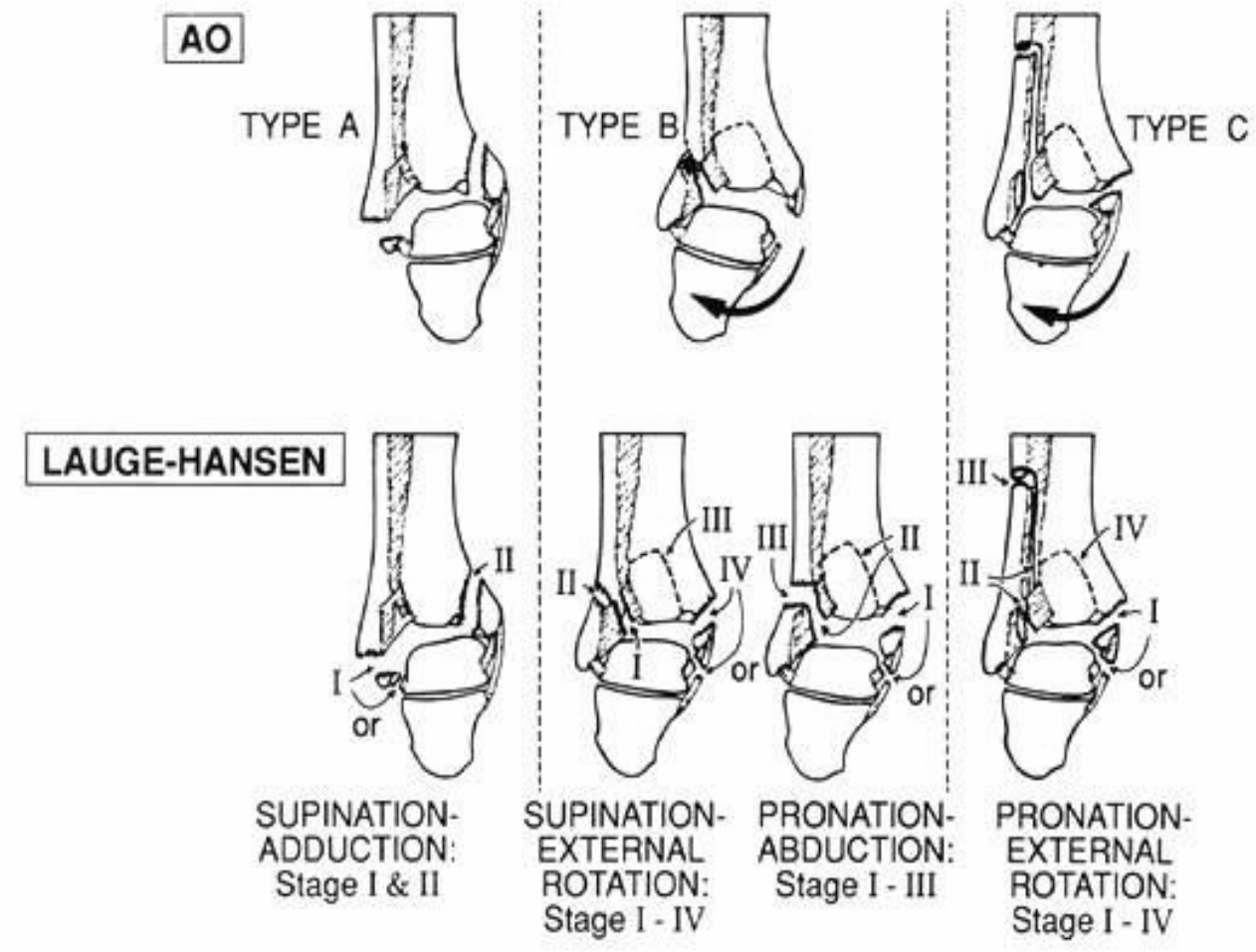
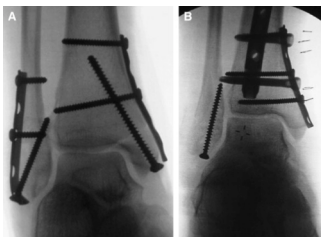
Classification and Diagnosis

Lauge-Hansen Classification and Weber's classification

The Lauge-Hansen classification system is based on a rotational mechanism was applied to the **ankle** in one of three different directions. For a given foot position and deforming force at the **ankle**, a consistently reproducible pattern of osseous and ligamentous injury was described. The first part of the name in the classification system describes the position of the foot at the time of injury, while the second part of the name describes the direction of force applied to the foot.





