

IMAGE ACQUISITION PARAMETERS

T1-weighted coronal (repetition time (TR): 680-790 msec; echo time (TE): 8-12 msec; 12; slice thickness (SL), 5 mm; gap, 1 mm; flip angle (FA) and axial (TR , 680-790 msec; TE, 8-12 msec; SL, 6 mm; gap, 1 mm;)

STIR coronal (TR, 3500-6800 msec; TE, 42-58 msec; SL, 6 mm; gap, 1 mm;) and axial (TR , 3500-6800 msec; TE, 42-58 msec; SL, 7 mm; gap, 1 mm)

MRI DEFINITIONS APPENDIX

Overview:

Several parameters will be used for characterization and analysis of myositis MR images, including edema-like signal (muscle edema), fatty infiltration, atrophy, fascial edema and interfascial edema.

Rationale:

Generation of granular semiquantitative data will allow thorough analysis of myopathy MR images in a systematic, objective and reproducible fashion.

Method:

Each muscle is graded with respect to each parameter, as defined below.

When grading of a muscle is not possible, the following designations are used:

NA = not applicable (e.g. amputation, surgical resection)

NI = not interpretable (e.g. artifact prevents reasonable interpretation)

1. EDEMA-LIKE SIGNAL (MUSCLE EDEMA)

Muscle edema is defined as increased signal intensity within muscle tissues on fluid-sensitive sequences (e.g. STIR or fat suppressed T2 weighted images). As there are no absolute values or standardization for MRI signal intensity, internal references are used for comparison. Signal alteration is characterized by degree and extent.

A 4 point scale is employed to grade degree of muscle edema: normal (0), mild (1), moderate (2), or severe (3). In this scheme, normal muscle signal without edema-like signal is graded as 0, and fluid-like signal (the brightest signal on fluid-sensitive sequences) is graded as 3. Mild muscle edema (grade 1) is defined as increased fluid signal within muscle tissue, up to 1/3 of fluid signal intensity (qualitatively or quantitatively, using ROI signal measurements), with moderate (grade 2) defined as greater than mild and less than severe; that is, more than 1/3rd but not fluid-like signal intensity. Where muscle signal intensity is heterogeneous, the most severe focus of edema is scored.

Extent will be rated on a similar 4 point scale:

- 0 = none
- 1 = up to 1/3 of muscle volume involved
- 2 = 1/3 – 2/3 of muscle volume involved
- 3 = greater than 2/3 of muscle volume involved

Figures

- Grade 0: normal
- Grade 1: mild
- Grade 2: moderate
- Grade 3: severe

2. FATTY INFILTRATION

Fatty infiltration refers to replacement of muscle tissue with fat. On MRI, it is defined as intramuscular T1 hyperintense signal, which suppresses on STIR or fat-saturated images.

Grading is based on the estimated proportion of affected muscle volume using a 4 point scale:

- 0 = none
- 1 = up to 1/3 of muscle volume involved
- 2 = 1/3 – 2/3 of muscle volume involved
- 3 = greater than 2/3 of muscle volume involved

Figures

- Grade 0: normal
- Grade 1: mild
- Grade 2: moderate
- Grade 3: severe

3. ATROPHY

Muscle atrophy is defined as reduced muscle bulk. On MRI, atrophy is graded based on subjective assessment of the cross-sectional area of a muscle, compared to the contralateral side or other muscle groups. Cross sectional area will be estimated at the muscle's greatest area on axial images (typically mid-belly).

Grading is based on the estimated proportion of muscle volume loss using a 4 point scale:

- 0 = none (no loss of bulk)
- 1 = up to 1/3 loss of bulk
- 2 = 1/3 – 2/3 loss of bulk
- 3 = greater than 2/3 loss of bulk

4. FASCIAL EDEMA

Fascial edema is defined as circumferential fluid-like signal around the periphery of a muscle.

