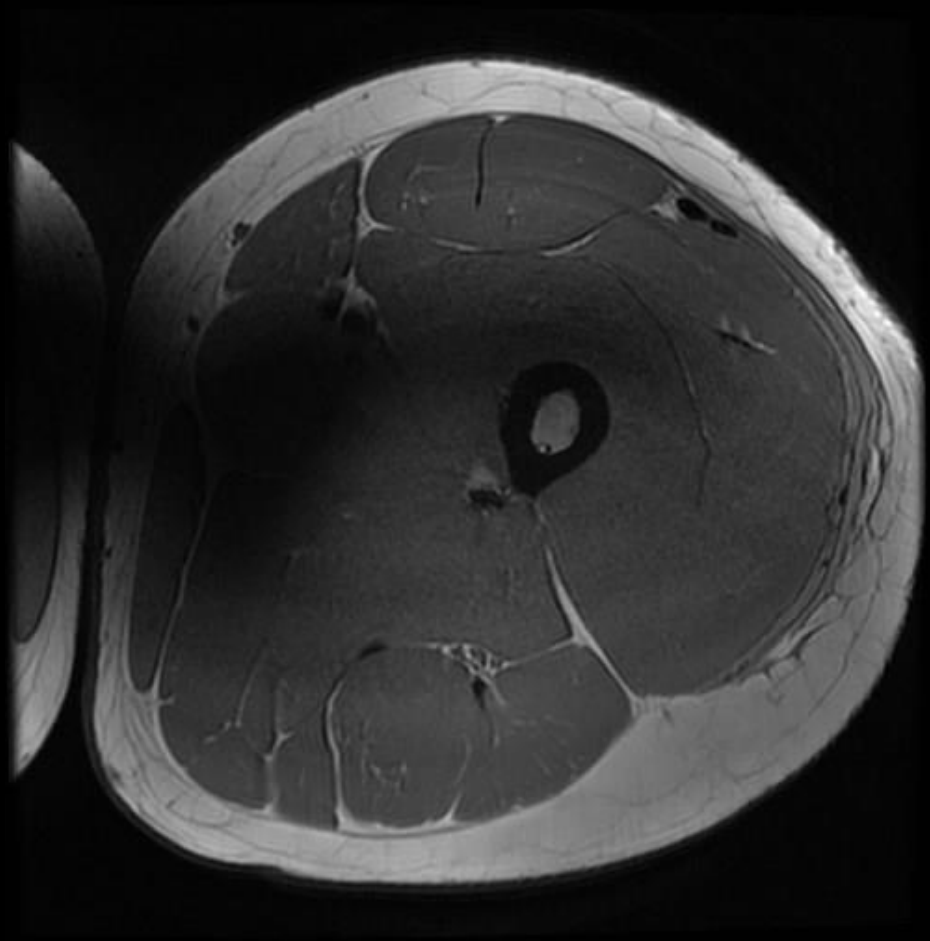
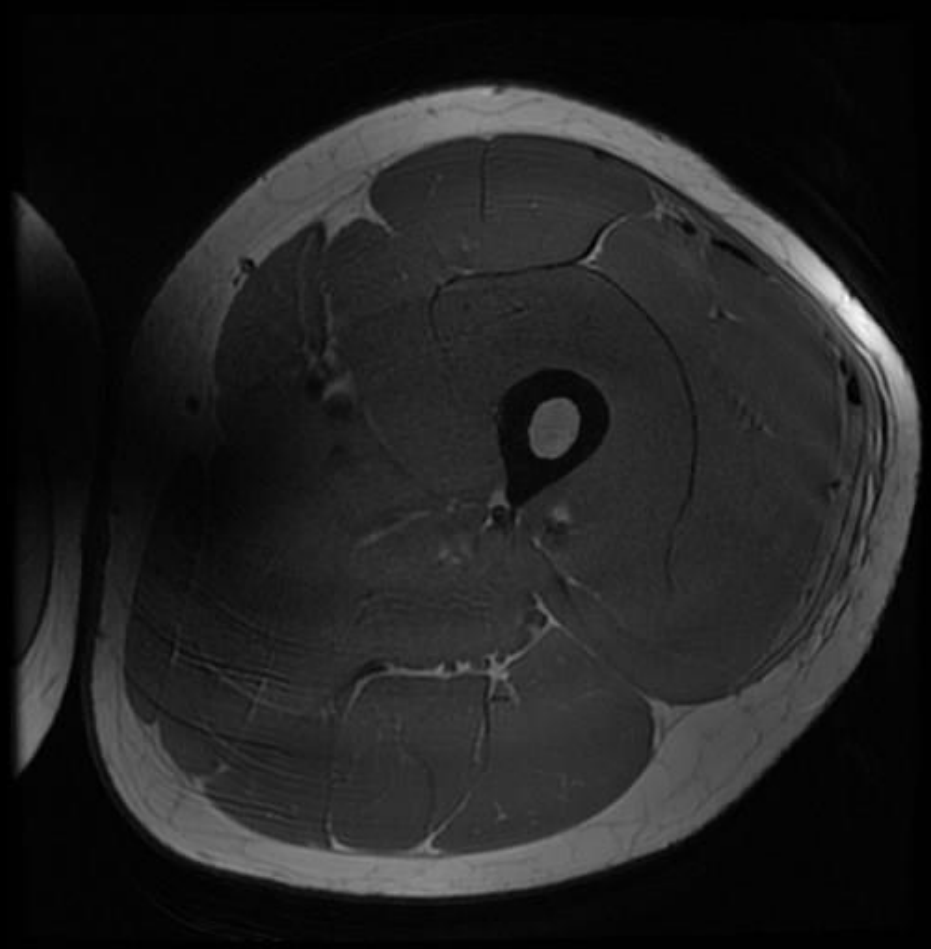
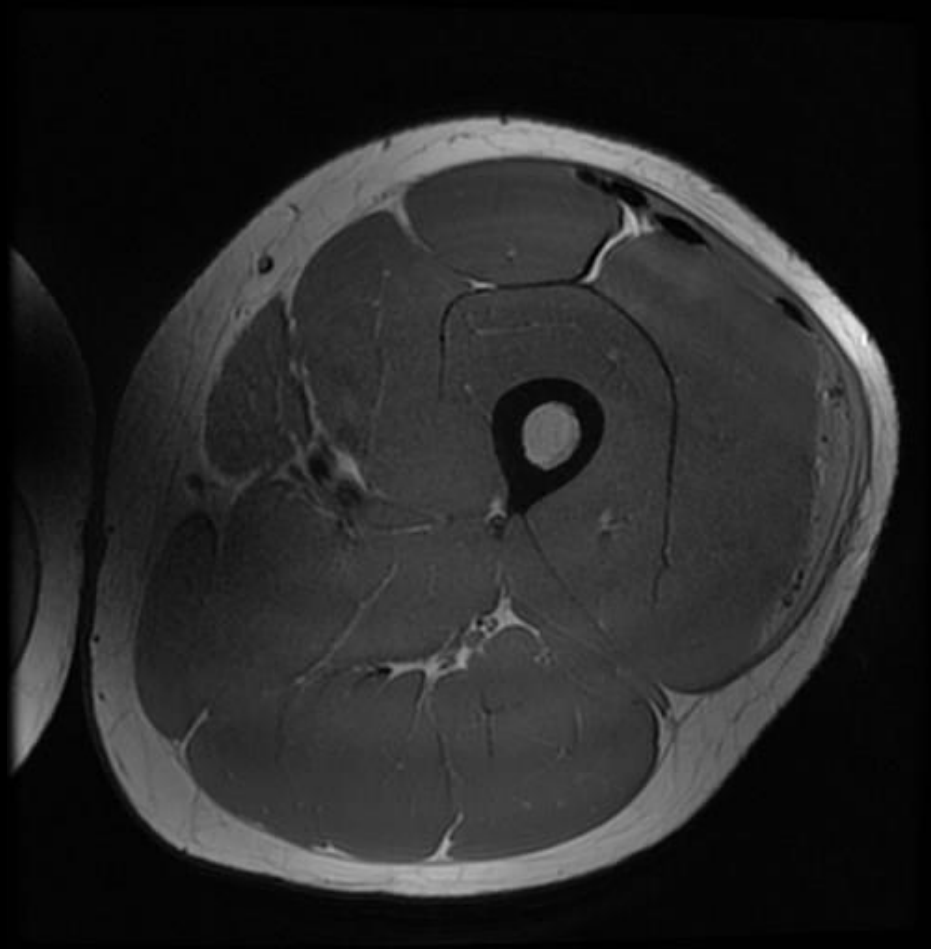
