
DeBUSK COLLEGE OF OSTEOPATHIC MEDICINE

Quadriceps Contusion

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Disclosures

- I have nothing to disclose regarding this topic

Objectives-At the conclusion of the presentation, the participant should be able to:

- 1. Define quadriceps contusion (QC) and its symptoms.
- 2. Discuss the physical exam and functional limitations of QC.
- 3. Describe diagnostic evaluation , differential diagnosis and key anatomic factors in the mechanism of injury for QC.
- 4. Outline the evidence-based, prioritized conservative initial care, rehabilitation, and procedural/operative care of QC.
- 5. Discuss health equity issues related to QC.
- 6. List considerations for laboratory and imaging modalities in the evaluation of QC.

7. Describe common possible complications of and related to treatment of QC.

What is Quadriceps Contusion?

- Most common quadriceps injury- others include quadriceps strain, partial tear of distal muscle head, & fascial rupture leading to muscle herniation
- Acute trauma damages muscle tissue, causing edema, hemorrhage, and inflammation.
- At 12-24 hrs. after injury, contusions are graded mild (>90 degrees KF and normal gait), moderate (45-90 degrees KF w/ antalgic gait), and severe (<45 degrees KF w/severely antalgic gait.

Usually from a direct blow (blunt trauma) to the anterior thigh; a contracted muscle absorbs more force, resulting in less severe injury.

Rectus femoris is the most commonly injured portion of the quadriceps due to its anterior location

- Muscle contusions and strains make up 90% of sport-related injuries.

Beiner, et.al. Am J Sports Med. 27. 2-9

Canale, et.al. Am J Sports Med.9.384-389

Wieting and Perry,Essentials of PM&R, 2026

Epidemiology

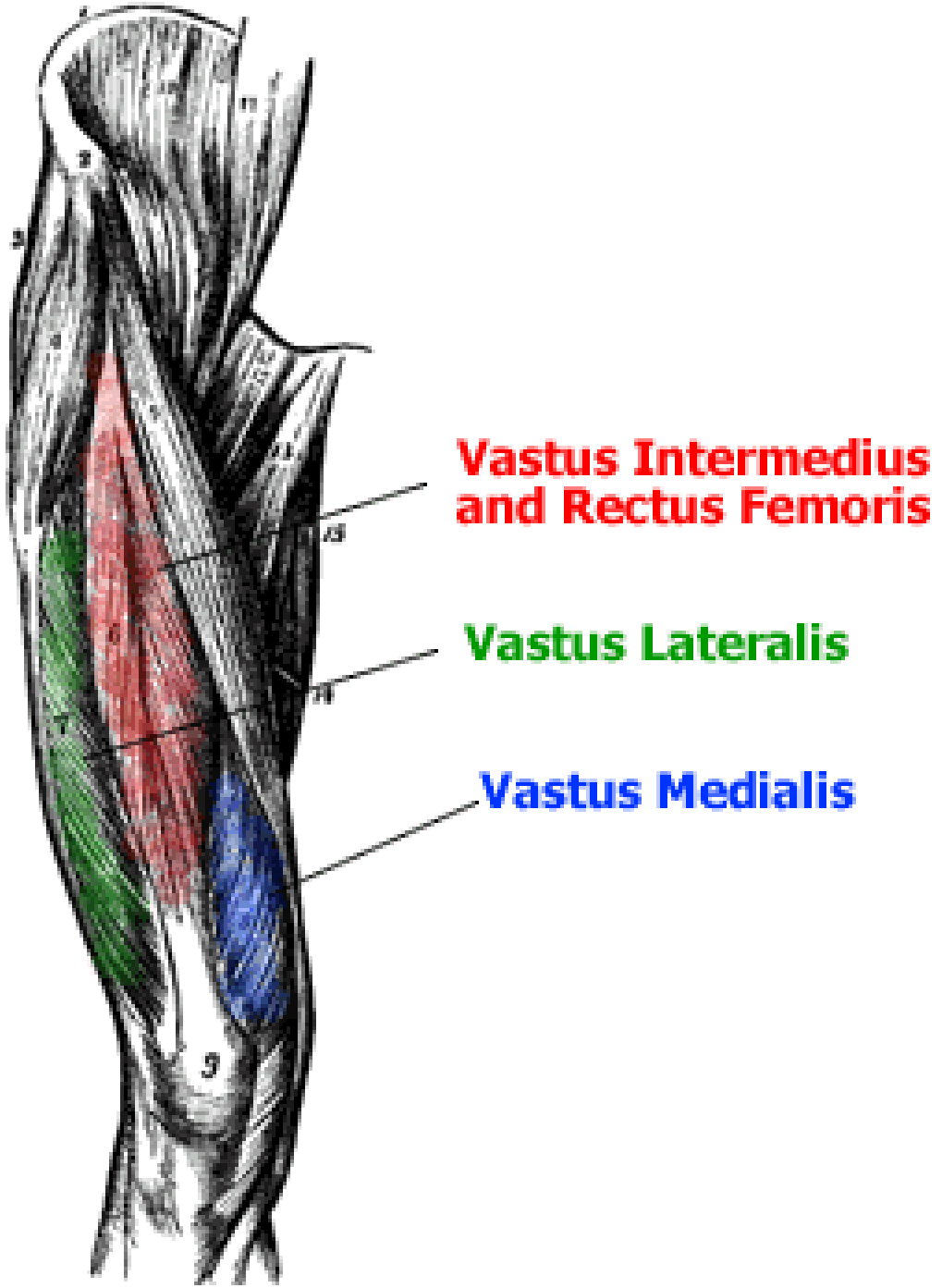
- Common, but not much data about frequency in individual sports. MC in contact sports (football, soccer, basketball, rugby, and wrestling), usually in competition rather than practice.
- 2:1 M:F ratio
- Data from USMA, where distribution per year has been reported as: rugby-4.7%, martial arts (judo and karate)-2.3%, and football-1.6%.
- Quadriceps hernia is more common in soccer, basketball, and rugby.
- Other quadriceps injuries (tendinitis, tendon rupture) are more common and associated with high jump, weight lifting, and basketball.