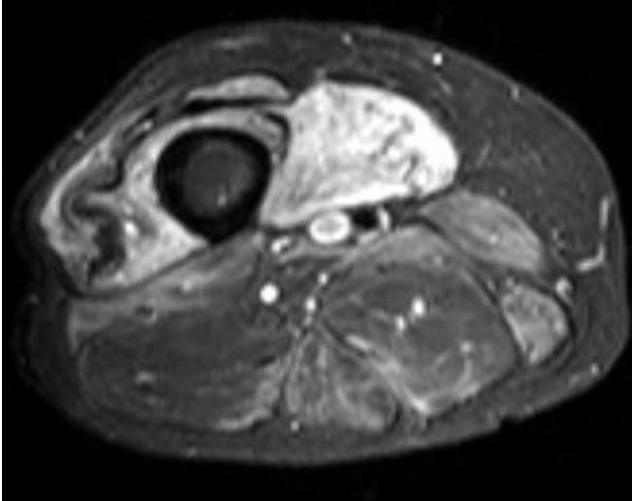
Grading is based on the estimated proportion of perimuscular signal abnormality using a 4 point scale:

- 0 = none
- 1 = up to 1/3 of circumference involved
- 2 = 1/3 – 2/3 of circumference involved
- 3 = greater than 2/3 of circumference involved

5. INTERFASCIAL EDEMA

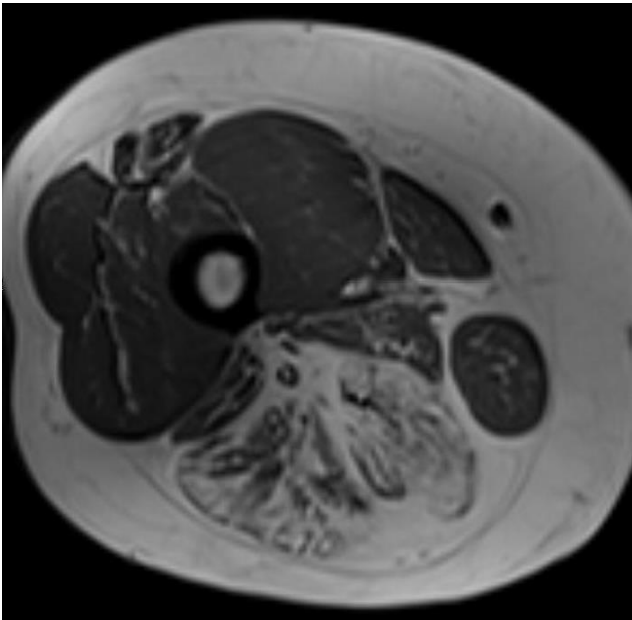
Interfascial edema refers to fluid-like signal between groups of muscles, and is graded subjectively based on reference images for each lower extremity, where 0 = none, 1 = mild, 2 = moderate, and 3 = severe.

Muscle edema



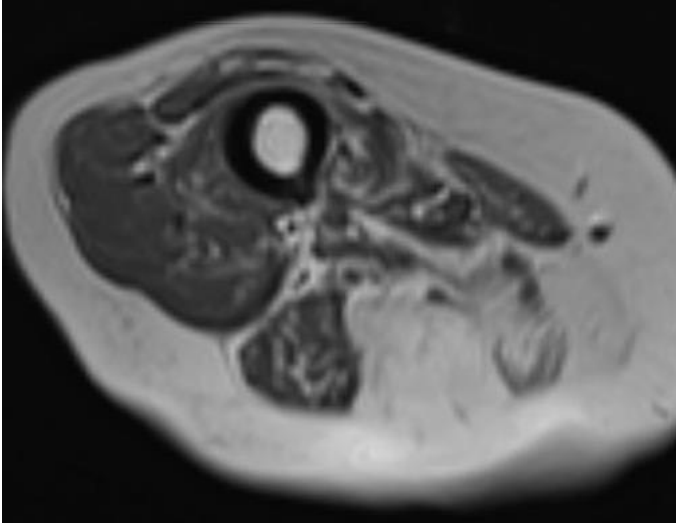
Grade 3 = Right vastus medialis
Grade 2 = Right semitendinosus, gracilis and sartorius
Grade 1 = Right biceps femoris

