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Original article

# Chronic Non-Traumatic Hip Pain in Adults: The Role of Magnetic Resonance Imaging

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## Abstract

**Background :**chronic non-traumatic hip pain is a commonly encountered problem in the adult population. The etiology includes intra-articular causes, extra-articular causes, and even referred pain. **Patients and methods:** This cross-sectional descriptive study aimed to retrospectively characterize the MRI findings in a random sample of 50 adult patients complaining of chronic non-traumatic hip pain. **Results:** The most frequent MRI finding was bone marrow edema, followed by joint effusion. Eighteen cases were reported as normal while 32 cases were reported to have pathology. The most frequently reported pathology was osteoarthritis followed by avascular necrosis. Other cases were bursitis, transient osteoporosis, acetabular labrum tear, femoro-acetabular impingement, myositis, osteo-chondroma, osteoid osteoma, and stress fracture. **Conclusion:** MRI is an appropriate imaging modality in cases of chronic non-traumatic hip pain in adults especially when the initial clinical and imaging findings are non-conclusive. MRI without contrast is the main technique used, MR arthrography should be used when suspecting an intra-articular pathology while IV contrast can be used in cases with suspected inflammation.

**Keywords:** hip, adults, MRI.

**List of abbreviation**

**AVN**: avascular necrosis; **CT**: computed tomography; **BME**: bone marrow edema; **BML**: bone marrow lesion; **FAI**: Femoro-acetabular impingement; **GTPS**: greater trochanteric pain syndrome; **IV**: intravenous; **FOV**: field of view; **MRA**: magnetic resonance arthrography; **MRI**: magnetic resonance imaging; **OA**: osteoarthritis; **PACS**: picture archiving and communication system; **PPV**: positive predictive value; **PVNS**: pigmented villo-nodular synovitis; **STIR**: short-time inversion recovery; **TE**: time for echo; **TR**: time for repetition; **TOH**: transient osteoporosis of the hip; **QST**: quantitative sensory testing.

## Background:

Chronic non-traumatic hip pain in adults has various causes (**Table I,** quoted from[1]). Intra-articular disorders, extra-articular conditions, and mimickers such as referred pain from the lumbar spine, the sacroiliac joint, and nerve entrapment syndromes can all cause hip pain in adults [2].

Intra-articular causes can be further classified into osseous, cartilaginous, labrum, capsulo-ligamentous, and synovial causes of pain, while extra-articular causes can be related to muscles, osseous, nerve pathology, or ischio-femoral impingement.

MRI is an appropriate imaging modality in patients with negative radiographs and according to the American College of Radiology Musculoskeletal Imaging Criteria; imaging with conventional MRI of the pelvic and hip- is best for symptoms of widespread pain or nonspecific physical exam findings. MR arthrography of the hip is considered the imaging approach of choice if symptoms or clinical exam findings reveal intra-articular disease [3].

This study aims to characterize the MRI findings in a random sample of 50 adult patients complaining of chronic non-traumatic hip pain.

Table 1: classification of causes of adult chronic non-traumatic hip pain quoted from [1]

| Intraarticular | Extra-articular | Mimickers/referred |
|---|---|---|
| Osseous: | Muscles: | Referred pain |
| FAI | Chronic myositis | Lumbar spine |
| AVN | Chronic tendinitis | Knee |
| Stress fractures | Impingement: | Non-musculoskeletal pathology |
| Neoplasm | Ischio-femoral impingement | |
| TOH | Osseous: | |
| Loose bodies | Neoplasm-Stress fracture | |
| Articular cartilage: | Nerves: | |
| Arthritis | Pyriformis syndrome | |
| Labrum: | Sciatica | |
| Tear- degeneration | | |
| Capsulo-ligamentous | | |
| Capsule laxity | | |
| Adhesive capsulitis | | |
| Synovial | | |
| Chondromatosis-PVNS | | |

## Patients and methods:

### Study patients:

The study protocol was approved by the Local ethical committee. This cross-sectional study was conducted in a private center. A random sample of fifty adult patients was collected retrospectively from

the picture archiving and communication system (PACS) in the period from November 2019 to November 2020, constituted the subject of this study. They all had chronic non-traumatic hip pain and they were referred to undergo MRI of the hip joints in the MRI Unit in a private center in Egypt. The PACS system had the patient information, including the clinical history, age sex, and other information that was the basis of this study.

The privacy of the data and ethical aspects were taken into consideration. The inclusion criteria were the adult age group (starting from 18 years) and patients with a clinical picture of chronic unilateral or bilateral hip pain for at least three months. The exclusion criteria were the pediatric age, the history of trauma, and patients with absolute contraindications for MRI. Patients included in the study were subjected to history taking and were asked to remove any metallic objects before entering the MRI room.

