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Case Report

Techniques in the Surgical Fixation of a Supination-Adduction Ankle Fracture

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Abstract

Correctly diagnosing and proper surgical fixation of an uncommon supination-adduction ankle fracture is challenging especially in the current climate of increasing osteoporotic fragility fractures. This case report highlights the importance of careful planning and the use of implants in order to achieve a successful fracture healing.

Case Report

A 69 year-old female patient was admitted following a fall in a shopping centre. She missed her footing and fell down three steps, twisting her ankle. She was in severe pain and was unable to weight-bear. When seen in the emergency department, her ankle was deformed and swollen. Radiographs of her ankle showed a trimalleolar fracture with dislocation of the ankle joint (Figure 1).

Figure 1: *Trimalleolar fracture with dislocation of the right ankle joint*

Initial manipulation and reduction performed by the orthopaedic medical officer did not improve her ankle dislocation (Figure 2).

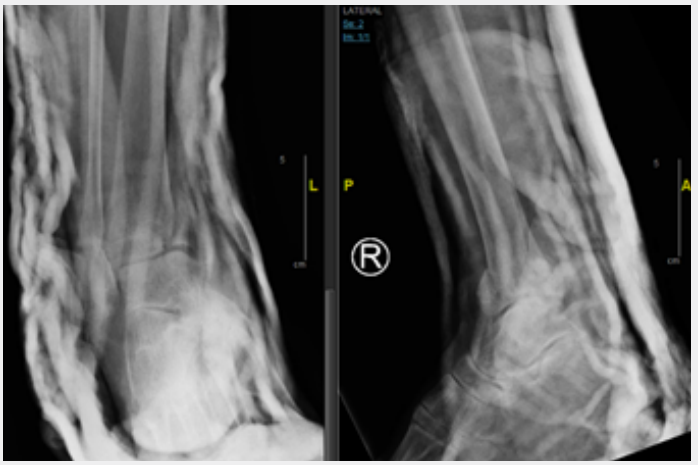

Figure 2: *First reduction attempt with minimal improvement*

Two further attempts were made with minimal improvement (Figure 3).

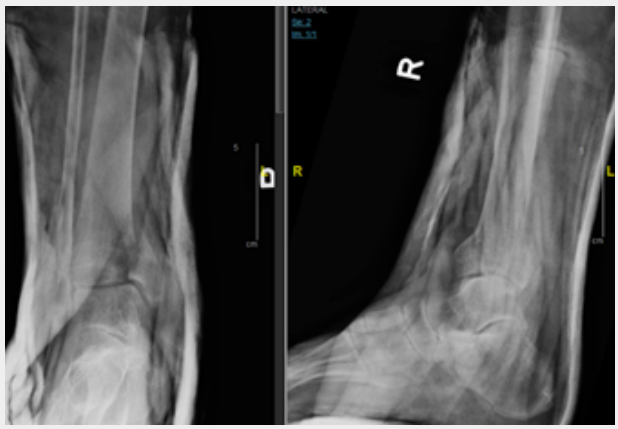

Figure 3: *Third reduction attempt of the fracture*

She was admitted with a plaster backslab applied to her lower leg. Radiographic analysis of her ankle joint suggests a Lauge-Hansen supination-adduction injury [1]. CT scan was performed which confirmed a large marginal impaction of the tibial plafond intraarticular surface. She was counselled for early surgery the following day which consisted of open reduction internal fixation of the fractures. The surgery was performed under general anaesthesia with the use of an image-identifier. The initial fixation of the Weber A fibular fracture went smoothly using a third tubular plate [2]. During the procedure, it was noticed that after the tibia metaphyseal comminution and depressed articular fragment were reduce using an osteotome, we were presented with a large bone defect (Figure 4).

