Management and outcome of ulnar fractures

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Introduction

The equine ulna provides an almost pure opportunity for application of the tension band principle because the bone is vestigial distally and strongly loaded in a fairly uniform vector by the triceps insertion on the olecranon process. Wire is extremely strong in tension so even minimal fixation along the tension surface of the caudal ulna can be adequate fixation for many fractures. The advantages of the technique include minimal instrumentation, lower implant costs, possibly smaller incisions and the complete elimination of possible iatrogenic damage to the ulnar articular surface. In young horses, the tension band wiring technique also minimises the risk of interference with growth of the proximal radius.

Plating an ulnar fracture using screws affixed to the radius through a narrow slit and work hard to place screws through the soft tissues. (A locking plate is best because it does not have to be placed in the proximal olecranon without extensive dissection of the triceps insertion. If a plate is bent over the top of the proximal protruding pins. A 14 gauge 1.5 or 2 inch

Case selection for tension band wiring

Although there is no absolute weight limit for this technique, there are distinct limitations for its use dictated by the configuration of the fracture and there are many occasions when plating is both easier and more reliable. The optimal indication for a wiring technique is in the young horse (<6 months) where plating techniques might compromise the proximal radial growth plate. Plating an ulnar fracture using screws affixed to the radius should be avoided if at all possible in any foal less than 6 months old. Tension band wiring is the technique of choice for Salter-Harris I fractures of the proximal olecranon and is highly recommended for repair of simple, minimally displaced fractures at or distal to the level of the humeroradial articulation in young horses. The technique is NOT well suited for comminuted or intrinsically unstable fractures and is usually not used in adult horses with fractures proximal to the joint level if there is enough bone to insert 3 screws into the proximal fragment.

Plating techniques are preferred for larger horses, comminuted fractures and most fractures proximal to the humeroradial articulation.

Surgical approach

A standard approach to the ulna is used between the ulnar head of the deep digital flexor and the ulnaris lateralis muscles. With simple wiring of the mid ulna, a very small incision is required. If a pin and wire technique is necessary, the incision is carried proximal to the point of the olecranon. Both pins and wires can be placed in the proximal olecranon without extensive dissection of the triceps insertion. If a plate is bent over the top of the olecranon, do NOT remove the triceps insertion. Get the plate through a narrow slit and work hard to place screws through the soft tissues. (A locking plate is best because it does not have to compress to the bone in order to provide stability.)

Technique

Wire alone (for fractures at or below the humeroradial joint level) (Fig 1)
The fracture is held in reduction digitally or with forceps. If there is any obliquity to the fracture plane, a 3.5 or 4.5 mm lag screw is inserted. A 2.5 mm (2.7 or 3.2) bit is used to drill holes transversely through the ulna at least 2–3 cm proximal to and distal to the fracture. Figure-8 loops of wire are passed through the holes and tightened with a wire tighter or vice grips. At least 2 loops of wire are used even in small foals. Usually 3 or 4 wires are used in yearling or adult horses. The wire should be at least 1.25 mm diameter and in larger horses, 1.5 mm wire is used.

In simple oblique fractures extending distal to the joint, one or 2 screws can be used in combination with a simple tension band wiring technique. This can be done through a very small incision.

Pins and wire (for fractures proximal to the joint) (Fig 2)
A pin held in a Jacobs chuck is inserted in a proximal to distal direction through the proximal fragment being careful to both centre the pin and allow enough room for a second pin to be placed. The pin size is dependent on bodyweight. In small foals, 3 mm pins are adequate but in an adult horse up to a ½ inch pin might be used. The 2 pins do not have to be the same size. The fragment is reduced through manipulation (elbow extension with varying amounts of rotation) and the fragment skewed onto the distal bone. It is highly desirable not to completely penetrate the distal cortex, only to engage it securely. Complete penetration can lead to the pin migrating distally in the limb over a period of weeks to months. The second pin is then inserted in a similar manner. One or 2 transverse 2.5–3.2 mm holes are drilled through the ulna approximately 3 cm distal to the fracture. At least 3 wires (sized as above) are passed through the holes and around the proximal protruding pins. A 14 gauge 1.5 or 2 inch
needle is helpful for wire passage. The wires are tightened alternately to help avoid any tendency to shift the fracture. The pins are cut (Don’t twist the handles of the cutters!) and tapped down with a mallet and nail set, leaving 6–8 mm above the bone surface. The pin and wire technique can also be used in conjunction with one or 2 lag screws if the fracture is oblique but care must be taken to leave enough room for the pins.

Plating (Fig 3)
Ulnar fractures provide the easiest and most successful long bone plating opportunities in horses. In most cases, a single narrow plate will suffice if it is properly positioned along the caudal surface. There are some guidelines to make it easier:
1. Always attempt to place a lag screw across any oblique fracture before applying the plate. This will provide interfragmentary compression (additional stability) and make it much easier to contour and place the plate.
2. Be meticulous with plate positioning. Common errors include placing the plate too laterally. This makes it very difficult to fully engage the proximal fragment of the olecranon process with long screws. A very common mistake is to have the drill/screw exit the concave medial side of the olecranon. ALWAYS check the position of both ends of the plate before placing the second screw. It is a major error if the distal part of the plate is not properly aligned with the slender ulna.
3. Do not excessively dissect the soft tissues from the proximal ulna. Especially with locking plates, it is best to leave the soft tissues as fully intact as possible. Even with smaller proximal fragments, do not try to wrap the top of the plate too far over the top of the olecranon.
4. Pay close attention to the joint. Don’t drill into the articular surface and definitely don’t place a screw through it.
5. Try to engage screws in the most cranial and proximal portion of the olecranon whenever possible, especially in fractures with small proximal fragments.
6. In horses less than a year old, try not to engage the radius with a screw. If you must do so to achieve stability, remove that screw as soon as possible after early healing is adequate.

7. Do not allow wounds over the fracture to deter an attempt at repair. Stability is a great means of minimising the risks of contamination.
8. Double plating with the second plate on the lateral surface is an excellent technique for comminuted fractures.
9. Locking plates have major advantages.

Closure and recovery
The closure with either technique is straightforward and reliable. Drains are neither necessary nor desirable unless there is an unusual amount of soft tissue damage. Recovery from general anaesthesia is a particularly high risk with this fracture so special care is always given. Foals should be physically restrained and lifted to their feet. Any special recovery system such as a pool or sling should be used if available. If not, a deep mat with head and tail rope assistance is advisable.

Results
We reported the results of wire fixation (+/- pins and screws) in 22 horses with ulnar fractures (Martin et al. 1995). Ages of these horses ranged from 2 weeks to 12 years with a median of 4 months. Fractures healed in 18/22 horses (82%). Long-term follow-up was obtained on 17 horses. Of these, 13 (76%) became athletically sound.

The reported results for plate fixation of ulnar fractures are quite favourable both in terms of fracture healing and athletic soundness. Simple fractures as well as those more distal in the ulna have the best prognosis. Displaced proximal physeal (Sh-I) fractures are among the most difficult to repair and severely comminuted fractures can be challenging, especially in large horses.

Nonsurgical treatment of ulnar fractures should only be recommended in minimally displaced fractures distal to the humero-radial articulation. Nonunions/pseudarthroses are common in displaced and unstable ulnar fractures.

Reference and further reading