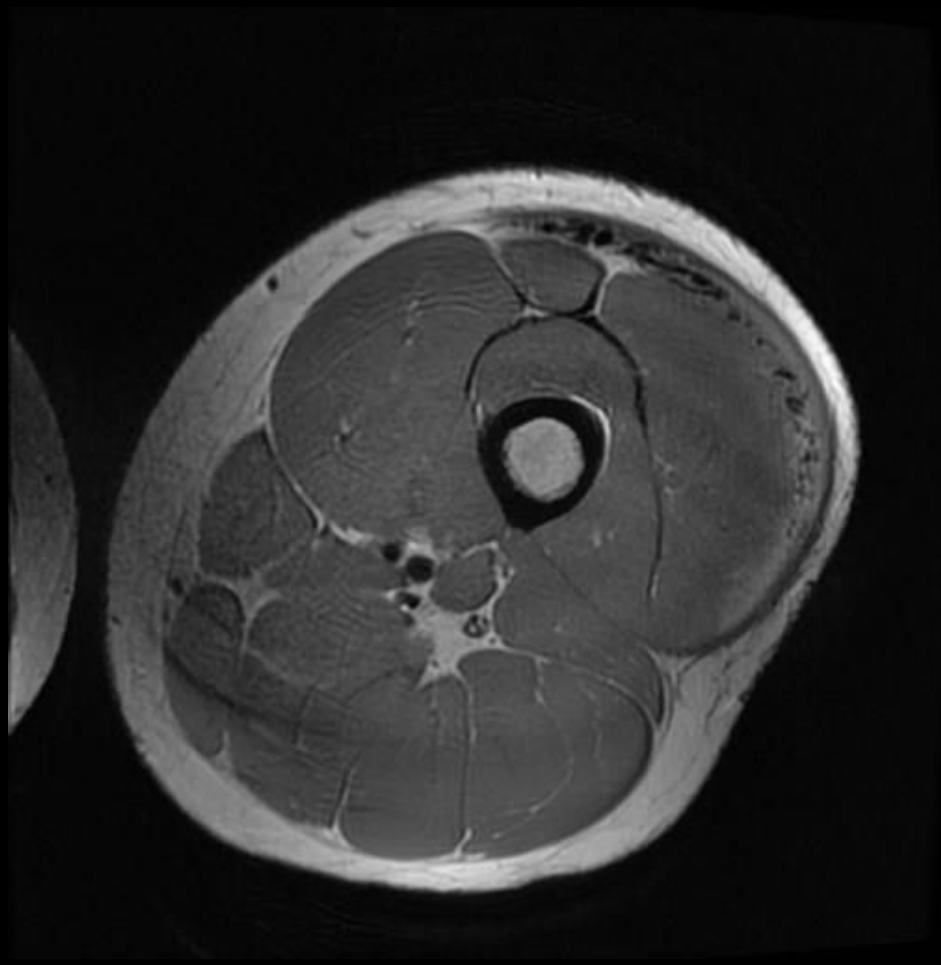
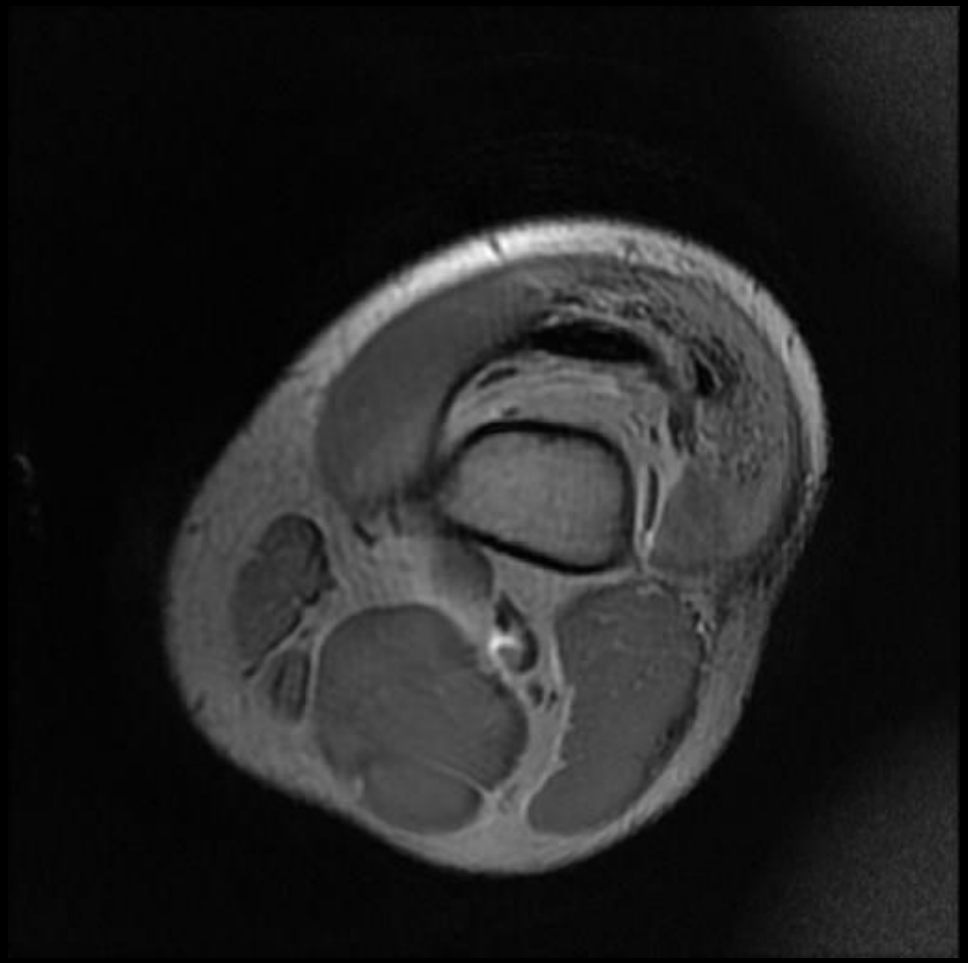
21 year old male with left lateral hip pain status post steroid injection.