Wieting and Perry, 2026

Anatomy

- Quadriceps femoris is a hip flexor and, mostly, a knee extensor.
- Composed of rectus femoris, vastus lateralis, vastus medialis, and vastus intermedius.
- Origins are ilium (rectus femoris) and femur (vastus muscles) and insertions are on tibial tuberosity
- Quadriceps is in contact with the femur throughout its length
- Susceptible to compression
- More resistant to injury if struck while contracted and non-fatigued

Kary. Curr Rev Musculoskel. Med.3.26-31, 2010


Vastus Intermedius
and Rectus Femoris
Vastus Lateralis
Vastus Medialis

Mechanism of Injury

- Trauma causes muscle fibers and connective tissue rupture, cellular muscle edema, capillary disruption, and local hemorrhage with hematoma formation
- Loss of knee ROM results from muscle and articular edema & physiologic inhibition of quadriceps group and “splinting” from pain.
- After injury, quad group often gets stiff with resultant difficulty with WBing w/ antalgic gait.

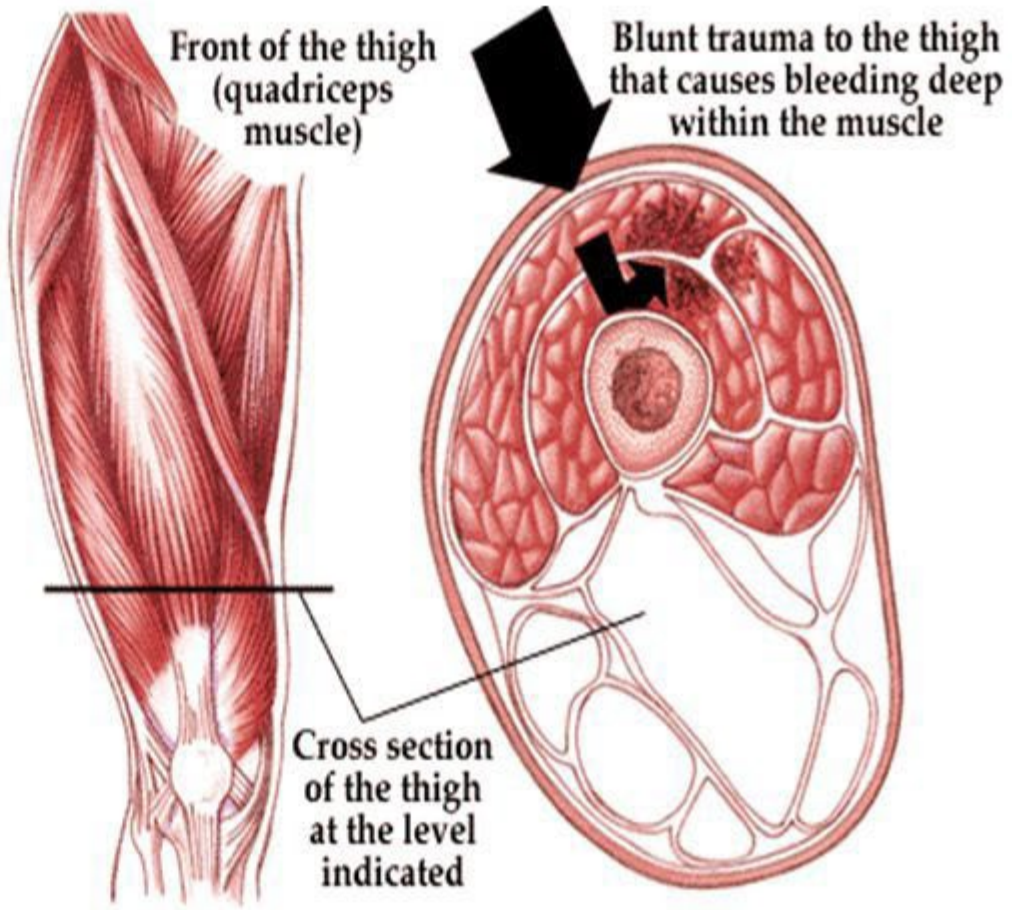
  Hemorrhage and resulting hematoma are intermuscular or intramuscular.