**Image acquisition**

All patients included in this study underwent one of the following:

(1) Conventional MRI 1.5 tesla (Achiva Philips Medical Systems). All the cases were examined in the supine position with toes strapped together, and body matrix coil was centered over both hips, bilaterally examined even if the patient complained of unilateral pain. Conventional MRI sequences were obtained (summarized in **Table II**).

(2) MR arthrography: 12% of cases were referred for intra-articular injection of contrast for better visualization of intra-articular structures of the joint.

- Fluoroscopic guided contrast injection.
- Patient position: supine with both feet taped together, maintaining internal rotation of the hip.
- The area was prepared and draped in a sterile fashion; then local anesthesia using lignocaine injection.
- A direct anterior or antero-lateral approach to the hip was used. The needle tip (22-gauge) is advanced until it reaches the femoral head.
- After the needle contacts the bone and penetrates the capsule, injection of the contrast starts (the mixture used is composed of 0.1ml gadopentetate dimeglumine, 5ml non-ionic contrast, 3ml xylocaine, and completed up to 20ml with sterile saline).
- Injection starts with a small amount to confirm intra-articular placement of the contrast material, then continues to fill the joint with enough contrast.
- The patient was then transferred to be scanned with MRI within 30 minutes of injection.
- The MRI sequences used are summarized in (**Table II**).

(3) Intravenous contrast injection was not performed in the current random sample.

(4) Complementary imaging: Complementary sequences or techniques were used in a minority of patients including diffusion-weighted MR sequence, CT, and X-ray according to the clinical scenario and initial imaging findings. Diffusion was added in the setting of suspected inflammation or neoplasm, while CT or x-ray were used in certain cases when there was a focal

pathology in the bones or at the joints and the radiologist thought they would add more value in assessing the patient condition according to the primary analysis of the MRI images.

**Images interpretation and analysis**

The produced MR images were transferred to the PACS system to be interpreted by two radiologists; a registrar with 10 years' experience who writes a primary report and a consultant with more than 20 years' experience who revises the reports. For each examined joint, certain points were assessed and reported including; MRI technique, use of complementary studies, articular relations, bone outline, joint space, sub-chondral region, bone marrow, bursal sites, and other soft tissue abnormalities.

**Data management and statistical analysis -**

Were performed using SPSS version 25 (IBM, Armonk, New York, United States). Age- the only quantitative variable- was assessed for normality using Kolmogorov–Smirnov test and direct data visualization methods. According to normality testing, age was summarized as the mean and standard deviation. Categorical data are summarized as numbers and percentages.

## Results

The current study included 50 patients. The mean age of the study patients was 43 ±18 years. More than half of the patients were males (56.0%), and more than one-third were females (44.0%).

The most frequent site of chronic hip pain was the left side (38.0%), followed by the right side (34.0%) and bilateral (28.0%).

The most frequent MRI technique used was MRI without contrast (88.0%). Only 12% underwent MRI arthrography **(Figure 1)**.

Complementary studies were conducted in 18.0% of the patients, the most frequent complimentary was CT.

The most frequent finding was bone marrow edema (32.0%), followed by joint effusion (30.0%) and joint space narrowing (26.0%). The least frequent findings were abnormal labrum signal (8.0%), bone marrow focal lesions (6.0%), and abnormal articular relations (2.0%) (**Table III & Figure 2**).

Intra-articular causes were more frequent than extra-articular causes or cases reported as normal (**Figure 3**).

The pathological distribution of the current sample: eighteen cases were reported as normal while 32 cases had pathology (**Table IV and Figure 3**). The most frequent pathology reported was osteoarthritis (16.0%) **(Figure 5),** followed by avascular necrosis (12.0%) (**Figure 6**), and bursitis (8.0%), while the least frequent pathology were stress fracture, osteoid osteoma, osteochondroma, and myositis (2.0% for each).

**2:** Protocol of hip MRI

| | FOV | Slice thickness | Gap | TR | TE |
|---|---|---|---|---|---|
| **Conventional MRI** | | | | | |
| Axial T1 TSE | 35–50 cm | 4–5 mm | 1 mm | 450–550 ms | 17–21 ms |
| coronal T1 TSE | 35–50 cm | 4–5 mm | 1 mm | 450–550 ms | 17–21 ms |
| Coronal T2 TSE | 35–50 cm | 4–5 mm | 1 mm | 3500–4500 ms | 110–120 ms |
| Coronal T2 fat sat | 35–50 cm | 4–5 mm | 1 mm | 3500–4500 ms | 110–120 ms |
| Sagittal T2 | 35–50 cm | 4–5 mm | 1 mm | 3500–4500 ms | 110–120 ms |
| MR arthrography | | | | | |
| Coronal T1 FAT SAT post-contrast | 15 cm | 4–5 mm | 1 mm | 450–550 ms | 17–21 ms |
| Axial oblique T1 FAT SAT post-contrast | 15 cm | 4–5 mm | 1 mm | 450–550 ms | 17–21 ms |
| Sagittal T1 FAT SAT post-contrast | 15 cm | 4–5 mm | 1 mm | 450–550 ms | 17–21 ms |

