

## MRI ASSESSMENT OF MUSCULAR LESIONS IN LOWER LIMB

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### ABSTRACT

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**Background:** Muscle disease is a disorder caused by derangement of the structure or function of muscle fiber, blood supply and/or connective tissue element of the muscle, the combination of clinical examination and MRI could improve the accuracy of phenotypic characterization of patients with muscular lesions, This may also be very helpful in the assessment of the degree of muscle compromise not only in the early phases of the disease but also during the follow-up and can be used especially in therapeutic trials.

**Aim of the work:** To assess the role of MRI in detection and evaluation of muscle diseases and its prognostic value for the follow up.

**Patients and Methods:** This study was conducted at the radiology department Ain Shams university, it included thirty patients, they all had clinical diagnosis have of muscular diseases of the lower limb, fulfilled inclusion criteria.

**Results:** The sensitivity of MRI in detection of malignant lesions compared to histo-pathology and clinical diagnosis as gold standered was 83.3%, specificity was 91.7% and accuracy was 90%, 76.7% of the studied cases had a benign which was lesion most frequently a hemangioma (10%), also 23.3% of the patients had a malignant lesion which was most frequently metastasis from other tumors (13.3%).

**Conclusion:** MRI is the modality of choice in evaluating lower limb muscular lesions due to its high soft tissue contrast resolution, and multi-planar capabilities. MRI may allow clinicians to more accurately estimate the time required before patient can return to normal life as well as the risk of recurrent injury.

**Key word:** Magnetic resonance image, lower limb muscular lesions.

### INTRODUCTION:

Muscle disease is a disorder caused by derangement of the structure or function of muscle fiber, blood supply and/or connective tissue element of the muscle<sup>(1)</sup>, the combination of clinical examination and MRI could improve the accuracy of phenotypic characterization of patients with muscular dystrophy, and this in turn could allow a more focused molecular analysis through muscle biopsy or genetic investigation. This

may also be very helpful in the assessment of the degree of muscle compromise not only in the early phases of the disease but also during the follow-up and can be used especially in therapeutic trials<sup>(2)</sup>, recently introduced advanced and quantitative MRI methods are quite promising including T2 relaxation time measurements and magnetic resonance spectroscopy. However, it is challenging in terms of quantification and

further specification of the disease process and disease monitoring<sup>(3)</sup>.

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**PATIENTS AND METHODS:**

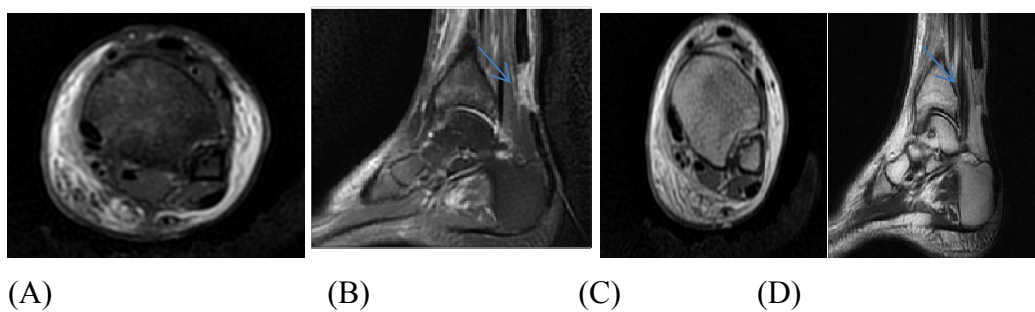
**1) Study population:** This study was conducted at the radiology department Ain Shams university during the period from October 2017 till January 2019, it included thirty patients, their ages ranged from 3 to 75 years ,they all had clinical diagnosis of muscular diseases of the lower limb with A-inclusion criteria that all patients in different age group and both sexes who presented with lower limb pain and clinical diagnosis of muscular lesions and B-Exclusion criteria: for any contraindication for MRI .