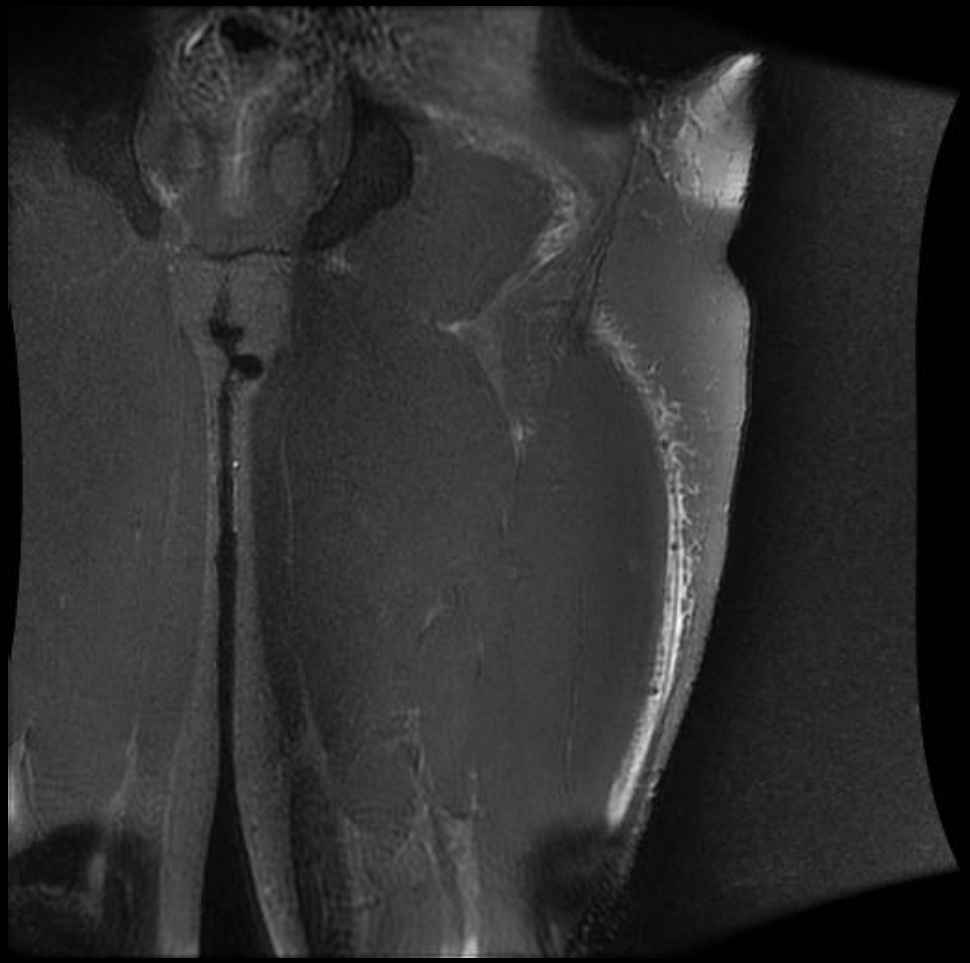


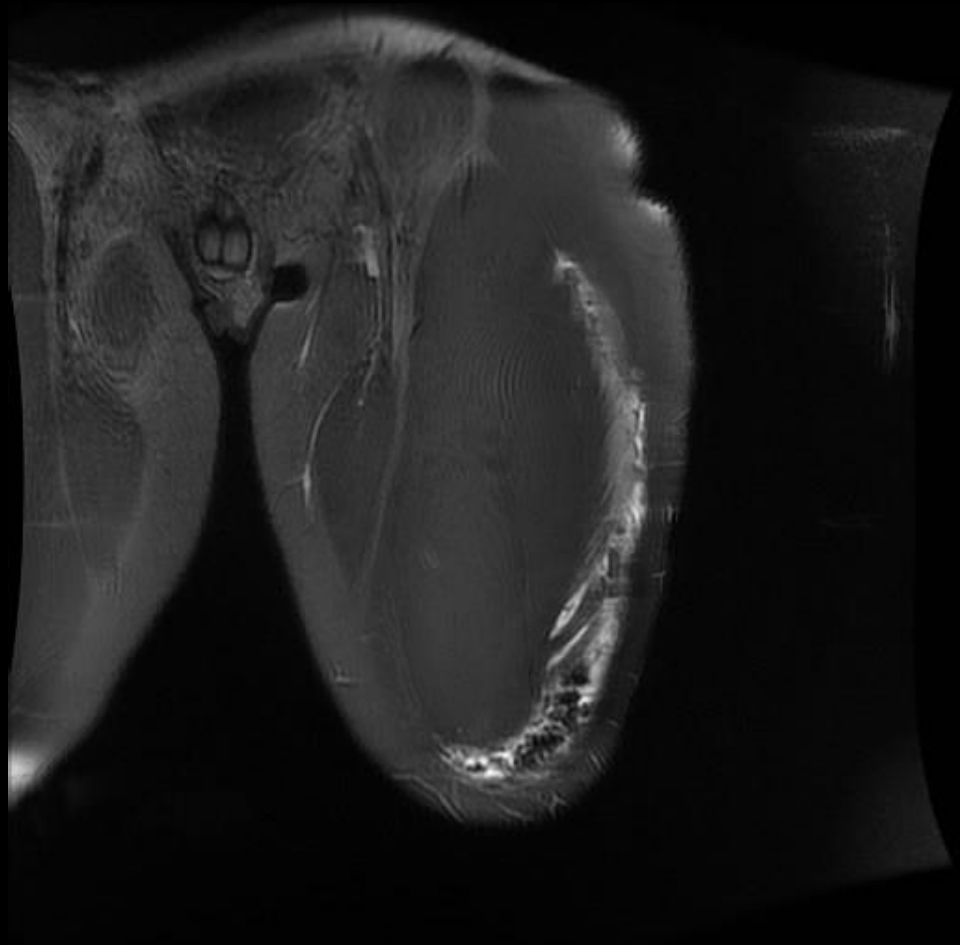


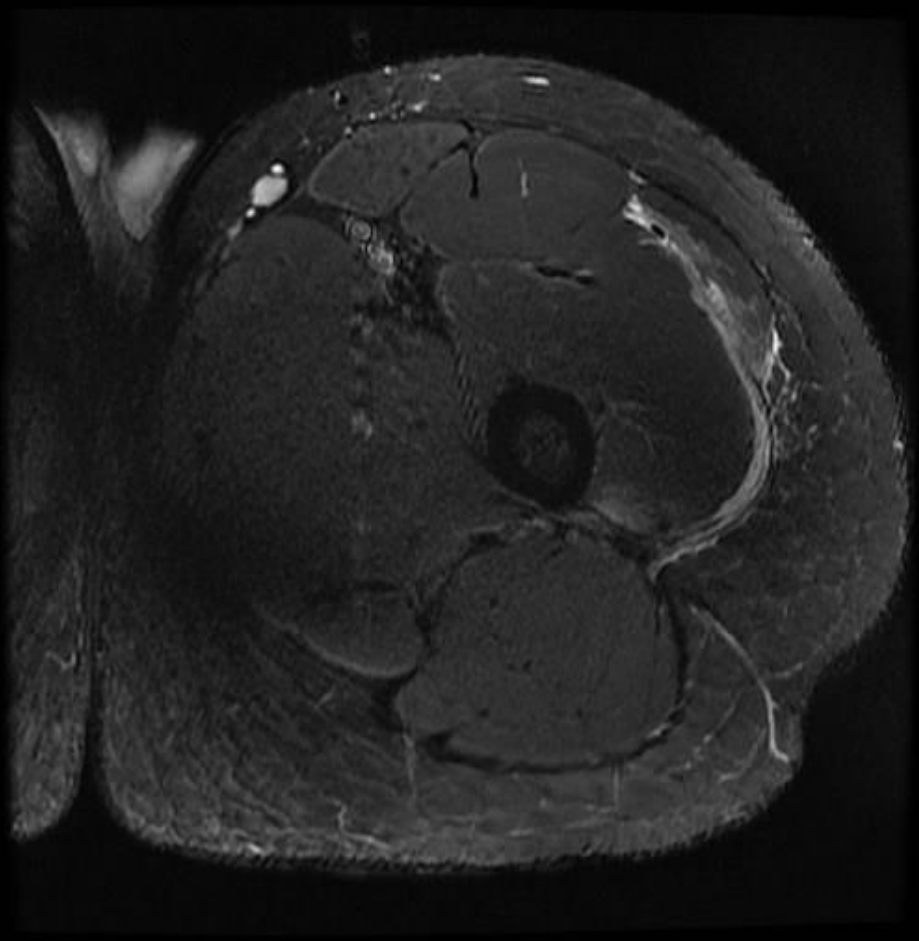


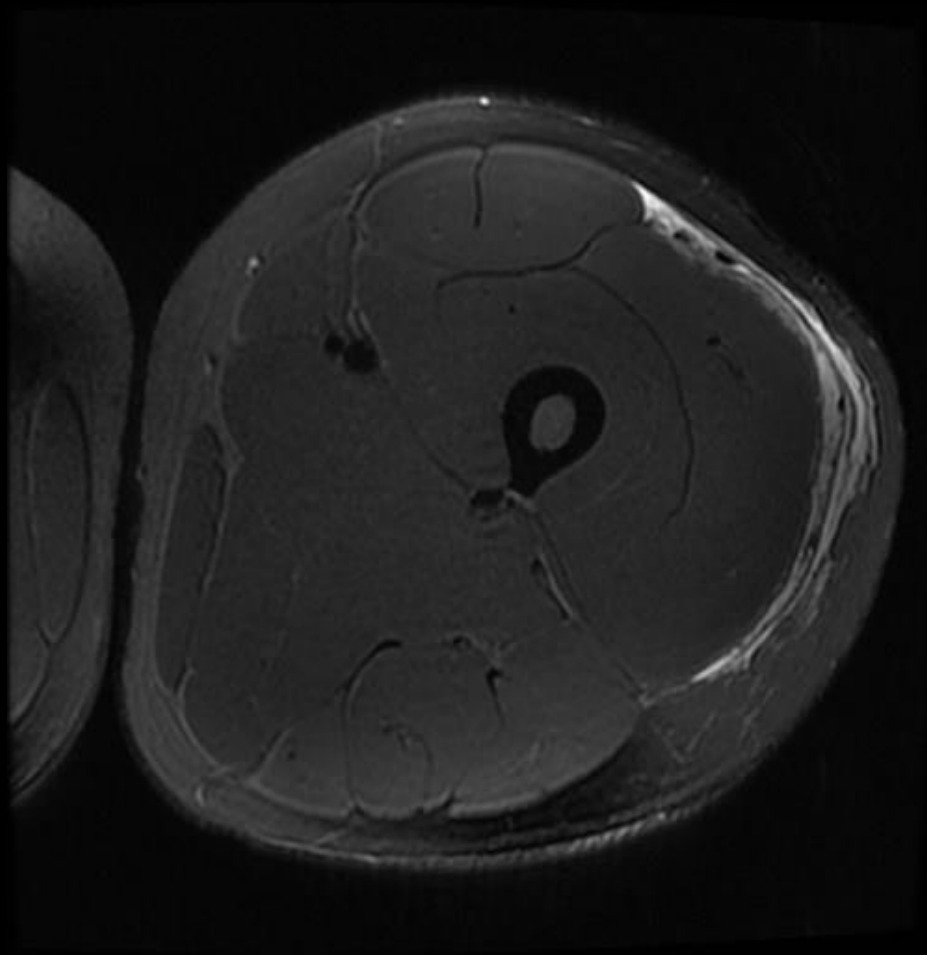


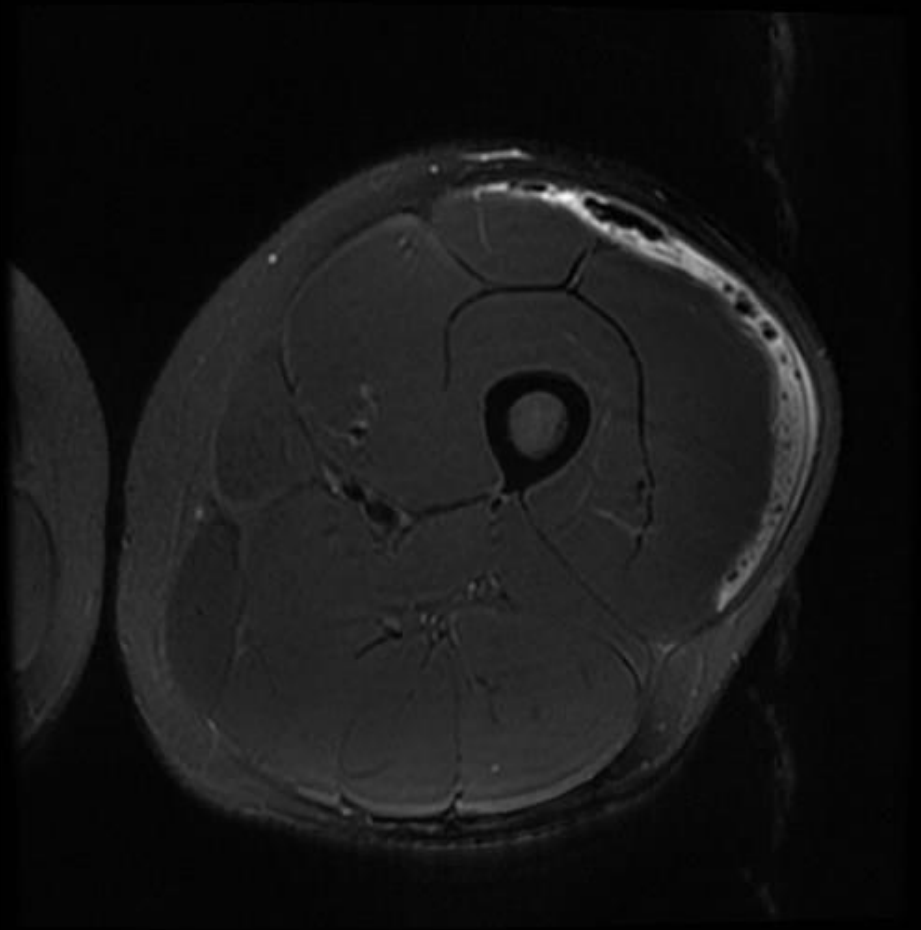


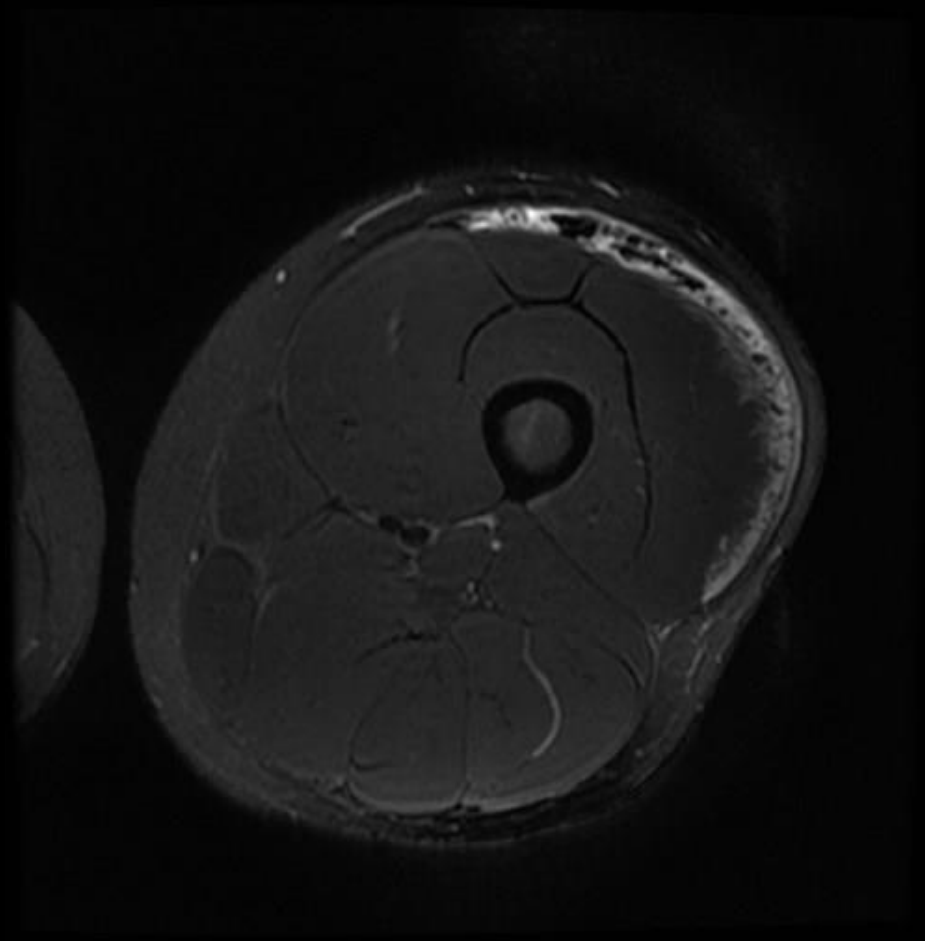


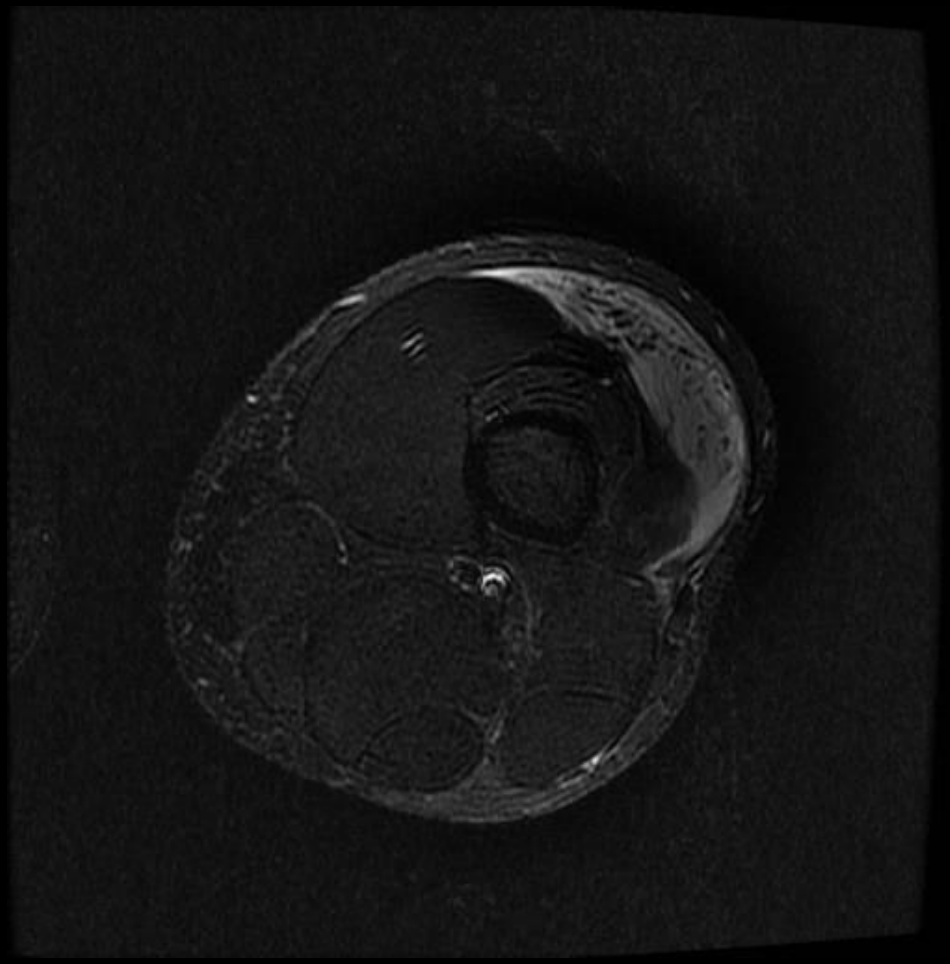












Necrotizing Fasciitis

- Aggressive, rapidly progressive soft tissue infection that tracks along both superficial (early) and deep fascial planes causing necrosis by microvascular occlusion
  - Fournier gangrene: Necrotizing fasciitis of perineum
- Deep to skin, superficial to muscles initially

- prevalence is thought to be rising
  - immunocompromised patients with HIV infection, diabetes mellitus, cancer, alcoholism, vascular insufficiency, and organ transplants. It can also occur after trauma or around foreign bodies in surgical wounds.
- most common type is a **polymicrobial infection** with both aerobic and anaerobic organisms
