

## MRI of the Muscles: Practical Features of MRI in the Evaluation of Inflammatory Myopathies and Infectious Process

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### Abstract

The aim of this article is determining the role of MR imaging in the assessment of muscle disorders with focus on inflammatory and infectious myopathies with description of MRI finding pattern [1-3].

We will discuss about the inflammatory myopathy disorders including inclusion body disorders, Dermatomyositis and Polymyositis, infectious process and abscess formation.

**Keywords:** *Dermatomyositis; Polymyositis; Abscess Formation*

### Introduction

Regarding the excellent soft tissue contrast, MR imaging is the most specific and sensitive method for detecting muscle abnormalities [1-4].

MR protocols should include both T1- and T2-weighted fat-suppressed sequences (and STIR sequences) to describe acute and chronic phases. T2FS or STIR images most commonly indicates muscle edema that is more common in the acute and less in subacute phase of disease.

On the other hand, T1-weighted images usually represents fatty degeneration in chronic stage of the disease. Regarding the history and pathology, the application of contrast study is challenging [5,6].

Muscle edema and fatty degeneration are nonspecific findings and could be seen not only in inflammatory myopathies but also in neuromuscular disorders and muscular dystrophy, infectious process or post traumatic and other conditions.

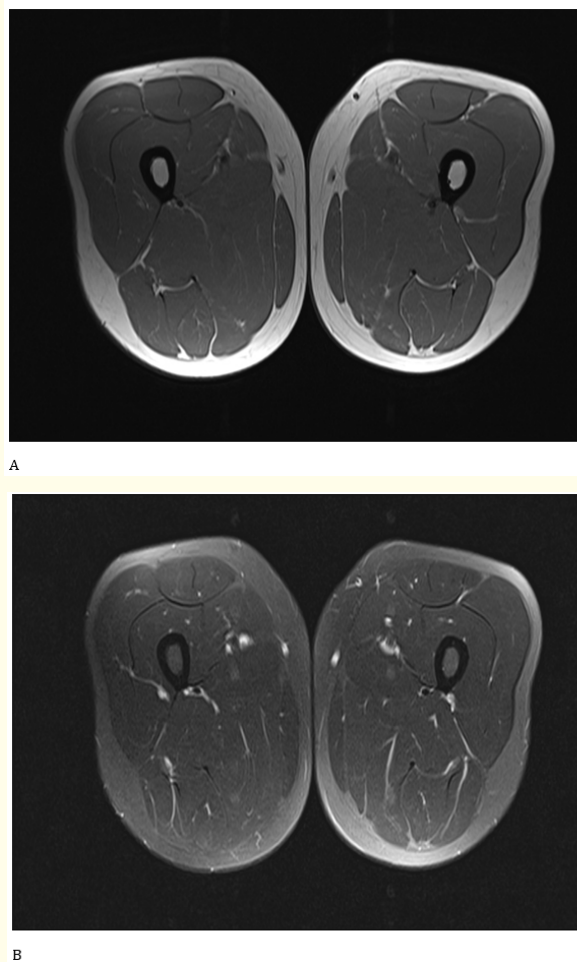
In MRI the distribution of muscle involvements can guide not only in determining the subtype of disease but also could be helpful in definition the best site for muscle biopsy [7,8].

To determine fat deposition in muscles by MR imaging, Qualitative and semi-quantitative evaluation can be performed by using the 4-point Mercuri score which was described in table 1 [3].

Stage	Findings
0	Normal appearance
1	Early moth-eaten appearance, with scattered small areas of decreased density on CT or increased density on the T1 MR sequence
2a	Late moth-eaten appearance, with numerous discrete areas of decreased density (CT) or increased density (MR imaging) with beginning confluence, comprising <30% of the volume of the individual muscle
2b	Late moth-eaten appearance, with numerous discrete areas of decreased density (CT) or increased density (MR imaging) with beginning confluence, comprising 30% - 60% of the volume of the individual muscle
3	Washed-out appearance, fuzzy appearance due to confluent areas of decreased density (CT) or increased density (MR imaging) with muscle still present at the periphery
4	End-stage appearance, muscle replaced by lower density (CT) or increased density (MR imaging) connective tissue and fat, with only a rim of fascia and neurovascular structures distinguishable

**Table 1:** Qualitative scoring of muscle degeneration as published by Mercuri and colleagues.

Normal muscle has relatively homogenous signal without fat deposition or edema (Figure 1A and 1B).