**2) Methods:** The study was performed on a 1.5 Tesla Philips achieva using a limb coil, sedation was needed in non-controllable group (children), the patient was positioned supine on the MRI table with no special preparation needed and the study duration was about 30 minutes, the sequences used were as follows :

- Axial T1-Weighted image (TR/TE = 400–700/14–30; FOV, 20-35).
- Sagittal T1- Weighted image(TR/TE = 2800–4500/80–120; FOV, 20-35).
- Axial short-tau inversion recovery STIR/T2-Weighted image .
- Sagittal short-tau inversion recovery STIR/T2-Weighted image.
- Coronal short-tau inversion recovery STIR/T2-Weighted image.
- Sagittal proton density .

**Cases:**

Case 1: A 23 year old male presented with pain in calf region after trauma during playing football, with MR Findings: loss of normal continuity and signal intensity of the Achilles tendon, displays iso-signal intensity at T1WI and high signal intensity at PD-STIR (A&B) and T2WI (C&D)of about =3 cm with distance from calcaneal attachment to the distal portion of the tear =5.5 cm (Fig 1).there is also diffuse circumferential soft tissue edema displayed high signal intensity at PD-STIR and diagnosed as complete full thickness tear of the Achilles tendon (gap about 3cm)



**Fig 1**

Case 2: A 35 year old male presented with history of trauma by instructs to the left leg, with MR Findings: abnormal muscular shape at the medial, lateral and posterior compartments of the upper 2/3 of the leg with multiple flocculent masses of different sizes with partial skin involvement and inter-

osseous extension ,display mixed low and high signal intensities at both T1WI&T2WI (A,B)with faint enhancement at post contrast study (C) (Fig 2) and diagnosed as Myositis ossificans.

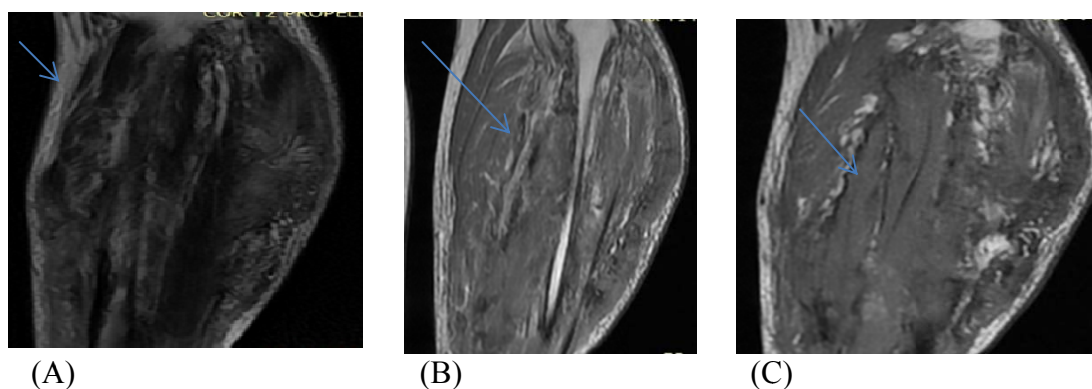


Fig 2

Case 3: A 59 year old male presented with history of surgically removed mass from right thigh and pathologically proven giant cell tumor with MR Findings: A well-defined globular shaped multilocular intra-muscular cystic lesion measures about 45x36x35 mm, at the right thigh muscles( lateral vastus muscle), displays mixed hypo

to iso intense signal at T1WI (A), mixed intermediate high signal at T2WI (B)and bright signal at PD-STIR (C&D)with hemorrhagic components (Fig 3) and diagnosed as right upper lateral thigh intra-muscular malignant lesion (recurrent giant cell tumor).

