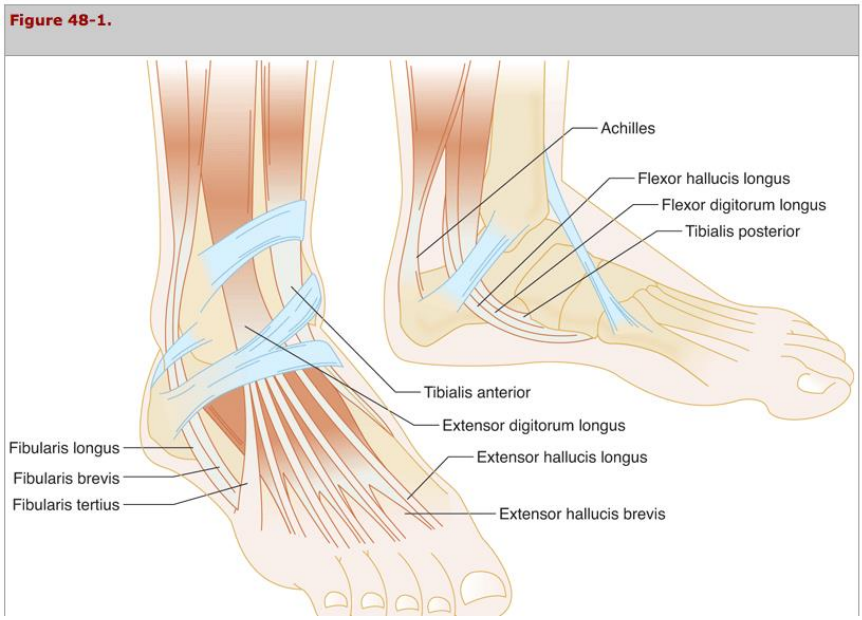
LACERATIONS OF THE LEG AND FOOT

PATHOPHYSIOLOGY

- THE DENSE FIBROUS FATTY TISSUE OF THE BALL OF THE FOOT AND HEEL MAKES WOUND EXPLORATION AND VISUALISATION DIFFICULT IN THE ED → LACERATIONS TO THE ARCH ARE LESS COMMON BUT MORE READILY EXPLORED
- IN CONTRAST TO THE PROTECTIVE PLANTAR SURFACE, THE DORSAL ASPECT OF THE FOOT AND THE ENTIRE ANKLE PROVIDES LITTLE PROTECTION OF THE UNDERLYING TENDONS, NERVES AND BLOOD VESSELS
- **SEVERAL IMPORTANT TENDONS IN THE ANKLE AND FOOT ARE AT RISK FOR INJURY (SEE BELOW):**



- The peroneus longus and brevis run behind the lateral malleolus and can be lacerated here
- Extensor hallucis longus, runs along the top of the first metatarsal
- The Achilles tendon may be severed by penetrating injuries to the posterior ankle
- Lacerations of the shin rarely involve vital nerves or tendon → however, in the infrapatellar area, lacerations can transect the PATELLAR TENDON
- Several factors create challenges for the proper healing of lower extremity lacerations:
    - CONTAMINATION
    - Blood and lymphatic vessels of the foot are under high hydrosctatic pressure → oedema results readily which can retard healing
    - Immobilisation produces logistical difficulties
    - Wounds often have irregular edges
- STAPH AND STREP ARE THE MOST COMMON AGENTS CAUSING INFECTION → special considerations are below:
    - FARMING ACCIDENTS → CLOSTRIDIUM PERFRINGENS

- WADING IN FRESHWATER STREAM (AEROMONAS HYDROPHILA)
- HIGH PRESURE WATER SYSTEMS USED FOR CLEANING → ACINOBACTER
- ANIMAL BITES → PASTEURELLA MULTOCIDA AND CAPNOCYTOPHAGA CANIMORSUS

