

## Statement of Purpose

Medial malleolar (MM) fractures can present in a variety of geometric fracture patterns, especially in active populations. Such injuries may present in isolation or in conjunction with other fractures. Unstable rotational ankle fractures propose a challenge in establishing stable fixation. This case study presents four different fixation techniques for complicated MM fractures.

## Literature Review

Ankle fractures occur at a rate of 187 per 100,000 people per year. Medial Malleolar (MM) fractures occur in about 50% of ankle fractures whether in isolation or in conjunction with lateral and posterior malleolar fractures amongst others.<sup>3</sup> Depending on the mechanism of injury, MM fractures can present with various geometric patterns. Due to the unstable nature of these fractures, they almost most often require operative management, especially in the active population.

A classification system developed by Herscovici is commonly used to describe four different MM fracture patterns; Type A-avulsions of the tip of the malleolus, Type B- fractures between the tip and the level of the plafond, Type C- at the level of the plafond and Type D- extended vertically above plafond level.<sup>1</sup> Non-operative conservative treatment has been shown in the literature to lead to prolonged pain and limitations in daily activity. In the active population, 64% of MM fractures present with syndesmotic injuries, making their presentation unstable and less amendable to non-surgical treatment.<sup>2</sup>

Traditionally, Types B and C MM fractures are more stable and fixated with two 3.5 or 4.0 cancellous or cortical screws. Types A and D MM fractures present a more challenging pattern for the surgeon in providing maximum stability via fixation construct.<sup>2,3</sup>

## Cases

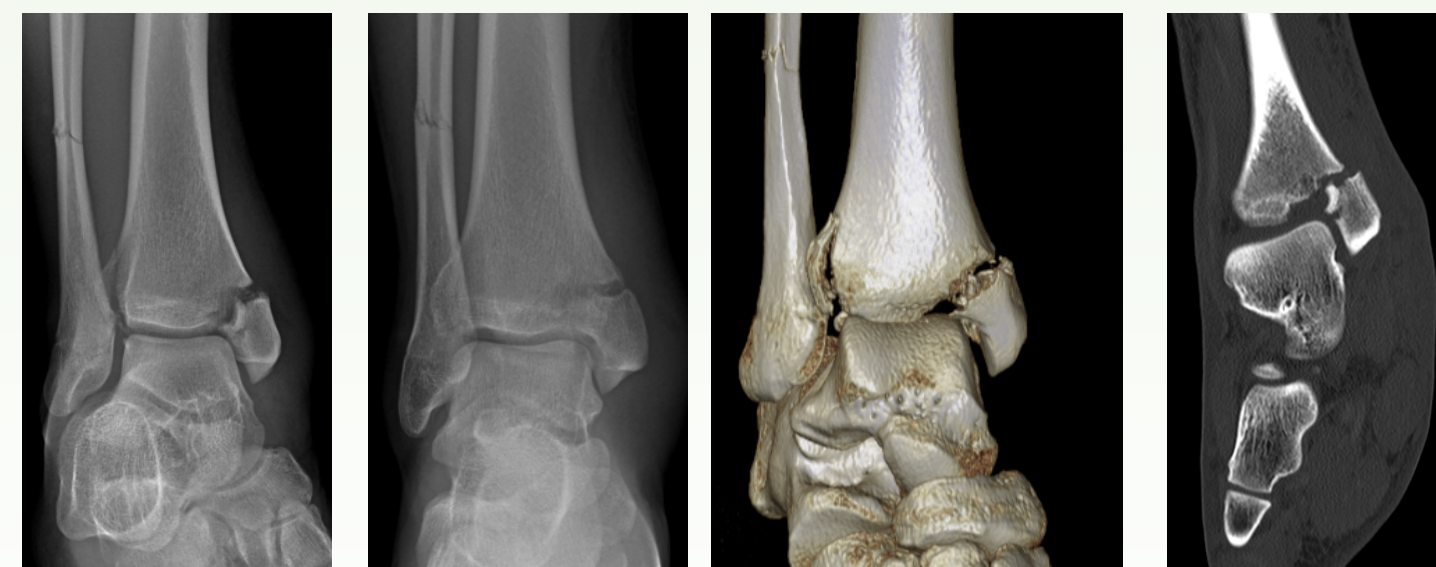
**Case 1:** 43 yo male presented with right ankle pain secondary to inverting his foot after crashing into boards while playing Hockey. X-rays and CT revealed a type D MM fracture with 3 mm displacement as well as comminution.



