

Proximal Hamstring Tears and Proximal Hamstring Syndrome

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Anatomy

- The hamstring is made up of 3 muscles:
 - Semitendinosus
 - Semimembranosus
 - Biceps femoris (long and short head)
- The origin is not centered directly at the inferior tip of the ischial tuberosity
- The Semitendinosus and long head of biceps femoris share a common origin; semimembranosus has a distinct origin, lateral and anterior to the other tendons.¹
- All three muscles are innervated by the Sciatic nerve.



1. Domb et al, Arthroscopy Techniques 2013.

Acute Hamstring Tears: Etiology and Mechanism

- 12% of hamstring injuries involve a tear or avulsion of the proximal hamstring origin, 9% of which are complete avulsions.¹
- Injury usually involves a traumatic event with forced hip flexion and the knee in extension.²



1. Barnett et al., Knee Surg Sports Traumatol Arthrosc 2014.
 2. Dierckman et al., Arthroscopy Techniques 2012.

Commonly Presenting Symptoms

- Weakness
- Pain at rest and with activity
- Difficulty sitting (in proximal injuries) and ambulating
- Occasional pins-and-needles sensation in the sciatic nerve distribution
- Bruising dependent on extent of injury



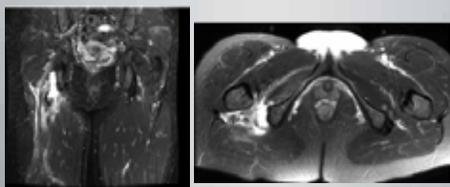
Clinical Examination

- Check for palpable gap
- Check for sensory and motor changes (include in history)
 - Especially in chronic injuries
- Check strength deficits



Hamstring Origin Imaging

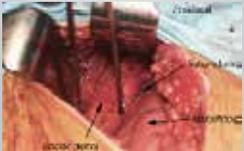
- MRI is used to assess extent of tearing, extent of tendinosis, and possible retraction



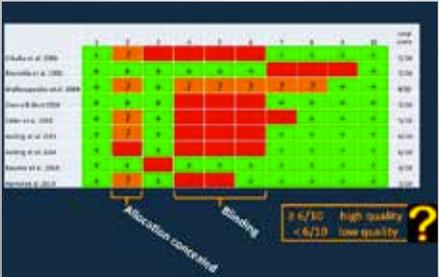
T2 weighted MRI in a patient with acute complete proximal hamstring rupture

Proximal Hamstring Syndrome

- Poor "basket" term
 - Tendinopathies are similar to other tendons with or without sciatic nerve symptoms
- Look for the extent of acute on chronic
- Association with sciatic neuritis poorly understood



Quality of Studies (PEDro Analysis) of Nonoperative Treatment



Six of these studies are "high quality"

Chronic Tendinopathy: Evidence for Nonoperative Treatment

- Agility and Core Strengthening
 - Compared to stretching
 - Moderate evidence for positive effect
 - Compared to running and stretching *Sherry and Best, 2004*
 - Limited evidence for no effect
- Stretching exercises *Slider et al, 2013*
 - Strong evidence for positive effect
- PRP *Asking et al (2013 and 2014)*
 - Conflicting evidence *Hamid et al 2014 and Reurink et al 2014*

Indications for Surgical Repair of Acute Tears and Tendinopathy

- Surgical repair is recommended for:
 - Athletically active¹
 - 2-tendon or osseous avulsions with > 2 cm retraction^{2,3}
 - 3-tendon tears regardless of the extent of retraction^{2,3}
 - Partial tears (tendinopathies) that remain symptomatic despite extensive conservative effort³
 - Persistent
 - Power loss despite rehabilitation
 - Pain
 - Sciatic nerve involvement³
- Contraindications for surgery:
 - Intramuscular injuries⁴
 - Chronic injuries with no pain or functional deficit⁴

¹ Rusk et al. AJSM 2014. ² Cohen, JAACS 2007. ³ Domb et al. Arthroscopy Techniques 2013. ⁴ Cornishall et al. J Bone Joint Surg Am. 2009.

