IMAGING OF HAMSTRING AVULSION INJURIES: DIAGNOSTIC, PROGNOSTIC AND TREATMENT IMPLICATIONS

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AGENDA

- Patient presentation
- Regional anatomy
- Presentation and epidemiology
- Diagnostic imaging
- Implications for treatment
- Conclusion of patient presentation
- Imaging of chronic hamstring injuries
OUR PATIENT: HISTORY

• 76-year-old man presented to the emergency room with sharp pain in the right posterior thigh
  • Sudden onset while running
  • 2/10 at rest
  • 10/10 with any active movement

• No prior history of lower extremity injury
OUR PATIENT: EXAM

• Extremities:
  • Pelvis stable and non-tender
  • No swelling, overlying ecchymosis, or palpable defect in muscles/tendons of posterior thigh
  • Tenderness to palpation over right superior posterior thigh
  • Active contraction of right hamstring limited by pain
OUR PATIENT: PLAIN FILM
OUR PATIENT: FURTHER HISTORY

- Given the patient’s history, there was high suspicion for a muscle tear
- An MRI was ordered for two days after the injury
OUR PATIENT: MRI - ISCHIAL TUBEROSITY
OUR PATIENT: MRI - BASE OF ISCHIAL TUBEROSITY

Findings:
• Normal tendon attachment
• Absent tendon attachment
• Edema and hemorrhage
OUR PATIENT: MRI - 1 CM BELOW ISCHIAL TUBEROSITY
OUR PATIENT: MRI - 2 CM BELOW ISCHIAL TUBEROSITY
OUR PATIENT: MRI - 4 CM BELOW THE ISCHIAL TUBEROSITY

Avulsed tendon head

MRI Axial - T1 C-

MRI Axial - T2 C-
Findings:
- Normal tendon attachment
- Avulsed tendon
OUR PATIENT: MRI - EXPANDED

- MRI Coronal - T1 C-
- MRI Coronal – STIR C- PACS-BIDMC

- Ischial tuberosity
- Tendon
DIFFERENTIAL DIAGNOSIS

Posterior thigh pain
- Hamstring strain
- Ischial tuberosity disease
- Hamstring enthesopathy
- Hamstring syndrome
- Referred pain
- Hamstring contusion
- Myositis ossificans
- Bursitis
- Ligament strain
- Posterior compartment syndrome
- Sciatic nerve pain
- Bone tumor
- Sacroiliitis
- Claudication

Radiologic differential for hamstring muscle complex injury
- Hamstring strain
- Hamstring avulsion/tear w/ or w/o ischial tuberosity involvement
REGIONAL ANATOMY

- Flex the knee and extend the hip
- The hamstring muscles cross two joints, predisposing to strains and tears
- Decelerates the leg during running and walking

REGIONAL ANATOMY – TENDON ATTACHMENTS

Semimembranous Tendon
Conjoint Tendon
Muscle body

PRESENTATION AND EPIDEMIOLOGY

• History
  • Sudden onset
  • Feeling of a “pop”
  • Pain is exacerbated by movement of the leg

• Epidemiology and risk factors
  • Adolescents - Avulsion of the ischial tuberosity is more common
  • Adults - Involvement of the muscle-tendon junction
  • Elderly – Tendon involvement most common
  • Poor flexibility and muscle weakness relative to the quadraceps
  • Sports related – Waterskiing, sprinting, playing soccer and football

IMAGING HAMSTRING AVULSIONS: GOALS

- Diagnosis
- Prognosis
- Determine surgical candidacy
IMAGING HAMSTRING AVULSIONS: MODALITIES

- **X-ray**
  - Often first study in practice
  - May help identify bony abnormalities and joint abnormalities

- **Ultrasound**
  - Most sensitive early for moderate to severe injuries
  - Slightly more sensitive than MRI in the first two weeks, but declines as fluid resolves
  - US may be most sensitive in adolescents

- **MRI**
  - Improved characterization of the injury
  - More prognostic information
  - Useful for following injury resolution

RADIOLOGIC FINDINGS ON X-RAY

Ischial tuberosity avulsion
RADIOLOGIC FINDINGS ON US

- Heterogenetity of the HMC tendons
- Surrounding edema
- Separation of conjoint and semimembranous tendons from the ischial tuberosity
- Can look for movement of the muscle tendon complex
RADIOLOGIC FINDINGS ON US: EXAMPLES

A

Ultrasound imaging showing a partial tear of the HMC (arrow) near the insertion point on the ischial tuberosity (*). Fluid can be seen tracking under the tendon complex (curved arrow).

B

Ultrasound imaging showing a normal HMC (arrow) near the insertion point on the ischial tuberosity (*). Superior to the insertion the HCM is difficult to separate from the sacrotuberous ligament (curved arrow).

RADIOLOGIC FINDINGS ON MRI

• Tendons are low-intensity on MR
  • Loss of low-intensity signal between tendons and bone may be visible on T1
  • Intervening edema between tendons and bone will be evident on T2

• On T2 imaging fluid may be seen tracking down the posterior compartment around the hamstrings.

• May be able to assess sciatic nerve integrity
RADIOLOGIC FINDINGS ON MRI: PARTIAL TEAR

- Partial tear
- Tendon is largely intact
- Subtle high-intensity edema around tendon

Courtesy of Dr. James Wu
TREATMENT

• Most evidence comes from small case studies
• No definitive guidelines for surgical vs. non-surgical management
• Most patient’s do well with non-operative management
• Elite athletes may benefit from surgical management
• Avulsion of the ischial tuberosity in adolescents may warrant surgical correction
OUR PATIENT: CONCLUSION

- The orthopedic surgeon decided to treat non-operatively.

- The patient is currently undergoing physical therapy.
COMPLICATIONS OF HAMSTRING AVULSIONS

- Re-injury
- Sciatic nerve irritation
- Myositis Ossificans
- “Hamstring syndrome”
CONCLUSIONS

• Hamstring injuries are a common musculoskeletal problem

• The choice to image should be based on the history and physical examination

• Imaging modality may be patient specific and depend on the availability of technology

• US and MRI are the two most sensitive technologies

• US is operator dependent, most sensitive early and best for moderate to severe injuries

• MRI provides overall assessment of the injury, surgical characterization and the potential for long-term monitoring
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