THIGH INJURIES

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ANATOMY

compartments

- divided into a posterior or flexor compartment and an anterior or extensor compartment that are divided by a lateral intermuscular septum

cutaneous sensory innervation

cutaneous nerves of the thigh
- posterior femoral cutaneous nerve
- medial femoral cutaneous nerve
- intermediate femoral cutaneous nerve
- lateral femoral cutaneous nerve

fascia and subcutaneous tissue

- fascia lata, a fascial envelope that surrounds the entire thigh musculature

posterior structures

- the hamstring muscles form the bulk of the posterior thigh and include the biceps femoris, the semitendinosus, and the semimembranosus
- originate from the ischial tuberosity
- inserts into the head of the fibular, the medial & lateral condyle of the proximal tibia
- innervated by the tibial portion of the sciatic nerve

Fuctional anatomy

Reciprocal actions of the hamstrings

- hip extension
- knee flexion

this complex two-joint role for the hamstrings makes them susceptible to injury

Lateral structures

- strong thickening known as the iliotibial tract which is distal fascial continuation of the tensor fasciae latae muscle and the gluteus maximus muscle.
- attachments to the lateral intermuscular septum, the vastus lateralis anteriorly and Gerdy`s tuberosity of tibia

Medial structures

- separated from the quadriceps by the medial intermuscular septuminnervated by the obturator nerve

adductors

- Gracilis
- Adductor longus
- Adductor brevis
- Adductor magnus (with contribution from the sciatic nerve)

Anterior structure

- the anterior thigh musculature, bounded laterally by the lateral intermuscular septum and medially by the adductor muscles and the vascular bundle, consists of the quadriceps muscle and the sartorius muscle. the quadriceps muscle is the largest muscle in the body and has rectus femoris, vastus lateralis, vastus intermedius and vastus medialis, supplied by the femoral nerve

Fuctional anatomy

- the main action of the quadriceps muscle is knee extension, also functions as a hip flexor. this two-joint function makes it particularly vulnerable to injury from abnormal stretch occurring with maximal knee flexion and hip extension.

PHYSICAL EXAMINATION

observation

- inspected in the standing position and squat or knee on the ground
- alignment of the extremity with the foot flat on the ground

supine examination

- inspected again for areas of deformity and palpation
- ROM of the hip and knee joints
- Thomas test
- Hamstring tightness or contracture is evaluated by lifting the legs off the examining table by the heels
- Hamstring contracture is measuring the popliteal angle

Prone Examination

- palpates the entire proximal thigh musculature.
- brings the hamstring muscles into tension
- Limitation of flexion secondary to contracture of the anterior thigh musculature (Ely' s test)

" Decubitus" position
- Ober' s test for contracture of the iliotibial tract

RADIOGRAPHS & OTHER STUDIES

- routine radiographs in the A-P & Lateral planes from the hip and the knee
- Other studies include ESR, alkaline phosphatase, Ca and P levels
- Computed tomography (CT) can be used to differentiate from compartment syndrome, myositis ossificans from other lesions
- Technetium bone scan
- Generally, ossification becomes apparent only 2 to 5 weeks

INJURIES

Fractures
Major Fractures

- For athletes, stable internal fixation permits early motion at the hip and knee

Stress Fracture

- infrequent and predominantly occur either proximal or distal to the femoral shaft due to the anterolateral bowing of the femur.
- low grade aching in the thigh without evidence of IDK
- plain X-ray have evidence only in the reparative phase of the stress fractures.
- bone scanning has become the gold standard confirmation of clinically suspected stress fractures in the use of triple phase technetium diphosphonate scanning.
- MRI demonstrate abnormality within 24 hrs. of the onset of the symptoms.
- method of treatment

Treatment of Femoral Shaft Stress Fractures

	Activity Level			
Phase*	*Crutches*	*Upper Body Conditioning*	*Lower Body Conditioning*	*Running or Training*
Initial phase, 2–3 wk	+	+	–	–
Intermediate phase, 3–8 wk	–	+	+	–
Late phase,† 6–12 wk	–	+	±	+

Fig. 1.

- serial radiographs on a monthly basis for 3 months to follow the healing response
- two criteria for entry into the late phase
  1) A minimum of 6 weeks
  2) a pain-free, sustained bike ride for 30 to 45 minutes.
- criteria for return to sports participation

Running Entry Protocol

Week	Activity	Total Miles per Week
Week 1	Walking	3–5
Week 2	Walking/running	5
Week 3	Running	5

Fig. 2.

Soft-tissue Injuries
Hamstring strain

Mechanism of injury

- most common injuries occur in the posterior compartment and are strains of the hamstring muscles at the musculotendinous junctions.
- During running, this injury occurs not only in the highly trained muscular individual, but also seems to have a higher frequency in the older age group.

