ORTHOPAEDIC AND FRACTURE

Lower limb trauma (lec 5)

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ANKLE LIGAMENT INJURIES

Ankle sprains are the most common of all sports related injuries, accounting for over 25 % of cases. In more than 75 % of cases it is the lateral ligament complex that is injured, in particular the anterior talofibular and calcaneofibular ligaments. Medial ligament injuries are usually associated with a fracture or joint injury.

ACUTE INJURY OF LATERAL LIGAMENTS

Clinical features

Twisting injury followed by pain and swelling

Imaging

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Treatment

- Initial treatment consists of **p**rotection, **r**est, **i**ce, **c**ompression and **e**levation **(PRICE)** for 1–3 weeks
- (NSAIDs) in the acute phase can be helpful,
- Functional treatment, i.e. ‘protected mobilization’, leads to earlier recovery of all grades of injury than either rigid immobilization or early operative treatment.

OPERATIVE TREATMENT

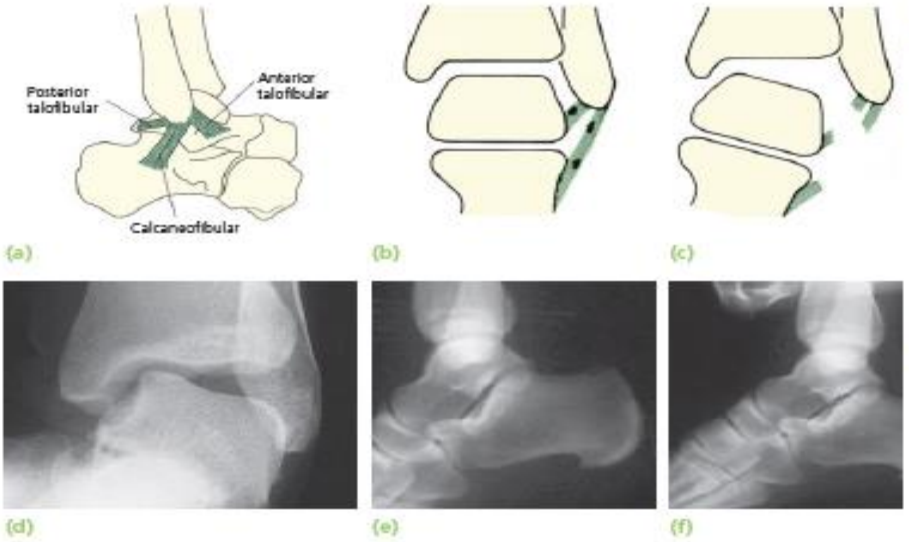
- Persistent problems at 12 weeks after injury, despite physiotherapy, may signal the need for operative treatment.
- Residual complaints of ankle pain and stiffness, a sensation of instability or giving way and intermittent swelling are suggestive of cartilage damage or impinging scar tissue within the ankle.
- Arthroscopic repair or ligament substitution is now effective in many cases, allowing a return to full function and sports.

DELTOID LIGAMENT TEARS

- Rupture of the deltoid ligament is usually associated with either a fracture of the distal end of the fibula or tearing of the distal tibiofibular ligaments (or both). The effect is to destabilize the talus and allow it to move into eversion and external rotation.
- The diagnosis is made by x-ray: there is widening of the medial joint space

Treatment

Provided the medial joint space is completely reduced, the ligament will heal. Occasionally the medial joint space cannot be reduced; it should then be explored in order to free any soft tissue trapped in the joint. A below-knee cast is applied with the foot plantigrade and is retained for 8 weeks.



31.1 Ankle ligament injuries (a) Schematic diagram showing the mortise-and-tenon articulation and main ligaments of the ankle. (b) The three components of the lateral collateral ligament. (c) The commonest injury is a partial tear of one or other component of the lateral ligament. Following a complete tear, the talus may be displaced in the ankle mortise; the tibiofibular ligament may have ruptured as well, shown here in somewhat exaggerated form. (d) Stress x-ray showing talar tilt. (e,f) X-rays demonstrating anteroposterior instability. Pulling the foot forward under the tibia causes the talus to shift appreciably at the ankle joint; this is usually seen after recurrent sprains.

