Clinical Commentary

Fractures of the tibial malleoli

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Summary

Fractures of the tibial malleoli are relatively uncommon injuries, and most frequently affect the lateral malleolus. They most commonly occur following falls. The tibial malleoli have extensive collateral ligament attachments, and this is likely to contribute to fracture pathogenesis. Although most fractures are best managed by surgical removal, large fractures should be repaired as removal may result in tarsal instability. Arthroscopic removal has recently become the standard of care for most fractures, and good results can be expected following surgery.

Introduction

The distal extremity of the tibia is quadrangular in form and larger medially than laterally. It presents an articular surface that is adapted to the trochlea of the talus and consists of 2 grooves separated by a ridge. These and the corresponding trochlear ridges of the talus are directed obliquely forward and laterally, and are bound on either side by the tibial malleoli. The lateral malleolus develops from a separate centre of ossification (the distal end of the fibula) to the rest of the distal extremity, and fuses to the tibia during the first year of life (Getty 1975). The medial malleolus is more prominent than the lateral, but the latter is broader, with a vertical groove for passage of the lateral digital extensor tendon. The tibial malleoli have extensive collateral ligament attachments from both the long and short components, and their anatomy has been previously described in detail (Updike 1984). Superficial to the long lateral collateral ligament, and sitting in a groove in its surface, a fascial tunnel houses the lateral digital extensor tendon and its synovial sheath. The long lateral collateral ligament has distal attachments to the talus, calcaneous, fourth tarsal bone, and third and fourth metatarsal bones. There are 2 short lateral collateral ligaments, which lie axial to the long lateral collateral ligament, and are named according to their respective insertions (the pars tibiotalaris and pars tibiocalcanea). The pars tibiotalaris can be further divided into superficial and deep components. The long medial collateral ligament has distal attachments to the fused first and second tarsal bones, talus, central and third tarsal bones, and the second and third metatarsal bones. There are 3 short medial collateral ligaments which, like their lateral counterparts, lie axial to the long medial collateral ligament, and are named according to their respective insertions (the pars tibiotalaris superficialis, pars tibiocalcanea, and pars tibiotalaris profundus; Updike 1984). Together, the medial and lateral collateral ligaments confer axial stability to the hock throughout its range of flexion and extension.

Fractures of the tibial malleoli are relatively uncommon injuries. The lateral malleolus is more commonly fractured than the medial malleolus. In total, there have been 44 cases reported in refereed English literature (Jakovljevic et al. 1982; Wright 1992; O’Neill and Bladon 2010; Smith and Wright 2011), and a further 6 in a textbook (Nixon 1996). Site of fracture was reported in 44 cases; 42 had fractures of the lateral malleolus (one bilaterally), one the medial malleolus, and one both the medial and the lateral malleolus (Jakovljevic et al. 1982; O’Neill and Bladon 2010; Smith and Wright 2011). The case reported by Getman et al. (2012) adds a further horse, and is only the second reported with biaxial fractures. Unique to this case, computed tomographic imaging was performed preoperatively, and both medial and lateral fractures were repaired.

Aetiology

Reported causes of tibial malleolar fractures include falls, becoming cast in a stable, and kick injuries. A fall is the most common history, particularly in Thoroughbred horses racing over jumps (Jakovljevic et al. 1982; O’Neill and Bladon 2010; Smith and Wright 2011). It is likely that fractures occur as a result of complex forces including axial loading and medial or lateral stress, but this has not been demonstrated experimentally.
In the horse, lateral malleolar fractures are often smaller than their medial counterparts (Nixon 1996), and are frequently both displaced and comminuted (O’Neill and Bladon 2010; Smith and Wright 2011). Forces applied by collateral ligament attachments to the fracture fragment(s) probably contribute to displacement, and most commonly fragments both rotate and displace distally (Fig 1). Soft tissue attachments invariably include the short lateral collateral ligaments, but the long lateral collateral ligaments are infrequently involved (Smith and Wright 2011). Due to, in the majority of cases, remaining intact (long) lateral collateral ligament attachments, demonstrable instability of the tarsus is rarely encountered, and for such fractures, fragment removal is indicated. Larger fractures of either the lateral or medial malleolus disarm the majority of the respective collateral ligaments, with a greater chance of creating instability. As a consequence, fracture repair is favoured over removal.

