

Hip Magnetic Resonance Imaging: Descriptive Epidemiology and Outcome in Jordan University Hospital

Azmy M. Hadidy,*¹ Deema M. Abu- Labn,¹ Tahani M. Ahmad,¹ Azmi A. Haroun,¹ Maher T. Al-Hadidi,² Waleed S. Mahafza,¹ Emad S. Tarawneh,¹ Mustafa M. Nadi,³ Osama A. Samara¹

Abstract

Aim: To evaluate the experience in Jordan University Hospital regarding hip magnetic resonance imaging and to compare our findings with those published in medical literature.

Methods: one hundred eighty two hip magnetic resonance images performed over the period of 7 years were reviewed, 88 patients (48.3%) had normal hip magnetic resonance image and were excluded from the study while the remaining 94 images (51.6%) with variable abnormalities were included in our study.

Results: Variable hip pathologies were seen, the most common was bone marrow edema syndrome found in 22 patients representing (23.4%) of the pathologies detected, followed by transient osteoporosis in 16 (17%) patients and avascular necrosis of the hip joint in 13 (13.8%) patients. Slipped femoral capital epiphysis and Paget's disease were the least common seen in (1.1%) for each.

Conclusion: In Jordan University Hospital referred patients for hip MRI scanning showed diverse findings with the most common abnormality detected being bone marrow edema syndrome of the femoral head followed by transient osteoporosis and avascular necrosis. The great benefit from magnetic resonance imaging was in diagnosing transient osteoporosis, staging avascular necrosis of the hip joint and characterization of deep pelvic soft tissue masses. The prevalence of hip pathology among Jordan University hospital patients as revealed by magnetic resonance imaging was in concordance with what was published in the literature.

Keywords: Hip Pathology, Hip MRI, BMES.AVN, TOH.

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Introduction

Diseases of the hip are significant public health problems. Fractures and osteoarthritis of the hip are common in older age-groups, avascular

necrosis and transient osteoporosis are seen in different age groups mostly middle ages, while congenital dislocation of the hip, Legg-Calvé-Perthes disease, and slipped epiphysis affect certain proportion of infants, children, and

1. Department of Diagnostic Radiology, Jordan University Hospital, Amman, Jordan.

2. Department of Anatomy, Faculty of Medicine, University of Jordan, Amman, Jordan.

3. Department of Neurosurgery, Jordan University Hospital, Amman, Jordan.

* Correspondence should be addressed to:

Azmy M. Hadidy

Jordan University Hospital, University of Jordan, Amman 11942, Jordan.

E-mail: ahadidy@ju.edu.jo

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adolescents.^{1,2} The distribution of these common hip diseases in the population and etiological hypotheses were discussed in many articles.

Previously, many hip symptoms were considered non-specific and might need exploration to assess nature and extent, were diagnosed retrogradly when symptoms resolved later on when complications occurred. Nowadays, different methods for radiological investigation of hip symptoms are employed including plain X rays, arthrograms, ultrasound, computed tomography and Magnetic Resonance Imaging (MRI), each modality having advantages and limitations and certain roles of application.

Magnetic Resonance Imaging (MRI) plays an important role as an adjuvant to Computed Tomography (CT) and plain films in diagnosing and assessing bone lesions,³ in addition to its distinguished role in diseases involving the bone marrow and soft tissue masses.⁴ Hip MRI is now considered the investigation of choice for diagnosing Transient Osteoporosis of Hip joint (TOH) and staging Avascular Necrosis (AVN).^{5,6} It is a noninvasive and a reliable tool, but its high cost and claustrophobic nature besides being contraindicated in cases of pacemakers and recent implants put some limitations on its widespread usage and implication.

The aim of this retrospective study is to determine different hip pathologies observed in MRI among Jordan university hospital patients and to compare these findings with the world-wide prevalence as published in the literature.

Patients and Methods

Patient's Population

In our retrospective study, we reviewed the hip MRI of 182 patients, with a mean age of 39.9 years, who underwent hip MRI in Jordan university hospital between March 2001, and October 2008, 85 were females and 97 were males. Of the 85 females, 44 (51.8%) had abnormal scan, while 50 out of 97 of the total males examined had abnormal scan giving a

percentage of 51.5%. The image was considered normal when both hip joints appeared normal in alignment without joint effusion or any apparent defect in the labrum, and when normal contour and bone marrow signal of both femoral heads as expected for patient age without focal lesions neither in the bone, surrounding soft tissue nor in the visualized pelvic organs were insured.