Why operate?

- Nonsurgical treatment of complete ruptures associated with complications such as pain, muscle weakness and sciatic neuralgia.¹
- Surgical repair results project 58 to 95% rate of return to function and sports activity, near normal strength and decreased pain.^{1,2,3,4}



¹ Cohen, JAACS 2007. ² Rusk et al. AJSM 2014. ³ Mansour et al. American Journal of Orthopedics 2013. ⁴ Barnett et al. Knee Surg Sports Traumatol Arthrosc. 2014.

Procedure – Surgical Technique



- A transverse, longitudinal, or T-type incision
- Sciatic nerve and Posterior femoral cutaneous nerves are protected
- Gluteus maximus is retracted superiorly
- Tendons are examined, mobilized, and debrided to expose healthy tissue
- Repair to ischial tuberosity is achieved using suture anchors

¹ Cohen, JAACS 2007. ² Barnett et al. Knee Surg Sports Traumatol Arthrosc 2014. ³ Dardeman et al. Arthroscopy Techniques 2013.

Biomechanics of Suture Anchor Construct: 2 vs 5 study

	Anchor	Physical Anchoring Technique		
		2	3	5
Biomechanical test				
At 5000 cycles of 20,000 N	1.00 ± 0.27	7.30 ± 0.20	8.00 ± 0.80	1.00 ± 0.70
At maximum cyclic load	80.00 ± 0.14	80.00 ± 0.00	80.00 ± 0.00	80.00 ± 0.00
Workload, N-cm	700 ± 10	40 ± 10	40 ± 10	40 ± 10
At 5000 cycles of 20,000 N	1.00 ± 0.27	7.30 ± 0.20	8.00 ± 0.80	1.00 ± 0.70
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- The maximum load attained by the 5 anchor repair was significantly greater than the loads attained by either of the 2 anchor repairs
 - Regardless of anchor size
- Five anchors construct is similar to native tendon.

Hamming and Philippon AJSM 2014.

Three enough? Four enough?

Suture Constructs

- Cohen (Pittsburgh):** Configuration of an X using 5 anchors

Sutures are passed through the tendons using horizontal mattress sutures from the inferior to superior and tied down from superior to inferior
- Barnett (HSS):** 3 anchors (triangle)
- Carreira:** 4 anchor (diamond) with modified krackow and a pulley technique

Results: Acute vs. Chronic

Chronic ruptures: At final follow-up patients scored lower on the SANE test

"Feeling normal"

Acute: 80%

Chronic: 66%

Rust, AJSM, 2014

Acute repairs: Trend toward improved outcomes

Not statistically significant

Cohen, AJSM, 2012

Strength Recovery

- 52 patients
 - All: At or equal to 75%
 - No difference between acute or chronic
 - Trend noted

Cohen AJSM 2012

- 3/10 players with symmetric strength to opposite side

Mansour AJO 2013

- Series of 14 patients
 - 8/14: 100% recovery
 - All: 75% or greater strength

Bowman, AJSM, 2013

Return to Sport

- Average of 6.6 months
- All patients satisfied with level of return to function, although "not normal"

Cohen AJSM 2012

- 10/14 return to "strenuous activity"

Bowman AJSM 2013

- 70/96 (73%) complete ruptures returned to pre-injury level of activity

Versus

- 21/36 (58%) partial ruptures returned to pre-injury level activity

Barnett, Knee Surg Sports Traum, 2014

Barnett: Knee Surg Sports Traum, 2014:

- 86/96 (90%) complete ruptures with Good/Excellent results

Versus

- 26/36 (74%) partial ruptures with Good/excellent results

- 84/96 (88%) complete ruptures would have surgery again
- Improved outcomes (Good/excellent subjective report) with repair acutely versus chronic

