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Case Report

Surgical repair of fractures of the lateral and medial tibial malleoli in a yearling Arabian filly

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Summary

A yearling Arabian filly presented with a history of acute hindlimb lameness, marked tarsocrural effusion and associated soft tissue swelling and was diagnosed with fractures of both the lateral and medial malleoli of the distal aspect of the tibia. The fractures were repaired using a combination of cortical bone screws placed in lag fashion and a tension band wire. A full limb cast bandage was placed for recovery from general anaesthesia and the early post operative period. Despite radiographic development of osteoarthritis, 21 months after surgery the filly was clinically sound and racing successfully.

Introduction

Fractures of the lateral or medial malleoli of the distal aspect of the tibia occur infrequently but are the most commonly reported types of fractures involving the tarsocrural (TC) joint (Jakovljevic *et al*. 1982). They are acute, traumatic injuries that are usually the result of a fall or a kick; subsequently horses typically manifest severe lameness, marked TC effusion and soft tissue swelling of the affected side (Jakovljevic *et al*. 1982; Wright 1992; O'Neill and Bladon 2010; Smith and Wright 2011). Lateral malleolar fractures are more common than medial malleolar fractures and both structures are embedded within the substantial origins of the respective collateral ligaments (Jakovljevic *et al*. 1982; O'Neill and Bladon 2010; Smith and Wright 2011). Therefore, damage to these ligaments as a result of the trauma that caused the fracture can also occur. Each collateral ligament has 4 components - 3 short collateral ligaments and one long collateral ligament largely responsible for the stability of the TC joint (Updike 1984; Dyce *et al*. 2002).

Treatment of horses with lateral malleolar fractures has been described in several reports and options include stall rest alone, fracture fragment removal via arthrotomy or arthroscopy and fracture fixation with bone screws (Jakovljevic *et al*. 1982; Foerner 1992; Wright 1992; Auer 2006; Smith and Wright 2011). Regardless of the treatment elected, overall horses with these fractures have a good to excellent prognosis for resuming athletic activity at their previous level of performance (Jakovljevic *et al*. 1982; Wright 1992; Auer 2006; Smith and Wright 2011). Currently, the treatment of choice for horses with fractures of the lateral malleolus is removal of smaller fragments either by arthrotomy or arthroscopy and lag screw fixation of larger fragments (Auer 2006; Smith and Wright 2011). There are few reports on the management and outcome of horses with medial malleolar fractures but, in general, the same guidelines would seem to apply.

To the authors' knowledge, surgical repair of concurrent fractures of both the medial and lateral malleolus of the tibia has not previously been reported. Therefore, the purpose of this report is to describe the treatment and outcome of a yearling Arabian filly with this combination of injuries.

Case details

History

A 382 kg yearling Arabian filly was admitted to the George D. Widener Hospital for Large Animals for evaluation of left hindlimb lameness and tarsal region swelling. The filly was found in the field 5 days earlier nonweightbearing lame on that limb with marked soft tissue swelling of the tarsal region. The filly was managed using stall rest, phenylbutazone and bandaging with slight improvement but was still markedly lame at a walk at the time of examination.

Clinical findings

On admission the filly was toe-touching lame at a walk. There was moderate effusion of the TC joint and moderate soft tissue swelling extending from mid-tibia to the

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metatarsophalangeal joint. Radiographs (dorsoplantar, dorsal 45° lateral-plantaromedial oblique, dorsal 45° medial-plantarolateral oblique and lateromedial views) of the tarsus revealed a displaced fracture of the lateral malleolus of the tibia, a nondisplaced fracture of the medial malleolus of the tibia, a small defect in the lateral trochlear ridge of the talus, and a small intra-articular bony fragment distal to the medial malleolus (**Fig 1**). An ultrasonographic examination of the tarsus was performed due to concerns about the integrity of the collateral ligaments of the TC joint and revealed disruption of the short lateral collateral ligaments and desmitis of the long lateral collateral ligament at its origin. The medial collateral ligaments appeared normal.