Fatty replacement



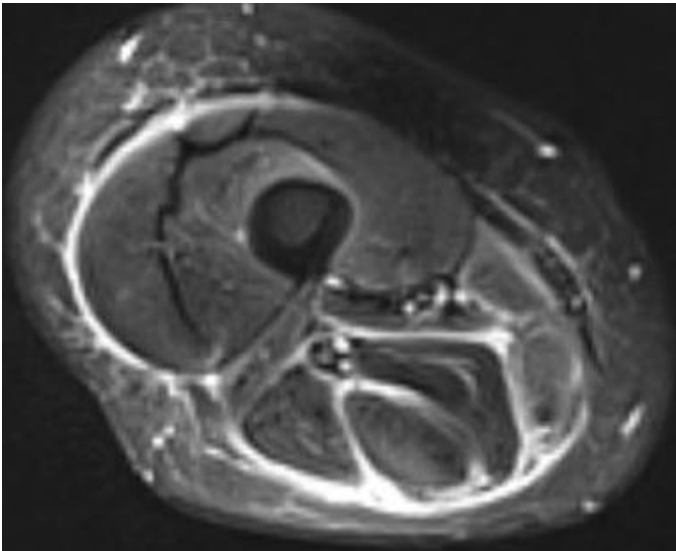
Grade 3 = Semimembranosus, semitendinosus
Grade 2 = Biceps femoris
Grade 1 = Adductor magnus, rectus femoris
Grade 0 = Vastus lateralis, vastus intermedius, vastus medialis, sartorius and gracilis

Muscle atrophy



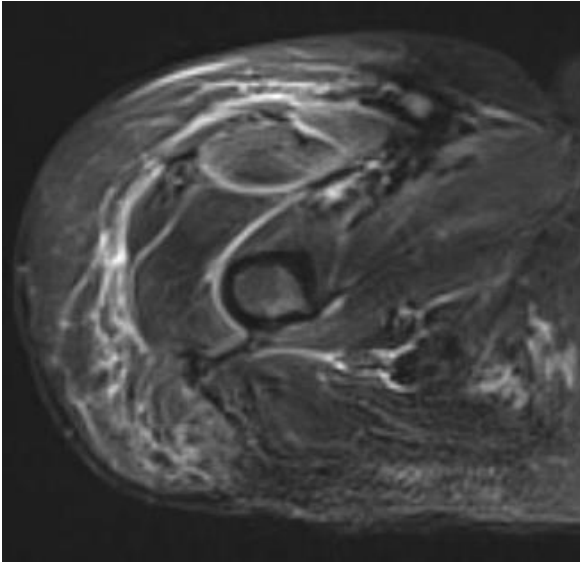
- Grade 3 = Vastus medialis, adductor magnus
- Grade 2 = Rectus femoris, semimembranosus
- Grade 1 = Vastus intermedius
- Grade 0 = Vastus lateralis

Fascial edema



- Grade 3 = Semitendinosus, semimembranosus, biceps femoris
- Grade 2 = Vastus lateralis, rectus femoris, sartorius, gracilis
- Grade 1 = Vastus intermedius

Fascial / Interfascial edema



Fascial edema

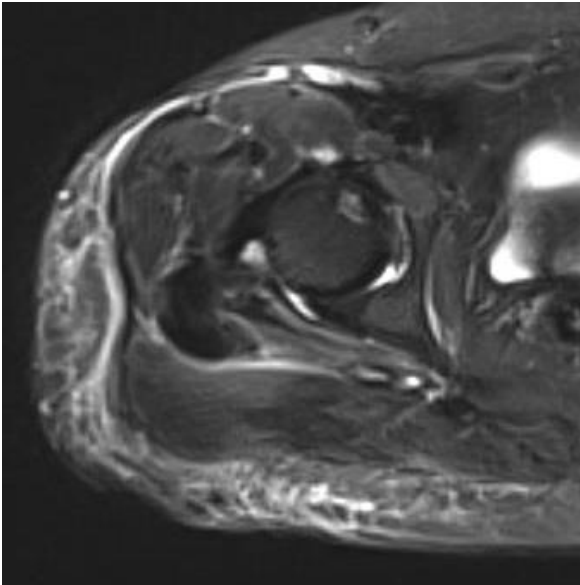
Grade 2 = Right obturator externus

Grade 3 = Right rectus femoris, vastus lateralis

Interfascial edema

Anterior compartment right thigh

Fascial / Interfascial edema



Fascial edema

Grade 2 = Right gluteus maximus, obturator internus

Interfascial edema

Anterior and lateral right thigh

MRI SCORE SHEET

History: Evaluate for myositis.