**Table 3**: radiological findings in our study and their frequency

| Radiological findings | n (%) |
|---|---|
| Abnormal articular relationships | 1 (2.0) |
| Joint space narrowing/irregularity | 13 (26.0) |
| Osteophytes | 8 (16.0) |
| Joint effusion | 15 (30.0) |
| Subchondral sclerosis | 8 (16.0) |
| Subchondral pseudocysts | 12 (24.0) |
| Bone outline and contour abnormality | 12 (24.0) |
| The type of bone outline abnormality | |
| Bony outgrowth | 1 (8.3) |
| Coxa magna | 1 (8.3) |
| Flattening | 7 (58.3) |
| Hump | 3 (25.0) |
| Bone marrow edema | 16 (32.0) |
| Bone marrow sclerosis or double line sign | 8 (16.0) |
| Bone marrow focal lesions | 3 (6.0) |
| Labrum abnormal signal | 4 (8.0) |
| Bursal fluid distension | 5 (10.0) |
| Other soft-tissue abnormalities | 8 (16.0) |
| Types of other soft tissue | |

| abnormalities | |
|---|---|
| Muscle edema | 3 (37.5) |
| Cartilage defect | 1 (12.5) |
| Enlarged uterus | 1 (12.5) |
| Abnormal tendon | 1 (12.5) |
| Adnexal cyst | 1 (12.5) |
| Prostatomegaly | 1 (12.5) |

**Table 4:** final diagnosis of the cases included in our study

| Pathology | n (%) |
|---|---|
| Myositis | 1 (2.0) |
| Avascular necrosis | 6 (12.0) |
| Bursitis | 5 (10.0) |
| Femoro-acetabular impingement | 2 (4.0) |
| Labral tear | 3 (6.0) |
| Normal study | 18 (36.0) |
| Osteoarthritis | 8 (16.0) |
| Osteochondroma | 1 (2.0) |
| Osteoid osteoma | 1 (2.0) |
| Stress fracture | 1 (2.0) |
| Transient osteoporosis | 4 (8.0) |