Surgical management

The filly was placed in a full-limb Robert Jones bandage and treated with phenylbutazone (Phenylbute injection 20%, 2.2 mg/kg bwt i.v. b.i.d.)[1]. The filly was taken to surgery on the second day of hospitalisation; penicillin G potassium (Pfizerpen, 22,000 iu/kg bwt i.v. q.i.d.)[2] and gentamicin sulphate (Legacy Gentamicin, 8.8 mg/kg bwt i.v. s.i.d.)[3] was administered and the filly was placed under general anaesthesia in right lateral recumbency. Computed tomography (CT) was performed using an 8 slice mobile CT scanner (EQUS I)[4] preoperatively in order to better evaluate the fracture configuration, assess any damage not visible radiographically and identify the optimal location for placement of bone screws (**Fig 2**). Skin staples were used as radiopaque markers to identify locations for screw insertion and the tarsus was then prepared aseptically and draped. A ~6 cm curvilinear incision was made over the lateral malleolus just cranial to the fracture line. Subcutaneous tissues and deep fascia were incised to the level of the fracture fragment. The fracture line was debrided and the fracture was then reduced and held in place by bone reduction forceps with points[5]. Using fluoroscopic guidance, a 4.5 × 56 mm long cortex bone screw was placed in lag fashion across the fracture line in a distolateral-to-proximomedial direction. A 1.25 mm stainless steel wire was then placed in a figure-of-8 configuration through 2 mm drill holes. One drill hole was through the fracture fragment in a cranial-to-caudal direction and the other was drilled in the lateral aspect of the tibia proximal to the fracture line in a craniomedial-to-caudolateral direction. The surgical table was elevated (i.e. the filly remained in right lateral recumbency) and the medial malleolar fracture then repaired using a 1 cm incision through the skin to periosteum of the medial malleolus at a site predetermined by CT examination. Under fluoroscopic guidance a 4.5 × 48 mm long cortex bone screw was placed in lag fashion across the fracture line in a distomedial-to-proximolateral direction. The lateral incision was closed in 3 layers: the deep fascial layer was closed with No. 0 polyglactin 910 (Vicryl)[6] with a combination of simple interrupted and cruciate sutures, the subcutaneous tissue was closed with 2-0 polyglactin 910 in a simple continuous pattern and the skin apposed with 2-0 poliglecaprone (Monocryl)[6] in a simple continuous pattern. The skin of the medial stab incision was apposed with 2-0 poliglecaprone in a simple interrupted pattern. The TC joint was injected with 500 mg amikacin (Amiglyde-V)[7]. A pneumatic tourniquet was placed mid-crus and maintained for 20 min; i.v. regional limb perfusion was performed using 2.5 g amikacin diluted to a total volume of 60 ml with 0.9% saline and infused over 5 min through the saphenous vein via a 25 gauge butterfly catheter[8]. A full-limb Robert Jones bandage was applied to the limb and then 5 rolls of 5 inch casting tape (Vetcast Plus Veterinary Casting Tape)[9] placed around the bandage from just distal to the stifle to the fetlock, leaving the pastern and foot exposed. The casting material was allowed to harden and the filly was placed in a recovery stall on a padded mat and assisted to recover from general anaesthesia with head and tail ropes.

Post operative progress

After surgery the filly was immediately fully weightbearing; post operative radiographs documented adequate reduction and fixation of both fractures (**Fig 3**). The filly remained comfortable on a decreased amount of phenylbutazone (Phenylbute paste, 1.1 mg/kg bwt *per os* s.i.d.)[10] for the duration of hospitalisation. The cast bandage was removed at 5 days after surgery; at that time the incisions were healing well with no discharge and minimal tarsal swelling was present. The filly was placed in a Robert Jones bandage and the bivalved cast material was reapplied over the bandage. She was discharged the following day with instructions to continue phenylbutazone therapy for 5 days and change the cast bandage once weekly for 2 weeks. Thereafter, the filly was to be kept in a full limb bandage for an additional 2 weeks and to be maintained on strict stall rest until re-examination at 2 months.