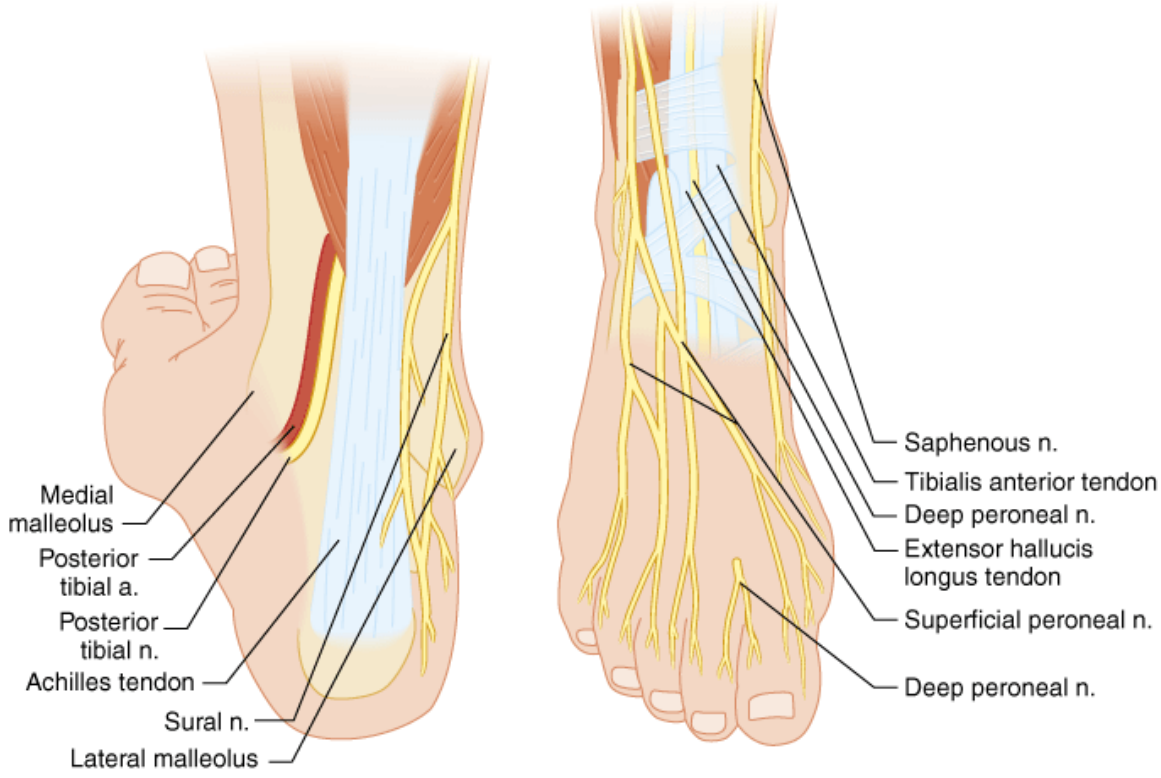
CLINICAL FEATURES:

HISTORY:

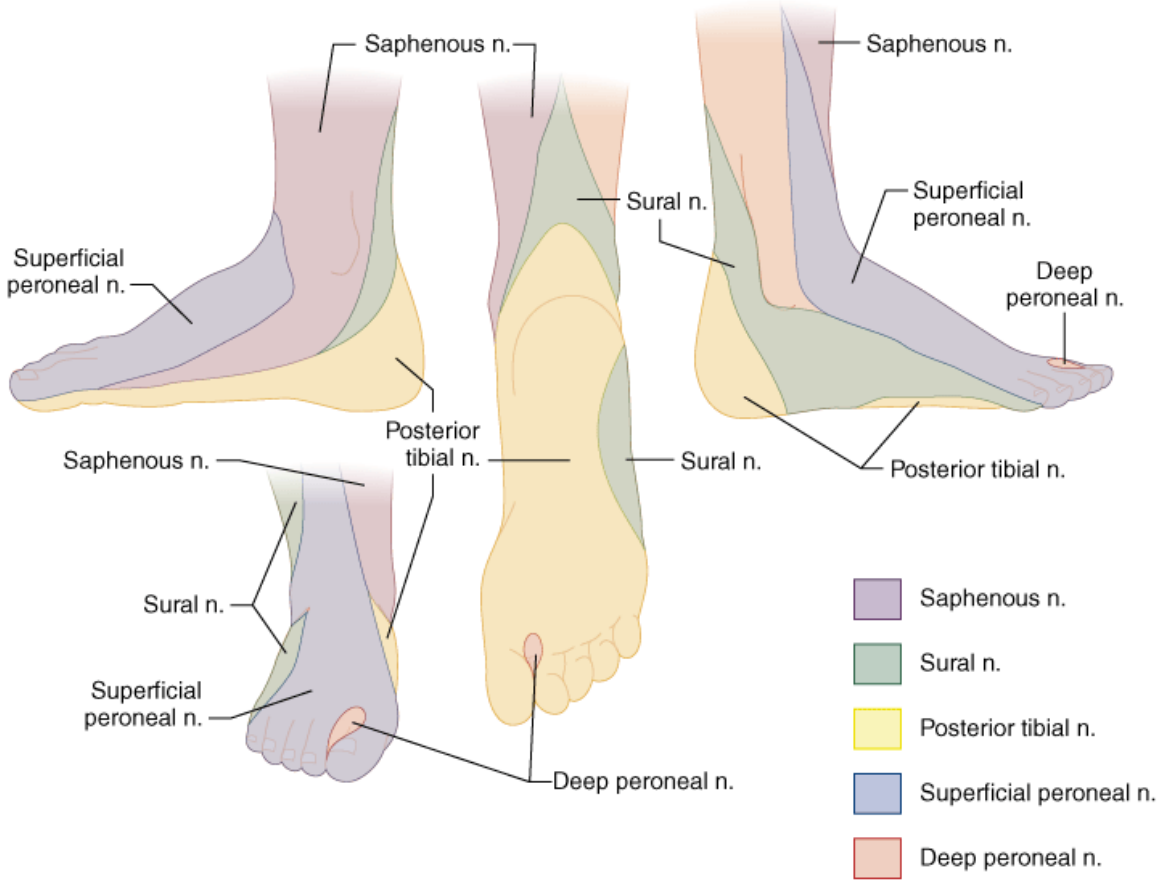
- The time interval from injury to evaluation is important to assess because of the increased incidence of infection
- The complaint of any new paraesthesiae, anaesthesia, weakness or loss of function suggests nerve, vascular or tendon injury
- Ask about factors that will retard wound healing → immunosuppression, DM, PVD.
- Also ask about risk of bacteraemia → valvular heart disease, asplenia

PHYSICAL EXAMINATION:

- Should determine the following:
  - Location, length, depth and shape of the wound
  - A wound on the weightbearing surface should be noted → NWB will form a part of management
- Distal sensory nerve function, motor function and vascular integrity should be assessed



- SENSORY NERVES PREDOMINATE IN THE FOOT:



- Most motor control is performed by nerves and muscles in the lower leg → the exception are that the posterior tibial nerve innervates intrinsic foot musculature and the deep peroneal nerve innervates the extensor digitorum brevis and extensor hallucis brevis muscles → injuries to these nerve may result in toe-clawing
- Two-point discrimination varies along the foot and is not reliable in those with neuropathy (e.g. DM)
- Typically, nerve injuries caused by open blunt injuries are NOT REPAIRED AT THE TIME OF INJURY
- The loose, thin skin over the dorsum of the foot allows for adequate visual, digital and instrument exploration for tendon lacerations, as well as for FB discovery
    - The dense tissue of the plantar surface limits wound visualisation
- ACHILLES TENDON ASSESSMENT:
    - THOMPSON TEST → patient prone, squeeze the midcalf → if the tendon is intact, then the foot plantarflexes. Partial lacerations of this tendon are noted if it "catches"
    - Palpate posteriorly for obvious defects

ANCILLARY STUDIES:

- Radiographic imaging useful when a fracture, radioopaque FB or joint penetration is suspected

    - For radio-opaque FB, plain films suffice (glass >2mm or gravel >1mm will be seen with >95% sensitivity)
    - Organic material seen on US → high risk of infection
- Lacerations over the ankle and knee should be examined for joint capsule integrity → the detection of joint penetration by examination alone is OFTEN INCORRECT → air within the joint on plain x-ray is a sign of joint penetration
    - Another method is to inject sterile saline using a standard arthrocentesis approach at a site separate from the lacerations → fluid leaking from the wound indicates joint penetration

TREATMENT:

- AGE CONSIDERATIONS:
    - Patients of any age will have difficulty after immobilisation, but splints to prevent knee or ankle flexion may be the only way to ensure proper immobilisation for large lacerations over the pretibial surface or over anterior knee
    - In young kids → the smaller the child, the larger the dressing is a useful rule of thumb to protect wounds
    - In elderly → fragile skin predisposes to skin tears that will not close with sutures as the skin will tear again
        - Also more likely to have comorbidity that delays healing
- WOUND ANAESTHESIA:
    - Lacerations to dorsum of foot can be adequately infiltrated with local anaesthetic
    - PLANTAR SURFACE → INFILTRATION ALONE IS POOR, often need regional anaesthesia (posterior tibial or sural nerve block) → adrenaline mixed with lignocaine in standard preparations is not harmgul and likely advantageous for digital blocks in the fingers and toes
- WOUND PREPARATION AND REPAIR:
    - Due to inherent risk of infection of foot lacerations, wound irrigation with copious amounts of saline at high pressure is recommended
    - Lacerations under significant tension should be repaired with a multiple layered closure using absorbable sutures deep, interrupted/mattress sutures to skin
    - In wounds that are contaminated or otherwise prone to infection, deep sutures is avoided
    - Debridement to remove devitalised tissue is considered an important aspect of wound care to reduce the risk of wound complications
    - Lacerations of the toenail require close attention → on the dorsum of the phalanx, the skin is attached directly to the periosteum with no intervening lay of subcutaneous tissue – therefore a laceration to the nail bed places the underlying bone at risk for bacterial contamination
    - Consider delayed primary should be considered in cases of delayed presentation or heavy contamination

TREATMENT OF PLANTAR FOOT LACERATIONS:

- Best done with patient prone using heavy and large suture needles
- Simple interrupted sutures are appropriate unless there is tissue loss or the site is under tension → a vertical mattress suture may be required

TREATMENT OF DORSAL FOOT AND ANKLE LACERATIONS:

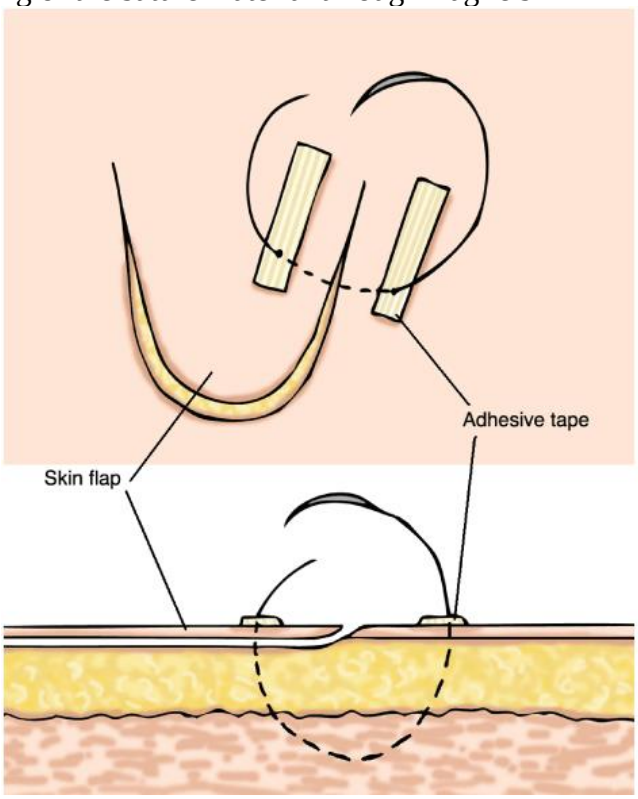
- Repaired almost exclusively with non-absorbable monofilament
- Deep sutures considered inappropriate because of the proximity of bones, nerves and tendons