- Inflammatory cells and macrophages enter injury site and clean necrotic muscle cells over 2-3 days.

- Muscle cells try to regenerate while scar tissue is forming.

Quadriceps Contusion

- S/S:
  - Pain
  - Pt. tender
  - Bleeding into the muscle
  - Swelling
  - Temporary loss of function



History

- Usually, a blow to the anterior thigh with an object (ball, stick, puck,), person (kick, knee, elbow, etc.), or gear (helmet, shoulder pad)

- Immediate pain (esp. anterior thigh) worse with dynamic movement and KF; swelling; symptoms worse with active muscle contraction and passive stretch.
- Decreased ROM

- Impaired ability to bear weight and walk

Physical Examination

- Pain w/ palpation-if unusually high, consider compartment syndrome)
- Tense swelling and tenderness of anterior thigh; discoloration from hematoma and intramuscular bleeding. variable.
- Limited knee flexion (mild=>90 degrees, moderate=45-90 degrees, severe=< 45 degrees); knee extension less painful.

Wieting and Perry. Essentials of PM&R. 2026

- Increased thigh circumference; firm palpable mass in anterior thigh d/t hematoma
- Medial and posterior thigh usually without apparent injury
- Knee effusion may be present; patellar MSR may be inhibited.
- SLR intact unless extensor mechanism compromised
- Sensation usually intact-unless compartment syndrome impacting femoral and lateral/medial/intermediate cutaneous nerves; CHECK NEUROVASCULAR STATUS.
- Check hip if there is knee pain-knee pain can be referred from hip via obturator nerve. Examine both hips.

Physical Examination

- Extension lag or lack of extension is noted in partial or complete quadriceps rupture (fairly rare; more common in patients > 50 yrs. of age and often associated with underlying metabolic and/or inflammatory disease)

- Bone incongruity and tenderness may indicate fracture of femur, patella, or tibial plateau.

- Sensation is usually intact, as noted, unless compartment syndrome impacting distal femoral pulses, capillary refill, and saphenous, lateral/medial/intermediate cutaneous nerves- CHECK NEUROVASCULAR STATUS SERIALLY.
- Paresthesia, loss of distal pulses, distal pallor, intense pain and decreased temperature should alert to possible compartment syndrome.

- Intermuscular hematoma with septal/fascial sheath hemorrhage more likely to disperse and cause distal ecchymosis; contusion in the distal 1/3 of the quadriceps will show discoloration and edema into the knee from gravity.
- Intramuscular hematoma resolves more slowly and is more often associated with myositis ossificans.
- Check thigh circumference serially, esp. in first 72 hours.

Quadriceps Contusion

- Result of a severe blow to the quad
- Muscle tissues hit the femur due to great force
- RICE and NSAIDS
- Must ice in flexed position!!!

Differential Diagnosis

- Contusion-blunt compressive force to muscle; painful PROM and AROM, residual function remains*
- Quadriceps tear or strain, tendon rupture, soft tissue trauma

Jumper's Knee-patellar tendinopathy/tendinitis-aching anterior knee pain, point tender at patellar poles, tibial tuberosity

- Femoral Neck Stress Fracture-gradually worsening pain in hip, groin,thigh,back;pain worse at extremes of ROM, esp. internal rotation, log rolling, single leg standing. Danger: AVN if missed.
- Fracture of patella or tibial plateau

Slipped Capital Femoral Epiphysis-L>R, hip/knee pain, decreased ROM, limp, decreased WBing, all without trauma; hip held in passive external rotation, antalgic out-toed gait, obesity, decreased and painful hip internal rotation

Differential Diagnosis/Functional Issues

- Metabolic issues leading to tendon injury, such as hypocalcemia and steroid use
- Morel-Lavalee Lesion: closed internal degloving injury where skin and subcutaneous fat are torn away from underlying fascia, creating space that fills with blood, lymph, and fat, usually over the greater trochanter.