Hamstring Strain Classification

Grade I	Small disruption of structural integrity at musculotendinous junction
Grade II	Partial tear, some musculotendinous fibers remain intact
Grade IIIA	Complete rupture of musculotendinous unit
Grade IIIB	Avulsion fracture at tendon's origin or insertion site

Fig. 3.

- the incidence of hamstring strains also increases in athletes who have not had adequate warmup
- tearing can result with pain, inhibition of movement, spasm, and swelling
- Treatment

Hamstring Treatment Protocol

Phase I

Rest, ice, compression, elevation (RICE)

Phase II

Ice Stretch NSAIDs Electrical stimulation Isometrics ± Isotonics Condition

Phase III

Ice Stretch NSAIDs ± Electrical stimulation Isotonics ± Isokinetics* Condition

Phase IV

Ice Stretch Isokinetics* Running Sport-specific training

Phase V

Return to sports

Fig. 4.

- operative treatment indicated in greater than 2 to 3 cm displacement from ischial tuberosity

prevention of reinjury

- at the time of return to sports, appropriate knee bracing or taping which prevented hyperextention.
- stretching is always performed before and after athletic participation

criteria for return to sports following hamstring sprain

- Equal (preferably increased) flexibility
- hamstring strength parity
- Appropriate hamstring/quadriceps isokinetic ratio
- Equal isokinetic power and endurance
- no pain or tenderness
- Hip adductor and abductor strenth parity

Quadriceps contusion

Quadriceps contusion*

Degree of Injury	Pain	Swelling	Flexion (Degrees)	Average Recovery Time (Days)
First	Mild	+	>90	13
Second	Moderate	++	45-90	19
Third	Severe	+++	<45	21

Fig. 5.

- treatment

The goal of phase I with RICE is to limit hemorrhage, crutches are used.

phase II when the pain free thigh at rest, a cool whirlpool is used with isometric exercises.

phase III begins with greater than 120 degrees of active pain free motion, functional rehabilitation with strength and endurance.

Factors associated with development of myositis ossificans following quadriceps contusion

- Motion 〈 120 degrees
- Football injuries
- Previous quadriceps injury
- delayed treatment
- ipsilateral knee effusion

Criteria for return to sports following a quadriceps contusion

- normal quadriceps flexibility
- quadriceps strength parity between legs
- Normal quadriceps/hamstring isokinetic ratio
- Fabrication and fitting of protective padding
- normal hip adductor, abductor, and flexor strength and flexibility

Myositis ossificans

- recurrent injuries or massive contusions can cause the formaton of heterotopic bone.
- initial radiographs of a contusion with follow-up comparison studies shoe the development of this heterotopic bone
- A CT scan demonstrates mature bone at the periphery of the lesion
- parosteal osteogenic sarcoma can be differentiated from myositis ossificans
- alkaline phosphatases levels are elevated with the sarcoma
- surgery on myositis ossicans needs to be delayed until the ossifying mass has reached maturity for at least 6 to 12 months

compartment syndrome

- devastating sequela of a quadriceps contusion is generally associated with femoral fracture, application of antishock trousers or compression after narcotic overdose, muscle over use and contusion.
- compartment pressure measurement of all compartments, up to 50 to 60 mmHg, should have prompt decompressive fasciotomy

Quadriceps strain

Quadriceps Strain Treatment Protocol

Phase I

Rest, ice, compression, elevation (RICE)

Phase II

Ice NSAIDs Electrical stimulation Isometrics Isokinetic ±Condition Active stretch

Phase III

Ice NSAIDs Electrical stimulation Isotonics Isokinetics Active stretch Condition

Phase IV

Ice Isokinetics Running Sport-specific training Passive stretching

Phase V

Return to sports

Fig. 6.

- forceful contraction of quadriceps muscle with the knee flexed and hip extended is common mechanism of injury, for example, when kicking a ball.
- pain, "something has torn", a defect may be palpable in the rectus.
- treatment

Addutors strains

- sudden forced contractions of the adductor muscles groups when thigh is externally rotated and the hip is abducted in ice hockey, soccer, track and field, gymnastics, karate, and horseback riding.
- RICE, NSAIDs, for a period of 2 to 3 days in the mild strain or for as long as for 2 to 3 weeks in musculotendinous rupture.

Vascular problems (adductor canal syndrome)

- an abnormal musculoskeletal band arising from the adductor magnus and lying adjacent and superior to the adductor tendon may lead to compression of the femoral artery at the adductor hiatus
- exercise-induced claudication is present.
- workup are non-invasive vascular testing as doppler and arteriography
- surgery should consist of excision of band, artery, and autogenous saphenous vein graft.

SUMMARY

- physician, trainer, and the patient confuse the definition of treatment and rehabilitation with that of training or conditioning. It needs that rehabilitation is an effort of modalities to diminish pain, allow for healing of the damaged tissue, reestablish the musculotendinous length, and redevelop basic strength.
- understanding anatomy, pathophysiology, biomechanics, and sports are crucial to have better treatment and rehabilitation.