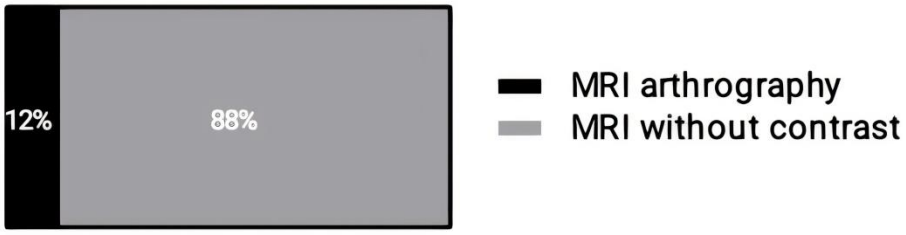


**Figure 1:** Frequency of the techniques used in the studied cases

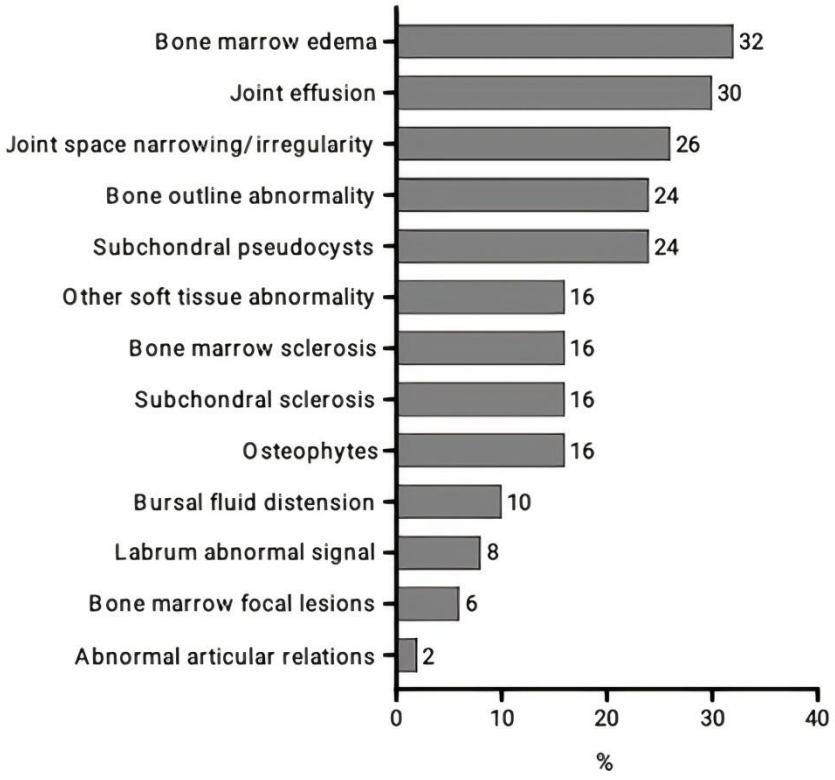


**Figure 2:** Frequency of MRI findings in our study

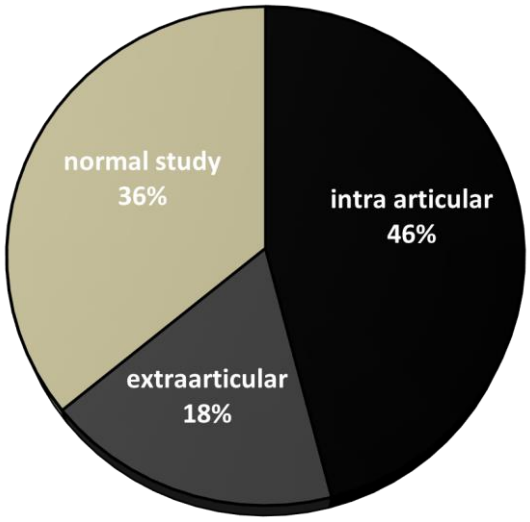


**Figure 3:** Categorization of the pathology in our study

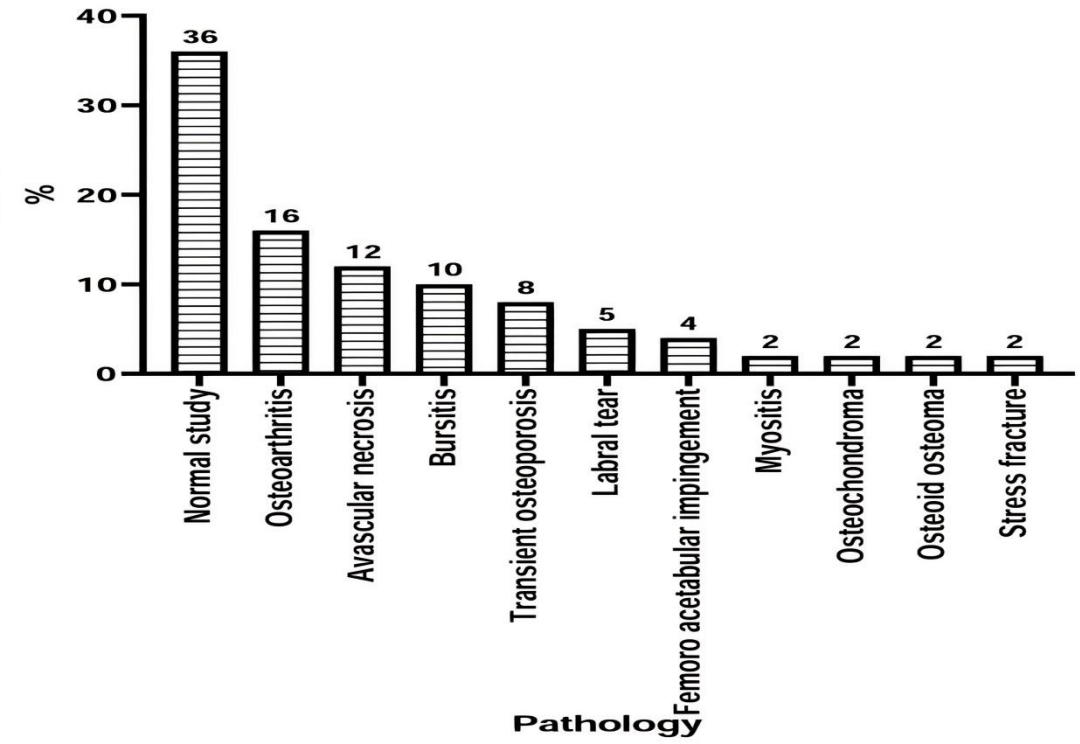


**Figure 4:** Frequency of pathology in our study

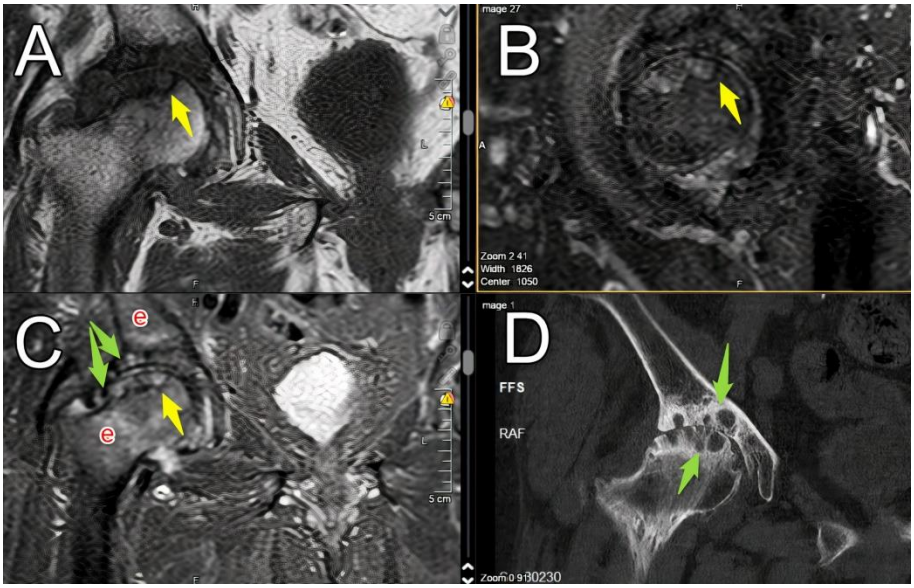


**Figure 5:** selected images from coronal MRI T1 (A), sagittal PDW-SPAIR (B), coronal MRI STIR (C), and complementary coronal CT (D) in a case of advanced osteoarthritis secondary to AVN. serpentine geographic low signal line surrounding an area of abnormal signal (yellow arrows). Osteoarthritic changes with narrowed irregular joint spaces and marginal osteophytes. Note the subchondral pseudocysts (green arrows) and the edema signal both displayed as low signal in T1 turning high in STIR. The osteoarthritic changes are also nicely demonstrated by the complementary CT

**Figure 6**: Coronal TI MRI showing osteonecrosis of the right femoral head presenting as a geographic hypointense line bordering an area of abnormal signal.

## Discussion

Hip pain is a frequent yet nonspecific symptom that can be caused by various articular and extra-articular problems. Imaging is critical in the evaluation of hip pain, and MRI is a useful imaging tool in these circumstances [4].

The current study included 50 patients in the adult age group, presenting with chronic non-traumatic hip joint pain referred to conduct MRI examination.

The mean age of the study patients was 43 ±18 years. More than half of the patients were males (56.0%). The most frequent site of chronic hip pain was unilateral at the left side (38.0%). These demographic and symptomatic findings agree with a previous study by Gautam & More [5].

