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Review

What's new in ankle fractures

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ABSTRACT

The diagnosis and treatment of ankle fractures has evolved considerably over the past two decades. Recent topics of interest have included indications for operative treatment of isolated lateral malleolus fractures, need for fixation of the posterior malleolus, utilization of the posterolateral approach, treatment of the syndesmosis, and the potential role of fibular nailing. In this update, we concisely review these topics and what to expect in the future literature.

Contents

Introduction

Ankle fractures are one of the most common reasons for visits to the Emergency Department [1,2]. With the mechanism of injury varying from a simple fall to high-energy motor vehicle accidents, ankle fractures present a wide spectrum of fracture patterns. While outcomes have been encouraging, they have not been perfect [1,3]. Some of the most recent research topics have addressed areas that may help to further improve outcomes. The purpose of this article is to provide a concise, comprehensive update on these frequently debated topics in the treatment of ankle fractures: 1) the indications for fixation of isolated fibula fractures; 2) the need for fixation of the posterior malleolus; 3) the role for the posterolateral approach; 4) treatment of the syndesmosis and 5) the potential role of fibular nailing.

Revisiting indications for surgery: who should be fixed?

The Lauge-Hansen Classification has proved valuable in not only providing information on the mechanism and general sequence of injury, but also guiding treatment [3–6]. The original study, performed with cadaveric specimens in a controlled, biomechanical testing laboratory, has been difficult to reproduce in the lab, but clinically has been shown to hold true [5,7]. Warner et al. prospectively assessed 300 ankle fracture classifications with pre-operative magnetic resonance imaging (MRI) [7]. When comparing these pre-operative MRI results with intra-operative classification findings, the authors found that 94% of the MRIs correctly correlated with the predicted Lauge-Hansen injury type; additionally, the MRI results agreed with Lauge-Hansen injury stage in 85% of the cases [7]. The authors concluded that the Lauge-

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Hansen Classification remains a reliable predictor of ligamentous injury [7].

However, controversy remains in determining indications for surgery. Koval et al. analyzed over 33,000 Medicare patients, and noted high variation in operative treatment across the United States, ranging from 14 to 72% depending on region [8]. Factors associated with physicians choosing operative intervention were male gender, younger age, fewer number of comorbidities, (including lack of diabetes or peripheral vascular disease) and treatment in a region without a designated teaching hospital. Interestingly, regions with a higher concentration of orthopaedic surgeons were not associated with a higher rate of surgery [8].

Certain fractures obviously meet operative criteria, such as fracture-dislocations and displaced trimalleolar and bimalleolar fractures. In contrast, controversy and treatment variability lies in the management of isolated lateral malleolus fractures. Some difficulty in indicating surgery for isolated lateral malleolus fractures lies in determining the stability of the medial ligamentous structures.

Traditional methods to assess the status of the medial ligaments involve dynamic stress views either by external rotation or gravity as well as evaluation of medial-sided symptoms [9–11]. However, there is no overall agreed upon amount of medial clear space widening or constellation of medial clinical findings that indicates the need for operative intervention [9,12]. Egol et al. observed that tenderness, swelling, and ecchymoses along the medial side were not sensitive enough to help predict medial clear space widening on stress radiographs [9]. Additionally, the authors found that all of their patients who were treated non-operatively for a positive stress radiograph without clinical symptoms of a medial-sided injury fared extremely well, having high American Orthopaedic Foot and Ankle Society (AOFAS) scores [9]. Assessment of medial clear space widening can also vary depending on the rotation of the foot (with ankle dorsiflexion-external rotation being most predictive of a deep deltoid injury after a distal fibula fracture) [10], making both the stress test and clinical exam truly insufficient in determining true ankle stability in isolated lateral malleolus fractures. Here, magnetic resonance imaging (MRI) may offer a better diagnostic modality to help determine the need for operative intervention [12]. Koval et al. prospectively followed 21 patients with isolated lateral malleolus fractures who had a positive external rotation stress test (defined as greater than 5 mm of medial clear space widening including gross subluxation and evidence of syndesmotic injury) [12]. These 21 patients had an ankle MRI to evaluate the status of the deltoid and guide treatment. Of these 21 patients, only 2 had a complete deep deltoid tear, and the authors' analysis indicated that there was no correlation between a deep deltoid tear and the amount of medial joint space widening [12]. Nineteen of the 21 patients only had a superficial deltoid tear as seen on MRI and were treated non-operatively. None of these patients had any adverse sequelae, clinically or radiographically, at 1-year follow-up. Additionally, there was no significant correlation between the medial clear space measurement at the time of injury and any of the clinical outcomes at follow-up [12]. Although the study was underpowered, the authors' assessment with advanced imaging offered a closer look at the true underlying pathology, which may be treated without surgery, despite positive stress test findings. Further analysis by Slobogean et al. in 2012 supported nonoperative treatment of isolated lateral malleolus fractures. Following a multicenter randomized controlled trial comparing operative versus nonoperative management of stress-positive isolated lateral malleolus fractures, the authors noted that operative treatment of these fractures was not cost-effective at one-year [13]. However, operative fixation of isolated stress-positive lateral malleolus fractures was determined cost-effective if it decreased the lifetime incidence of post-traumatic ankle arthritis [13]. With more larger studies and further analysis with MRI, we may arrive at a more definitive conclusion that we are probably operating on too many isolated lateral malleolus fractures.