Technique: Coronal T1 and STIR, sagittal T1 and T2 and axial T1 and STIR weighted images of the bilateral femurs.

Findings:

HIP ROTATORS:

RIGHT: The gluteus maximus muscle demonstrates ### muscle edema, # atrophy, # replacement and # fascial edema. The obturator internus muscle demonstrates # muscle edema, # atrophy, # replacement and # fascial edema. The obturator externus muscle demonstrates # muscle edema, # atrophy, # replacement and # fascial edema.

LEFT: The gluteus maximus muscle demonstrates # muscle edema, # atrophy, # replacement and # fascial edema. The obturator internus muscle demonstrates # muscle edema, # atrophy, # replacement and # fascial edema. The obturator externus muscle demonstrates # muscle edema, # atrophy, # replacement and # fascial edema.

ANTERIOR COMPARTMENT:

RIGHT: The rectus femoris muscle demonstrates ### muscle edema, # atrophy, # replacement and # fascial edema. The vastus medialis muscle demonstrates ### muscle edema, # atrophy, # replacement and # fascial edema. The vastus intermedius muscle demonstrates ### muscle edema, # atrophy, # replacement and # fascial edema. The vastus lateralis muscle demonstrates ### muscle edema, # atrophy, # replacement and # fascial edema.

LEFT: The rectus femoris muscle demonstrates ### muscle edema, # atrophy, # replacement and # fascial edema. The vastus medialis muscle demonstrates ### muscle edema, # atrophy, # replacement and # fascial edema. The vastus intermedius muscle demonstrates ### muscle edema, # atrophy, # replacement and # fascial edema. The vastus lateralis muscle demonstrates ### muscle edema, # atrophy, # replacement and # fascial edema.

MEDIAL COMPARTMENT:

RIGHT: The sartorius demonstrates # muscle edema, # atrophy, # replacement and # fascial edema. The gracilis demonstrates 0 muscle edema, # atrophy, # replacement and # fascial edema. The adductor longus demonstrates # muscle edema, # atrophy, # replacement and # fascial edema. The adductor brevis demonstrates # muscle edema, # atrophy, # replacement and # fascial edema. The adductor magnus demonstrates # muscle edema, # atrophy, # replacement and # fascial edema.

LEFT: The sartorius demonstrates # muscle edema, # atrophy, # replacement and # fascial edema. The gracilis demonstrates # muscle edema, # atrophy, # replacement and # fascial edema. The adductor longus demonstrates # muscle edema, # atrophy, # replacement and # fascial edema. The adductor brevis demonstrates # muscle edema, # atrophy, # replacement and # fascial edema. The adductor magnus demonstrates # muscle edema, # atrophy, # replacement and # fascial edema.

POSTERIOR COMPARTMENT:

RIGHT: The semimembranosus demonstrates # muscle edema, # atrophy, # replacement and # fascial edema. The semitendinosus demonstrates # muscle edema, # atrophy, # replacement and # fascial edema. The biceps femoris demonstrates # muscle edema, # atrophy, # replacement and # fascial edema.

LEFT: The semimembranosus demonstrates # muscle edema, # atrophy, # replacement and # fascial edema. The semitendinosus demonstrates # muscle edema, # atrophy, # replacement and # fascial edema. The biceps femoris demonstrates # muscle edema, # atrophy, # replacement and # fascial edema.

INTERFASCIAL EDEMA:

RIGHT: #

LEFT: #

COMMENTS:**INTERPRETATION:****IMPRESSION:**