According to the American college of Radiology diagnostic criteria for individuals with chronic hip pain, radiographs of the pelvis and hip should be the first test ordered. When radiographs are negative, equivocal, or non-diagnostic and there is a suspicion of an extra-articular noninfectious soft tissue abnormality, or when suspecting pigmented villonodular synovitis or osteo-chondromatosis- an MRI hip without IV contrast is indicated.

In cases of suspected impingement, MR Arthrography is more appropriate than MRI hip without IV contrast, and it is equally appropriate in cases of suspected articular cartilage problems. The use of intravenous contrast injection is limited to situations in which an infection is a concern [3].

This agrees with the technique used in the current study, where the most frequent MRI technique used was MRI without contrast (88.0%) while MRI arthrography constituted 12%.

Complimentary studies were conducted in 18.0% of the patients with CT was the most frequent complementary test used especially when there was a concern about the bones.

The most frequent MRI finding in the current study was bone marrow edema, which agrees with the recent studies.

Gautam & More [5] said that bone marrow edema (BME), is a common cause of hip pain. BME has patho-physiological implications, including a relation to capillary wall destruction within the bone marrow, which can result in increased intra-osseous pressure and sensory nerve discomfort.

BME of the hip can be diagnosed in patients with traumatic or non-traumatic hips, and it manifests in cases of transient BME of the hip, in advanced osteoarthritis, avascular necrosis (AVN), transient osteoporosis, stress injuries, and viral or inflammatory disorders.

The presence of a subchondral bone marrow lesion (BML) is one factor that raises the likelihood of OA progression. BMLs were found to raise the risk of OA by 2.5 times [6].