**Diagnosis**

The diagnosis of malleolar fractures is usually straightforward. There are obvious localising clinical signs in the acute phase (e.g. tarsocrural joint distension, soft tissue swelling), and confirmation is readily obtained radiographically, whilst other imaging modalities can provide additional information. Ultrasonographic examination was performed in the currently reported case, identifying both short and long lateral collateral ligament disruption (Getman et al. 2012). Ultrasonography has been demonstrated to provide accurate assessment of collateral ligament involvement in cases with fractures of the lateral malleolus of the tibia (Smith and Wright 2011), and prediction of extensive (long) lateral collateral ligament disruption is important for planning case management (e.g., necessity for cast coaptation and the assessment of risk for general anaesthesia). Additional information important to surgical management and prognosis can also be obtained – for example, concurrent capsular disruption is common and ultrasonography has reasonable accuracy for preoperative prediction (W.J.H. Barker, unpublished data). Computed tomography was employed by Getman et al. (2012), to both provide further information on fracture configuration, and also aid surgical planning. This 3D imaging modality has great potential to aid surgical decision making and guide implant placement (Richardson 2011), and no doubt will come into more common usage as experience grows.

**Surgical management and prognosis**

Wright (1992) reported the first case series of fractures of the lateral malleolus of the tibia, managed surgically by fragment removal. An open approach and arthrotomy was employed in all cases. More recently, arthroscopic techniques for fragment removal of the same have been described and results and observations reported in 2 separate case series in the UK (O’Neill and Bladon 2010; Smith and Wright 2011). The technique is both a safe and repeatable means for assessment and treatment of fractures of the lateral malleolus of the tibia and described.

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documents a favourable success rate, with a combined total of 31/36 reported horses having successful outcomes (O’Neill and Bladon 2010; Smith and Wright 2011). Arthroscopy enables a comprehensive evaluation of the tarsocrural joint prior to fragment removal – in the report by Smith and Wright (2011), scattered pieces of osteochondral debris were commonly identified (in over twice as many cases as predicted by preoperative radiography), and could be removed using arthroscopic techniques. In addition, arthroscopic examination enabled identification and appropriate management of additional capsular pathology. Arthroscopic removal of fractured tibial malleoli is efficient but technically demanding, requiring careful dissection of the fragment from the soft tissue attachments (Smith and Wright 2011). O’Neill and Bladon (2010) used a less refined technique, reducing the size of the fragment with a mechanical burr prior to removal piecemeal. Although success rates were similar, there is potential for creation of scattered osteochondral debris by burring, and the current author favours sharp dissection. With experience, surgical time can be reduced using arthroscopy compared to arthrotomy. Arthroscopy also causes less patient morbidity, is associated with shorter periods of perioperative antimicrobials and hospitalisation, and the overall costs of treatment are less (Smith and Wright 2011). In the case reported by Getman et al. (2012), arthroscopy was sensibly recommended, but declined due to financial constraints. In addition to precluding the above-mentioned advantages, intra-articular fragmentation was left in situ, potentially having an adverse effect on case outcome by contributing to development of degenerative joint disease.

Fractures of the tibial malleoli are almost always articular, and successful repair therefore requires accurate anatomic reconstruction. The chosen method of internal fixation should enable stabilisation of the fracture, and counteract the distracting forces applied by the collateral ligaments. Placement of one or 2 AO/ASIF cortex screws in lag fashion is the most commonly employed technique, and has resulted in good success in a limited number of cases (Nixon 1996; M.R.W. Smith and I. Wright, unpublished data). Providing the fragment is large enough, 2 screws are preferable to provide additional rotational stability (Fig 2). The adjunctive use of a tension band wire for transverse fractures may provide additional stability, providing the opposing (axial) subchondral bone plate can be reconstructed and is able to withstand compression. The tension band converts tensile forces acting on the lateral cortex into compressive forces. However, to date failure of fixation when using screw repair in lag fashion alone has not been reported in the horse, and the benefit of additional tension band wiring is therefore unclear.

Recovery from general anaesthesia in a cast is a sensible precaution when there is any degree of joint instability (following removal of large fractures), and also following internal fixation, to protect the repair. External coaptation may be maintained post operatively whilst healing commences, and necessity and duration should be determined on an individual case basis. In the case reported by Getman et al. (2012), a bandage cast was applied from just distal to the stifle, to the metatarsophalangeal joint. The purpose of the cast is predominantly to provide mediolateral stability, and a full limb cast therefore is unnecessary. Short hock casts,
extending from the distal third of the gaskin to the proximal third of the metatarsus (Fig 3), also have been used successfully in cases with malleolar fractures and collateral ligament injury (Smith and Wright 2011). Although significant complication related to their use has not been encountered by the author, concerns have been raised regarding ending of the cast close to the diaphysis of the third metatarsal bone, and as such short hock casts have not received universal acceptance to date.

Summary

The case reported by Getman et al. (2012) provides an interesting addition to the current literature. There remains limited experience in managing biaxial tibial malleolar fractures, and further cases are necessary to be able to define guidelines for treatment, and expected outcomes. Until this is achieved, much of the current knowledge will remain based on observations from management of uniaxial fractures, and the comments made in this article should hopefully provide some useful information.

Author’s declaration of interests

No conflicts of interest have been declared.

References