**Figure 1:** A) T1 axial B) T2 fat sat: Normal signal of muscles without edema.

### Some types of myopathy disorders

There are several types of myopathy disorder as inflammatory, dystrophic, infectious, drug induced, traumatic and vascular related and we will discuss about the MRI findings in inflammatory Myopathies in Dermatomyositis, Polymyositis, Inclusion-body myositis and Infectious myopathy and myositis and abscess formation

### Idiopathic inflammatory myopathies

Idiopathic inflammatory myopathies are categorized as a heterogeneous group of rare immune-mediated myopathies and their causing factor is unknown.

Most common subtypes in the adult population are dermatomyositis, polymyositis and inclusion body myositis.

Early diagnosis and treatment could prevent fatty degeneration. A common clinical finding of idiopathic inflammatory myopathies is muscle weakness.

Muscle edema is seen in more than 85% of cases, but it is a nonspecific finding and according to it, the diagnosis of inflammatory myopathy cannot be done. Muscle edema is a common finding in the early and middle stage of disease. In chronic phase, muscle atrophy and fatty degeneration can occur. Dominant edema with less fatty changes or atrophy is more common seen in dermatomyositis and polymyositis.

### Dermatomyositis and polymyositis

Both are more common in women ages of 40 - 60 and could be associated with malignancy.

They commonly involve the proximal muscles of upper and lower extremities and the muscles of the trunk are relatively spare.

Skin manifestation consist of Gottron's sign, Heliotrope rash, Shawl sign and V sign and Muscle weakness are typically Bilateral, symmetric and more in proximal limbs.

On MR imaging in acute phase there are subcutaneous and bilateral symmetric muscular and peri-muscular edema of the proximal thigh and pelvic muscles in fluid-sensitive sequences with varying degrees of post contrast enhancement and in chronic phase fat replacement and muscle atrophy could be seen. MRI could help in early diagnosis of disease and guide in determining the suitable site for biopsy and evaluation of response to therapy.

Edema along subcutaneous fat and muscle fascia is a common finding in MRI of dermatomyositis patients accompanied with less involvement of Rectus and biceps femoris muscles.

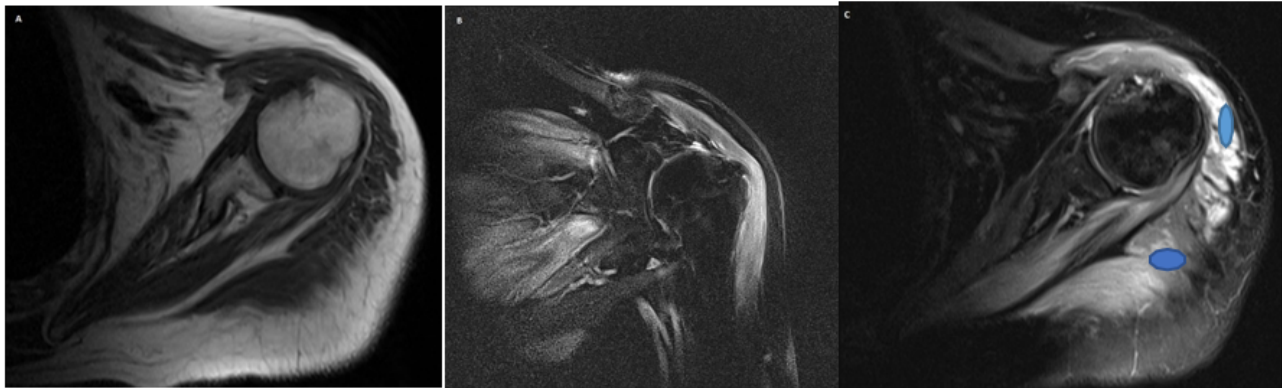
In following case a 57 years old female with history of polymyositis (Figure 2).

40 years old man with dermatomyositis (Figure 3).

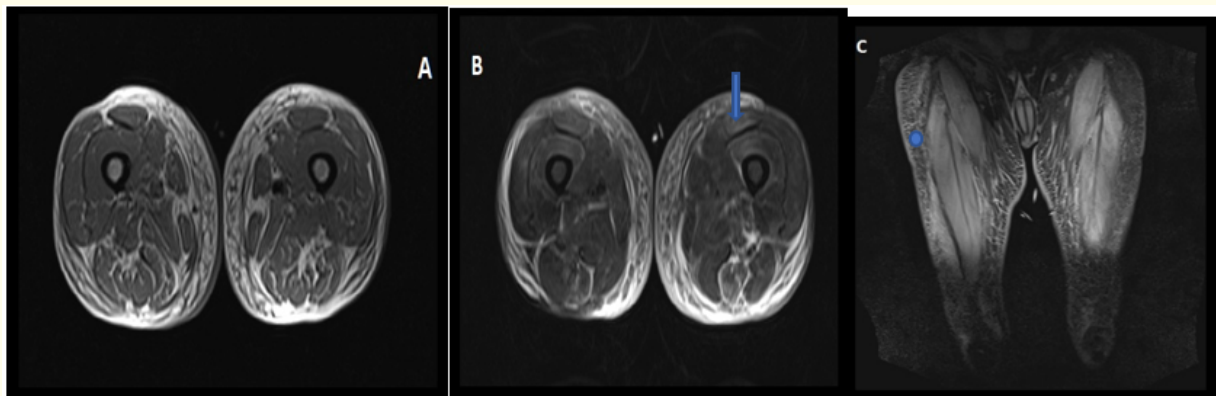
26 years old man with history of dermatomyositis (Figure 4).