The filly did well at home and did not experience any complications. Two months after surgery the filly was examined by the referring veterinarian and found to be sound at a walk with moderate soft tissue swelling of the tarsus. Radiographic examination at that time revealed progressive healing of both fractures, periarticular periosteal proliferation at the joint capsule attachments both proximally and distally and marginal enthesiophytes (**Fig 4**). The owners were instructed to begin hand walking the filly for short increments daily. Four months after surgery the filly was again examined by the referring veterinarian and found to be sound at a walk but was *grade 2* out of *5* lame at a trot in the affected limb. Continued hand walking, limited turnout and physical therapy (including passive flexion of the hock and daily

Fig 1: Digital radiographic images of the left tarsus showing a displaced fracture of the lateral malleolus of the tibia (large arrow), a nondisplaced fracture of the medial malleolus of the tibia (*), a bony defect in the lateral trochlear ridge of the talus (▶) and intra-articular bony fragment distal to the medial malleolus (small arrow). Lateromedial (a), dorsal 45° medial-plantarolateral oblique (b), dorsoplantar (c) and dorsal 45° lateral-plantaromedial oblique (d) images.

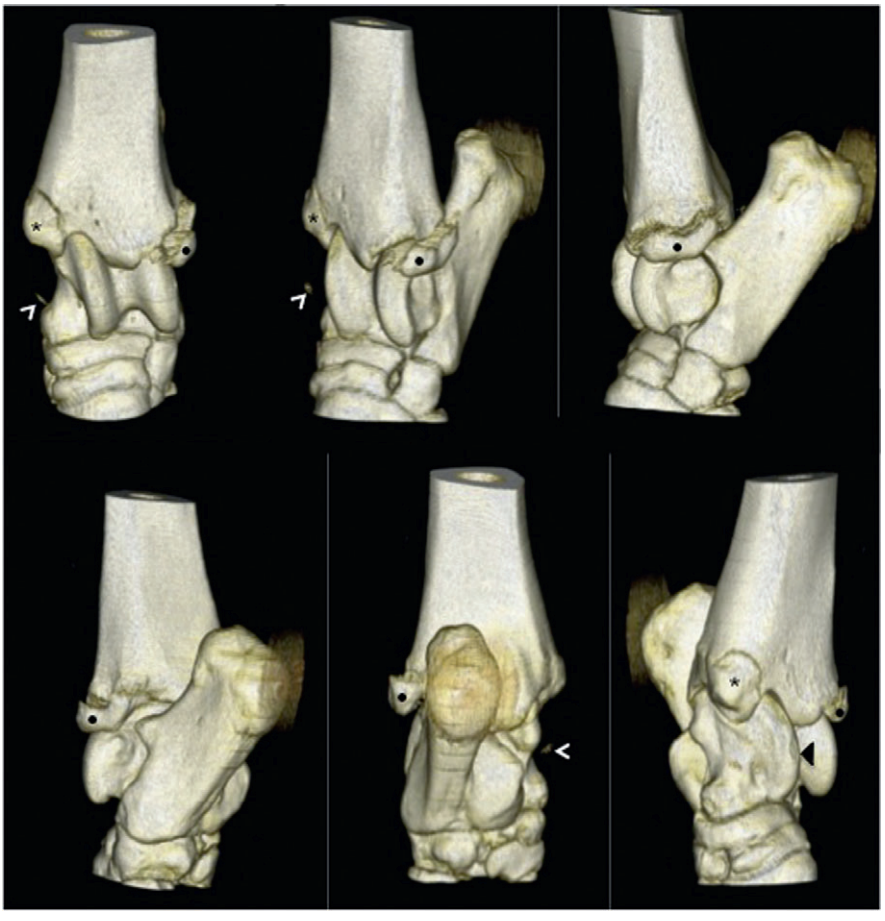

Fig 2: Computed tomographic images (3D reconstruction views) of the left tarsus illustrating the lateral (●) and medial (*) malleolar fractures, defect in the lateral trochlear ridge of the talus (◀) and small intra-articular fragment (<).

topical application of 1% diclofenac sodium [Surpass][11] to the tarsus) was recommended. Twenty-one months after surgery the filly was in active race training and sound according to her trainer. She had made 3 starts, finishing second in 2 starts and winning a stakes race in the most recent start.

Discussion

It has been theorised that these malleolar fractures occur with the foot in a fixed position while tibia or tarsus experiences an external rotational force (O'Neill and Bladon 2010). This would also seem to be a valid aetiology for the fractures for this Arabian filly but we hypothesise that the filly must have experienced an exceptionally large torsional force in order to fracture both malleoli. Such a force would potentially cause more soft tissue damage to the tarsus than typically seen with singular fractures, evidenced in this case by injuries to the short and long lateral collateral ligaments, displacement of the large lateral fracture fragment and presence of small avulsion fracture fragments.