  - Clostridium, Proteus, Escherichia coli, Bacteroides, and Enterobacteriaceae: the second form of the disease is caused by a **single organism:** most commonly group A streptococci, the “flesh-eating bacteria,” and is seen in approximately 10-15% of cases 3-4; toxic shock syndrome may complicate this latter form

Clinical Presentation

- Sudden onset of pain, swelling, and often erythema
  - Early on, can be very difficult to differentiate from cellulitis, but pain is often much more severe
- As infection progresses, pain may disappear and area may become anesthetic
- Skin may demonstrate patchy areas of bluish-purple discoloration &/or hemorrhagic bullae
- Although some patients may present in florid sepsis, many may appear remarkably well because of blunted immune response

LRINEC Score

- The LRINEC (Laboratory Risk Indicator for Necrotizing Fasciitis) score was developed to distinguish necrotizing fasciitis (nec fasc) from severe cellulitis or abscess.
- Necrotizing fasciitis defined as operative exploration finding: presence of grayish necrotic fascia, lack of resistance of normally adherent muscular fascia to blunt dissection, lack of bleeding of the fascia during dissection, and the presence of foul-smelling “dishwater” pus.
- From developmental cohort, authors derived scoring system of six criteria, each worth 0, 1, 2 or 4 points.
- Patients were classified into three groups: low (LRINEC score ≤ 5, <50% risk for nec fasc), moderate (LRINEC score 6-7, 50-75% risk for nec fasc), and high risk (LRINEC ≥ 8, > 75% risk for nec fasc).
- Using LRINEC ≥ 6 as a cut-off for nec fasc yielded PPV of 92% and NPV of 96%. ~90% of patients with nec fasc had LRINEC ≥ 6 while only 3.1-8.4% of control patients had score ≥ 6.
- 10% of patients with nec fasc still had a LRINEC score < 6.
- Patient with a concerning history or physical exam (pain out of proportion to exam, rapidly progressive cellulitis, for example)
- Patients with a LRINEC score of > or = 6 should be carefully evaluated for the presence of necrotizing fasciitis.

Wong CH, et al. **The LRINEC (Laboratory Risk Indicator for Necrotizing Fasciitis) score: a tool for distinguishing necrotizing fasciitis from other soft tissue infections.** Crit Care Med. 2004 Jul;32(7):1535-41.