MALLEOLAR FRACTURES OF THE ANKLE (POTTs Fracture)

- Fractures and fracture dislocations of the ankle are common. Most are low-energy fractures of one or both malleoli, usually caused by a twisting mechanism.
- Less common are the more severe fractures involving the tibial plafond, the pilon fractures, which are high-energy injuries often caused by a fall from a height.

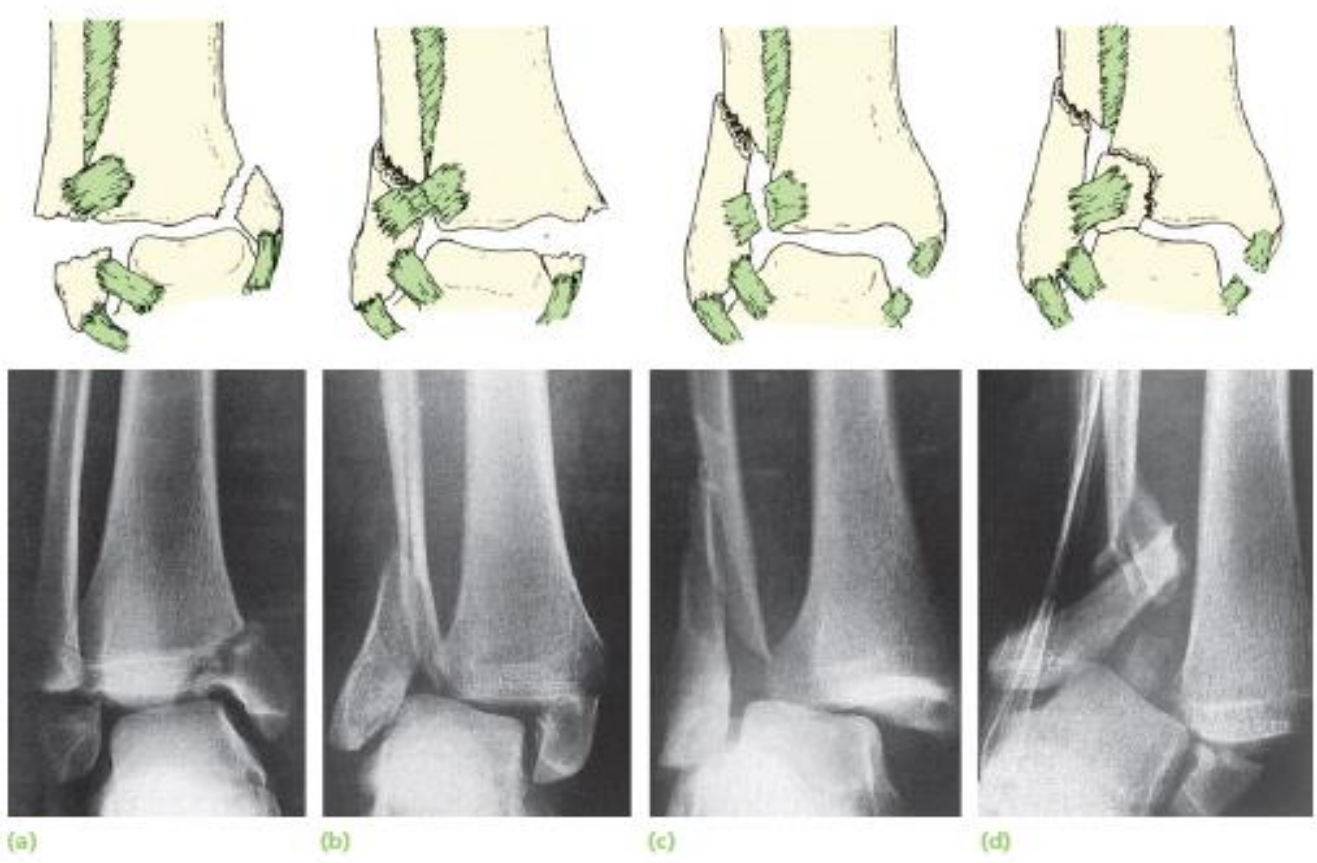
- The Danis–Weber classification OF ankle based on the level of the fibular fracture

Type A – a fibular fracture below the syndesmosis and an oblique fracture of the medial malleolus (caused by forced supination and adduction of the foot).

Type B – fracture at the syndesmosis, often associated with disruption of the anterior fibres of the tibiofibular ligament and fracture of the posterior and/or medial malleolus, or disruption of the medial ligament (caused by forced supination and external rotation).