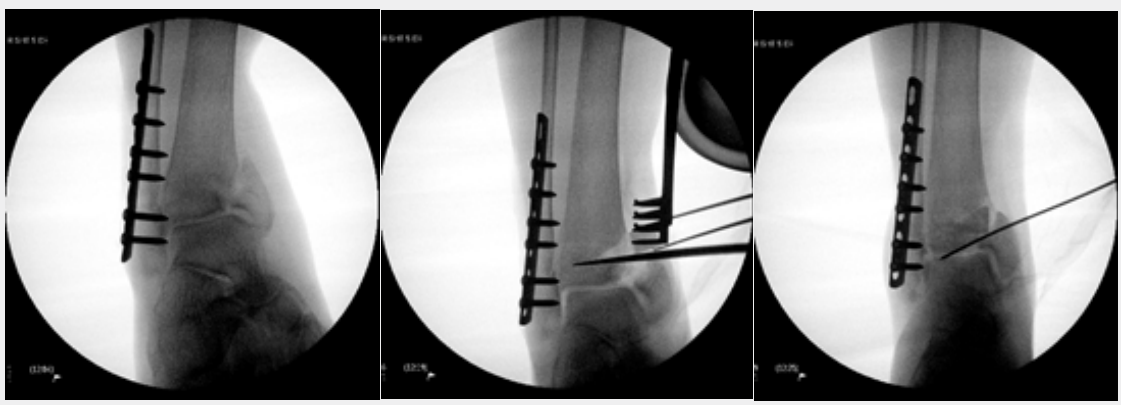

Figure 4: *Large bone defect presented after reduction of the tibia metaphyseal comminution and depressed articular fragment. 'Calcium phosphate' graft was used for filling the defect, with a k-wire for temporarily holding the reduction of the articular fragments.*

This was rectified by filling this defect with a piece of bone substitute 'calcium phosphate' graft (ChronOs^{R}). The reduction of the articular fragment was held with a temporary k-wire which was placed away from the anti-glide plate which was then applied to reduce and secure the medial malleolus fragment (Figure 5).

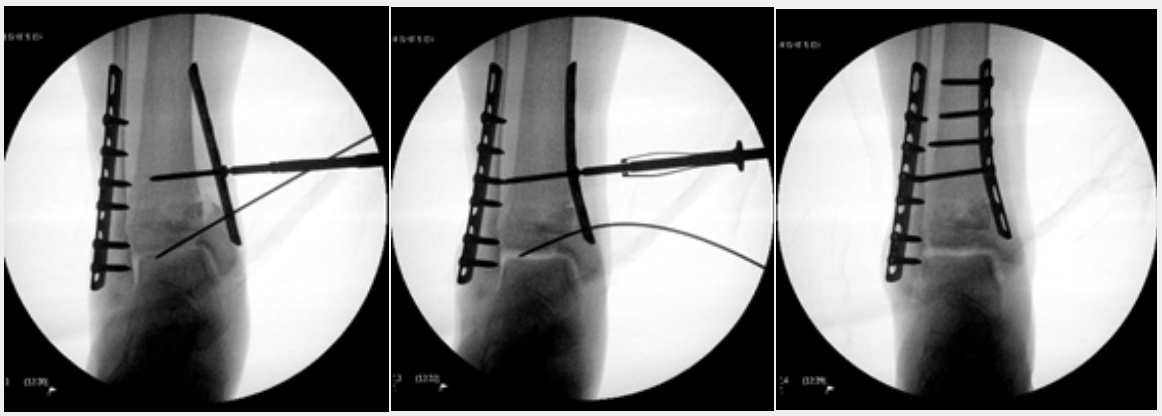

Figure 5: *Anti-glide plate applied to reduce and secure the medial malleolus fragment*

Following the restoration of the distal tibial plafond surface, the posterior malleolus which accounted for 25% of the articular surface was fixed using a 3.5mm partially threaded screw from an anterior approach. Soft tissue and skin closure were performed without any difficulties. Final radiographs taken 2 months post-surgery showed fully healed fractures (Figure 6).