The clinical presentation for the majority of patients was hip pain experienced in the groin, buttock or thigh regions. Others complained of difficulty in movement or decreased range of motion affecting their daily activities, some had painful limping gait. Neither institutional ethics committee approval nor informed consent was required for reviewing patient records and images.

Techniques

Hip MRI was performed using 1.5 Tesla super conducting MRI unit (Magnetom vision plus Siemens, Erlangen, Germany). A pre-designed protocol was done using standard phased array body coil: both hip joints were imaged using T1 spin echo sagittal and axial and T2 SE coronal and axial images in addition to T2 fat sat images in coronal and axial planes with thickness of 4 mm without intersection gap. No intravenous contrast medium was used, unless clinically indicated (suspicion of tumor or infection) or requested by a radiologist after non-contrasted study being reviewed, using 0.1mmol/kg (gadolinium DTPA). Coronal images were acquired from anterior to posterior, axial images were acquired from proximal to distal. Skin marker (fish oil or vitamin E capsule) was put at the area of maximum tenderness if it was very small.

Images were reviewed by two consultant radiologists experienced in musculoskeletal magnetic resonant imaging followed by a consensus to resolve any difference in interpretation. Hip MRI was studied thoroughly for any abnormality in the joint space, focal bony lesions, bone marrow signal, bone contour, surrounding soft tissue, fracture lines and any asymmetry.

Results

Of the 182 patients investigated during the period between March 2001 to October 2008, 97 were males (53.2 %) and 85 were females (45.9%) with mean age 39.9 years (range 1- 74 years), male to female ratio was 1.2:1. Eighty eight (48.3%) were excluded as no hip abnormality was seen, while the remaining 94 (51.6%) patients were included in this study (Table1). Twenty two patients were grouped under the common title of bone marrow edema syndrome with the highest percentage of (23.4%). Thirteen patients (13.8%) had AVN of the femur head, 16 patients (17%) showed changes of transient osteoporosis, both Osteoarthritic changes and tumoral bony lesions were manifested equally in 9 images for each representing (9.5%) of the cases (Table 2).

Table (1): Demographic data of our patients.

	<i>Males</i>	<i>Females</i>
<i>Number of Patients</i>	50	44
<i>Percentage</i>	53.1%	46.8 %
<i>Mean Age</i>	43 .0 yr	39.4 yr

Table (2): Hip pathological findings as detected by MRI.

DISEASE	Bone marrow edema syndrome		Transient osteoporosis		Avascular necrosis		Bone neoplastic lesions		Metastasis		Osteoarthritis		Fractures		DDH		Deformed
	male	female	male	female	male	female	male	female	male	female	male	female	male	female	male	Female	Male
Number of cases	22		16		13		10		9		9		3		2		2
%	23.4		17		13.8		10.6		9.6		9.6		3.2		2.1		2.1
Number of Cases	14	8	14	2	5	8	3	7	6	3	5	4	2	1	-	2	2
Mean Age/yr	53	46	43	74	43	30	43	34	61	43	46	38	35	-	-	3	24.5
MALE: FEMALE	7:4		7:1		5:8		3:7		3:1		5:4		2:1		0:5		
Worldwide %					14.3								46		6.6		

Discussion

Descriptive epidemiological studies are important as these show variations in frequency and prevalence of the studied abnormality by time, age, gender, histological type, geographic region, and ethnicity.⁷ This study was meant to be a descriptive retrospective study evaluating the prevalence of different hip pathologies in Jordan University Hospital patients as revealed by MRI.

In reviewing the literature, many studies had been conducted to evaluate certain hip pathologies regarding incidence, prevalence and risk factors.¹ Others compared the incidence of certain pathology in normal population and among those with obvious or supposed increased risks.⁸ The most fearful hip pathology with significant sequale is agreed to be Avascular Necrosis (AVN),^{9,10} however its frequency and prevalence in most countries are unknown. The rate of AVN of the hip is 2-4.5 cases per patient-year in the United States with approximately 15,000 new cases reported each year. A Japanese survey estimated that 2500-3300 cases of AVN of the hip occur each year; of these 34.7% were due to corticosteroid use, 21.8% to alcohol abuse, and 37.1 to idiopathic mechanism.⁹