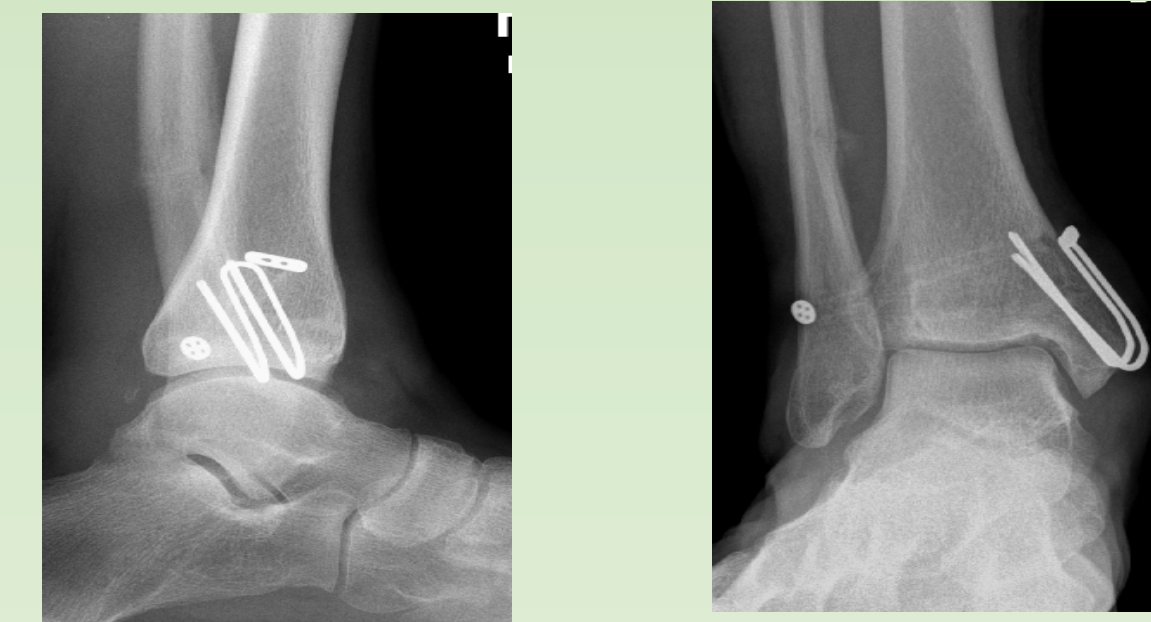
The patient underwent ORIF with two 4.0 cannulated screws across the site as well as posterior to anterior and anterior to posterior screws for further fixation. fracture



**Case 2:** 15 yo male presented with right ankle pain secondary to tripping on another players foot during a football game. X-ray and CT revealed a Type C and comminuted MM fracture and displaced fibular fracture.



The Patient underwent ORIF with use of a medial malleolar sled as well as syndesmotic fixation.



**Case 3:** 53 yo male runner and cyclist developed a painful medial malleolar stress fracture that failed conservative treatment of 5 weeks of non-weightbearing. Stress fracture/Type A non-union were confirmed by CT.