Table 2

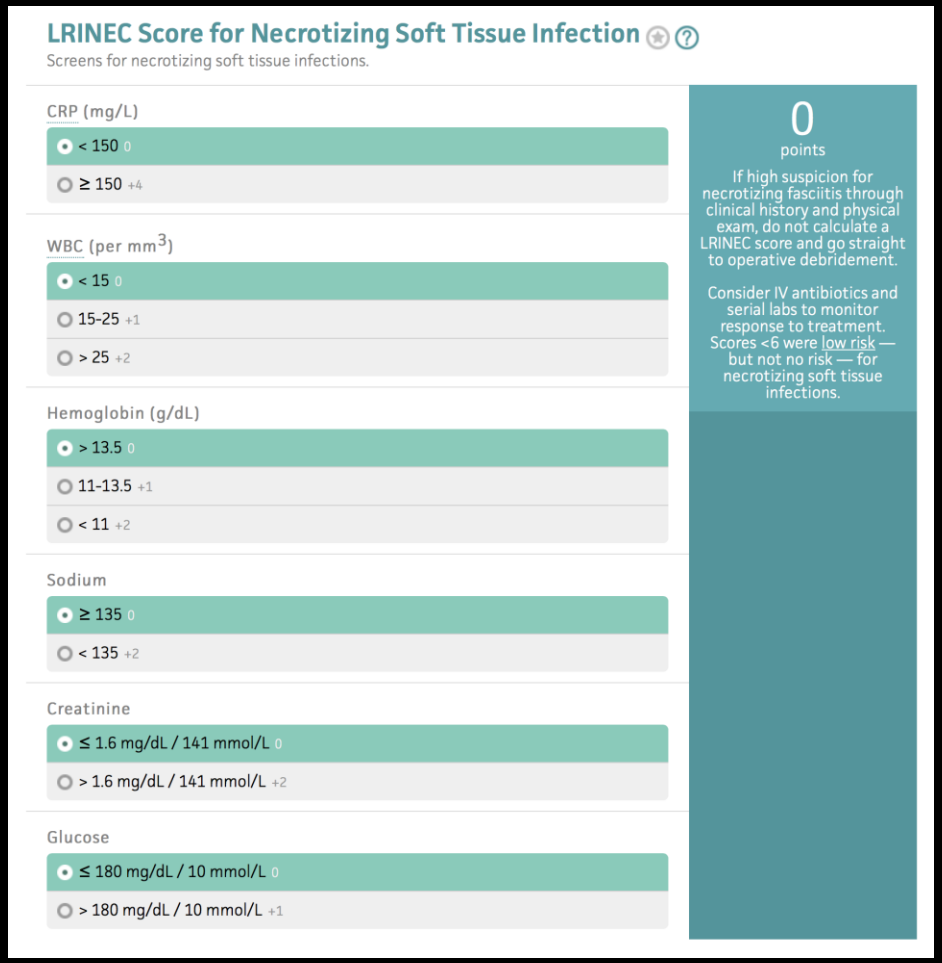
LRINEC Scores

Laboratory Finding*	LRINEC Score
CRP level (mg/dL)	
<15	0
≥15	4
WBC count (cells per mm^3)	
<15	0
15–25	1
>25	2
Hemoglobin level (g/dL)	
>13.5	0
11–13.5	1
<11	2
Sodium level (mmol/L)	
≥135	0
<135	2
Creatinine level (mg/dL)	
≤1.6	0
>1.6	2
Glucose level (mg/dL)	
≤180	0
>180	1

* CRP = C-reactive protein, WBC = white blood cell.

Kim, KT et al. **Can necrotizing infectious fasciitis be differentiated from nonnecrotizing infectious fasciitis with MR imaging?** Radiology. 2011 Jun;259(3):816-24

LRINEC Score



LRINEC Score for Necrotizing Soft Tissue Infection

Screens for necrotizing soft tissue infections.

CRP (mg/L)

- (•) < 150 0
- ( ) ≥ 150 +4

WBC (per mm^3)

- (•) < 15 0
- ( ) 15-25 +1
- ( ) > 25 +2

Hemoglobin (g/dL)

- (•) > 13.5 0
- ( ) 11-13.5 +1
- ( ) < 11 +2

Sodium

- (•) ≥ 135 0
- ( ) < 135 +2

Creatinine

- (•) ≤ 1.6 mg/dL / 141 mmol/L 0
- ( ) > 1.6 mg/dL / 141 mmol/L +2

Glucose

- (•) ≤ 180 mg/dL / 10 mmol/L 0
- ( ) > 180 mg/dL / 10 mmol/L +1

0
points

If high suspicion for necrotizing fasciitis through clinical history and physical exam, do not calculate a LRINEC score and go straight to operative debridement.

Consider IV antibiotics and serial labs to monitor response to treatment. Scores <6 were low risk — but not no risk — for necrotizing soft tissue infections.

http://www.mdcalc.com/lrinec-score-for-necrotizing-soft-tissue-infection/#next-steps

Imaging Findings

- Dissecting gas collections: Superficial &/or deep
  - tracking along fascial planes Thickened fascia with fluid plus regions of necrosis suggestive of diagnosis
- Seen by radiograph, CT, or MR
- Subcutaneous edema may be present
- Less prominent in necrotizing fasciitis than in cellulitis
- Fascial thickening, increased T2 signal is present but not specific
- In NF, fascial thickening almost always involves both superficial and deep fascia
- Nonenhancing islands within & surrounded by enhancing abnormal fascia suggest necrosis

Can Necrotizing Infectious Fasciitis Be Differentiated from Nonnecrotizing Infectious Fasciitis with MR Imaging?[1]

Kyoung-Tae Kim, MD
Yeo Ju Kim, MD
Ju Won Lee, MD
Youn Jeong Kim, MD
Sun-Won Park, MD
Myung Kwan Lim, MD
Chang Hae Suh, MD

Radiology

Purpose: To retrospectively evaluate whether magnetic resonance (MR) imaging findings can be used to differentiate necrotizing infectious fasciitis (NIF) from nonnecrotizing infectious fasciitis (non-NIF).

Materials and Methods: Institutional review board approval was obtained, but patient consent was not required for this retrospective review of records and images because patient anonymity

Kim KT, Kim YJ, Won lee J et-al. Can necrotizing infectious fasciitis be differentiated from nonnecrotizing infectious fasciitis with MR imaging? Radiology. 2011;259 (3): 816-24.

Figure 2

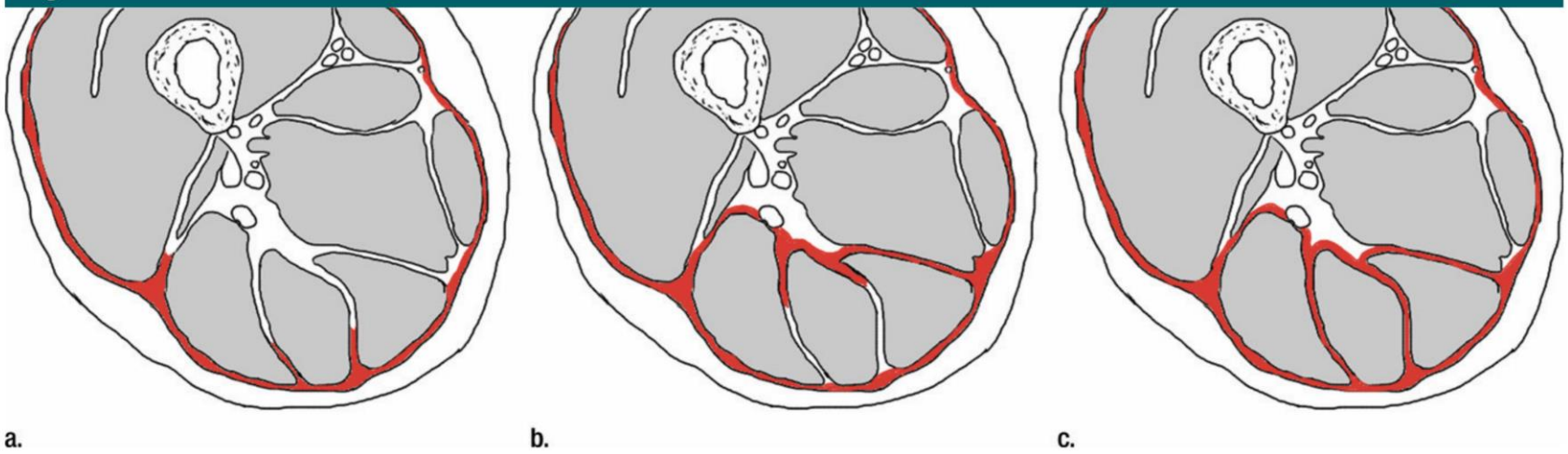


Figure 2: Drawings illustrate degree of deep fascia involvement in a compartment. **(a)** With partial involvement, areas of abnormal signal intensity are seen only in deep fascia that is abutting superficial fascia. **(b)** With extensive involvement, areas of abnormal signal intensity are seen in deep fascia with and without abutting superficial fascia. **(c)** Also with extensive involvement, areas of abnormal signal intensity are seen in all deep fasciae surrounding muscle.

Kim, KT et al. **Can necrotizing infectious fasciitis be differentiated from nonnecrotizing infectious fasciitis with MR imaging?** Radiology. 2011 Jun;259(3):816-24.

Results

- Patients with NIF had a significantly greater frequency of thick (≥3 mm) abnormal signal intensity on fat-suppressed T2-weighted images,
- low signal intensity in the deep fascia on fat-suppressed T2-weighted images
- a focal or diffuse nonenhancing portion in the area of abnormal signal intensity in the deep fascia
- extensive involvement of the deep fascia
- involvement of three or more compartments in one extremity ($P < .05$).