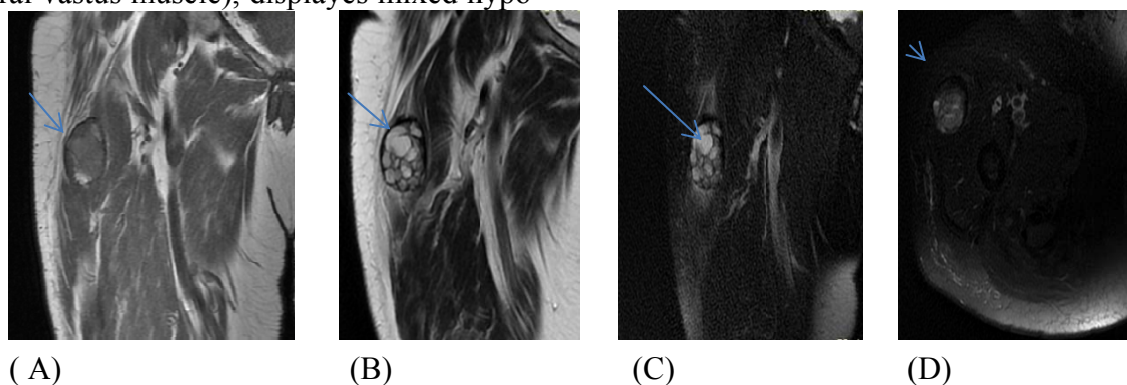


Fig 3

Case 4: A 18 year old male presented with history of blow trauma during playing hockey with MR Findings: well defined oblong shaped intra-muscular mixed signal intensity lesion measuring about 53x43x35 mm at the lateral aspect of the right leg

related the lower third of the fibula, displayed high signal intensity at T1WI (A)& mixed low and high signal intensity at T2WI (B&D)and bright at PD-STIR (C)(Fig 4) and diagnosed as Intra-muscular hematoma.

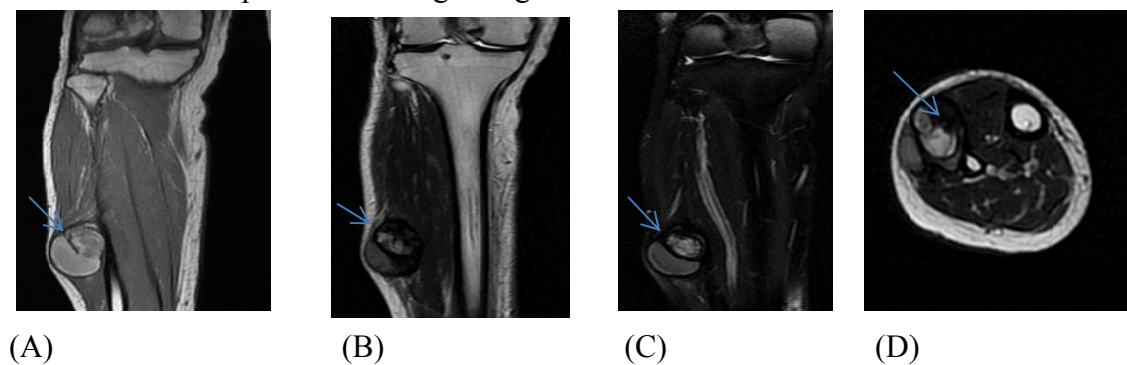


Fig 4

Case 5: A 18 year old female presented with history of pain and swelling in the sole of left foot with MR Findings: Lobulated soft tissue lesion infiltrating the planter aspect of the left foot measures about 70 x35 mm involving the underlying muscular structure displayed up to low signal

intensity at T1WI (A) and relative intermediate signal intensity at T2WI and high signal intensity at PD-STIR (B&C) with intense in-homogenous post contrast enhancement (D) (Fig 5) and diagnosis as fibrosarcoma.

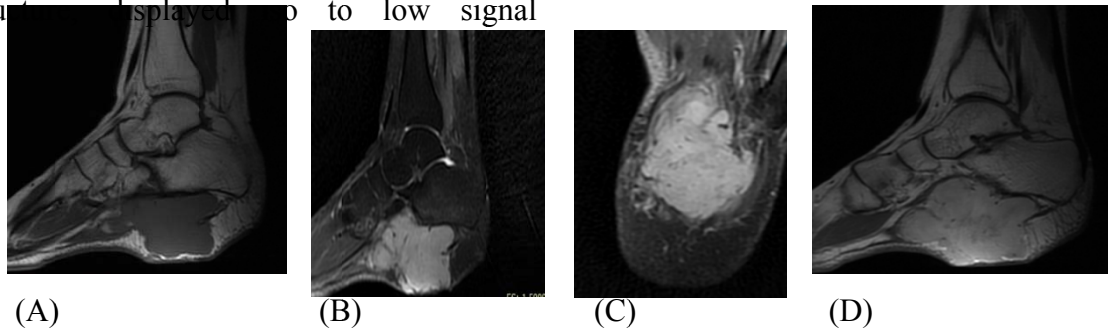


Fig 5

**Results:**

Table (1): Demographic data of the studied cases:

Variable	(n=30)	
Age : (year)		
Mean ± SD	36.37±21.53	
Median	36.5	
Range	3 – 75	
Variable	No	%
Sex:		
Female	12	40
Male	18	60
Occupation:		
Not working	4	13.3
House wife	5	16.7
Student	7	23.3
Farmer	5	16.7
Skilled	1	3.3
Specialist	8	26.7
Residence:		
Rural	13	43.3
Urban	17	56.7

Table (2): Clinical data of the studied cases:

Variable	(n=30)	
	No	%
Type:		
Non traumatic	20	66.7
Traumatic	10	33.3
During sport	5	16.7
Instrument or object	4	13.3
Fall from stairs	1	3.3
Symptoms:		
Pain	11	36.7
Swelling	5	16.7
Skin discoloration	2	6.7
Difficult in movement	1	3.3
Muscle weakness	1	3.3
Osteoarthritic change	1	3.3
Size fluctuation	1	3.3
Night sweat	1	3.3
Malaise	1	3.3
Systematic comorbidity:		
No	28	93.3
Yes	2	6.7
Cancer breast	1	3.3
Hemolytic disorder	1	3.3

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Table (3): Investigation results among the studied cases:

Variable	(n=30)	
	No	%
<b>Pathology:</b>	10	33.3
<b>Benign</b>	4	13.3
Lipoma	1	3.3
Myxoma	1	3.3
Nonspecific myositis	1	3.3
Ganglionic cyst	1	3.3
<b>Malignant</b>	6	20
Giant cell tumor	3	10
Fibrosarcoma	2	6.7
Muscular sarcoma	1	3.3
<b>CT:</b>	2	6.7
Intra muscular hemangioma	1	3.3
Myositis ossificans	1	3.3
<b>MRI:</b>		
<b>Benign</b>	23	76.7
Complete tendon achilles tear	2	6.7
Partial thickness tear of tendon Achilles	2	6.7
Anterior talo-fibular ligament sprain	1	3.3
Posterior tibio-talar ligament sprain	2	6.7
Tibialis posterior and flexor tendonstenosynovitis	1	3.3
Post traumatic infection + callus	1	3.3
Intra muscular hematoma	2	6.7
Intramuscular inflammatory lesion	1	3.3
Myositis ossificans	1	3.3
Fatty degeneration	2	6.7
Intra muscular lipoma	2	6.7
Intra muscular hemangioma	3	10
Intra muscular anscesses	1	3.3
Ganglionic cyst	2	6.7
<b>Malignant:</b>	7	23.3
Intra muscular sarcoma	1	3.3
Neurogenic	2	6.7
Metastasis and recurrence	4	13.3

Table (4): Validity of MRI in diagnosis malignant lesions in comparison to pathology and clinical as Gold standard:

MRI:	Pathology & clinical		Total	Kappa	P
	Malignant	Benign			
Malignant	5	2	7	0.70	<0.001
Benign	1	22	23		
Total	6	24	167		
Validity	Sensitivity:83.3% Specificity: 91.7%				
	PPV: 71.4%			NPV: 95.7%	
Accuracy	90%				

### DISCUSSION:

Our study included 30 patients; males represented 60% while females represented 40 %, their age ranged from 3 to 75 years (mean age was 36.37 years),regarding the occupation, the specialists was the most affected followed by the students then

house wives and farmers (26.7%, 23.3%, 16.7% & 16.7% respectively) .This was in agreement with the study of Elgohary was conducted on 40 patients (12 females and 28 males) ranged in age between 12 and 60 years with mean age (mean  $\pm$  SD: 34.95) and the percentage of occupation among his

patients (25.9%, 23.8%, 16 %, 17.7 %) respectively ,however this was not in line with El-Liethy whose study was on 30 patients (18 females and 12 males) their age ranging from 18 to 50 (mean age 29.15) and the percentage of occupation among his patients (20.7 %, 26.3 % , 13.7% ,22.5%) respectively <sup>(4 &5)</sup> .