Horses with fractures of either the medial or lateral malleolus are reported to have a good prognosis for athletic function with surgical management (Jakovljevic *et al*. 1982; Wright 1992; O'Neill and Bladon 2010; Smith and Wright 2011), which includes surgical removal via arthrotomy or arthroscopy for small lateral malleolar fragments or fracture repair with bone screws for larger medial or lateral malleolar fragments (Auer 2006). However, the optimal treatment or prognosis for a horse with a combination of these injuries is unknown. In horses with fractures of one malleolus there is often some degree of damage to the associated collateral ligaments (Wright 1992; Auer 2006; Smith and Wright 2011). Generally, this does not affect the horse's outcome if the damage is mild because the other collateral ligaments maintain stability of the tarsus. It has been suggested that the outcome of horses with malleolar fractures depends on the ability to maintain the integrity of the long medial collateral ligament (McIlwraith *et al*. 2005). Collateral ligament damage and the displaced nature of the large lateral fragment prompted us to augment simple screw fixation with a tension band wire. Whether the fracture would have healed maintaining parity in outcome without using this technique is unknown but a combination of screws placed in lag fashion and tension band wiring was useful in maintaining stability of the tarsus and the fixation.

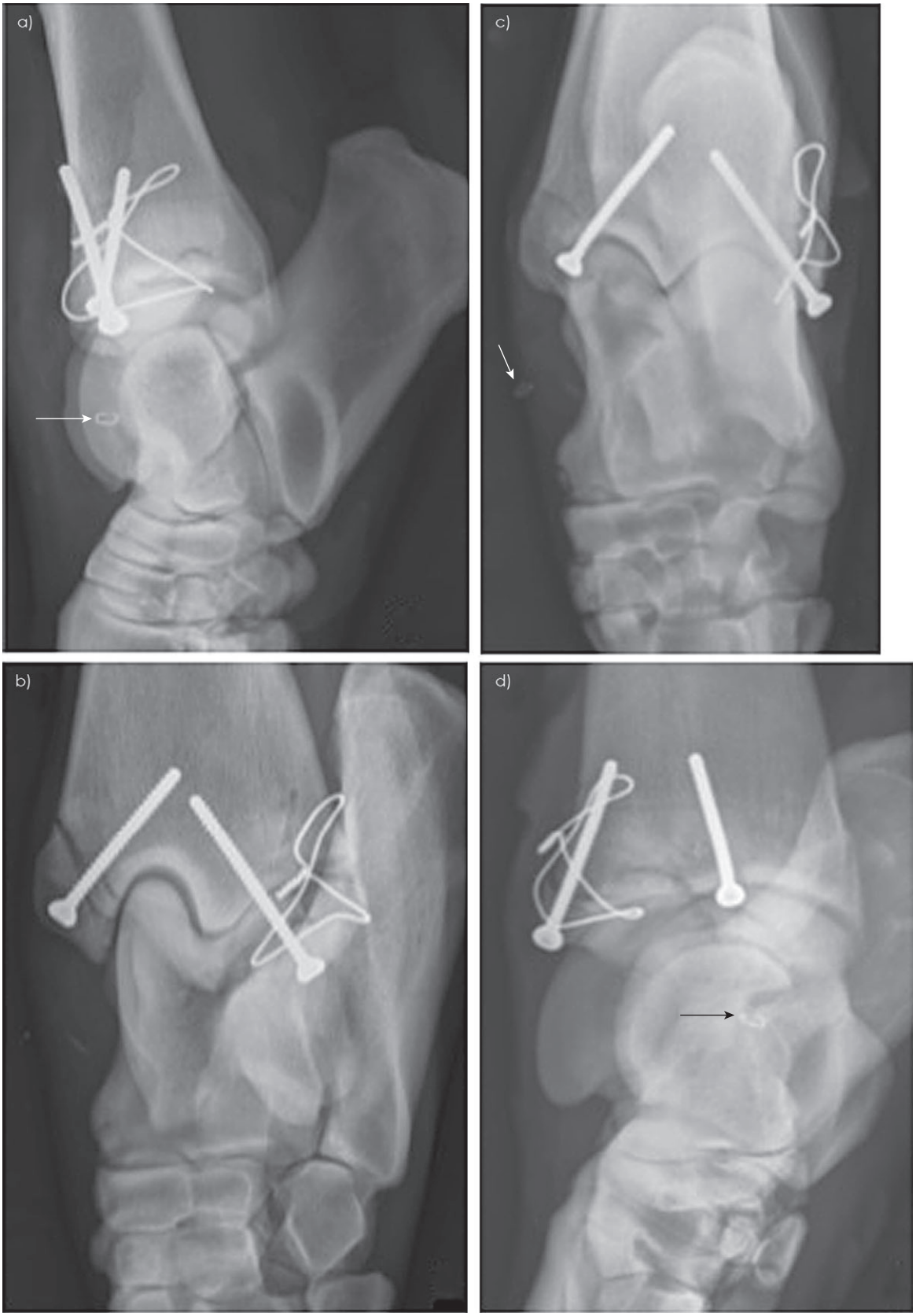

Fig 3: Post operative digital radiographic images of the left tarsus. Lateromedial (a), dorsal 45° medial-plantarolateral oblique (b), dorsoplantar (c) and dorsal 45° lateral-plantaromedial oblique (d) images. The staple seen in the skin (arrow) was used as a surgical guide for screw insertion and was subsequently removed.