Table 3

Laboratory Results for Patients in NIF and Non-NIF Groups

Laboratory Finding*	NIF Group ($n = 7$)†	Non-NIF Group ($n = 23$)†	*P* Value
ESR (mm/h)	48.28 ± 25.71	45.05 ± 28.48	.721
WBC count (cells per mm^3)	129371 ± 4115	14077 ± 7340	.922
CRP level (mg/dL)	26.00 ± 10.509.9	10.52 ± 8.39	.004‡
Hemoglobin level (g/dL)	11.35 ± 1.992.2	13.10 ± 2.00	.61
Sodium level (mmol/L)	137.42 ± 4.644.4	139.08 ± 3.43	.323
Creatinine level (mg/dL)	1.65 ± 1.08	1.01 ± 0.66	.005‡
Glucose level (mg/dL)	197.42 ± 175.73	135.04 ± 50.93	.980

* CRP = C-reactive protein, ESR = erythrocyte sedimentation rate, WBC = white blood cell.

† Data are mean values ± standard deviations.

‡ Significant difference ($P < .05$) between the two groups.

Kim, KT et al. **Can necrotizing infectious fasciitis be differentiated from nonnecrotizing infectious fasciitis with MR imaging?** Radiology. 2011

Table 4

LRINEC Score Results

LRINEC Score	NIF Group ($n = 7$)	Non-NIF Group ($n = 23$)
Overall*	5.42 ± 2.07	2.56 ± 2.40
≤5 (Low risk)	4 (57)	20 (87)
6–7 (Moderate risk)	2 (29)	2 (9)
≥8 (High risk)	1 (14)	1 (4)

Note.—Unless otherwise noted, data are numbers of patients, with percentages in parentheses.

* Mean overall LRINEC scores ± standard deviations. The difference in LRINEC score between the NIF and non-NIF groups was significant ($P = .008$).

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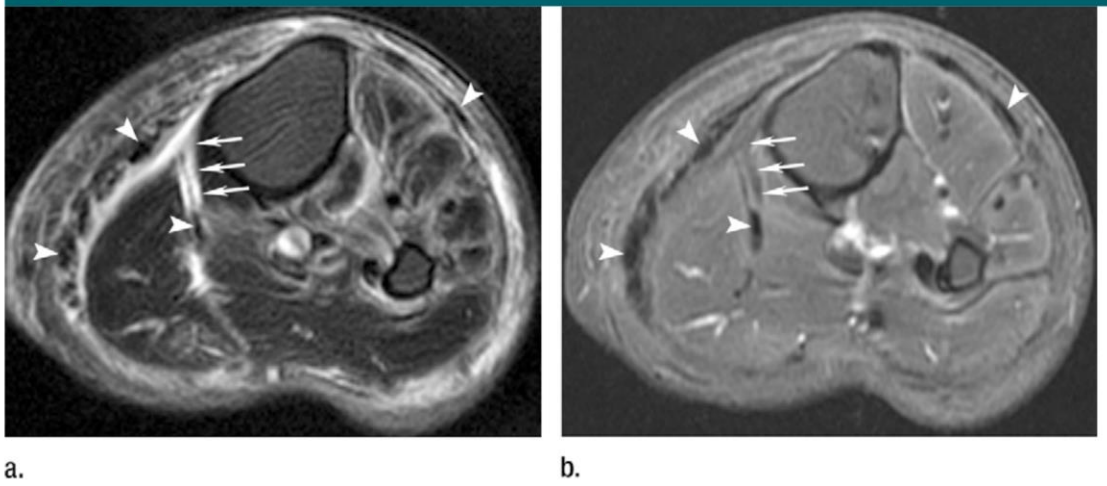
Figure 3



a. b.

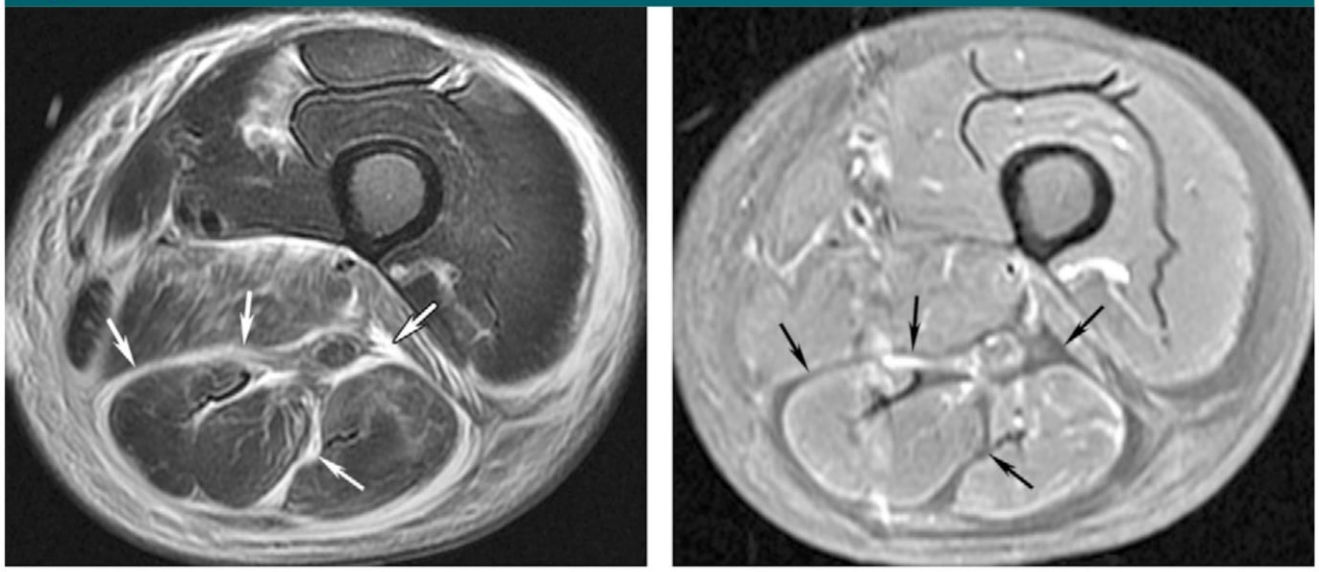
Figure 3: Axial MR images in 55-year-old woman with surgically confirmed NIF in lower region of left leg. **(a)** Fat-suppressed T2-weighted image (5000/102 [repetition time msec/echo time msec]) shows thick (≥3 mm) areas of high signal intensity (arrows) in deep fascia. Combined areas of low signal intensity (arrowheads), representing gas, are seen in superficial and deep fasciae. High-signal-intensity areas in deep fasciae are seen in nearly all deep fasciae surrounding muscle in anterior, lateral, deep posterior, and superficial posterior compartments (extensive deep fascia involvement of three or more compartments). **(b)** On contrast-enhanced fat-suppressed T1-weighted image (600/15), portions of high-signal-intensity area in deep fascia seen in **a** do not show enhancement (arrows). Areas of low signal intensity (arrowheads), representing gas, are seen in superficial and deep fasciae.

Table 5

Interobserver Agreement Regarding MR Findings

Kim, KT et al. **Can necrotizing infectious fasciitis be differentiated from nonnecrotizing infectious fasciitis with MR imaging?** Radiology. 2011 Jun;259(3):816-24.

