

Anatomy

- Mortise stability relies on integrity of ring of bones & lig.
- Main articulation between talus and tibial plafond (*Fr ceiling*)
- Medially the talotibial joint supported by the med malleolus and the med collateral (deltoid) ligament, which is stronger than its lat counterpart.
- Laterally there is flexible support by the lateral complex (fibula, syndesmosis and lateral collateral bands)
- The syndesmosis (fibrous connection) = ant & post tibiofibular lig (at the plafond level) + interosseus ligament (2cm above plafond).
- Lat collateral lig connect distal fibula to talus & calcaneus.
- The flexibility of the lateral complex allows talus & fibula to rotate and translate



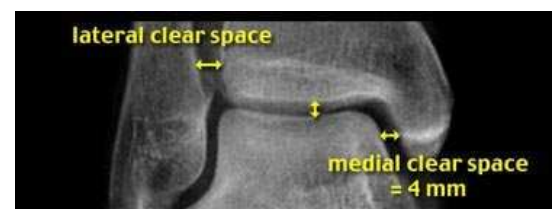
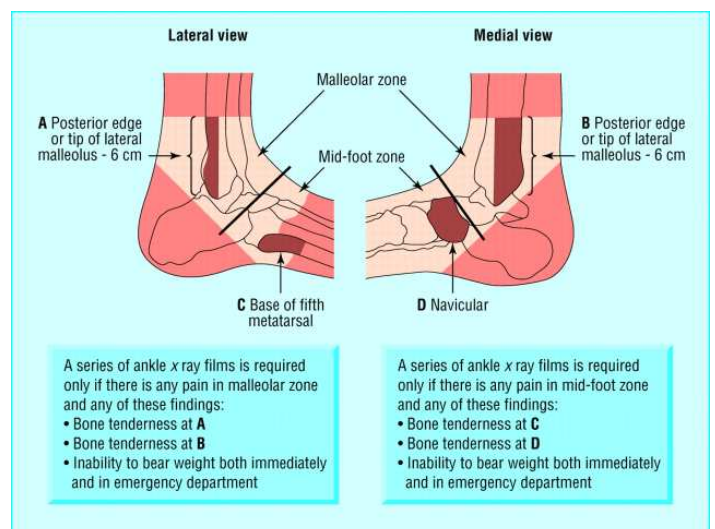
Features

- Most injuries occur with foot is fixed on the ground in supination [foot curled down & in] (80%) or pronation [lifted out] (20%) and a rotation or adduction force is applied.
- While it actually is the leg and ankle fork that rotates upon the fixed foot, injuries are described as if it is the talus that rotates upon the leg.
- Extreme pronation will result in med collateral lig rupture or avulsion/transverse # of med malleolus. The lat malleolus or fibula may sustain oblique or spiral #.
- Extreme supination holds fib tight & results in rupture of lat collateral lig, avulsion or transverse # of lat malleolus.
- Ext rot (of talus) has tension increasing from ant→lat→post→med, resulting in:
 1. ant tibiofib lig (ant syndesmosis) rupture/ant tib tubercle avulsion #
 2. oblique # fibula at or above syndesmosis
 3. post tibiofib lig (post syndesmosis) rupture/post malleolar #
 4. med colleteral lig may rupture/med malleolus avulsion #



Radiology

- Ottawa Ankle/Foot Rules (~98% sens)
- Mortise-view (AP + int rot of foot shows jt spaces) & lateral view ± AP-view.
- Ankle mortise widens in ligament rupture.
- Talar tilt normally <5°
- Medial clear space should be ≤4mm (as is plafond-talus separation usually)
- Widening of the medial clear space >6 mm or more requires disruption of the medial collateral ligament.
- Lateral clear space (medial border of fibula to lateral border of post tibia 1cm above tibial plafond). More dependent on positioning but clear widening indicates syndesmotic rupture (≥5.5mm)
- A normal lateral or medial clear space does not exclude ligamentous rupture or instability.



Classification

Descriptive: Simple (*Potts*) malleoli involved (uni- {med/lat}, bi- or tri-malleolar) & displacement.

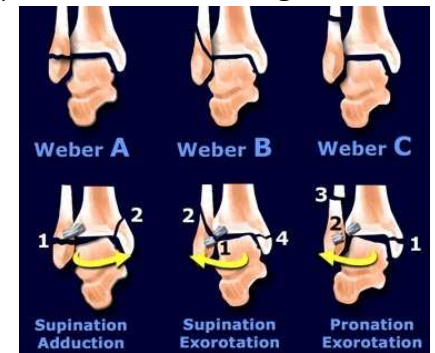
Weber (similar to Davis Webster):

Based upon level of fibula #: below (A), at (B) or above (C) level of syndesmosis. The higher the level, the more chance for syndesmotic rupture & instability.

Lauge-Hansen:

Based on foot position at time of injury and direction of the force on talus → 4 basic # types:

- Supination-Adduction (essentially Weber A): ~20%
- Supination Exorotation (essentially Weber B): ~55-60%
- Pronation Exorotation (essentially Weber C): ~20%
- Pronation-Adduction - <5%



These basic # types are sub-divided into stages reflecting the sequential disruption of bone and ligaments. The higher the stage reached the more chance for instability and dislocation.

