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.

All three muscles are innervated by the Sciatic nerve.

12% of hamstring injuries involve a tear or avulsion of the proximal hamstring origin, 9% of which are complete avulsions.

Injury usually involves a traumatic event with forced hip flexion and the knee in extension.

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
  - Tendonopathies 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
  - Limited evidence for no effect
- Stretching exercises
  - Strong evidence for positive effect
  - PRP
  - Conflicting evidence

Sherry and Beet, 2004
Slider et al, 2013
Askling et al (2013 and 2014)
Hamid et al 2014 and Reurink et al 2014
Indications for Surgical Repair of Acute Tears and Tendinopathy

- Surgical repair is recommended for:
  - Athletically active
  - 2-tendon or osseous avulsions with > 2 cm retraction
  - 3-tendon tears regardless of the extent of retraction
  - Partial tears (tendinopathies) that remain symptomatic despite extensive conservative effort
  - Persistent pain
  - Sciatic nerve involvement

- Contraindications for surgery:
  - Intramuscular injuries
  - Chronic injuries with no pain or functional deficit

1. Rust et al., AJSM 2014.

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

2. Rust et al., AJSM 2014.

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


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

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, the five anchor 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

- 3/10 players with symmetric strength to opposite side

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

Mansour AJO 2013
Bowman, AJSM, 2013

Return to Sport

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

- 10/14 return to “strenuous activity”

- 70/96 (73%) complete ruptures returned to pre-injury level of activity
  - Versus
  - 21/36 (58%) partial ruptures returned to pre-injury level activity

Bowman AJSM 2013

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

<table>
<thead>
<tr>
<th></th>
<th>Cohen</th>
<th>Derrickman</th>
<th>Barnett</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brace</td>
<td>Leg placed in a custom fitted hip orthosis that permits flexion from a range of only 15° to 30° (discontinued at week 6)</td>
<td>Hinged knee brace fixed at 90° of flexion for 4 weeks (non-weight-bearing); brace is used for 6 weeks while patients mobilize partially weight-bearing or in chair.</td>
<td>Hinged knee brace fixed at 90° of flexion for 4 weeks (non-weight-bearing).</td>
</tr>
<tr>
<td>Rehabilitation</td>
<td>At 4 weeks the knee is gradually extended by about 25° per week to allow full weight-bearing by 6 to 8 weeks, while the patient continues to use crutches.</td>
<td>Hamstring strengthening is begun at 10-12 weeks.</td>
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</tr>
<tr>
<td>Return to Sport</td>
<td>Average return to sports occurs at 6 to 8 months.</td>
<td>No restrictions noted to return at 10 months.</td>
<td>Gradual return to sports is dependent on knee.</td>
</tr>
</tbody>
</table>

Complications

- Functional difficulty – activities that require repetitive eccentric lengthening of the hamstring (sprinting, cutting, kicking).

- Postoperative incisional numbness and rarely posterior thigh numbness.
Current Trends

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

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 for the origin of the hamstrings 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.

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
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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