### Inclusion body myositis (IBM)

Inclusion body myositis is known as a slowly progressive degenerative muscle disease that is more common in patients older than 50 years.



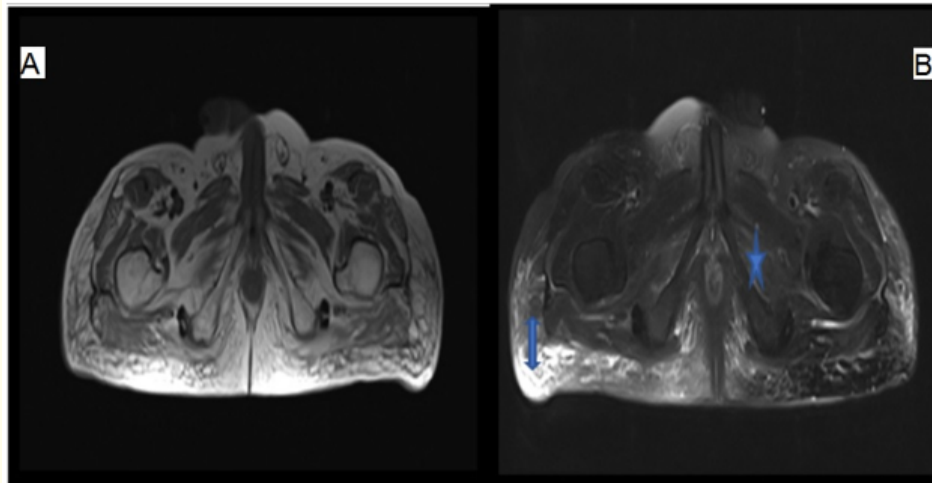
**Figure 2:** A: T1WI axial, B: T2WI fat sat coronal C: T2 fat sat axial of shoulder.  
Muscular edema in deltoid and supraspinatus and infraspinatus and teres minor muscles (color marker).



**Figure 3:** A: T1WI axial, B: T2 fat sat axial, C: T2 coronal fat sat.  
Diffuse subcutaneous edema and fascial thickening and fat stranding in both thighs (\*).  
Note: Muscular edema in bilateral semitendinosus and left rectus femoris and vastus intermedius (Arrow).

In these patients, atrophic and fatty degeneration are the predominant finding however inflammatory changes are less common than dermatomyositis and polymyositis and mostly may be seen secondary to degeneration rather than autoimmune process and they are not associated with malignancy unlike them.

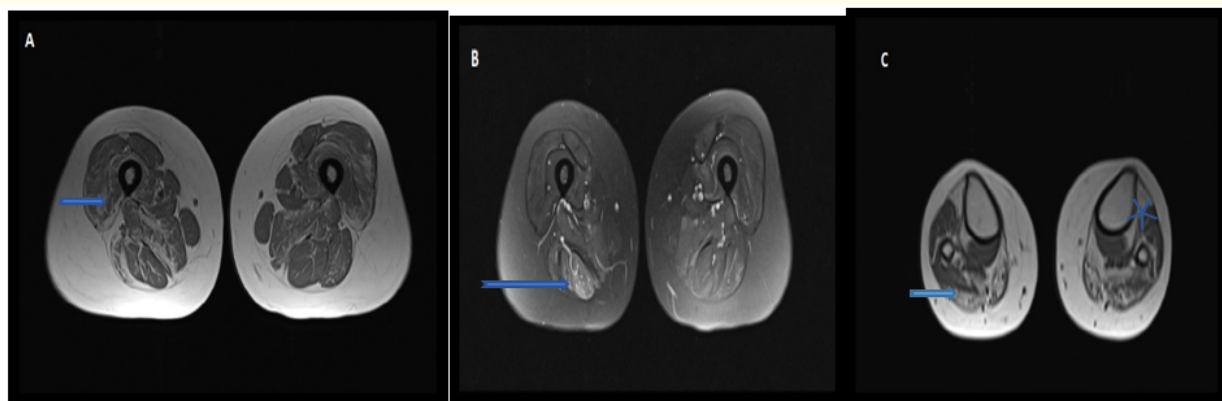
They mainly involve anterior compartment of the thigh muscles including vastus lateralis, medialis and intermedius (with sparing of the rectus femoris muscle), the distal sartorius muscle, iliopsoas, tibialis anterior, deltoids, biceps brachii, triceps muscles, wrist and finger flexors and ankle dorsiflexors.