It was found that 13.5% of patients with renal transplant developed MRI evidence of AVN.⁸ 52% of SLE patients who were on corticosteroid therapy according to Javisiodha et al. and Oka and Monu study.^{12,13} Similarly, 9% of multiple myeloma patients who underwent treatment with dexamethasone based regimens and high dose chemotherapy found to have AVN (none had received radiation therapy to the affected bone).¹⁴

It is also common in patients with sickle cell disease to have a varying rate of occurrence from 9.7%¹⁵ and 19%-31%.^{16,17} Another study from France reported AVN in 4.3% of allogenic bone marrow transplant recipients.¹⁰ AVN was also reported in 1.29% of human immunodeficiency virus infected patients (HIV).¹⁸ In our study, 13.8% of the reviewed images revealed AVN of the hip. This relatively high incidence compared

with what is published in the literature is attributed to the fact that all our MRI studies were done for symptomatic patients with high clinical suspicion of such pathology, and as mentioned before MRI is the best modality for diagnosing AVN of the hip.

MRI also plays a fundamental role in revealing subtle hip fractures in patients with high clinical suspicion, but normal plain film findings as in Oka and Monu study¹³ in which seventy-six MRIs were performed in 73 patients whose radiographic findings were negative or equivocal for hip fracture, forty-six percent (35/76) of the MR images showed subtle fractures. Seventeen fractures were in the proximal femur and 18 in the innominate bone.¹⁹ A Smaller number of cases in our study (3 patients, 3.2%) had fractures, due to the fact that we depend in our center on plain X ray films for showing up fractures and very rarely is MRI done for query of subtle fractures with very strong clinical suspicion.

In addition, MRI proved to be a helpful tool in children with undiagnosed hip pain as it provided a positive diagnosis in 22 out of 55 children (40%) according to Trace R et al study²⁰ detecting various pathologies like transient synovitis, osteoid osteoma, trochanteric bursitis, hemarthrosis, sacroiliac infection, synovitis secondary to juvenile idiopathic arthritis, ischio-pubic osteochondromata, acetabular dysplasia, and eosinophilic granuloma.¹²

In our study, we evaluated a wide age range (1-71 years), figure (2 A and 2B), thus the great diversity of pathologies detected were not unexpected and involved Developmental Dislocation of the Hip (DDH), TOH, AVN, bony neoplastic lesions, Osteoarthritis (OA) and others as detailed earlier (Table 2). The great portion of our patients (23.4%) demonstrated Bone Marrow Edema Syndrome (BMES) which is a reversible bone marrow edema pattern without associated radiological changes of osteopenia. Like TOH of the hip, it is a self-limited condition.¹³ Transient Osteoporosis of femoral Head (TOH) was the second most common finding (17%), it is a condition of acute hip pain with poorly defined

etiology. Currently, MRI is being used increasingly in diagnosing TOH. The characteristic signal intensity on MRI and its evolutionary pattern during the course of TOH makes MRI a very accurate tool for diagnosing TOH. The pattern of signal intensity on MRI can also readily determine the presence of TOH and distinguish it from Avascular Necrosis (AVN), since AVN shows subchondral focal curvilinear signal alterations on all pulse sequences.^{12, 15}

In the absence of any routine screening program, approximately one child in 1000 will require surgery for late presentation of DDH. Bache et al.²¹ reported an incidence of 6.6% of hips being abnormal at birth when all children's hips were screened by clinical and dynamic ultrasound assessment. This incidence is higher than ours as MRI is not the study of choice for suspected DDH and those seen in our study were mostly incidental or co-accidental findings.

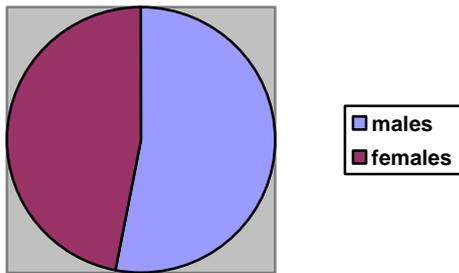


Figure (1): Male to female distribution.

DDH covers a spectrum of conditions from fixed dislocation of the hip to occult late acetabular dysplasia. The reported incidence of DDH varies on the basis of more than one factor such as population characteristics, the timing and type of examination used to detect hip abnormality, and the type of selective screening program used.