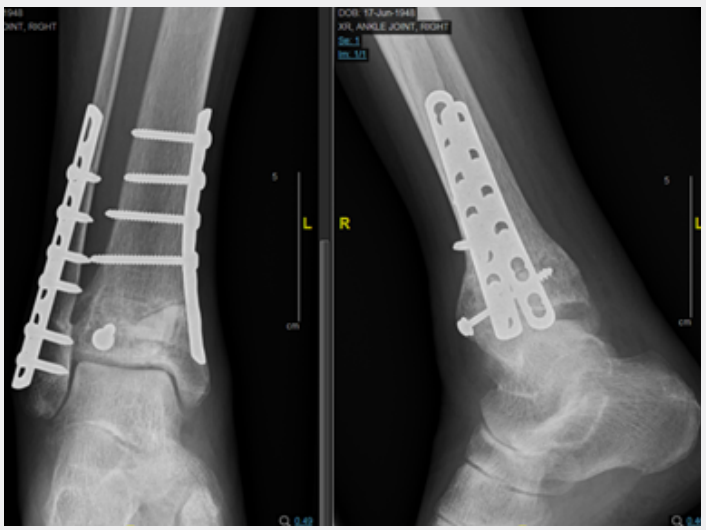

Figure 6: *2 months post-surgery with fully healed ankle joint*

Discussion

The surgery for fragility fragments are becoming more common. As the elderly ages and continue to mobilise independently, there will be instances of fractures from falls. Osteoporotic or fragility fractures are challenging as they are unforgiving in holding up metalwork and often lead to early failure in the fracture healing stage and rehabilitation. Careful allowance of weight-bearing of a patient and the maintaining muscle strength and mass need to be balanced carefully.

In our case, the challenges that we faced were the timing of surgery and the technical difficulties in reducing and holding the fracture fragments. With the presence of a dislocated or subluxed joint, the skin and soft tissues are compromised. Therefore reduction of such joints should be performed emergently and often with the aid of a spanning external fixator. In our case, the soft tissue condition allowed early open reduction and internal fixation but we must emphasise that keeping the ankle elevated with ice application over the ankle prevented further swelling to the ankle region preoperatively.

In this case, we would also like to place importance in the identification and classification of such fractures. The learning resident in orthopaedics should be able to classify such a fracture and thus would help in the planning and surgical fixation of this type of fracture pattern. The supination-adduction type injury required a deep understanding of the biomechanics of the medial fracture which is caused by a shearing force and thus requires the use of an anti-glide plate as the crucial technique and device to prevent the vertical fracture line from displacing. This would have happen if only screws are used as in most medial malleolar fracture fixations. The patient's fibula fracture was classified as Weber A according to Danis-Weber classification as the fibula fracture was below the level of tibial plafond. This system does not provide any definite guidance for treatment of medial injuries, options for fixation (except for the syndesmosis), or prognosis although it is a straightforward classification. In general, when the medial structures remain uninjured, it can be treated only with a short leg cast or ankle brace without operation, and early weight bearing is suggested. However since our patient was found to have trimalleolar fracture, the fragment size of the posterior malleolar fragment being larger than 25% of the width of the tibial plafond in the anterior to posterior direction requires fixation [3].

A recent study on CT findings showed that as high as 61% of SAD-II ankle fractures involved marginal impaction of the tibial plafond. They recommended a CT scan to rule out marginal impaction but is not necessary if the impaction is visible on plain radiographs as the scan report will not change the operative management planning [4].

In such a challenging case which requires fixation of an unstable fracture pattern, the dis-impaction of the marginal impaction fragments to form a congruous plafond is the first step. Bone graft may be needed to fill any defects, and then malleolar fragments are reduced and stabilized. The fibula can be fixed with three methods; tension band wire for very small fragments, lag screws combined with plating for medium sized fragments, or even a hook plate if large fragments are found. The medial malleolar vertical fracture should be always fixed with an anti-glide plate as in our example above.

In the Lauge-Hansen system, the classification carries two words for the 4 types mentioned. The first reflects the position of the ankle joint at the point of injury and the second word denoted the deforming force. In our case, the ankle was in a supinated position when an adduction force was applied to it at the point of the fall which resulted in the fracture pattern seen (Figure 1). Whereas the Danis-Weber system described one of three possible fractures of the lateral malleolus based on the position (level/height) of the fracture line in relation to the ankle syndesmosis [2].

Conclusion

In conclusion, we have presented an interesting yet challenging case which will help the young resident orthopaedic doctor understand, plan and hopefully make the surgical procedure and outcome successful for such cases in the future.

Bibliography

1. Lauge Hansen, N. (1948). Fractures of the ankle: analytic historic survey as basis of new experimental roentgenologic and clinical investigations. *Arch Surg., 56*(3), 259-317.

2. Weber, B. G. (1977). *The injury of the upper jump joint*. Berlin, Verlag Hans Huber.

3. Macko, V. W., Matthews, L. S., Zwirkoski, P. & Goldstein, S. A. (1991). The joint-contact area of the ankle: the contribution of the posterior malleolus. *J Bone Joint Surg Am., 73*(3), 347-351.

4. Alluri, R. K., Hill, J. R., Donohoe, S., Fleming, M., *et al.* (2017). Radiographic detection of marginal impaction in supination-adduction ankle fractures. *Foot Ankle Int., 38*(9), 1005-1010.