**Figure 4:** A: T1WI axial B: T2WI fat sat axial.

Subcutaneous edema in bilateral gluteal region and lateral aspect of both upper thighs more in right side (arrow). Minimal intermuscular edema deep to gluteal muscle and intramuscular edema in external obturator (\*) muscle are present.

Also, severe atrophy of medial head of gastrocnemius muscle is present but involvement of the adductor and abductor muscles of the shoulder and pelvic girdles are relatively spared. In IBM asymmetrical involvement is more common than symmetric involvement in dermatomyositis (Figure 5).



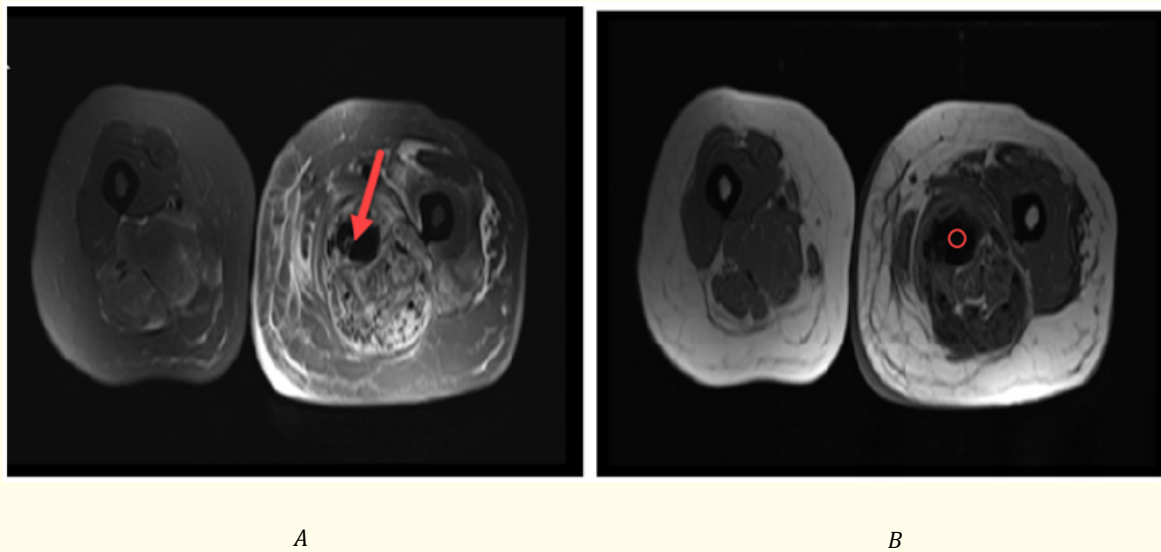
**Figure 5:** A: T1WI, B: T2WI fat sat, of thigh C: T1WI axial view of leg 35 years old man with Inclusion body myositis. Mild edema in right semitendinosus is seen (arrow in B). Note to the patchy Grade 2a fatty replacement in vastus lateralis (arrow in A) and Complete fat replacement (grade IV) in anterior tibialis and Gastrocnemius muscles. (\* and arrow in C).

Other myopathies with fatty degeneration of the quadriceps muscles, such as limb girdle muscular dystrophy (LGMD) or Becker dystrophy, are in DDX but unlike IBM, these myopathies also commonly involve the biceps femoris, semimembranosus and also adductor muscles of thigh too.

### Infectious process and necrotizing fasciitis (NF) and abscess

#### Infectious myositis

Consists of infection of skeletal muscle and could be acute, subacute, or chronic. It occurs mostly in young adults. At MR imaging, high T2 signal intensity along the deep fascia, especially the deep intermuscular fascia is noted as characteristics of involvement of the deep fasciae include (a) extensive involvement of the deep intermuscular fascia (b) thickening of fascia measuring 3 mm or more at fat sat sequence images (c) involvement of three or more compartments (d) low signal intensity with fat-suppressed T2-weighted imaging in the deep fascia with corresponding non enhancement on post contrast images. Soft tissue gas is characterized by low signal-intensity foci in all sequences (Figure 6-8).