The total number of different pathology was somehow low as the available images for hip MRI with abnormal findings were limited. This is mostly attributed to the fact that our hospital is a multi-disciplinary center and not an orthopedic rehabilitation center. However, our group of patients could accurately be considered a representative group of our community.

The drawback of our study may be resided in not comparing the MRI findings with the plain films. Furthermore, we did not follow up the patients or review their medical records to compare our MRI findings with their final diagnosis as most of these patients after receiving their essential treatment continued their follow up in primary care centers. We are hoping in the near future to elaborate more on this topic and to bypass these limitations.

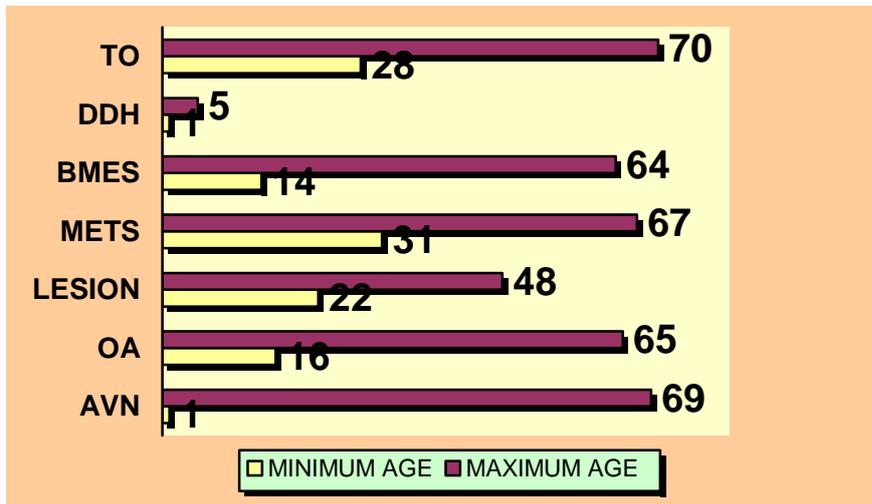


Figure (2a): Age ranges of hip pathologies among females.

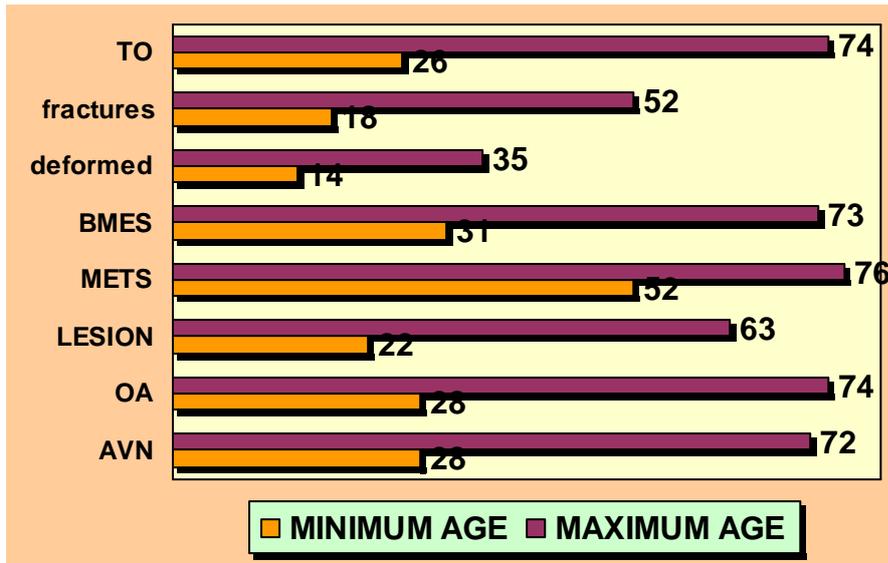


Figure (2b): Age ranges of hip pathologies among males.