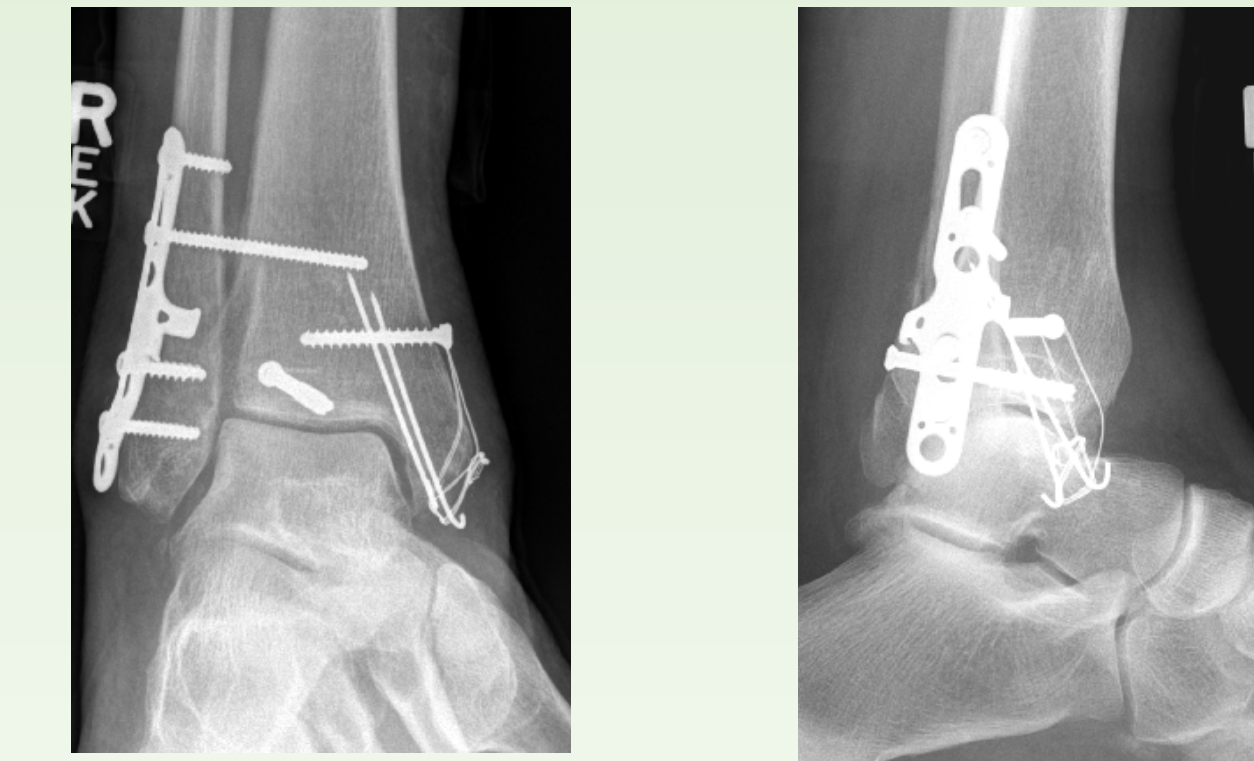
The Patient underwent ORIF with one 4.0 solid screw fixation with autograft.



**Case 4:** 55 yo female presented with a painful right ankle secondary to a misstep and fall. Patient had a previous history of an ankle ORIF. X-ray and CT revealed a re-fracture of the MM inferior to the hardware, consistent with Type B, a displaced fibular fracture and a posterior malleolus fracture.



The Patient underwent ORIF which included tension band wiring for medial malleolus, neutralization plating of the fibula, posterior malleolar fixation as well as syndesmotic fixation.



## Results

Excellent anatomic reduction was achieved in all four cases. In the post-operative period all patients transitioned through non-weight bearing to full weight bearing in a CAM boot, and then finally to regular shoe gear and physical therapy. All patients were able to fully return to physical activity at pre-injury levels. No complications were experienced in any of the cases. The Average follow up time period was 22 months.

## Discussion

Medial malleolar fractures come in all types of patterns depending on the rotational forces applied to the ankle joint on impact. Many studies have looked at these different geometric presentations as well as the strength of fixation constructs. Type B and C fractures of the medial malleolus are more amenable to the traditional two screw compression constructs. In these types of fracture patterns, the screws are able to provide true compression as they are perpendicular or close to perpendicular to the fracture sites. In our study, the Type B fracture had previous fixation in a two screw compression construct, but due to the refracture, alternate construct was performed.

Multiple studies have looked at the strengths of screw type and length for this construct as well. Avulsion or type A medial malleolar fracture present a more difficult challenge for the surgeon as they are more difficult to capture with traditional screws. Tension band wiring is the recommended technique for this type of fracture pattern and has even been shown in the literature to provide stronger compression than traditional screws. Lastly, vertical fractures of the medial malleolus provide a challenge for the surgeon as well. This pattern often requires multiplanar fixation or plating due to its unstable nature, which is likely due to the added motion in the sagittal plane.

Fixation techniques for MM fractures will vary depending on the fracture pattern. The surgeon needs to be able to use these methods to improve compression and stability at the fracture site consequently improving clinical outcomes.

## References

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