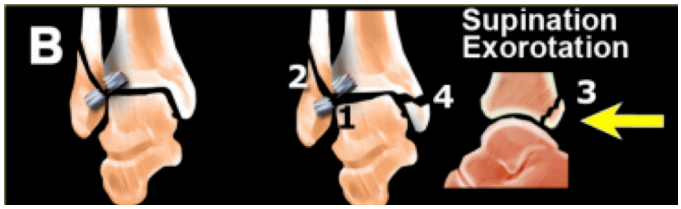
I Supination-Adduction [20%]

Supinated foot experiences a forceful adduction force without a rotational moment.

Stage I Webers A or the lateral collateral ligament : Type A fracture lateral fibula or

Stage II: As the severity of the adduction moment increases, the talus gets displaced toward the medial malleolus and a vertical fracture line is created extending from the medial axilla of the joint and proximally into the metaphyseal cortex of the tibia. Frequently, the medial tibial plafond will present an impaction injury.

II Supination and external rotation:

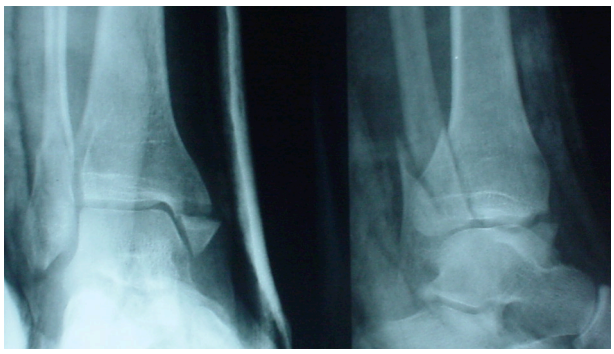


The SER mechanism has four stages of injury [50%]

Here, the foot is in a supinated position while an external rotation force is imparted to the **ankle** relative to a fixed tibia. A shearing force is therefore imparted to the fibula.

Stage I Anterior tibial-fibular ligament (ATFL) and, when present as an isolated injury

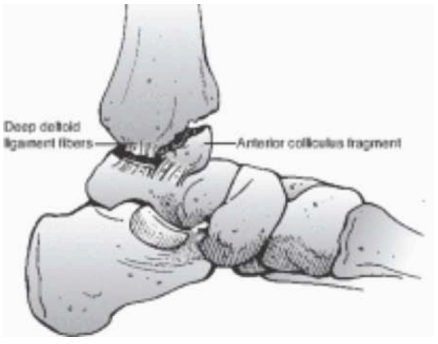
Stage II Oblique fracture line of the fibula [weber b] associated with either a midsubstance rupture of the ATFL or an avulsion fracture of the ATFL insertion into the tibia (Chaput tubercle) or its origin on the fibula (Wagstaffe tubercle).



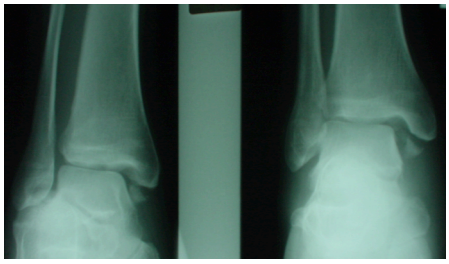
Stage III A posterior tibial-fibular ligament rupture or fracture of the posterior malleolus. [Partial diastasis]

Stage IV: Progresses to the medial-sided structures where the medial malleolus fracture.

Variant: The injury may be an isolated medial malleolus fracture (an oblique fracture line at the level of the axilla in the majority of cases), or an isolated deltoid ligament injury (the deep and superficial portions of the deltoid are ruptured).



More recently, a combination of both a medial malleolus and deltoid injury has been characterized. In this fracture pattern, the anterior colliculus of the medial malleolus is fractured; while the posterior colliculus remains intact, the injury passes through the deep fibers of the deltoid ligament that are attached to the posterior colliculus of the medial malleolus. It has therefore been suggested that the size of the medial malleolar fragment was the most important variable in predicting deltoid competence. When the medial malleolus fragment is greater than 2.8 cm wide (supracollicular fracture), the deltoid ligament is likely intact and stress view is negative. When the fragment is less than 1.7 cm wide (anterior collicular or intercollicular fracture), the deltoid may be incompetent and the stress view should be performed.

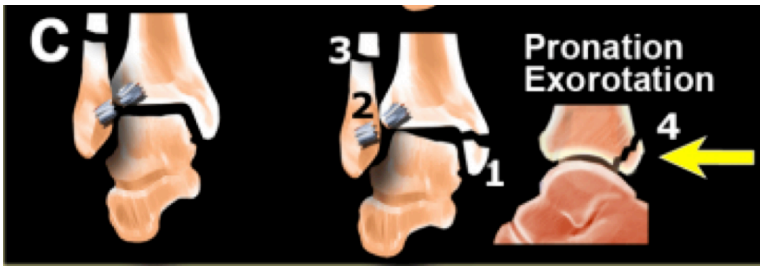


Pronation-Abduction. 5% to 21%

Stage I: The typical appearance is an avulsion-type medial malleolus

Stage II: As bending forces at the fibula create a relatively transverse fracture or commonly have either lateral butterfly or comminution related to the bending failure. The fibula usually **fractures** 5 to 7 cm above the joint.