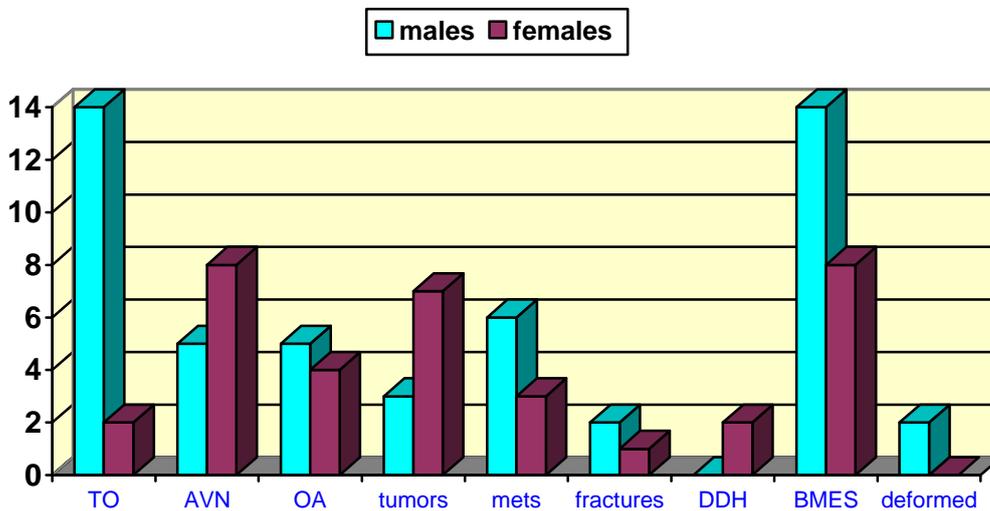


Figure (3): Prevalence of hip pathology in males and females by MRI.

Conclusion

The distribution and prevalence of hip diseases among Jordan University Hospital patients as revealed by MRI regarding age, gender and symptoms corresponded to what is published in medical references worldwide. With the most common hip pathology detected being bone marrow edema syndrome, followed by transient osteoporosis and avascular necrosis of the hip joint.

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تصوير الرنين المغناطيسي لمفصل الورك في مستشفى الجامعة الأردنية: دراسة وصفية وإحصائية ومحصلة النتائج

عزمي الحديدي¹، ديمة أبو لبن¹، تهاني احمد¹، عزمي هارون¹، ماهر الحديدي²، وليد محافظة¹، عماد الطراونة¹، مصطفى النادي³،
أسامة سمارة¹
1- قسم الأشعة والطب النووي، مستشفى الجامعة الأردنية؛ 2- قسم التشريخ والأنسجة، كلية الطب، الجامعة الأردنية؛ 3- قسم
جراحة الدماغ والأعصاب، مستشفى الجامعة الأردنية

الملخص:

الهدف: تقييم خبرة مستشفى الجامعة الأردنية في تصوير الرنين المغناطيسي لمفصل الورك ومقارنة نتائجه بما نشر من أبحاث طبية في هذا المجال.
الطرق: مراجعة صور مائة واثنين وثمانين مريضاً تم تصويرهم بالرنين المغناطيسي لمفصل الورك في سبع سنوات، وقد كانت الصور في 88 منهم (48.3%) طبيعية وتم استئناؤهم من الدراسة، بينما احتوت صور 94 منهم (51.6%) على تغيرات وتم دراستهم في هذا التقرير.

النتائج: اعتلالات مختلفة وجدت وكان معظمها يحتوي على متلازمة وذمة النخاع العظمي التي وجدت في 22 مريضاً (34.4%)، وبعدها الهشاشة المؤقتة التي وجدت في 16 مريضاً (17%) والنخر العظمي الفخذي اللاوعائي في 12 مريضاً (13.8%) بينما كانت المشاشة الفخذية المنزقة ومرض باجيت الأقل نسبة (1.1%).

الختامة: إن تصوير الرنين المغناطيسي لمفصل الورك للمرضى المحولين إلى مستشفى الجامعة الأردنية اظهر أن أكثر الحالات شيوعاً هو متلازمة وذمة النخاع العظمي في رأس عظمة الفخذ ثم الهشاشة المؤقتة يليها النخر العظمي الفخذي اللاوعائي. إن الفائدة الكبرى للرنين المغناطيسي كانت في تشخيص الهشاشة المؤقتة وتصنيف درجة النخر العظمي الفخذي اللاوعائي وتصنيف اعتلالات الأنسجة الرخوة في الحوض، وان نتائج الدراسة متطابقة مع الأبحاث الطبية المنشورة في المراجع الطبية العالمية.

الكلمات الدالة: اعتلالات مفصل الورك، الرنين المغناطيسي للورك، متلازمة وذمة النخاع العظمي، النخر العظمي الفخذي اللاوعائي، الهشاشة المؤقتة