Kijima et al. [7] said that on MRI, the patients with more pain have BMLs of the femoral head that extend not only to the loading area but also to the central-inferior area, according to a study of the differences between painless and painful osteoarthritis of the hip. But, they also found that the discomfort was worse in patients with significant psoas atrophy, even when the X-ray findings were similar. Muscle atrophy was not a prevalent finding in the current study.

The second most frequent MRI finding in the current study was joint effusion.

Hip OA causes the synovial joint structures to degenerate over time, resulting in pain and impairment, however, the link between joint structural change and pain is unclear. Because the cartilage is aneural and avascular, there is little link between early cartilage loss and discomfort.

Pain can be mediated by inflammatory processes such as synovitis and effusion, which can change over time. Synovitis and effusion are common in osteoarthritic joints, and they have been linked to the development of symptomatic OA.

In a study by by Mayes et al.[8] in female ballet dancers, hip joint effusion-synovitis was linked to higher degrees of pain and lower sports/recreation function. There was no link between effusion-synovitis and hip rotation ranges of motion, general joint hypermotility, or cartilage abnormalities. Dancers were the only ones who had larger joint effusion-synovitis while other non-dancing athletes were not.

In a more recent study by Ahedi et al. [9], it was suggested that hip pain may be linked to hip effusion-synovitis. Hip BMLs and hip cartilage defects are intimately connected and predict deteriorating hip, implying that defects, BMLs, and effusion-synovitis- are all linked. In the study by Gautam & More [5] avascular necrosis was the most frequent diagnosis, which is a little bit different from the present study results.

The present study revealed 32 diseased joints and the most frequent pathologywere osteoarthritis (8 cases) followed by avascular necrosis (6 cases).

The most common structural abnormalities detected in the current study were joint space narrowing and irregularity (26%)

followed by bone outline abnormality (24%). Bone outline abnormalities were mostly related to cases of impingement as well as the structural collapse of the head of the femur in advanced cases of OA.

A study by Hattori et al.[10]suggested that central sensitization may be involved in the joint pain of patients with hip OA who complain of severe pain despite less severe joint deformity.

They found no significant difference in radiologic severity between patients with strong/severe and mild/moderate joint pain groups. By contrast, they found a significant difference in central sensitization represented by quantitative sensory testing (QST) between strong/severe and mild/moderate joint pain groups.

The second most frequent pathological diagnosis in the current study was avascular necrosis. Gehlot et al.[11]found that the most sensitive method for diagnosing AVN-is MRI. This imaging method is more sensitive than CT scanning or bone scans and provides the gold standard of non-invasive diagnostic evaluation. Because young guys were commonly affected and diagnosed with advanced-stage disease, they recommended that all patients presenting with hip symptoms, particularly those in the reproductive age group, get a screening MRI. Mentioning that, it is worth saying that another study by Khaladkar et al. [12] suggested a rapid protocol composed of only coronal T1W sequence is an easy, rapid, and cost-effective method for detecting unilateral or bilateral AVN.

In the present study, we used both T1 and other fluid-sensitive sequences. In our opinion, this is more appropriate but of course with more cost and time-consuming.

Other causes of chronic non-traumatic hip pain in the present study were; bursitis, transient osteoporosis, femoro-acetabular impingement (FAI), myositis, osteochondroma, osteoid osteoma, and stress fracture.

The distended bursa shows a low signal in T1 and a high signal in T2 corresponding to the fluid content. Gadolinium intravenous injection may show wall enhancement. Mural thickening indicates chronicity.

MRI has been used to help confirm the diagnosis of greater trochanter pain syndrome (GTPS) by demonstrating peri-trochanteric edema on T2 sequences, according to several authors. The presence of peri-trochanteric abnormalities on T2 MRI is not conclusive of GTPS, but the absence of these findings ruled out GTPS [13].

The current study included five cases with bursitis, two of them are trochanteric, two iliopsoas, and one gluteus medius bursitis. Two of these cases were associated with joint effusion and one case also showed mild osteoarthritic changes. The current study also included 4 cases of transient osteoporosis. Again, the absence of additional localized lesions in the subchondral bone- which distinguishes transient osteoporosis from chronic diseases- is a very sensitive and specific marker of transient osteoporosis [14].

Cabarrus et al. [15] found that in the diagnosis of insufficiency fracture, MRI had a sensitivity of 95% and the CT had a sensitivity of 53% in detecting fractures.

The present study included a case of insufficiency fracture that underwent a complementary CT. The fracture was detected on both CT and MRI but was more obvious on MRI.

Most tumors that affect the proximal femur are benign. Osteoid osteoma, giant cell tumor, osteochondroma, aneurysmal bone cyst, and Langerhans cell histiocytosis- are all common primary tumors and pseudotumors of the hip [16].

