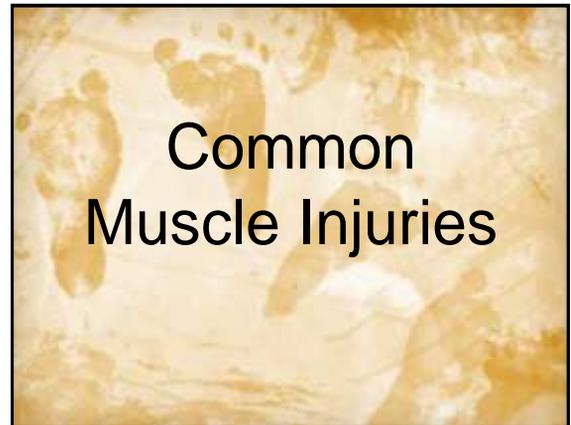


The Foot and Ankle

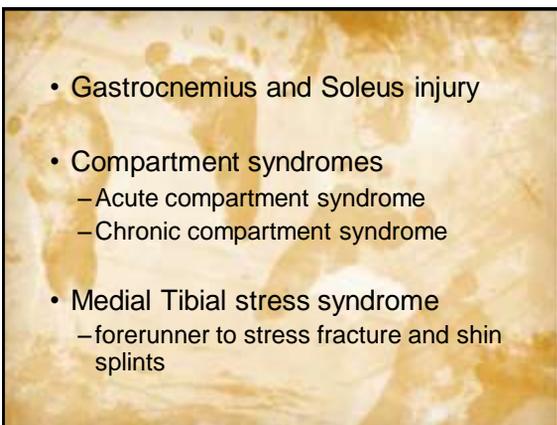
Identification, Assessment and Treatment of Common Injuries

Soft Tissue Injuries

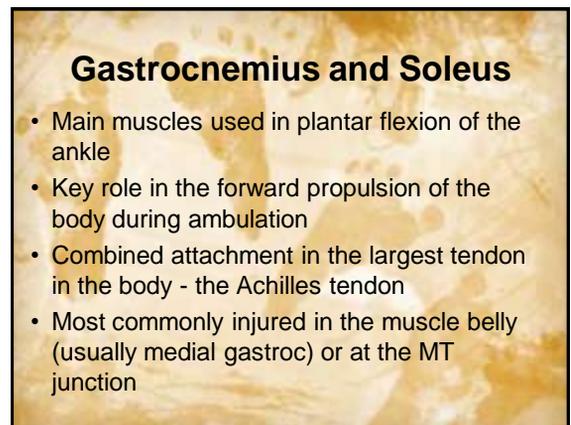
- Those involving the major muscles in the area
- Those involving the major ligamentous restraints in the area
- Those involving neural structures
- Those involving other soft tissue structures



Common Muscle Injuries



- Gastrocnemius and Soleus injury
- Compartment syndromes
 - Acute compartment syndrome
 - Chronic compartment syndrome
- Medial Tibial stress syndrome
 - forerunner to stress fracture and shin splints

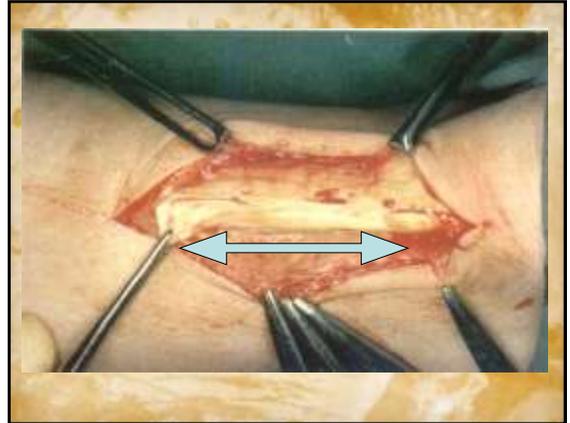


Gastrocnemius and Soleus

- Main muscles used in plantar flexion of the ankle
- Key role in the forward propulsion of the body during ambulation
- Combined attachment in the largest tendon in the body - the Achilles tendon
- Most commonly injured in the muscle belly (usually medial gastroc) or at the MT junction

Achilles Tendon Injury

- The largest tendon in the body with a constant relative avascular portion 2-6cm above the insertion into calcaneus.
- Tendon rotates laterally as it descends beginning 12-15cm above the insertion.
- Degree of rotation depends on the amount of fusion between the gastrocnemius and soleus muscles - min. rot. is associated with greater fusion.