Weber A = Supination Adduction (Lauge Hansen)

Foot fixed on ground in supination (lat side under tension) & adduction force applied to talus.

Stage 1: lat collateral lig tear/transverse #/avulsion of lat malleolus tip just below level of tibial plafond.

Stage 2: More talar tilt can lead to med malleolus oblique #



Weber B = Supination Exorotation (Lauge Hansen)

Stage 1. Talus exorotates so ant tibiofibular ligament is ruptured or avulsed (Tillaux #).

Stage 2. More rotation → ant to post oblique/spiral fibula # at level of joint & extends up.

Stage 3. Posterior displacement of lat malleolus fragment by talus → post tibiofibular lig tear or post malleolus avulsion #.

Stage 4. Finally as talus subluxates further posteriorly, the medial collateral lig tears or avulses tip of med malleolus.



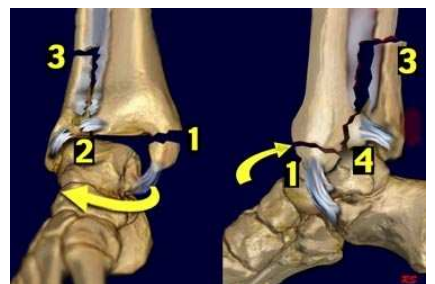
Weber C = Pronation Exorotation (Lauge Hansen)

Stage 1. Tension → med collateral lig or a med malleolar avulsion #.

Stage 2. Freed from medial attachment exorotating talus moves laterally, twists fibula & tears ant tibiofibular ligament.

Stage 3. Interosseus membrane will rupture up to a point where the fibular shaft will fracture. Much exorotation will result in a high fibular # (*Maissoneuve fracture*), less exorotation & more abduction will result in a # only just above the talotibial joint.

Stage 4. Finally the post tibiofibular ligament ruptures or avulses the posterior malleolus.



Pronation Abduction (Lauge Hansen).

Uncommon & difficult to differentiate from the Pronation Exorotation-type. Tends to fracture more close to the level of the joint.

Management

Standard Fracture Mx.

- Urgent reduction (usually conscious sedation) for vascular compromise or gross fracture-dislocation.

Review history & XR films: id & classify #. Look for injuries predicted by L-H type.

Non-operative (POP x 6w - partial wt bearing after 2w) if:

- Fibula # undisplaced or minimally displaced
- No medial lesion

Operative Mx:

- Open #
- Displaced or unstable #
- Incongruity of mortise
- Bi- or tri-malleolar #s



Complications

Neurovascular injury/compromise:

Mal/Non-union

Swelling of ankle may delay surgery for >6d.

Stiffness, late arthritis.

Example X-rays



Weber A (L-H stage 1)



Weber B (L-H stage 4)



Weber C (L-H stage 4)

Foot Fractures

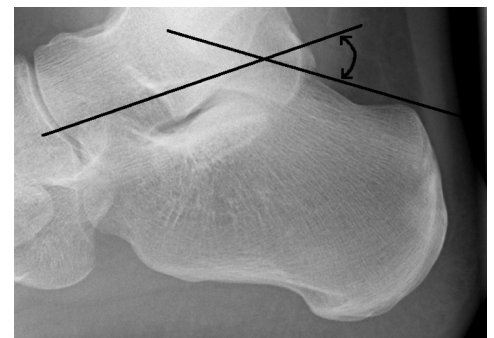
Talar fractures

Neck & Body #: Flake fractures common. Classification: (Hawkins):

- I - undisplaced, 10% AVN;
- II - #neck+displacement, 30% AVN, ORIF;
- III - displaced neck # = subtalar & ankle jt dislocation, needs ORIF, 90% AVN.

Calcaneal fractures

- Mostly fall from height onto feet. (Lover's triad: calcaneal/lumbar/forearm #s)
- Assoc with: pelvic #, 10% cervical/lumbar #, 25% other limb injuries. Reduced Boehler's angle (Norm 20-40°)
- ±CT, admit, ±OT esp if talo-calcaneal jt involved.



Metatarsal fractures

Base 5th MT: Common inversion injury.

- Jones #: Transverse #, max 50% non-union. Pseudo-Jones: Avulsion # by peroneus brevis
- Note: Epiphyseal plate is longitudinal or oblique not transverse
- Mx: Jones - POP non-weight bearing x 6w. Avulsion only - Crepe bandage or cast shoe.

Lisfranc (tarso-metatarsal joint) fracture-dislocations:

Fractures may include: 2nd MT± cuboid, cuneiforms or navicular

Homolateral: all 5 MT move across. **Partial or Isolated:** 1-2 MTs displaced. **Divergent:** 1st MT moves medially, others move laterally. All need Orthopaedic r/v ± operations.

Normal Xray: Medial margin 2nd MT base should be in line with medial margin of middle cuneiform on AP view. Medial margin 3rd MT base should be in line with medial margin of lateral cuneiform on oblique view.