The current study included a case of osteoid osteoma and a case of osteochondroma.

It is the high levels of prostaglandins within the nidus of osteoid osteoma that mediate vasodilatation and inflammation in the tissues around it causing pain, which is highly responsive to non-steroidal anti-inflammatory drugs [17].

Osteochondromas can induce compression of the nearby structures, such as nerves, resulting in pain [18].

Muscle inflammation is the most common atraumatic pattern at MRI with low signal in T1WI and high T2/STIR signal. Symmetric bilateral edema is related to inflammatory and drug-related myopathies while asymmetric edema is related to infection, radiation necrosis, and compartment syndrome. The presence of a marginally enhanced abscess is characteristic of infection [19].

The current study included a case of myositis and septic arthritis resistant to treatment with abscess formation. The patient did a previous operative evacuation of an abscess 45 days ago, he presented with recurrence of symptoms and MRI revealed a recurrent abscess formation. Although intravenous contrast injection is indicated in inflammatory conditions, in this case, the added DWI sequence revealed restricted diffusion in the abscess with the clinical scenario were sufficient to reach the diagnosis. MR arthrography was used in 6 cases for assessment of possible intra-articular pathology and better assessment of femoro-acetabular impingement.

El-Liethy et al.[20]said that in the preoperative assessment of FAI patients, MR arthrography is a useful imaging modality.

It detects labral tears with excellent sensitivity and PPV, in addition to determining the type of impingement by measuring alpha angle and acetabular depth among other measurements. Their results demonstrated great specificity despite being less sensitive in detecting chondral anomalies.

The present study revealed 3 cases of acetabular labral tear and one case with focal cartilage defect using MRI arthrography.

The current study revealed 18 cases reported as normal MRI. To the best of our knowledge, little research was conducted on explaining normal imaging findings while the patient is complaining of chronic non-traumatic hip pain.

In our perspective, normal conventional MRI warrants further assessment of occult intra-articular pathology, for example, labral tears, using MR arthrography.

Another explanation is that the pain may be referred to the hip joint, for example, from the lumbar spine, which should be excluded by clinical examination and imaging. This viewpoint agrees with a study by Buikstra et al. [21] where they found that although MRI

is widely used to image hip disease-where clinical suspicion exists despite otherwise normal imaging- fluoroscopic guided injections of local anesthesia are indicated.

Their study revealed a 98 percent risk of intra-articular hip pathology being identified on hip arthroscopy in individuals with normal XR and MRI with a good response to an intra-articular injection who have failed conservative therapy and that there is a high rate of acetabular labrum tears in patients having hip pain that is resolved by local anesthetic and a normal MRI.

The current study was limited by the low sample size which was limited by the ability of the PACS system to preserve the study information for only few months.

## Conclusions

In cases of chronic non-traumatic hip pain in adults, MRI is an appropriate imaging modality, particularly when the first clinical and imaging findings are inconclusive.

Intra-articular causes were more prevalent in the current sample, but larger studies should be considered.

The most common approach is MRI without contrast, however, MR Arthrography can be used when there is a suspicion of intra-articular pathology, and IV contrast can be indicated mainly when there is a suspicion of inflammation.

We emphasize the importance of fluid-sensitive sequences and recommend that at least two planes should be included in the protocol.

Before considering a case as fully normal after initial unremarkable conventional MRI findings, we propose MR arthrography can rule out concealed intra-articular disease. Also transferred pain from an extra-articular source should be excluded clinically and by imaging.

The main drawback against MR arthrography is its invasiveness, so, further research toward non-invasive techniques should be encouraged.

## References


1. El-Bakoury A, Williams M. Management of hip pain in young adults. Surgery (Oxford) 2020;38:74–8.https://doi.org/10.1016/j.mpsur.2019.12.004.
2. Jude CM, Modarresi S. Imaging evaluation of the painful hip in adults - UpToDate 2021. https://www.uptodate.com/contents/imaging-evaluation-of-the-painful-hip-in-adults (accessed December 28, 2021).
3. Mintz DN, Roberts CC, Bencardino JT, Baccei SJ, Caird MS, Cassidy RC, et al. ACR Appropriateness Criteria ® Chronic Hip Pain. Journal of the American College of Radiology 2017;14:S90–102. https://doi.org/10.1016/j.jacr.2017.01.035.
4. Anu Kapoor KVR. MR Evaluation of Non-Traumatic Hip Pain. Jmscr2017;05:19090–101. https://doi.org/10.18535/jmscr/v5i3.126.
5. Gautam A, More D. Role of MRI in Non-Traumatic Adult Chronic Hip Joint Pain. Journal of Cardiovascular Disease Research 2020;Vol 11:163 166. https://doi.org/10.31838/jcdr.2020.11.02.26.
6. Kapil N, Samuel LT, Kamath AF. Management of Bone Marrow Lesions of the Hip With Subchondral Calcium Phosphate Injection: Surgical Technique and Tips. Arthroscopy Techniques 2020;9:e863–75. https://doi.org/10.1016/j.eats.2020.02.022.
7. Kijima H, Yamada S, Konishi N, Kubota H, Tazawa H, Tani T, et al. The Differences in Imaging Findings Between Painless and Painful Osteoarthritis of the Hip. Clin Med Insights Arthritis MusculoskeletDisord2020;13:117954412094674. https://doi.org/10.1177/1179544120946747.
8. Mayes S, Ferris A-R, Smith P, Cook J. Hip Joint Effusion-Synovitis Is Associated With Hip Pain