- Functional: initial antalgic gait and WBing limitations.
- First 24 hours: pain limits activity, crutches likely needed, RICE followed by hamstring and other quads, Achilles, and ITB stretches.
- After that, stair climbing, running and kicking activity limited by knee stiffness and decreased ROM, and pain with terminal knee flexion and extension.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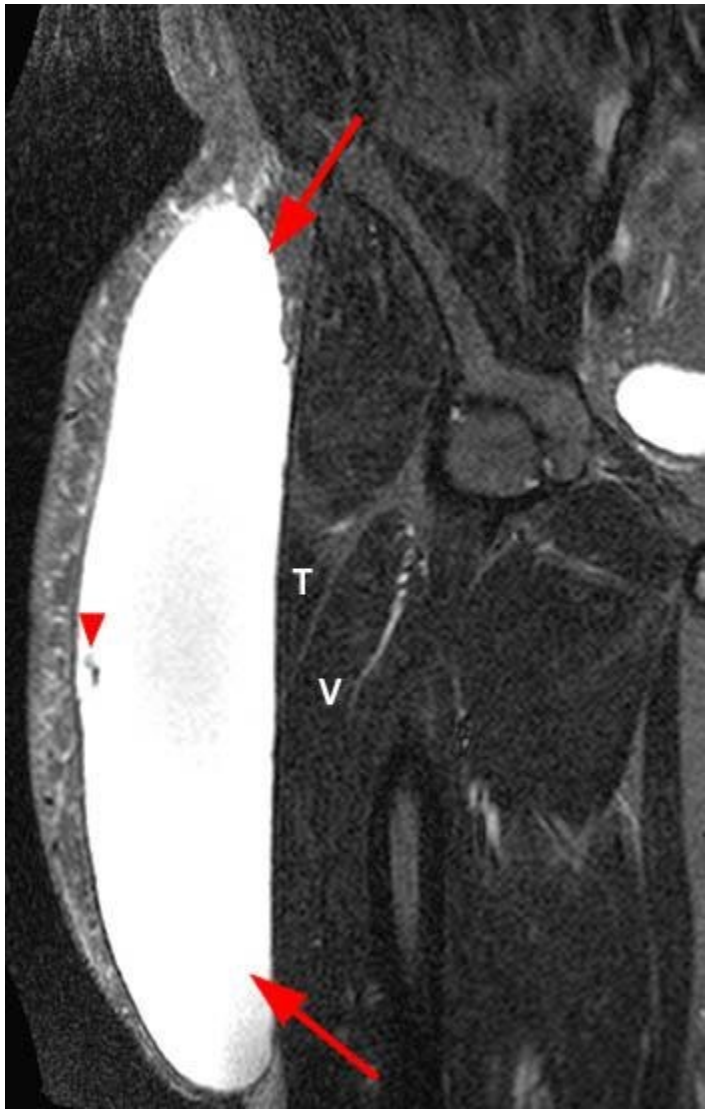
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Labs

- Usually not needed unless patient has renal or hyperparathyroid disease, a suspected soft tissue tumor, diabetes, on anticoagulation, or has a known bleeding disorder.

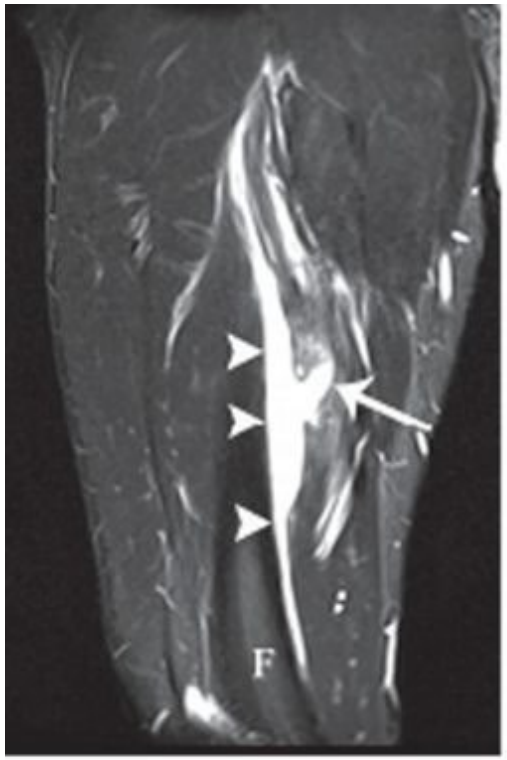
- If the patient looks sick and symptoms are severe: consider obtaining creatine kinase, hemoglobin and hematocrit, and/or coagulation studies (if patient has spontaneous edema or is on anticoagulants).
- Compartment pressures- more likely with associated fracture, crushing/large vessel injury, multiple trauma, bleeding disorder, or patient on anticoagulants.