Postoperative numbness

- Incisional
 - 20/52 (38%)
- Posterior thigh
 - 5/52 (10%)

Cohen AJSM 2012

Postoperative Management

	Cohen	Dierckman	Barnett
Brace	Leg placed in a custom fitted hip orthosis that restricts flexion to a range of only 15° to 30°. Discontinued at week 6.	Hinged knee brace fixed at 90° of flexion for 4 weeks (non-weight bearing).	A brace is used for 6 weeks while patients mobilize partially weight-bearing on crutches.
Rehabilitation	3 phase rehabilitation lasting 10-12 weeks I. Toe-touch weight bearing and passive ROM. II. Full weight bearing at week 6 and normal gait training. III. Dry land jogging and sports specific activities.	At 4 weeks the knee is gradually extended by about 30° per week to allow full weight bearing by 6 to 8 weeks, while the patient continues to use crutches. Hamstring strengthening is begun at 10-12 weeks.	From week 6 onwards, full weight-bearing is permitted, without support. Stretching and closed-chain strengthening exercises are begun at 3 months under physiotherapist supervision.
Return to Sport	Average return to sports occurs at 6.5 months.	Full, unrestricted activity is allowed at 4 months.	Gradual return to sports is undertaken by 6 months.

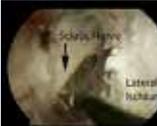
Complications

- Functional difficulty – activities that require repetitive eccentric lengthening of the hamstring (sprinting, cutting, kicking).¹
- Postoperative incisional numbness and rarely posterior thigh numbness.²

1. Bowman et al. AJSM 2012
2. Cohen et al. AJSM 2012

Current Trends

- Endoscopic repair for proximal hamstring tears^{1,2}
- Sciatic nerve neurolysis unnecessary in acute cases?³
- Achilles allograft: good preliminary results.³




Solid arrows reveal Achilles tendon/proximal hamstring construct

1. Dierckman et al., Arthroscopy Techniques 2012
2. Domb et al., Arthroscopy Techniques 2013.
3. Rust et al., AJSM 2014.

Achilles Allograft

- Proximal hamstring reconstruction with an Achilles allograft for chronic ruptures is successful when direct repair is not possible.
- Chronic ruptures present a challenge. Retraction of the tendon and scar formation can make repair difficult, in these cases the use of an Achilles allograft shows good preliminary results.
- Use of the allograft technique is indicated when mobilization of the tendon does not allow for primary repair. Greater than 5 to 6 cm retraction was predictive of the need for allograft reconstruction.
 - A 7 or 8 mm bone plug was inserted into a tunnel drilled into the center of the footprint (on the ischial tuberosity) and secured by a titanium screw. If the footprint was not visualized due to a large gluteus maximus, the allograft was directly attached (no tunnel) to the tuberosity with suture anchors.
 - The graft was then secured to the proximal hamstring tendons with a combination of non-absorbable and absorbable locking sutures while placing maximal tension distally on the allograft and proximally on the hamstring tendon with the knee at 40° of flexion and the hip at 20° of flexion.

1. Rust et al., AJSM 2014.

Proposed Advantages of Endoscopic Repair

- Safe approach to the area of damage in most tears
- Avoid having to elevate the gluteus maximus
- Superior visualization/magnification? to allow protection of the sciatic nerve
- Decreased risk of infection
- Evaluation of partial thickness tears
- Potentially decreased neurovascular complications
- Decreased bleeding




1. Dierckman et al., Arthroscopy Techniques 2012
2. Domb et al., Arthroscopy Techniques 2013.

My advice/opinion:

- The hamstring and its various pathologies should be treated like the Achilles
- Surgical treatment of tendinosis: Inadequate debridement and takedown of diseased tendon associated with failures
- Surgical acute: Create a wide footprint of tendon apposition for healing

Thank you!

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