and Sports/Recreation Function in Female Professional Ballet Dancers. Clinical Journal of Sport Medicine 2018;Publish Ahead of Print. https://doi.org/10.1097/JSM.0000000000000595.

9. Ahedi H, Aitken D, Blizzard L, Cicuttini F, Jones G. Quantification of hip effusion-synovitis and its cross-sectional and longitudinal associations with hip pain, MRI findings and early radiographic hip OA. BMC MusculoskeletDisord2020;21:533. https://doi.org/10.1186/s12891-020-03532-7.
10. Hattori T, Shimo K, Niwa Y, Tokiwa Y, Matsubara T. Association of Chronic Pain with Radiologic Severity and Central Sensitization in Hip Osteoarthritis Patients. JPR 2021;Volume 14:1153–60. https://doi.org/10.2147/JPR.S296273.
11. Gehlot PS, Agrawal K, Mangal R, Sodani V. Avascular Necrosis of Femoral Head: A Retrospective Study of MRI Scans. JCDR 2019. https://doi.org/10.7860/JCDR/2019/40929.13251.
12. KhaladkarMs, Randhawa S, Singh G, Aditi G, Rajesh K, Rajeshwar S. Rapid magnetic resonance imaging protocol for detecting femoral head avascular necrosis: A case series-it′s utility in the general population in developing countries. Med J DY Patil Univ 2015;8:189. https://doi.org/10.4103/0975-2870.153156.
13. Sunil Kumar KH, Rawal J, Nakano N, Sarmento A, Khanduja V. Pathogenesis and contemporary diagnoses for lateral hip pain: a scoping review. Knee Surg Sports TraumatolArthrosc2021;29:2408–16. https://doi.org/10.1007/s00167-020-06354-1.
14. Szwedowski D, Nitek Ż, Walecki J. Evaluation of transient osteoporosis of the hip in magnetic resonance imaging. Pol J Radiol2014;79:36–8. https://doi.org/10.12659/PJR.889827.
15. Cabarrus MC, Ambekar A, Lu Y, Link TM. MRI and CT of Insufficiency Fractures of the Pelvis and the Proximal Femur. American Journal of Roentgenology 2008;191:995–1001. https://doi.org/10.2214/AJR.07.3714.
16. Bloem JL, Reidsma II. Bone and soft tissue tumors of hip and pelvis. European Journal of Radiology 2012;81:3793–801. https://doi.org/10.1016/j.ejrad.2011.03.101.
17. May CJ, Bixby SD, Anderson ME, Kim YJ, Yen Y-M, Millis MB, et al. Osteoid Osteoma About the Hip in Children and Adolescents. The Journal of Bone and Joint Surgery 2019;101:486–93. https://doi.org/10.2106/JBJS.18.00888.
18. Aldashash F, Elraie M. Solitary osteochondroma of the proximal femur causing sciatic nerve compression. Annals of Saudi Medicine 2017;37:166–9. https://doi.org/10.5144/0256-4947.2017.166.
19. Smitaman E, Flores DV, Mejía Gómez C, Pathria MN. MR Imaging of Atraumatic Muscle Disorders. RadioGraphics2018;38:500–22. https://doi.org/10.1148/rg.2017170112.
20. El-Liethy NE, Zeitoun R, Kamal HA, El-Azeem AHA. Magnetic Resonance Arthrography, a valuable preoperative imaging modality in femoro-acetabular impingement. Egypt J RadiolNucl Med 2019;50:79. https://doi.org/10.1186/s43055-019-0049-0.
21. Buikstra JG, Fary C, Tran P. Arthroscopic findings of a diagnostic dilemma- hip pathology with normal imaging. BMC MusculoskeletDisord2017;18:120. https://doi.org/10.1186/s12891-017-1485-5.

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