Imaging

Plain films to rule out coexisting fracture if suspected.

- Consider imaging in the case of night pain, metabolic disease, tumor, suspected quadriceps rupture, patellar or femur fracture, in the case of failure to respond to conservative treatment.
- Myositis ossificans may show up several weeks to months after the injury
- MRI has the highest sensitivity and specificity for quadriceps issues; resolution lags behind functional recovery.
- Ultrasound may be helpful if tendon injury, soft tissue pathology, muscle strain, and Morel-Lavalee lesion(also on US) is suspected.
- Bone scan-more sensitive for heterotopic bone and monitoring its resolution.
- Advantages of US: portability, less cost, allows dynamic assessment; usually start over mid-anterior thigh and transverse (short axis) view, starting with rectus femoris, vastus medialis, intermedius, and lateralis; then evaluate quads in longitudinal (long axis view) for muscle contusion (hyperechoic) and swelling, calcification (myositis ossificans iusually shows up 4-8 weeks after injury).

Wieting and Perry. Essentials of PM&R . 2026



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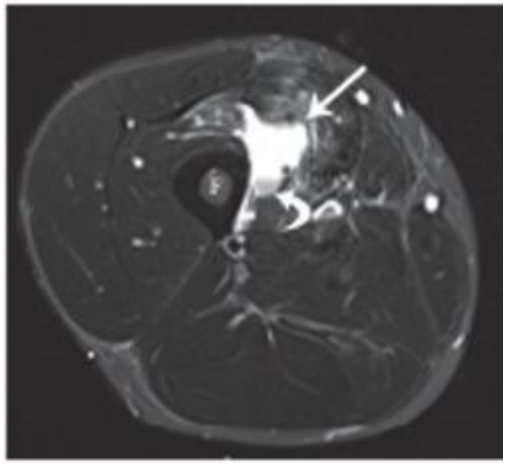

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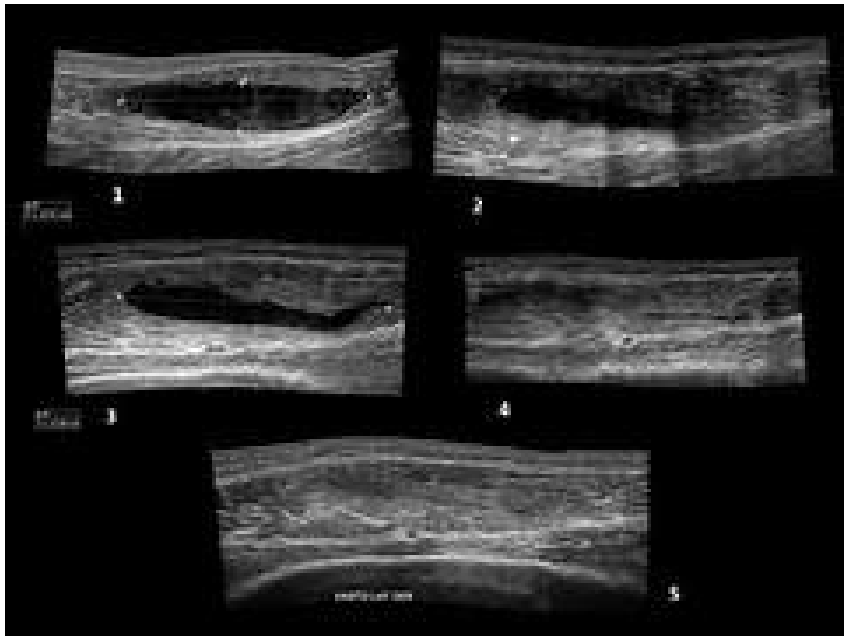