Type C – a fibular fracture above the syndesmosis; the tibiofibular ligament must be torn

Type D --the ligament avulses a small piece of the tibia. Here, again, there must also be disruption on the medial side of the joint – either a medial malleolar fracture or rupture of the deltoid ligament.



X-ray

At least three views are needed: anteroposterior, lateral and a 30-degree oblique 'mortise' view. The level of the fibular fracture is often best seen in the lateral view

Treatment

Always look for clues to the invisible ligament injury– widening of the tibiofibular space, asymmetry of the talotibial space, widening of the medial joint space, or tilting of the talus – before deciding on a course of action.

In assessing the accuracy of reduction must be met

(1) the fibula must be restored to its full length;

(2) the talus must sit squarely in the mortise, with the talar and tibial articular surfaces parallel;

(3) the medial joint space must be restored to its normal width, i.e. the same width as the tibio-talar space (about 4 mm);

(4) oblique x-rays must show that there is no tibiofibular diastasis.

UNDISPLACED FRACTURES

- a below-knee cast is applied with the ankle in the neutral (anatomical) position. The plaster may need to be split and, if so, it must be completed or replaced when swelling has subsided.
- A check x-ray is taken at2 weeks to confirm that the fracture remains undisplaced. An over boot is fitted and the patient is taught to walk correctly as soon as possible.
- The cast can usually be discarded after 6–8 weeks. Ankle and foot movements are regained by active exercises when the plaster is removed.

DISPLACED FRACTURES

Reduction of these joint and internal fixation is usually performed to stabilize the reduction, not all such fractures require surgery.

The medial malleolar fracture is nearly vertical and after closed reduction it often remains unstable; internal fixation of the malleolar fragment with one or two screws directed almost parallel to the ankle joint is advisable.

A perfect reduction should be aimed for, with accurate restoration of the tibial articular surface. Loose bone fragments are removed. The lateral malleolar fracture,

unless it is already perfectly reduced and stable, should be fixed with a plate and screws or tension-band wiring. Postoperatively a ‘walking cast’ or removable splintage boot is applied for 6 weeks; the advantage of removable splintage is that early physiotherapy can be commenced.

Postoperative management After open reduction and fixation of ankle fractures, movements should be regained before applying a below-knee plaster cast, or removable support boot. The patient is then allowed partial weightbearing with crutches; the support is retained until the fractures have consolidated (anything from 6–12 weeks).

Complications

EARLY Vascular injury , *Wound breakdown and infection*

LATE

Incomplete reduction , *Non-union , Joint stiffness , Algodystrophy , Osteoarthritis*

31.16 Triplane fracture The three fracture planes may not be seen in a single x-ray, but can be visualized from a combination of images. In this case the epiphyseal fracture is dearly seen only in the coronal plane CT scan (c).

Tillaux fracture (a,b) This avulsion fracture of the lateral part of the physis was reduced and fixed percutane

31.7 Ankle fractures – open treatment (1) (a,b) Danis–Weber type A fractures can often be treated conservatively, but if the medial malleolar fragment involves a large segment of the articular surface, it is best treated by accurate open reduction and internal fixation with one or two screws. (c,d) An unstable fracture–dislocation such as this almost always needs open reduction and internal fixation. The fibula should be restored to full length and fixed securely; in this case the medial malleolus also needed internal fixation; (e) and (f) show the range of ankle movement a few days after operation and before a ‘walking plaster’ was applied.

PILON FRACTURES

occurs when a large force drives the talus upwards against the tibial plafond, like a pestle (pilon) being struck into a mortar. There is considerable damage to the articular cartilage and the subchondral bone may be broken into several pieces; in severe cases, the comminution extends some way up the shaft of the tibia.

Clinical features

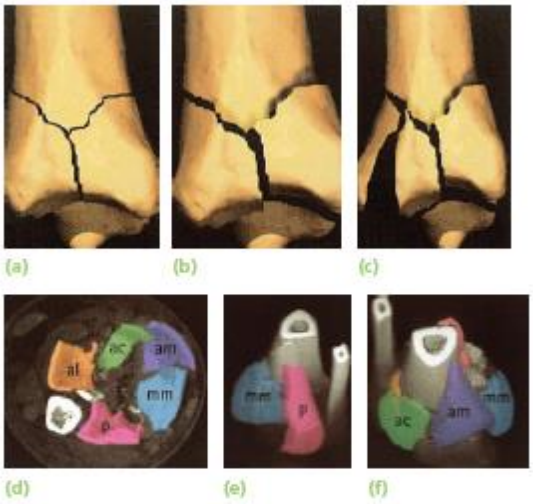
little swelling initially but this rapidly changes and fracture blisters are common. The ankle may be deformed or even dislocated; prompt approximate reduction is mandatory.

