al. MRI diagnosis of tears of the hip abductor tendons (gluteus medius and gluteus minimus). AJR Am J Roentgenol. 2004;182(1):137-43.
15. Hartigan DE, Perets I, Walsh JP et al. Imaging of abductor tears: stepwise technique for accurate diagnosis. Arthrosc Tech. 2017;6(5):e1523-e1527.
16. Kong A, Van der Vliet A, Zadow S. MRI and US of gluteal tendinopathy in greater trochanteric pain syndrome. Eur Radiol. 2007;17(7):1772-83.
17. Blankenbaker DG, Ullrick SR, Davis KW et al. Correlation of MRI findings with clinical findings of trochanteric pain syndrome. Skeletal Radiol. 2008;37(10):903-9.
18. Dwek J, Pfirrmann C, Stanley A et al. MR imaging of the hip abductors: normal anatomy and commonly encountered pathology at the greater trochanter. Magn Reson Imaging Clin N Am. 2005;13(4):691-704, vii.
19. Chi AS, long SS, Zoga AC et al. Prevalence and pattern of gluteus medius and minimus tendon pathology and muscle atrophy in older individuals using MRI. Skeletal Radiol. 2015;44(12):1727-33.
20. Bird PA, Oakley SP, Shnier R et al. Prospective evaluation of magnetic resonance imaging and physical examination findings in patients with greater trochanteric pain syndrome. Arthritis Rheum. 2001;44(9):2138-45.