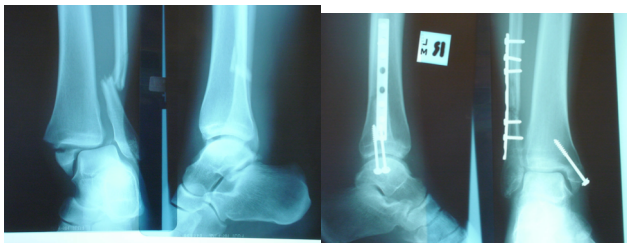
Pronation External-Rotation. 19% of **ankle fractures**.

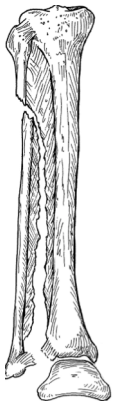


Stage I Transverse fracture medial malleolus or rupture of deltoid ligament

Stage II The next structure injured is the anterior tibial-fibular ligament (AITFL)

Stage III A fibular fracture. The characteristic fibular lesion is a fracture at a level above the syndesmosis that is typically spiral in nature. The fibula fracture progresses in a direction opposite from its SER4





A Pronation ER variant known as the Maisonneuve fracture is characterized by a proximal fibula shaft fracture.
A Maisonneuve fracture should always be suspected when an isolated medial malleolus fracture is seen and is best screened for by palpation of the proximal fibula and assessing for tenderness followed by a tibial-fibular radiograph.

In a study assessing PER **ankle** injuries, Michelson applied their unconstrained axially loaded cadaver **ankle** model to show that in the face of intact medial structures, even a syndesmotic injury is not destabilizing. In this iteration of the cadaver experiment, when the medial osteoligamentous structures were disrupted along with a high fibular fracture and a disrupted syndesmosis, the talus dislocated from the mortise. When the medial structures were intact, the talus remained reduced. Solari et al. also demonstrated the importance of the medial malleolus in the stability of Weber C **fractures** in a cadaver study evaluating the need for syndesmotic screws [J Orthop Trauma 1991;5:190-195]. In this study, the rotational component of instability was assessed specifically. A Weber C fracture pattern where the medial malleolus alone was treated attained 56% of total rotational talar stability, isolated lateral malleolus fixation attained 36% stability, and fixation of the lateral malleolus and medial malleolus (without syndesmotic fixation) attained 76% of total stability. Their conclusion was that the medial malleolar osteoligamentous complex is the single most important contributor to **ankle** stability in Weber C fracture patterns.

AO-Orthopaedic Trauma Association Classification

Danis-Weber classification

Weber type A	Has a fibula fracture below the level of the syndesmosis.
Weber type B	At the level of the syndesmosis
Weber type C	Above the level of the syndesmosis.

Common Surgical Approaches

Lateral Approach for Lateral Fibular Plating

a. The superficial peroneal nerve pierces the fascia and traverses the lateral

compartment into the anterior compartment 10 cm proximal to the tip of the lateral malleolus, although it can be found within 5 cm in 20% of ankles. A relative safe zone is directly over the center of the fibula extending to a distance of 5 cm from the tip of the lateral malleolus, above which a more careful dissection is advised.

b. Skin flaps should be kept thick to prevent any undue trauma and decrease the risk of skin breakdown.

Posterior Approach for Fibular and Posterior Malleolus Plating

For large laterally based fragments where the posterior malleolus does not extend to the medial malleolus, a direct posterior approach is helpful. The patient is ideally placed in the prone position, and a longitudinal incision is undertaken on the lateral side of the Achilles tendon.
The sural nerve is at risk for injury as it passes through the middle of the operative field.
Careful dissection will mobilize the nerve laterally as the interval between the peroneal tendons and the Achilles (superficially) and FHL tendon (deep) is approached.

Medial Approach for Medial Malleolar Plating

1. Anteromedial approach: (hockey stick incision)
   At risk with this approach are the saphenous vein and nerve at the proximal incision and the posterior
   tibial tendon at the distal extent of the incision.
   Ideal for visualization of the medial joint axilla and therefore allows fixation of medial impaction
2. A straight vertical incision over the midsubstance of the medial malleolus.

An anterior approach: The interval used here is between the anterior tibialis tendon and the extensor hallucis longus tendon to fix posterior malleolus by an indirect method.