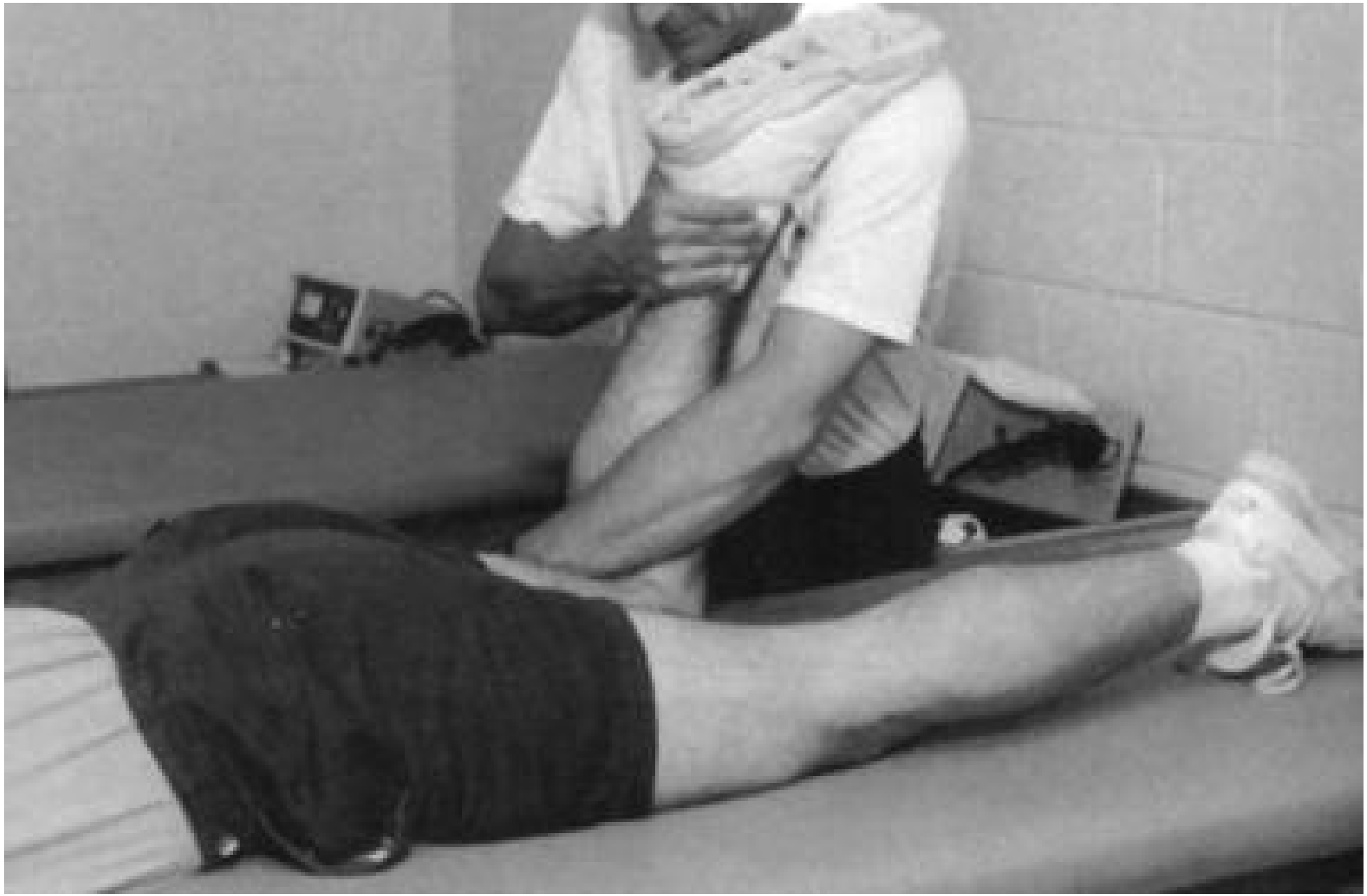
Treatment

- Immediate rest, Immobilization, Ice and Compression. No heat –direct, whirlpool, therapeutic ultrasound.. No massage for 1-2 weeks
- Surgery if compartment syndrome, to remove large hematoma, if complete quadriceps rupture, or bony avulsion of muscle insertion
- Put knee immediately in elevation, 120 degrees flexion, immobilize with elastic bandage or adjustable brace for 24 hours to tamponade hemorrhage, keep muscle lengthened, and limit muscle spasm
- Crutches, non-weight bearing initially, then PWB, gradual return to WBAT, then FWB when vastus medialis bilaterally equal in tone and size.
- Discontinue 120 KF at 24 hrs., begin active pain free static quad strengthening and stretching, then e-stim and/or passive stretch followed with icing for 2-3 days in mild injury, thigh pad in between icing; pulsed US;
- Begin active pain free quad stretch and strengthening 3-4x/day