Need to stabilize the posterior malleolus

The posterior malleolus has recently been garnering more attention with a renewed interest in fixation via the posterolateral approach. Recent studies have reported up to a 44% incidence of posterior malleolus fractures in all ankle fractures with incredibly variable fracture patterns and sizes, including small avulsions and large displaced fragments [14]. Furthermore, the importance of the posterior malleolus and its intimate association with the syndesmosis as well as its role as a static stabilizer in posterior translation of the talus has increased interest in obtaining anatomic reduction when possible, and therefore not necessitating the need for syndesmotic fixation [14,15]. Miller et al. prospectively compared 31 patients who either received posterior malleolar fixation, syndesmotic screw stabilization, or both [15]. They reported that there was no difference in clinical outcomes between the two methods of fixation with regards to syndesmotic stability [15].

Recent studies have highlighted the difficulty in determining the size and morphology of the posterior malleolus. Lateral radiographs alone are unreliable and have low interobserver reliability (Fig. 1a-c) [16–18]. Bartonicek et al. evaluated the posterior malleolus on plain radiographs in 137 ankle fractures and determined that x-rays alone were insufficient to evaluate the size of the morphology of the posterior malleolus fragment, thus making it difficult to determine if operative fixation of this fracture were necessary [16]. Buchler et al. reported that only the presence and extent of the posterior malleolar fracture were reliable, but radiographs alone were inadequate in assessing fracture comminution or impaction; the authors here recommended mandatory preoperative computed tomography (CT) for all trimalleolar fractures [17]. Several studies support the use of CT in order to assess the true size, shape and displacement of the posterior malleolus as well as the fracture's relationship with the fibular notch and tibiotalar joint (Fig. 2) [16–18].

Better characterization of the size and morphology of the posterior malleolus may not help to determine the need for fixation. Evers et al. retrospectively reviewed 42 patients who had sustained a trimalleolar fracture to determine whether the size of the posterior malleolar fragment was an indication for its fixation [18]. The authors concluded that not only was computed tomography crucial in determining the size of the posterior malleolus, but that the size of that fragment was important in determining treatment. The authors reported the best overall outcome of fixation of posterior malleolus fractures in fractures which had articular surface involvement greater than 25% [18]. Other studies have reported conflicting outcomes. Biomechanical studies have demonstrated that the surrounding ligamentous structures play a larger role than the size of the posterior malleolar fragment in anterior-posterior ankle stability [19,20]. Raasch et al. showed no significant increase in posterior talar translation with osteotomies of less than or equal to 40% of the posterolateral tibia with an intact AITFL [19]. Harper et al. additionally demonstrated no increased posterior talar translation with posterior malleolar fractures encompassing less than or equal to 50% of the articular surface with intact medial and lateral ligaments [20]. In a systematic review of the literature of 68 studies including 886 fractures, Veltman et al. observed that while the general consensus is that posterior malleolar fractures comprising over 25% of the articular surface and having greater than 2 mm of displacement should undergo operative fixation, there is evidence to either