**Figure 6:** A) T2 fat sat and B) T1 axial in a Patient with pyomyositis at adductor and hamstring muscles and abscess and internal gas (◦) in adductor muscles of left thigh.

If the infectious process involves muscle (myositis) with abscess formation (hall mark of pyomyositis) it is seen as abnormal intramuscular signals associated with ill-defined or well-defined border collections that could be seen as rim enhancing lesions, follow contrast injection. Sometimes the infection could extend to adjacent bone and causes osteomyelitis.



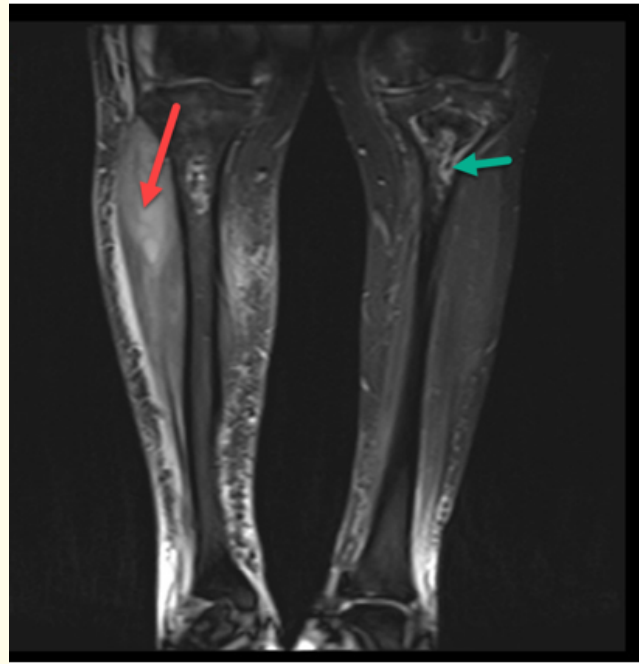


**Figure 7:** A 77 years old male with history of myositis and abscess.

A: T2WI fat sat axial, B: T2WI Fat sat coronal, C: plain knee lateral conventional radiography.

Collection in popliteal fossa (\* in A) with adjacent muscular and fascia edema (blue arrow) with gas bubble (red arrow in B).

Note to gas density (red arrow) and fabella (blue arrow) in C.



**Figure 8:** Muscle abscess in a 24 years old woman with history of SLE (Red arrow). Note to the bilateral upper metaphysis bony infarcts. (Green arrow)

## Conclusion

Regarding the excellent soft tissue resolution of MRI, it is the best modality in evaluation of muscles.

Muscle edema has multiple differential diagnosis including, inflammatory, dystrophic, post traumatic, infectious process and etc, that regarding the history and MRI pattern of edema and fatty changes and distribution of involved muscles could be categorized.

## Bibliography

1. Smitaman E., *et al.* "MR Imaging of Atraumatic Muscle Disorders". *RadioGraphics* 38.2 (2018): 500-522.
2. Zheng Y., *et al.* "Magnetic resonance imaging changes of thigh muscles in myopathy with antibodies to signal recognition particle". *Rheumatology* 54.6 (2014): 1017-1024.
3. Schulze M., *et al.* "MRI findings in inflammatory muscle diseases and their noninflammatory mimics". *American Journal of Roentgenology* 192.6 (2009): 1708-1716.
4. Fischer D and Wattjes MP. "MRI in Muscle Dystrophies and Primary Myopathies". In *Magnetic Resonance Imaging of the Skeletal Musculature*. Springer, Berlin, Heidelberg (2013): 241-254.
5. Filli L., *et al.* "Imaging of myopathies". *Radiologic Clinics* 55.5 (2017): 1055-1070.
6. Elessawy SS., *et al.* "The role of MRI in the evaluation of muscle diseases". *The Egyptian Journal of Radiology and Nuclear Medicine* 44.3 (2013): 607-615.



7. Elessawy SS., *et al.* "Whole-body MRI for full assessment and characterization of diffuse inflammatory myopathy". *Acta Radiologica Open* 5.9 (2016): 2058460116668216.
8. Fraser DD., *et al.* "Magnetic resonance imaging in the idiopathic inflammatory myopathies". *The Journal of Rheumatology* 18.11 (1991): 1693-1700.
9. Mohammad Reza Hayeri., *et al.* "Soft-Tissue Infections and Their Imaging Mimics: From Cellulitis to Necrotizing Fasciitis". *Radio-Graphics* 36.6 (2016): 1888-1910.

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