Aronen, et. al. Clin J Sport Med.,16,383-387, 2014; Wieting and Perry, 2026

Treatment-continued

- If treatment delayed until after IM bleeding and spasm and limited knee flexion:
- Keep/treat patient prone, flex knee to pain free limit, resist patient's isometric contraction attempting to extend knee, then relax when patient feels fatigue; as muscle fatigues, do passive quad stretch by taking knee into flexion while patient prone (Muscle Energy-like)
- Effleurage to thigh, follow with petrissage after knee ROM 120, wait 1-2 weeks.
- Repeat combination of KF, relaxation, KF 3 times, then immobilize in maximum pain free KF; use crutches.
- Repeat 2x/day and gradually increase reps
- Stop bracing/immobilization when get to 120 KF
- Sport specific exercises, progressive, start at 50% intensity, increase gradually



More Treatment

- Stop crutches when vastus medialis are equal in size and tone bilaterally.
- Surgery later if myositis ossificans is functionally limiting and only after mature.
- Protective pad over injured area for rest of season and during play for 3-6 months.
- NSAIDs- controversy here: not in first 24-48 hrs.; interference with inflammatory response; if so, only in days 3-7. NSAIDS reduces inflammation causing pain & swelling but inflammatory cells needed to attract cells to start soft tissue healing and clear necrotic muscle, followed by regeneration and scar formation. Exception: myositis ossificans
- No steroids due to potential for delayed healing & reduced biomechanical tensile strength of muscle.
- RTP 2 days-10 wks depending on injury severity, when KF=120 and HF full, no quad muscle atrophy or weakness

Rehabilitation

- 3 phases, all should include stretching, ROM, and quad/hamstring strengthening
- Goals of 1st phase: limit bleeding, immobilize knee in flexion, elevate leg for 24 hrs., relative rest, avoid alcohol or excessive activity
- Phase 2 Goals: restore motion, use therapeutic modalities; gradual progressive return to WBing; D/C KF at 24 hrs., begin passive stretch/strengthening and e-stim. followed by icing, and pain-free active quad stretch/strengthening, PWB till 90 degrees active and passive KF, good quad control and minimal/no limp. No forced stretching. Use PNF with reciprocal inhibition of quads/hamstrings.
- Phase 3 Goals: starts at 120 degrees pain free KF and excellent quad control; can resume NON-contact sport with active knee ROM, PRE, and cycling. Goal is pain-free ROM within 10 degrees of unaffected limb; incorporate sprinting, cutting, and jumping only now.
- Procedures: occasional needle aspiration of hematoma to relieve pain and pressure.
- Surgery: rare except with compartment syndrome and/or associated fracture; for heterotopic bone, only after 1 year and when bone scan indicates bone formation is mature.

Possible Complications

- Myositis ossificans (9%)-incidence increased with initial ROM< 120 degrees, repeated quad injury, knee effusion, or treatment delay (3+ days)

  - differentiate from soft tissue neoplasm

  -usually stabilizes by 6 months.