X-rays

This is a comminuted fracture of the distal end of the tibia, extending into the ankle joint.

(Ruedi and Allgower, 1979),

- Ruedi *type 1* is an intra-articular fracture with little or no displacement of the fragments; in
- *type 2* there is more severe disruption of the articular surface but without very marked comminution.
- *Type 3* is a severely comminuted fracture with displacement of the fragments and gross articular irregularity.



31.9 Pilon fractures – Imaging These are either (a) undisplaced (type 1), (b) minimally displaced (type 2); (c) markedly displaced (type 3). CT (d) shows that there are usually five major tibial fragments: anterolateral (al), anterocentral (ac), anteromedial (am), the medial malleolus (mm) and the posterior fragment (p). These elements are better defined by three-dimensional CT reconstruction (e,f).

Treatment

span, scan, plan.

Control of soft tissue swelling is a priority; this is best achieved either by elevation and applying an external fixator across the ankle joint (the spanning external fixator, or travelling traction). It may take 2– 3 weeks before the soft tissues improve, and fracture blisters can be actively managed rather than hidden under plaster.

Surgery can be planned, based on the CT scan. Once the skin has recovered, an open reduction and fixation with plates and screws (usually with bone grafting) may be possible. However, the more severe injuries (types 2 and 3) do not readily tolerate large surgical exposures for plating and significant wound breakdown and infection rates have been reported. Better results have followed wider use of indirect reduction techniques (e.g. applying a bone distractor or utilizing the spanning fixator across the joint to obtain as much reduction as possible through ligamentotaxis) and plating through limited exposures. Recently, these injuries have been successfully treated by using a combination of indirect reduction methods and small screws to hold the articular fragments, coupled with axially stable locking plates.

PRINCIPLES IN MANAGING INJURIES OF THE FOOT

Injuries of the foot are followed by residual symptoms and loss of function, which seem out of proportion to the initial trauma. Severe injuries affect the foot as a whole, whatever the particular bone that might be fractured. A global approach is therefore essential in dealing with these injuries, the objective being a return to full weight bearing without pain, with an appropriate propulsive gait. Identification of these injuries is particularly challenging in the patient with multiple trauma, where the more subtle foot injuries might be missed as the life threatening truncal injuries and limb-threatening long bone injuries distract attention from the more subtle injuries to the foot, which may nonetheless impair eventual function.

Clinical assessment

The entire foot should be examined systematically, no matter that the injury may appear to be localized to one spot. Multiple fractures, or combinations of fractures and dislocations, are easily missed. The circulation and nerve supply must be carefully assessed; a well-reduced fracture is a useless achievement if the foot becomes ischaemic or insensitive. Similarly, attention must be paid to the soft tissues and functional movement of the foot; the stiff, painful foot is impaired for propulsion, and maybe even for stance. Fractures and dislocations may cause tenting of the skin; this is always a bad sign because there is a risk of skin necrosis if reduction is delayed.

Imaging

- anteroposterior, lateral and oblique x-rays of the foot.
- CT is especially useful for evaluating fractures of the calcaneum,
- MRI is helpful in diagnosing osteochondral fractures of the talus.

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Treatment

- Swelling is always a problem. Not only does it make clinical examination difficult, but more importantly it may lead to definitive treatment being delayed; fractures and dislocations are more difficult to reduce in a swollen foot.
- **The principles are:**
    - realign and splint the foot, keep it elevated and apply Cryo-Cuff or ice-packs and intermittent pneumatic compression foot pumps;
    - make the diagnosis, defining the extent of injury;
    - start definitive treatment as soon as the fracture pattern is properly defined and swelling permits.
    - In the rehabilitation phase, if the foot has to be immobilized, exercise those joints that can be left free.
    - Start weight bearing as soon as the patient will tolerate it, Prolonged immobilization predisposes to stiffness, impaired function, localized osteoporosis and complex regional pain syndrome.