About the underlying cause of lesion among our studied cases the non- traumatic lesions were 20 cases (66.7 %) and 10 cases (33.3%) had a history of trauma mostly occurred during playing sports (16.7%), this was in line the study of Fletcher whose study shows 67.2% were non-traumatic lesions and 32.8% were of traumatic lesions but differ from Nagata which the non-traumatic lesions were 35.9 % and the traumatic lesions were 64.1% <sup>(6&7)</sup> .

According to the presenting symptoms and systematic comorbidity, the most frequent symptoms were pain followed by swelling and skin discoloration (36.7%, 16.7% and 6.7% respectively) and 2 cases had systematic comorbidity one case had cancer breast and the other had hemolytic disorders, this agree with the study of Murphy which study (36.1%, 17.1 % & 6.5 % respectively) and differ with Nagata which study (8.7%, 10.9 % & 16.6 % respectively) <sup>(8 &7)</sup> .

MRI findings among the studied cases are 76.7% have benign lesions most frequent is hemangioma (10%), followed by <sup>(2)</sup> complete tendon achilles tear ,partial thickness tear of tendon Achilles, posterior tibio-talar ligament sprain, intra muscular hematoma, intra muscular lipoma , ganglionic cyst (6.7) for each one and (3.3) for each one of the following :anterior talo-fibular ligament sprain, tibialis posterior & felxor tendons tenosynovitis, post traumatic infection + callus, intramuscular inflammatory lesion, myositis ossificans and intra muscular abscesses, Also 23.3% have malignant lesion most frequent is metastasis from other tumors (13.3%) followed by

neurogenic tumors (6.7%) then intra-muscular sarcoma (3.3%) ,this in agreement with the study of Fletcher where the benign lesions 75.9 % and the malignant lesions 24.1 % and but not match with the study of Aga where the benign lesions 36.9 % and the malignant lesions 63.1% and metastasis from other tumors <sup>(6&9)</sup> .

The sensitivity of MRI in detection of malignant lesions compared to histopathology and clinical diagnosis as gold standard was 83.3%, specificity was 91.7% and accuracy was 90% and the statistical significance agreement between two methods by Kappa test ,this is in line with Murphy that had sensitivity 84.1 %,specificity 91.9% and accuracy 91% respectively<sup>(8)</sup> .

**Summary:** Our study included 30 patients; males represented 60% while females 40 % with their age ranged from 3 to 75 years (mean age was 36.37 years), regarding the occupation ;among the studied cases was specialists had the highest affection and about the underlying cause of lesion , the non- traumatic lesions were 20 cases (66.7 %) and 10 cases (33.3%) of the studied cases had history of trauma.

According to symptoms and systematic comorbidities among the studied cases, the most frequent symptoms among the studied cases were pain, swelling and skin discoloration (36.7%, 16.7% and 6.7% respectively). Also 2 cases only had systematic comorbidity one case had cancer breast and the other had hemolytic disorders.

As to MRI findings , 76.7% had benign lesions most frequently hemangioma (10%) and 23.3% presented with malignant lesion, majority was metastasis from other tumors (13.3%)

The sensitivity of MRI in detection of malignant lesions compared to histopathology and clinical diagnosis as gold standard methods was 83.3%, specificity was 91.7% and accuracy was 90% and there

were statistical significance agreement between two methods by Kappa test

**Conclusion:**

MRI is the modality of choice in evaluating lower limb muscular lesions due to its high soft tissue contrast resolution, and multi-planar capabilities. MRI may allow clinicians to more accurately estimate the time required before patient can return to normal life as well as the risk of recurrent injury.