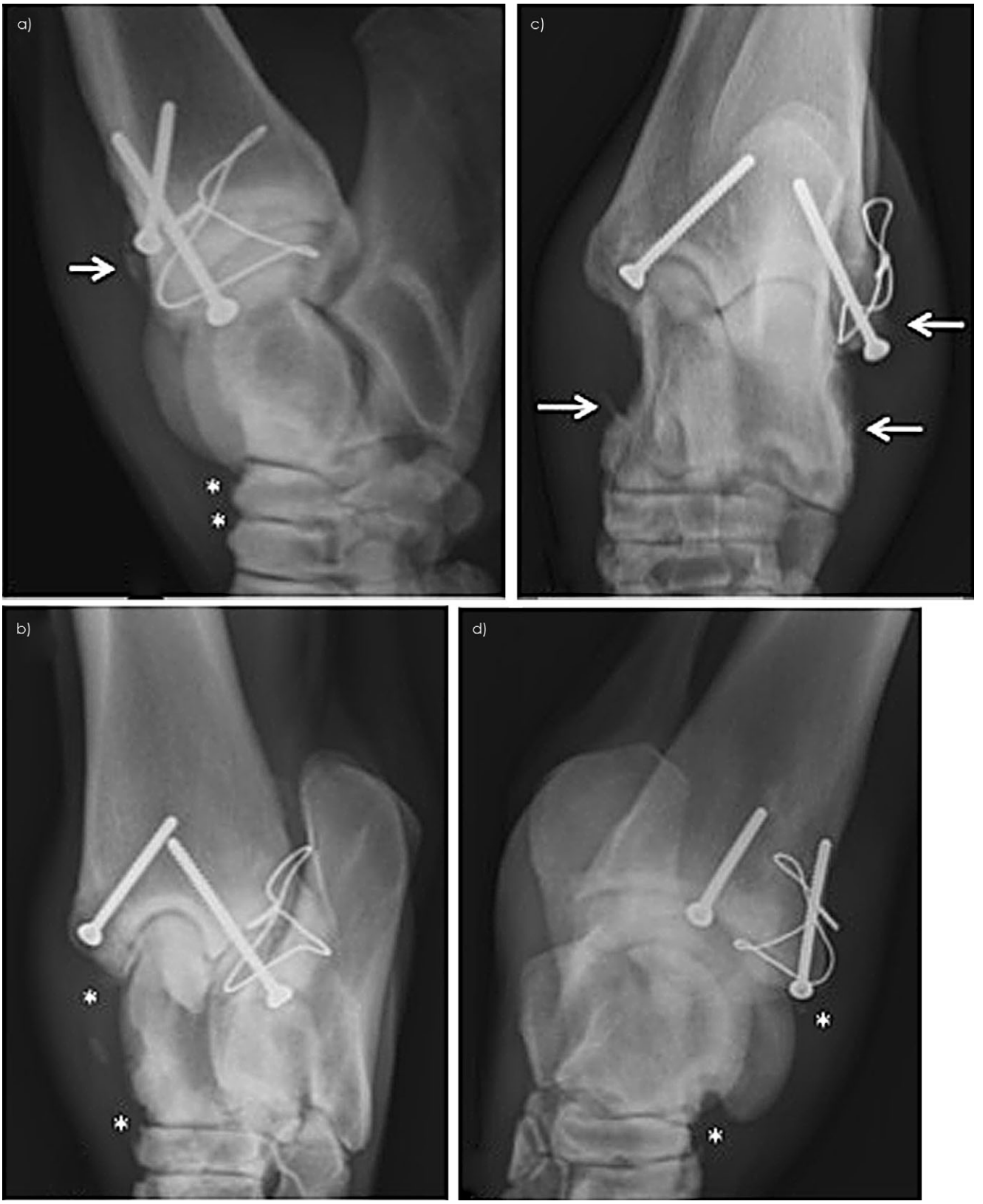

Fig 4: Digital radiographic images of the left tarsus taken 2 months after surgery showing progressive healing of both fractures, evidence of periosteal proliferative changes at the joint capsule attachments both proximally and distally (arrows) and marginal enthesiophytes (*). Lateromedial (a), dorsal 45° medial-plantarolateral oblique (b), dorsoplantar (c) and dorsal 45° lateral-plantaromedial oblique (d) images.

Some authors indicate that the prognosis for horses with malleolar fractures may be inversely related to the degree of comminution of the fracture fragment (Foerner 1992). Arthroscopic evaluation of the TC joint and intra-articular fragment removal was recommended in this case but declined due to financial restrictions. Since arthroscopy was not performed the degree of articular cartilage damage was not assessed and small loose fragments were not removed. The contribution of these fragments to the subsequent development of radiographic evidence of osteoarthritis is unknown. The development of radiographic changes consistent with osteoarthritis of the TC joint has also been reported after injury to the short and long medial collateral ligaments (Rose and Moore 2003) and those injuries could have also been contributing factors. The positive outcome in this case despite the radiographic changes could be due to the fact that most of the proliferative changes are periarticular and primarily associated with damage to soft tissue structures, with less damage to the joint surface itself. In one report, 85% of horses with septic arthritis of the TC joint that subsequently developed radiographic evidence of osteoarthritis after treatment were still able to return to athletic function, suggesting that radiographic changes in this joint after infection or trauma may not directly correlate with the horse's clinical outcome (Ross *et al*. 1991).