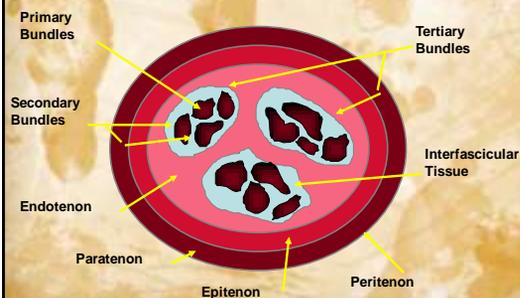


- Rotation produces a sawing across the fibres causing friction & damage -> degenerative changes -> rupture.
- The MT junction between the med. head of gastroc. and the tendon may also be injured.
- Three common injuries:
 - At the tendon-bone junction
 - At the musculotendinous junction
 - “True” tendinitis (2-6cm above insertion)

Classification of Injuries

- The achilles has no true synovial sheath and so tenosynovitis is a misdiagnosis.
- ‘Peritendinitis’ is used to describe inflammation of the peritendon.
- Inflammation, swelling and disruption of the tendon are known as ‘tendinosis’.
- ‘Partial rupture’ should be reserved for cases of definite fibre disruption.

Cross-section of the Achilles



Achilles Tendinitis

- Caused by altered biomechanics of the forefoot and rearfoot leading to increased stress placed on the tendon.
- Calf muscle fatigue following exercise may preclude tendinitis - repetitive eccentric load-induced microtrauma.
- Poor footwear design and/or fitting - high, inflexible achilles tabs on sports shoes or flat shoes -> stretching of the tendon.

History of Complaint

- Progressively worsening symptoms usually following a traumatic event.
- Partial tears likely to have a sudden onset.
- Patients often complain of being struck in the back of the leg or feeling like they have been shot in the back of the leg.
- Past history and progression of symptoms should be noted.

Signs and Symptoms

- Pain is dominant symptom accompanied by inflammation.
- Morning stiffness is common.
- PT may feel crepitus, nodules, localised pain or thickening.
- Swelling - hard lump which moves with the tendon may mean damage to the tendon - fluctuant swelling may mean damage to the paratenon.

Diagnosis

- Should be sent for medical examination to rule out partial/complete tears.
- Test used is Homan's sign
- Ultrasound scanning may indicate whether surgery is indicated or not.
- Site of pain may indicate other structures - # calcaneus, retrocalcaneal bursitis, plantar fasciitis, subcutaneous bursitis.

Management

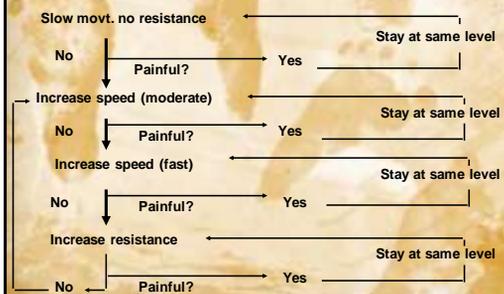
Conservative

- Rest from aggravating activities - crutches.
- Taping to prevent excessive movement.
- Gentle stretching and strengthening programs.
- Ice and NSAIDs to control inflammation.
- Transverse frictions, PUS, TENS.
- Steroid injections may have lost favor but peritendinous injections have proven effective.

Exercise Programs

- General warm-up - no jumping or running
- Gastrocnemius and soleus stretches.
- 3x10 reps. eccentric exercise followed by stretching and ice - done 1 x daily.
- Failure in the program comes from judging the pain incorrectly and moving too quickly to the next level. (only mild discomfort in last 10 reps)
- May be no change for 2-3 weeks but should persevere.

Progression of Exercise



Surgical Management of Achilles Tendinitis



- Achilles ruptures may also be repaired by surgical intervention
- A Z-plasty is performed
- The torn tendon is repaired by sewing the tissue together using a Z shaped suture line

Surgical Management of Achilles Tendinitis



- Prior to closing the incision the integrity of the repaired tendon is checked
- Care must be taken not to damage this delicate repair through over-activity in the early stages

Shin Splints

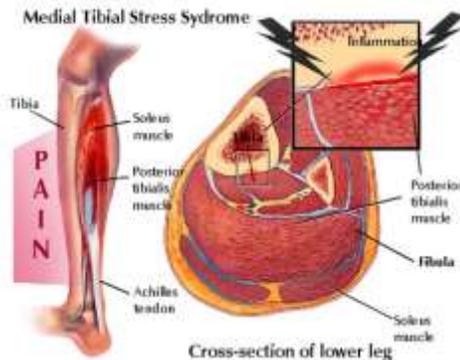
- Medial
- Anterior



Medial Tibial Stress Syndrome

- Tenderness is usually found between 3 and 12 centimeters above the tip of the medial malleolus at the postero-medial aspect of the tibia.
- Inflammation of the periosteum (periostitis)
- Most frequently involved is the Tibialis Posterior tendon and muscle, but the Flexor Digitorum Longus and Flexor Hallucis Longus may also be involved.
- Stress fractures can also occur in this area.