  - diagnose with 50% calcification

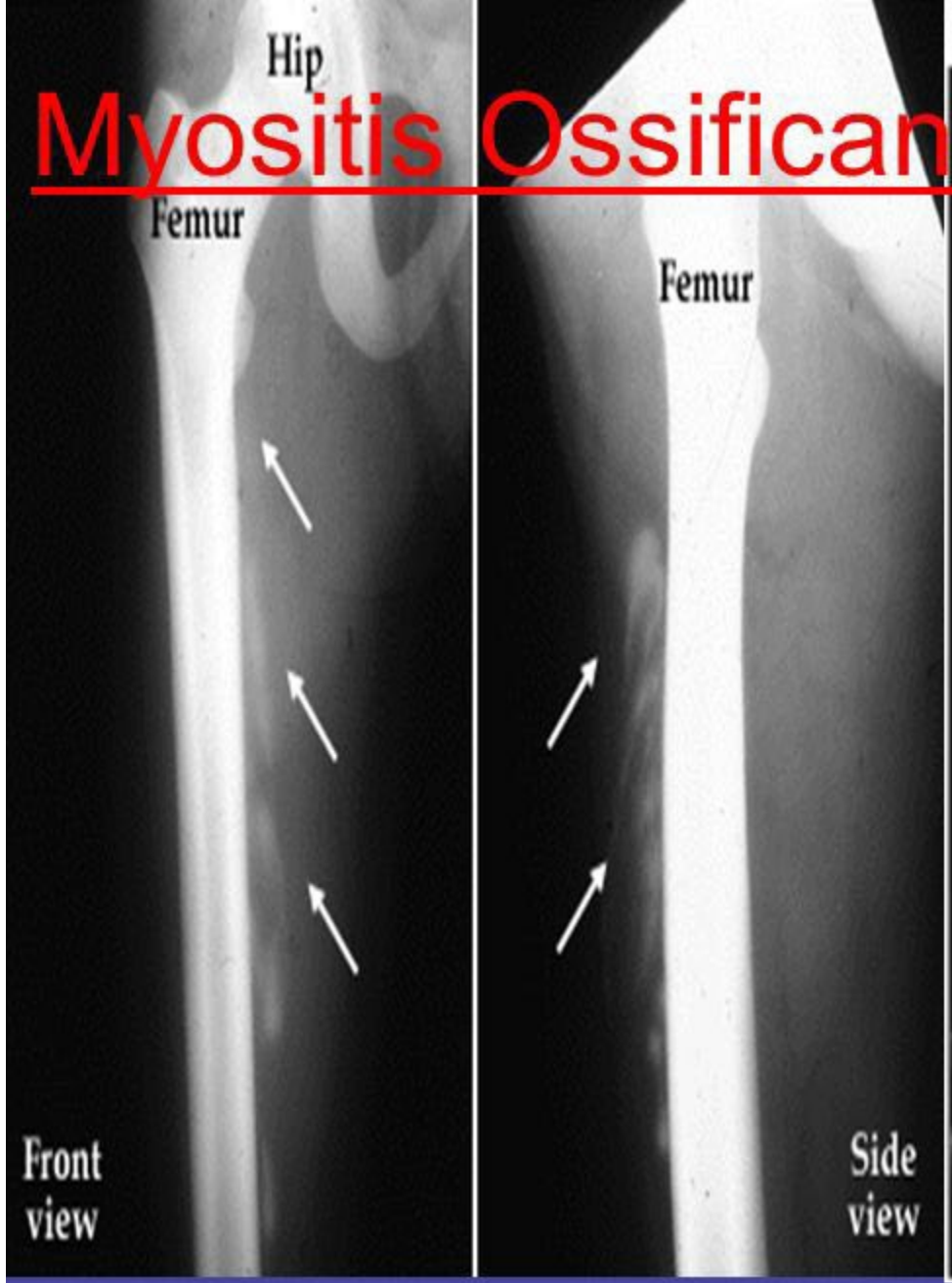
  -more common if initial knee flexion <120, repeated injury, knee effusion, football injury, treatment delayed over 3 days, if RTP too soon, or if heat applied; more common at mid-shaft of femur; serial bone scans to monitor bone resolution, esp. in symptomatic patient.

Hematoma formation; bleeding/hematoma if too vigorous/early massage.

Compartment syndrome-rare; warm quad region w/suddenly increased edema, progressive/disproportionate pain @ rest, paresthesia w/ abnormal neurovascular exam, quad weakness.

SEs: of NSAIDS: gastric, renal, hepatic; of steroids: tendon weakening/rupture, SQ atrophy, skin thinning/discoloration/hypopigmentation, localized infection, blood sugar spikes, insomnia.

Myositis Ossificans X-Ray



Figures 1: Courtesy of Christopher M. Larson, MD

FIGURE 1. A plain radiograph of a 21-year-old woman who sustained a thigh injury during a soccer game reveals myositis ossificans (arrow) that resulted from a quadriceps contusion.

Prognosis/HealthEquity Issues

- Usually full recovery if patient compliant with treatment regimen.
- May be compromised if complications exist

- Higher incidence in females in sex-comparable sports d/t larger Q-angle causing increased lateral stress on the knee and higher quad injury rate, muscle strength differences.
- Black/African American individuals may have slower recovery in quad strength esp. if no access to specialized rehab care.
- Indirect association with ineffective communication between patient and clinician, too short visit time, transportation access issues (all more common in economically disadvantaged populations).Less access to athletic trainers, qualified clinicians (often underfunded school programs
- Athletes often at convergence of racial and socioeconomic health inequity.

Summary

- 1. QC is common, usually resulting from direct blow to rectus femoris during contact sports.
- 2. QC results in muscle fiber, connective tissue and capillary disruption, edema, and local hemorrhage.
- 3. QC presents with pain, swelling, decreased mobility and exam reveals painful swelling, normally intact sensation and circulation and decreased knee ROM
- 4. Labs usually not needed except in certain comorbidities; imaging usually needed in case of complications.
- 5. Treatment usually nonsurgical and involves rest, immobilization, ice, and compression, NWB, working to active pain free ROM, stretching then strengthening, and advancing to activity specific exercise

Summary- continued

- 6. Prognosis for QC is usually favorable for full recovery, though time to do so varies with circumstances.
- 7. Complications can occur, but are rarely serious; compartment syndrome is the most serious complication.
- 8. Health equity issues are associated with quadriceps contusion

- THANK YOU VERY MUCH!!