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**REFERENCES:**

1. Adams R.D. and Victor: Principles of clinical myology: diagnosis and classification of muscle diseases Princ Neurol (5th ed.), McGraw Hill Inc (1993), pp. 1184–1197
2. Sookhooa S., MacKinnona I. , Bushby K., Chinnery P.F., et al.: MRI for the demonstration of subclinical muscle involvement in muscular dystrophy Clin Radiol, 62 (2) (2007), pp. 160–165
3. Nagaty M, Aref S, El-Essawy S, Saied E, et al., 1999: Neuroimaging in muscle diseases. Neurology thesis Egypt. pp.
4. Elgohary MMIA, Abdul Rahim SAA, and Ibrahim TAA(2017): Role of MRI in evaluation of traumatic ankle injuries. The Egyptian Journal of Hospital Medicine; 69(3):2016-2024.
5. El-Liethy N, and Kamal H (2016): High resolution ultra-sonography and magnetic resonance imaging in the evaluation of tendino-ligamentous injuries around ankle joint. The Egy.
6. Fletcher, C.D.M., 2014: The evolving classification of soft tissue tumours - an update based on the new 2013 WHO classification. Histopathology, 64 (1), pp.2–11.
7. Nagata, S. et al., (2008): Diffusion-weighted imaging of soft tissue tumors: usefulness of the apparent diffusion coefficient for differential diagnosis. Radiat Med, 26 (5), pp.287– 295. ptian Journal of Radiology and Nuclear Medicine; 47: 543-55.22.
8. D F Murphy, D A J Connolly, B D Beynnon (2003): Department of Orthopaedic Surgery, University of Vermont, Burlington, VT, USA; 10.1136/.37.1.13.
9. Aga, P. et al., (2011): Imaging Spectrum in Soft Tissue Sarcomas. Indian Journal of Surgical Oncology, 2(4), pp.271–279.

دور التصوير بالرنين المغناطيسي في تشخيص امراض العضلات في الطرف السفلي  
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**الخلفية:** مرض العضلات هو اضطراب ناتج عن تشويش بنية أو وظيفة ألياف العضلات ، وإمدادات الدم و/ أو عنصر النسيج الضام للعضلة ، وقد يؤدي الجمع بين الفحص السريري والتصوير بالرنين المغناطيسي إلى تحسين دقة التوصيف المظهري للمرضى الذين يعانون من آفات العضلات ، قد يكون هذا مفيداً أيضاً في تقييم درجة التسوية العضلية ليس فقط في المراحل المبكرة من المرض ولكن أيضاً أثناء المتابعة ويمكن استخدامه خاصة في التجارب العلاجية.

**الهدف من العمل:** تقييم دور التصوير بالرنين المغناطيسي في اكتشاف وتقييم أمراض العضلات وقيمتها النذير للمتابعة.

**المرضى والطرق:** أجريت هذه الدراسة في قسم الأشعة بجامعة عين شمس ، حيث شملت ثلاثين مريضاً ، وكان لديهم جميعاً تشخيص سريري لأمراض العضلات في الطرف السفلي ، ومعايير الاشتمال المستوفاة.

**النتائج:** كانت حساسية التصوير بالرنين المغناطيسي في الكشف عن الآفات الخبيثة مقارنةً بالنسج والتشخيص السريري ، حيث كان الذهب ثابتاً بنسبة ٨٣.٣ ٪ ، وكانت الخصوصية ٩١.٧ ٪ ، وكانت الدقة ٩٠ ٪ ، ٧٦.٧ ٪ من الحالات التي تمت دراستها كان لها آفة حميدة في كثير من الأحيان ورم وعائي (١٠ ٪) ، وأيضاً ٢٣.٣ ٪ من المرضى لديهم آفة خبيثة والتي كانت في معظم الأحيان ورم خبيث من أورام أخرى (١٣.٣ ٪).

**الخلاصة:** التصوير بالرنين المغناطيسي هو طريقة الاختيار في تقييم آفات العضلات السفلية للطرف بسبب ارتفاع تباين الأنسجة الرخوة ، وقدرات متعددة المستويات. قد يسمح التصوير بالرنين المغناطيسي للأطباء بتقدير أكثر دقة للوقت المطلوب قبل عودة المريض إلى الحياة الطبيعية بالإضافة إلى خطر الإصابة المتكررة.