Medial Tibial Stress Syndrome



Compartment Syndromes

- Inflammation of the origin of muscles in the anterior compartment of the lower leg.
- Increase in swelling puts pressure on structures already contained by a tight fascia.
- This increased pressure can decrease blood flow as vessels are occluded.
- Results in pain and decreased muscle or nerve function.

Different Compartments

- **Anterior** - muscles affected are tibialis anterior, extensor hallucis longus and extensor digitorum.
- **Lateral** - muscles affected are the peroneals (longus and brevis).

Different Compartments

- **Superficial Posterior** - muscles affected are gastrocnemius and soleus.
- **Deep Posterior** - muscles affected are tibialis posterior, flexor hallucis longus and flexor digitorum.

Anterior Compartment Syndrome

- Soft tissue injuries at the muscular origin and bony or periosteal interface of the bone and muscle origin.
- Due to micro tears of the Tibialis Anterior either at the origin or in the fibers themselves.
- Or microtrauma to the bone structure itself.
- Stress fractures can also occur in this area.

Exertional Compartment Syndrome

- Caused by the muscles swelling within a closed compartment with a resultant increase in pressure in the compartment.
- The blood supply can be compromised and muscle injury and pain may occur.
- Abnormal compartment pressure:
 - A resting pressure greater than 20 mm Hg; or
 - An exertion pressure greater than 30 mm Hg; or
 - A pressure of 25 mm Hg or higher 5 minutes after stopping exercise.
- This may require surgical decompression of the compartment.

Key Causes

- Tight posterior muscles
- Imbalance between the posterior and anterior muscles
- Running on concrete or other hard surfaces
- Improper Shoes - inadequate shock protection
- Overtraining



Management of Compartment Syndromes

- Very commonly surgical intervention is indicated.
- The tight fascia layer is split to relieve the pressure build up.
- Care must be taken post-surgery to limit the development of scar tissue which may tighten and negate the beneficial effects of surgery.

Management

- Rest. The sooner you rest the sooner it will heal.
- Apply ice 10-15 minutes for 2-3x per day in the early stages when it is very painful.
- Anti inflammatory drugs
- Wear shock absorbing insoles in shoes.
- Maintain fitness with other non weight bearing exercises.
- Apply heat and use a heat retainer after the initial acute stage, particularly before training.

Stress Fractures

- Bone remodeling
- Repetitive stress weakens the bone
- 10-20% of injuries to athletes
- Most common locations: tibia, fibula and metatarsals.
- Tibial and fibular stress fractures can develop from "shin splints"

Bone Scans May Show Hot Spots



- Dark shadow on the left tibia shows active tissue indicating that fracture repair is in progress
- Where there is repair, there has been a fracture

Ankle Ligament Injuries

Ankle Sprains

- Most common athletic injury. 25% of all injuries.
- The risk of ankle sprains varies with the sport – 21-53% basketball, 17-29% soccer, 25% volleyball.
- Ankle sprains account for 10% to 15% of all lost playing time
- The medial malleolus is shorter than the lateral malleolus so there is naturally more inversion than eversion.



FIGURE 1-1 Anterior view of the ankle. Note the distal tibia (lateral malleolus) is shorter than the distal fibula (medial malleolus). This lateral malleolus is shorter than the medial malleolus, so there is naturally more inversion than eversion, so most ankle sprains are caused by inversion.

Figure 1-2 Posterior view shows the bones and ligaments of the ankle.

Ligaments of the Ankle

Lateral Complex

- **ATF** - thickening of the capsule anteriorly. 5mm x 12mm, perpendicular to tibia.
- **CF** - 6mm wide lies at a 10-45° angle to fibula.
- **PTF** - 6mm x 9mm, resists ext. rot. in plantarflexed position.
- **LTC** - occasionally considered as part of the set.



Lateral Ligament Injuries

- Injuring position - plantarflexion + inversion.
- 1st structure damaged is the **lateral capsule**.
- ATF stressed next -> complete rupture.
- CF becomes stressed -> partial/complete tear.
- Sufficient force may disrupt the PTF ligament.

Injuring Action for ATF Sprain



- 'Going over on your ankle'
- Inversion with plantarflexion is most common position for ATF strains

Grades of Injury

- **Grade I** - mild stretch with no instability.
- **Grade II** - partial but incomplete tear of ATF with mild instability.
- **Grade III** - complete tear of ATF and CF ligaments with gross instability and laxity.

Ankle Sprains





Diagnosis

- Obtain description of injury from patient.
- CF lig. injured on inversion in neutral position.
- Swelling \neq severity of injury.
- Immediate swelling present - suspect fracture or complete disruption.
- Grade III pain may be less than lower grades.

Anterior Drawer Test

- Used to definitively diagnose ankle ligament injuries.
- Talus is drawn forward in relation to the tibia.
- Positive sign -> comparison of movement with other foot.
- Occasional 'clunk' may be felt.
- Suction dimple -> lat. aspect of ankle suggests tear in capsule.