Figure 4

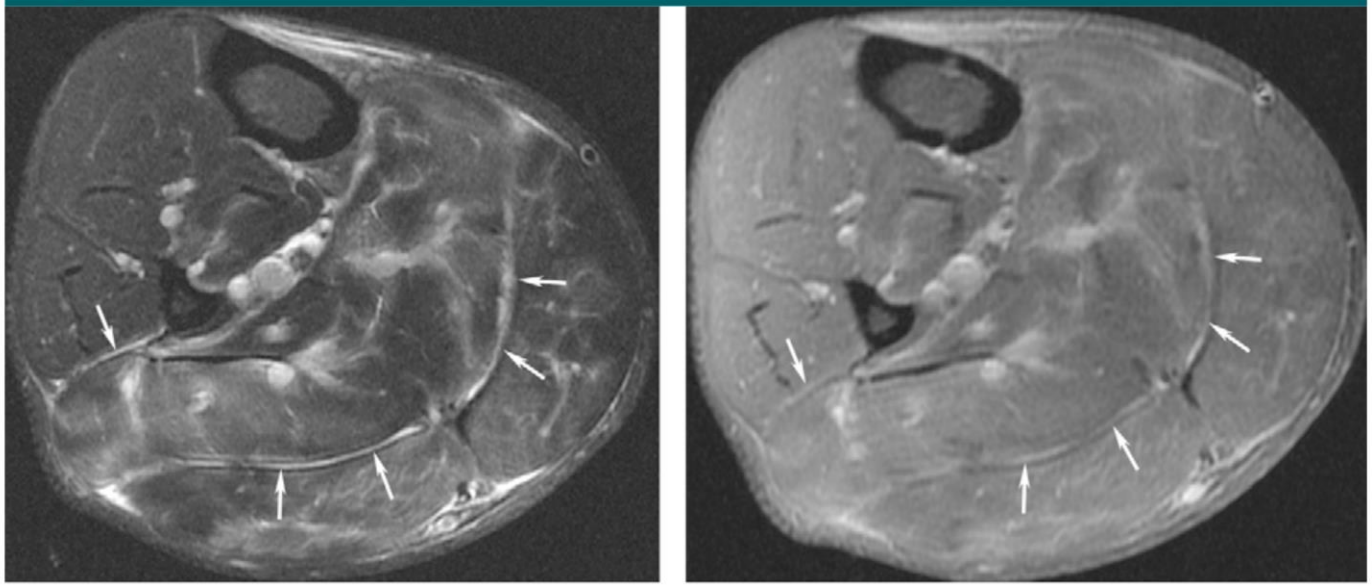


a. b.

Figure 4: Axial MR images in 77-year-old man with surgically confirmed NIF in left thigh. **(a)** Fat-suppressed T2-weighted image (4300/100) shows areas of high signal intensity in all deep fasciae surrounding muscle of medial-posterior compartment and in some deep fasciae of anterior compartment of left thigh (extensive deep fascia involvement of three or more compartments). Areas of high signal intensity (arrows) greater than 3 mm in thickness are seen in posterior compartment. **(b)** On contrast-enhanced fat-suppressed T1-weighted image (500/10), thick high-signal-intensity areas in deep fasciae seen in **a** do not show enhancement (arrows).

Kim, KT et al. **Can necrotizing infectious fasciitis be differentiated from nonnecrotizing infectious fasciitis with MR imaging?** Radiology. 2011 Jun;259(3):816-24.

Figure 6



a. b.

Figure 6: Axial MR images in 67-year-old man with non-NIF in lower part of right leg. **(a)** Fat-suppressed T2-weighted image (4600/90) shows thin (<3 mm) areas of high signal intensity (arrows) in deep fasciae abutting superficial fasciae of superficial posterior and lateral compartments (partial deep fascia involvement of fewer than three compartments). **(b)** On contrast-enhanced fat-suppressed T1-weighted image (600/10), high-signal-intensity areas in deep fasciae seen in **a** show enhancement (arrows).

Kim, KT et al. **Can necrotizing infectious fasciitis be differentiated from nonnecrotizing infectious fasciitis with MR imaging?** Radiology. 2011 Jun;259(3):816-

Figure 7

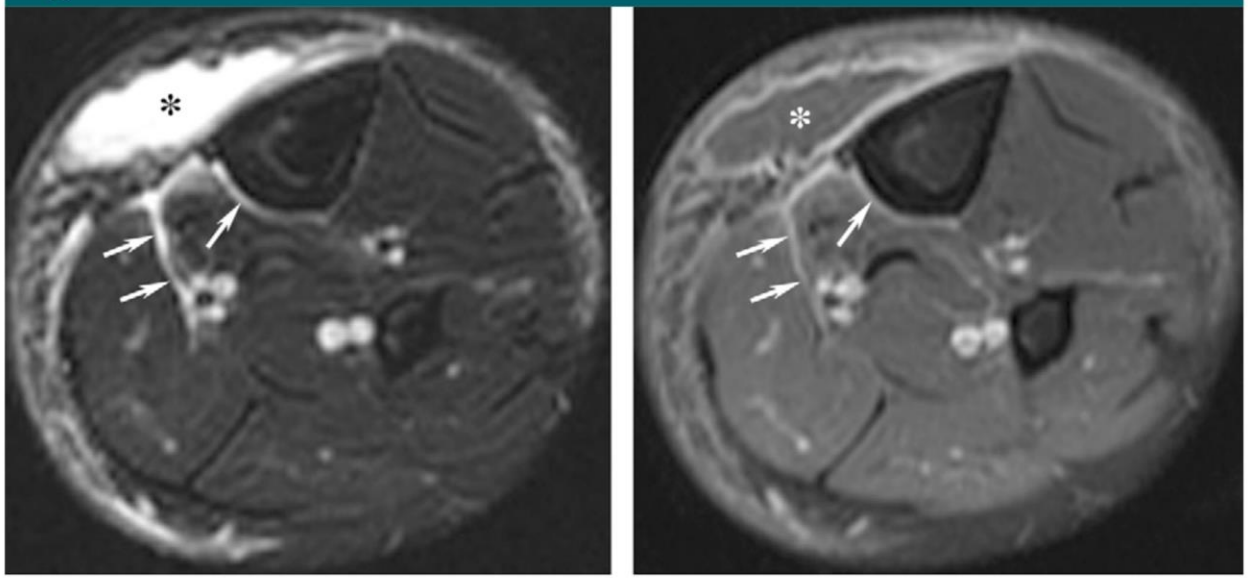


Figure 7: Axial MR images in 41-year-old man with non-NIF in lower region of left leg. **(a)** Fat-suppressed T2-weighted image (4300/100) shows thin (<3 mm) areas of high signal intensity (arrow) in deep fascia that abuts superficial fascia of only the superficial posterior compartment (partial deep fascia involvement of fewer than three compartments). An abscess (*) is apparent in subcutaneous layer. **(b)** On axial contrast-enhanced fat-suppressed T1-weighted image (500/10), enhancement (arrows) is seen in areas of high signal intensity in deep fascia seen in **a**. Abscess (*) in subcutaneous fat layer has low-signal-intensity center and rim enhancement.

Kim, KT et al. **Can necrotizing infectious fasciitis be differentiated from nonnecrotizing infectious fasciitis with MR imaging?** Radiology. 2011 Jun;259(3):816-24.

NF Diagnosis and Management

- If real clinical suspicion for NF, imaging should not delay surgical biopsy/treatment
- NF is a clinical diagnosis even with negative or nonspecific imaging findings
- If real clinical suspicion of NF, surgical biopsy is necessary, regardless of imaging findings
- Main utility of imaging in cases of suspected NF is to aid surgical planning

Diagnosis and Mgmt Continued

- Any age but most are late middle-aged to elderly
- Extensive & rapid progression of soft tissue infection to sepsis & multiorgan system failure
  - Morbidity and mortality as high as 70-80%
- Treatment
  - Broad spectrum antibiotics, general supportive measures, and early, extensive surgical debridement
  - 90% polymicrobial with aerobes & anaerobes
- Hyperbaric oxygen therapy may reduce mortality

References

- 1.https://my.statdx.com/document/necrotizing-fasciitis/eae617b1-41d0-4b94-8f19-0c560847287a?searchTerm=Necrotizing%20Fasciitis
- 2. Rahmouni A et al: Differentiation of necrotizing infectious fasciitis from nonnecrotizing infectious fasciitis with MR imaging. Radiology. 262(2):732-3; author reply 733, 2012
- 3. Wong CH, et al. **The LRINEC (Laboratory Risk Indicator for Necrotizing Fasciitis) score: a tool for distinguishing necrotizing fasciitis from other soft tissue infections.** Crit Care Med. 2004 Jul;32(7):1535-41.
- 4. Kim, KT et al. **Can necrotizing infectious fasciitis be differentiated from nonnecrotizing infectious fasciitis with MR imaging?** Radiology. 2011 Jun;259(3):816-24. doi: 10.1148/radiol.11101164. Epub 2011 Mar 15.