MANAGEMENT OF FRACTURES OF THE FOREARM AND DIGIT IN THE FOAL

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Key points
- Fracture repair in the foal is generally more rewarding than that of the adult due to reduced size, generally less associated soft tissue trauma and quicker healing.
- Patient behavior and associated comorbidities represented challenges in foal fracture repair.
- The purpose of this talk is to describe the commonly seen fractures of the digit and forearm in the foal and discuss the treatments and expected outcomes.

General Considerations
Unlike adult horse laminitis from overweight bearing is not typically a problem in foals. Angular deformity and fetlock hyperextension of the support limb and flexural deformity of the injured limb however are common complications of poor weight bearing due to failure to properly manage the fractured limb. Alternatively flexor laxity of the affected limb due to excessive coaptation can be equally challenging to deal with. Additional issues which occur with higher frequency in foals are disorders of the respiratory and gastrointestinal systems as well as incisional problems secondary to recumbency. When dealing with foal fractures early return to full weight bearing avoidance of excessive coaptation and careful monitoring of other body systems are keys to success.

Fractures of the Digit
The most common fracture of the digit in foals are solar margin fractures of the third phalanx. These are most commonly seen in the summer months and are associated with hard pastures and can be predisposed by poor foot balance. The clinical signs are mild to moderate lameness with increased digital pulse and heat. They are often misdiagnosed as foot abscesses or coffin joint sepsis. Diagnosis is by physical examination, digital anesthesia and radiography. No specific therapy is needed the foal are usually confined until sound and then gradually allow increasing amounts of exercise. Complete return to soundness and radiographic healing is expected. Obviously the other types of coffin bone fractures are possible in foals. It is unusual not to be able to treat these fractures with rest, controlled exercise and occasionally therapeutic shoeing for articular fractures

Salter Harris I or II fractures of the first or second phalanx can occur they may lead to severe deformities such that joint luxation is often suspected. These injuries are usually closed and do not tend to cause additional associated soft tissue injuries. Management of these fractures is usually with cast coaptation for 3 to 6 weeks depending on the type of fracture and age of the foal. The inherent stability of these fractures and limited amount of bone for purchase of implants lends these fractures to treatment with cast. The fracture is reduced under general anesthesia and the reduction confirmed radiographically prior to placement of a half limb cast which encases the hoof. If necessary the cast is change once at 10 to 21 days depending on the age of the foal. Some degree of flexor laxity is typical after cast removal and the use of an extended heel shoe is typically necessary after cast removal.
More serious fractures requiring internal fixation of the digits occur in foals but less common than physeal fractures. Internal fixation with bone screws and plates and / or pastern arthodesis is occasionally performed in foals depending on the fracture configuration.

Base and apical fracture of the sesamoid bones occur commonly in foal. A common historical finding is lameness after turnout following a period of confinement due to a infirmity of the foal or mare. In acute cases the signs are consistent with septic arthritis of the fetlock joint. Radiography and fetlock joint fluid analysis confirm the diagnosis. In some foals the clinical signs of these fractures are subtle and the fractures are only identified later during survey radiographs for public auction. Management of these foals is similar to solar margin coffin bone fracture meaning stall rest until sound and then gradual increases in activity. Long term outcomes are typically good however follow up radiographs may reveal non healed fragment at the based of the sesamoid or enlargement of the sesamoid secondary to healing

Fractures of the Metacarpus / tarsus

Common types of fractures of the cannon bones include diaphyseal and distal physeal fractures. Salter Harris type I or II fractures of the cannon bone are typically treated with transphyseal bridging as the major implant device. It is important to realize which side of the physis is undergoing tension in the fracture and counteract it. Typically this should be the side opposite the metaphyseal spike in a SH II fracture. Because a unilateral transphyseal bridge may lead to angular deformity of the fetlock joint Placement of a transphyseal bridge on both sides for the distal cannon bone is recommended to prevent angular deformity. A single cortex screw may also be place through the metaphyseal spike to maintain reduction but it is important to realize that this fixation alone is insufficient to counteract the fracture forces. After repair bandage rather than cast coaptation is recommended.

Fracture of the diaphysis of the cannon bone lend themselves to bone plate fixation. While dynamic compression plates have been the workhorse for these fractures the advent of fixed angle constructs (locking compression plates) improves our chance of success and allows the implementation of minimally invasive osteosynthesis. Precise anatomic alignment and reconstruction of the bony column especially opposite of the plates to allow load sharing of the construct is paramount for successful repair. Reported success after diaphyseal fracture repair of the cannon bone is fair to good in foals. 60%

Fractures of the Radius

Fractures of the radius can involve the diaphysis (usually slightly proximal in the limb) or the proximal or distal growth plates. Proximal physeal fracture often have a accompanying ulnar fracture as well. Repair of physeal fractures are aided by fixed angle constructs. Mid diaphyseal fractures are generally treated by double plating with a cranially plate typically spanning the radius and a second lateral or medial plate. Removal of at least cranial plate is required prior to athletic use. Specifics of fracture repair of the radius will be discussed in the presentation.

Fractures of the Ulna

Fractures of the ulna in foals and weanling are reasonably common. Generally the fracture causes loss of triceps support to the elbow and a characteristic dropped elbow. Other considerations for this posture include radial nerve injury and humeral fracture. If the fracture is displaced repair is indicated. Some fracture distal to the articulation can be managed nonsurgically if the patient comfort is acceptable and there is no displaced articular component.
The key component of fracture repair of the ulna is counteracting the distracting forces of the triceps pull on the proximal portion of the fracture. Typically a 4.5 mm narrow DCP is used for this repair. Figure of 8 wire and pin/wire and plate /wire constructs are also used for different fracture configurations. If the fracture is comminuted to cause instability in the medial to lateral plane than a second plate may be needed and is placed on the lateral aspect of the ulna. Other important aspects of ulna fracture include:

- Reconstruction of the anconeal process at the articular margin
- Placement of the proximal screws in the dense bone of the cranial cortex of the ulna proximal to the articulation
- Avoidance of the radius in animals less than 12 months of age to avoid subluxation of the joint due to growth at the proximal radial epiphysis
- Taking care to place the proximal aspect of the plate up to the physeal scar to prevent a stress riser and fracture of the ulna at the proximal aspect of the plate

Original and 6 week follow up radiographs of a SH II fracture of the distal metatarsal physis of a 3 week old SDL F. The metaphyseal spike is lateral. Successful repair requires counteracting the distracting forces on the medial aspect of the physis opposite the metaphyseal spike. A cortex screw was placed to maintain reduction during the repair and a second transphyseal bridge place to prevent an fetlock varus deformity.
A) 1 month old TB F with closed MCIII fracture  
B) Postoperative appearance after repair with a dorsally 4.5 mm broad LCP and laterally applied 4.5 mm narrow DCP plates  
C) Healed fracture after staged plate removal  

Pre and 1 day post-operative radiographs of a 300kg SDL F with and SH II fracture of the proximal radius and ulnar body fracture repaired with a LCP and DCP
Preop, 1 day PO and 4 month PO radiographs of a distal radial fracture in a 150 kg TB M repaired with 2 LCP’s