INTERDIGITAL LACERATIONS:

- Use horizontal mattress sutures as simple interrupted sutures often leads to skin inversion and risk of failure

PRETIBIAL LACERATIONS:

- Wounds over the anterior tibial surface are often slow to heal → complicated by absence of underlying soft tissue and the tension of the skin → high rate of delayed healing → close follow up required
- When possible → primary two-layer closure
    - Consider placement of adhesive tape laid parallel to the wound edges before closure with percutaenous sutures through the adhesive tapes limits tearing of the suture material through fragile skin



- Flap-type pretibial lacerations are particularly prone to poor healing because of decreased blood supply to the flap → foam adhesive dressing that absorbs exudates has been shown to reduce healing time

TREATMENT OF KNEE LACERATIONS:

- For lacerations about the knee, potential joint capsule penetration and laceration of the patellar and quadriceps tendons should be assessed
- Common peroneal nerve is prone to injury as it runs over the head of the fibula laterally and distal limb function should be assessed (foot eversion and dorsiflexion)
- Deep popliteal wounds can injure the popliteal artery and tibial nerve
- Post repair → the knee should be splinted or placed in a knee immobiliser to decrease active tension and promote better wound healing

TREATMENT OF TENDON LACERATIONS:

- Many tendon lacerations involving the midfoot and forefoot can go unrepaired without compromising foot function → splint the foot and leave the tendon alon
- HOWEVER → lacerations of the EXTENSOR HALLUCIS LONGUS TENDON or TIBIALIS ANTERIOR tendon require consultation with an orthopaedic surgeon because of their importance in WALKING AND RUNNING
- Flexor tendon lacerations across the toes (excluding the great toe) can usually be left unrepaired without significant functional sequelae → occasionally the patient will develop a hammer toe or claw-toe deformity
- SIGNIFICANT TENDON LACERATIONS OF THE LOWER EXTREMITY ARE USUALLY REPAIRED A FEW DAYS TO WEEKS AFTER THE INITIAL INJURY → treatment in ED consists of skin closure, splinting of the foot, ankle and leg, with prophylactic antibiotics as needed

TREATMENT OF TISSUE LOSS AND AMPUTATION:

- Certain injuries can lead to major tissue loss as well as amputation → consideration of tissue grafts and flap reconstruction by plastics/orthopaedics
- Reimplantation of a severed toe is not typically performed
- Any severed part should be gently washed (NOT SCRUBBED) with steril saline to remove gross debris, wrapped in saline-soaked gauze and palce din a plastic bad that is then placed in an ice bath

TREATMENT OF RETAINED FOREIGN BODY:

- In the absence of chronic discomfort, inert foreign bodies can remain in the foot
    - Conversely, reactive organic material does not become encapsulated and does promote infection → should be aggressively identified and removed
    - Best referred to the surgeon for location and removal if deep

TREATMENT OF HAIR-THREAD TOURNIQUET SYNDROME:

- Seen during infancy → a long strand of hair or thread becomes wrapped around a toe, often producing stangulation and digital ischaemia → occult source of irritability
- Unwind the thread if possible using fine forceps
- A novel approach is use of hair-dissolving compounds
- DOES NOT WARRANT REPORTING AS SUSPECTED CHILD ABUSE

DISPOSITION AND FOLLOW UP:

- Most patients will go home with bulky dressing and avoidance of weightbearing for 5 days
- Advise elevation to decrease swelling and infection risk
- Sutures removed in 10-14 days
- PROPHYLACTIC ANTIBIOTIC USE:
    - Although infection occurs in 3-8% of lower extremity lacerations and up to 345 of plantar lacerations, there is no evidence that prophylactic oral antibiotics reduces the frequency of postrepair wound infections
    - Use of antibiotics is reliant on clinican discretion that relates to degree of contamination, presence of foreign debris, the presence of associated injuries and host factors that predispose to infection
    - SPECIAL CASES:
        - Animal bites → augmentin to cover Staph, strep, pasteurella and (C. canimorsus if asplenic)
        - AEROMONAS HYDROPHILA (laceration sustained in freshwater stream) → infections occur 8-48 hours after inoculation and are RAPIDLY PROGRESSIVE → fascia, tendon, muscle, bone or joint involvement occurs in 39% cases → compartment syndrome and amputation can result → prophylaxis with fluoroquinolones, established infection with agents below

***Aeromonas* species**

Infections by *Aeromonas* species are associated with exposure to fresh or brackish water or mud (water activities, caving) through cuts and abrasions. The resulting illness may be a superficial skin infection, myositis or sepsis with metastatic complications. In about 25% of cases, the patient has an underlying systemic illness. Use:

ciprofloxacin 400 mg (child: 10 mg/kg up to 400 mg) IV, 12-hourly
or ciprofloxacin 500 mg (child: 12.5 mg/kg up to 500 mg) orally, 12-hourly.

Meropenem or imipenem are possible alternatives for polymicrobial infection.

- Open fractures are most commonly infected by S aureus, so patients should receive antibiotics with first generation cephalosporin and an aminoglycoside

Compound (open) fractures

Management of compound (open) fractures requires urgent orthopaedic consultation. Irrigation is a key component in preventing infection after an open fracture, as it serves to decrease bacterial load and remove foreign bodies. There is insufficient evidence to support the use of local antibiotic therapies such as beads.

The patient with a compound fracture should have their immune status to tetanus assessed (see Table 2.19). Prophylaxis or early treatment directed particularly against *Staphylococcus aureus* should be given:

di/flucloxacillin 2 g (child: 50 mg/kg up to 2 g) IV, 6-hourly.

For patients hypersensitive to penicillin (excluding immediate hypersensitivity, see Table 2.2), use:

cephazolin 2 g (child: 50 mg/kg up to 2 g) IV, 8-hourly.

For patients with immediate penicillin hypersensitivity (see Table 2.2), use:

1 **clindamycin 450 mg (child: 10 mg/kg up to 450 mg) IV or orally, 8-hourly**

OR

1 **lincomycin 600 mg (child: 15 mg/kg up to 600 mg) IV, 8-hourly.**

Prophylaxis should be continued for up to 72 hours following injury, and discontinued 24 hours after wound closure. If presentation is delayed (8 hours or more), presumptive early treatment should be given for 5 to 7 days, but continued for longer if bone infection is established (see Osteomyelitis).

If **wound soiling or tissue damage is severe and/or devitalised tissue is present**, use:

1 **piperacillin+tazobactam 4+0.5 g (child: 100+12.5 mg/kg up to 4+0.5 g) IV, 8-hourly**

OR

1 **ticarcillin+clavulanate 3+0.1 g (child: 50+1.7 mg/kg up to 3+0.1 g) IV, 6-hourly**

FOLLOWED BY

amoxycillin+clavulanate 875+125 mg (child: 22.5+3.2 mg/kg up to 875+125 mg) orally, 12-hourly.

For patients with penicillin hypersensitivity (excluding immediate hypersensitivity, see Table 2.2), use:

cephazolin 2 g (child: 50 mg/kg up to 2 g) IV, 8-hourly

PLUS

metronidazole 500 mg (child: 12.5 mg/kg up to 500 mg) IV, 12-hourly

FOLLOWED BY

cephalexin 500 mg (child: 12.5 mg/kg up to 500 mg) orally, 6-hourly

PLUS

metronidazole 400 mg (child: 10 mg/kg up to 400 mg) orally, 12-hourly.