Gross Swelling of Injured Ankle



Syndesmotic Ankle Injuries

- Injury to interosseus membrane and Tib-Fib ligaments.
- Caused by ext. rot. or hyper-dorsiflexion injuries.
- 10% of ankle ligament injuries are syndesmotic sprains.
- Result from moderate force.

Diagnosis

- Tenderness over damaged ligaments or interosseus membrane.
- Passive ext. rot. in neutral d'flex. -> pain in antero-lateral region proximal to ankle joint.
- Slow to gain complete recovery.
- Treated by immobilisation -> careful attention to recovering d'flex, tib-fib glide, re-education of push-off during gait.

Medial Ligament Injuries

- Flat, fan shaped ligament with deep and superficial fibres.
- Uncommon due to shape of bony network.
- Sever force usually required -> fracture of the lateral malleolus.
- Large force -> large swelling and bruising.
- Pure eversion stress will cause damage.

Treatment of Ankle Ligaments

- **Grade I** - taping, short period of restricted weight bearing.
- **Grade II** - restricted weight bearing, more swelling and pain -> strapping, elevation, ice, compression.
- **Grade III** - No single most appropriate treatment identified.
(**Two options** - Surgery or Conservative 3-6 weeks immobilisation and restricted wb.)



Rehabilitation

- Deep transverse frictions
- Joint mobilising techniques
- Strengthening exercises
- Massage - ice compression for swelling
- Proprioception retraining techniques
- Walking -> Jogging -> Sprinting -> Jumping
- Balance exercises, uneven surfaces

Ankle Dislocations



- When the injuring force exceeds the strength of the ligamentous restraints, the ankle may dislocate
- At this point surgery is required



Injuries Affecting Neural Structures

Tarsal Tunnel Syndrome
Morton's Neuroma

Tarsal Tunnel Syndrome

- Entrapment of the deep peroneal nerve below the superficial fascia of the ankle.
- Symptoms include numbness in the first dorsal web space
- Patient may also complain of tightness or aching over the dorsum of the foot.

Morton's Neuroma

- Painful swelling of the bifurcation of the digital branches of the plantar nerve.
- Swelling at the bifurcation between 2 adjacent metatarsal heads.
- Usually between the 3rd and 4th.
- Quite common and occurs 4 times as often in women than men.
- Contributing factors may include tight shoes.

Morton's Neuroma

- Patients describe a sharp pain at the base of the 3rd or 4th metatarsal head.
- Pain is described as burning.
- May be numbness in the region.
- Relief may be gained by loose shoes, low heels and orthotics.
- Gentle intertarsal glides may be beneficial in relieving pain.

Other Structures Commonly Affected in the Foot

Fractures to the Bones of the Foot May Occur in Contact Sports



The Arches of the Feet

- The position of the bones of the foot combine to form the arches of the foot
- The medial longitudinal arch is the primary arch providing spring to the step
- The arches are held together by ligamentous and muscular supports
- Alterations in the arches can have effects further up the leg

The Arches of the Feet

- High arches (pes cavus) can lead to lateral rotation of the tibia and medial PFJ problems
- Low arches (pes planus) can lead to medial rotation of the tibia and lateral PFJ problems
- Problems caused by altered arches can be managed through the use of orthotics

Pes Planus

Flat Feet



Plantar Fasciitis

- Fascia acts as a tension band supporting the medial arch.
- Helps generate power for push-off in gait.
- Caused by repetitive micro-trauma at the insertion of the fascia at the medial tubercle of the calcaneus.
- May be related to high arch foot or by prolonged eversion at the mid-stance phase of gait causing a stretch.

Plantar Fasciitis

- Symptoms are felt near the proximal attachment.
- Acute pain occurs after prolonged sitting at rest - 'Physiological Creep'
- Patient may have an antalgic gait initially.
- Symptoms may decrease after gentle activity but increase as activity increases.
- Objectively there is restricted movement at the first MTP joint.

Plantar Fasciitis

- Heel pain in weight-bearing
- Increased pain with the first few steps of the morning when walking barefoot.
- Pain on palpation of the medial tubercle of the calcaneus.
- Limited extension of the first MTP joint.
- Excessively rigid or mobile foot.

Plantar Fasciitis

- Reduce symptoms by reducing stress on the fascia.
- Decreased weight-bearing
- Stretching
- NSAID's
- Mobilize the first MTP joint.

Turf Toe

- Turf toe is really a bruise or sprain that occurs at the base of the big toe at the metatarsal phalangeal joint.
- It usually occurs when the toe is jammed forcibly into the ground or, more commonly, when the toe is bent backward too far (hyper-extended)
- It causes significant pain and swelling at the base of the big toe.
- It can be a significant problem because players use the toe when they run and plant and push off.

Turf Toe

