Non-Traumatic Muscle Pathologies

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Objectives

• Define the range of non-traumatic pathologies affecting skeletal muscle.
• Evaluate the imaging findings associated with non-traumatic muscle conditions.
• Discuss the role of MR imaging in assessment of patients with muscle disease.

Abnormal Muscle Signal Intensity

• Inflammatory
• Infectious myositis
• Subacute denervation
• Compartment syndrome
• Rhabdomyolysis
• Radiation therapy
• Diabetic myonecrosis
• Early myositis ossificans

Inflammatory Myositis

• Types:
  – Polymyositis
  – Dermatomyositis
  – Connective Tissue Disorders
    • SLE, Sjögren’s, systemic sclerosis, MCTD
  – Idiopathic
  – Inclusion body myositis
    • ? paramyxovirus infection

Polymyositis / Dermatomyositis

• Autoimmune
• Gradual weakness
  – Thighs / pelvis girdle then upper extremity
• Age
  – Polymyositis: 4th decade
  – Dermatomyositis
    • Childhood
    • 5th decade: associated with malignancies
      – Breast, prostate, lung, ovarian, GI
**Polymyositis / Dermatomyositis**

- Bilateral symmetric edema
  - Muscle +/- fascia
- Proximal muscles
  - Vastus lateralis or intermedius
- Fatty infiltration chronic cases
- Dermatomyositis
  - Adductors common
  - Calcification
  - Skin/subcutaneous > PM
  - Atrophy less common than polymyositis

**Inclusion Body Myositis**

- Elderly male
- Inclusion of amyloid-β protein
- Proximal and distal muscles
- Refractory to treatment
- MRI
  - Anterior thigh compartment, deltoid, ankle
  - Fatty atrophy > edema
  - Heterogeneous edema and enhancement
- Fatty involvement ++ > PM/DM
Granulomatous and Vasculitic Disorders

- Granulomatous disease
  - Sarcoid
  - Crohn’s
  - Behcet’s
- May have more nodular appearance
  - Sarcoid: central star-shaped low T2 signal with peripheral increased SI = “dark star”
  - Behcet’s: central necrosis with peripheral edema and enhancement

Eosinophilic Fasciitis (Shulman Disease)

- Scleroderma like disorder
- Extremity swelling, stiffness, fatigue
  - Typically acute and rapidly progressive
  - May be associated with strenuous activity
  - 4th – 5th decade
- Peripheral eosinophilia
- Forearms and calves
- Diagnosis: Full-thickness skin to muscle biopsy
- Responsive to corticosteroid therapy

Eosinophilic Fasciitis

- MRI
  - Marked increased T2 signal fascia
  - Marked fascial enhancement
  - Perifascial muscle edema
    - Muscle changes less marked than fascial involvement
  - Usually resolve with treatment
Infectious Myositis

- **Causes**
  - Contiguous infection
  - Penetrating trauma
  - Vascular insufficiency
  - Hematogenous seeding

- **Associations**
  - Diabetes
  - Immunocompromised
  - Illicit drug injection

- **Bacterial**
  - Staph aureus: 70-90%
  - Group A streptococci
  - E. coli
  - Clostridium
  - Bartonella
  - TB

- **Viral**
  - Influenza A and B
  - Enterovirus
  - HIV

- **Fungi**
  - Candida
  - Balstomyces
  - Aspergillus

- **Parasites**
  - Trichinella
  - Taenia solium
  - Toxoplasma
  - Plasmodium
  - Sarcocystis

- **Pyomyositis**
  - Tropics ++++.
  - Hematogenous seeding: staph aureus
  - No trauma or contiguous infection
  - Invasive: 1-2 weeks: Infection but no collection
  - Suppurative: 2-3 weeks: Abscess
Infectious Myositis

• MRI
  – Initial:
    • Diffuse edema + enhancement
    • Swelling
    • No abscess
    • Adjacent changes: subcutaneous tissues / bone
  – Suppurative stage
    • Abscess
    • +/- adenitis
Myonecrosis

- Causes
  - Idiopathic
  - Diabetes
  - Sickle cell
  - Compartment syndrome
  - Crush injury

Diabetic Myonecrosis

- Causes
  - Poorly controlled diabetes
- Clinical features
  - Pain: typically thigh muscles
  - Low grade fever
- MRI
  - Lower extremity > upper esp anterior compartment
  - Muscle edema
  - Maintained architecture on T1
  - Fascia: mild displacement, edema
  - Peripheral / serpentine enhancement

Diabetic Myonecrosis

- MRI
  - Post gad T2 Fatsat

Rhabdomyolysis

- Causes
  - Trauma, crush injury
  - Severe exercise
  - Drugs / alcohol / carbon monoxide
  - Lipid lowering agents, corticosteroids, zidovudine,
    - Infection
- Pathology
  - Loss of integrity of cell membrane
  - Release of myoglobin and toxic intracellular metabolites
  - Elevated creatine kinase
    - Peaks 1-3 days, falls by 30-40% per day

Rhabdomyolysis - MRI

- Swelling
- Signal
  - Iso/hyper T1
  - Hyper T2
- Subfascial fluid collection
- Subcutaneous edema
- Variable distribution
  - Symmetric
  - Asymmetric or even unilateral (up to 50%)

- Type 1
  - Homogenous enhancement
  - No necrosis
  - Typically due to overexertion
- Type 2
  - Rim enhancement
  - Necrosis
Graft Versus Host Disease

- Allogenic stem cell transplantation
- Focal necrosis with massive lymphocyte infiltration
- > 2-3 months post transplant
- Skin/subcutaneous induration and plaques
  - Lichenoid type
  - Sclerodermatous type
- May lead to joint contractures

Graft Versus Host Disease

- MRI
  - Thighs > calves > pelvis > arms
  - Skin thickening
  - Subcutaneous septal thickening and edema
  - Fascial thickening and edema
  - Patchy or diffuse muscle edema
  - Less common than subcutaneous/fascial change
Muscle Denervation

• Causes
  – Entrapment neuropathies
  – Neuritis
  – Polyneuropathies
  – Spinal cord
• Commonly 2-4 weeks after denervation
  – Vs acute injury
  – No collections
• Distribution conforming to innervation

PIN (Supinator) Syndrome

Muscle Denervation

• Role of MRI
  – Assess for surgically treatable cause
  – Assess for chronic changes / fatty infiltration
• Combine with electrophysiological studies to narrow point of injury

Role of MRI in Non-Traumatic Muscle Pathologies

• Etiology:
  – History is key
    • CTD, diabetes, radiation, exertional, drugs, BMT, HIV
  – Distribution:
    • ? one compartment, bilateral
    • Proximal vs distal
    • ? Nerve distribution
    • Subcutaneous tissues / fascia
• Guide biopsy
• Monitor treatment

Conclusion

• Imaging findings generally non-specific
• History
• Guide biopsy