Because of possible tarsal instability, the filly in this report was placed in a cast bandage and assisted to recover from general anaesthesia. Generally horses with singular fractures without substantial collateral ligament damage do not require any special precautions be taken for recovery from general anaesthesia. However, in any horse where a repair has been performed or when there is substantial damage to any portion of the collateral ligaments, it is recommended that the horse be placed in a full-limb cast for recovery (Auer 2006). The authors chose to use a cast bandage in this case due to previous positive experiences with its use on horses with wounds to or injuries of the tarsal area. Other alternative precautionary measures such as pool, pool-raft or sling recovery systems could also be considered if available. The filly in this report was deemed too small to fit into the pool-raft recovery system available at our hospital.

Authors' declaration of interests

No conflicts of interest have been declared.

Manufacturers' addresses

[1]Sparkhawk Laboratories, Inc., Lenexa, Kansas, USA.
[2]Pfizer, Inc., New York, USA.
[3]Valley Vet Supply, Marysville, Kansas, USA.
[4]Universal Medical Systems Inc., Solon, Ohio, USA.
[5]Synthes Vet, West Chester, Pennsylvania, USA.
[6]Ethicon, Inc., Somerville, New Jersey, USA.
[7]Fort Dodge Animal Health, Overland Park, Kansas, USA.
[8]Terumo Medical Company, Elkton, Maryland, USA.
[9]3M, St Paul, Minnesota, USA.
[10]Schering-Plough Animal Health Corp., Union, New Jersey, USA.
[11]Boehringer Ingelheim, Ridgefield, Connecticut, USA.

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