Surgical Treatment of Equine Ulnar Fractures

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Fractures of the ulna or olecranon can occur in a variety of configurations in horses of any age. Fractures of the ulna were initially classified as types 1 through 4, based on their location and configuration. A fifth category (type 5) was subsequently described and included in the classification system. The following classification system is most frequently used to describe ulnar fractures:

- **Type 1a**—Nonarticular fracture involving only the physeal plate
- **Type 1b**—Articular or nonarticular fracture involving the physeal plate and the proximal semilunar notch

- **Type 2**—Articular fracture involving the semilunar notch
- **Type 3**—Nonarticular fracture involving the semilunar notch
- **Type 4**—Comminuted, articular fracture involving the body of the olecranon proximal to the radial physis and entering the semilunar notch
- **Type 5**—Articular or nonarticular fracture involving the ulnar shaft at the level of the radial physis and extending proximally into the distal semilunar notch

Any type of ulnar fracture can be open or closed, although most are closed. Type 2 fractures appear to
occur most commonly in horses, whereas type 3 fractures are rare. Type 1a and 1b fractures occur in young horses; the remaining fractures can occur in horses of any age. An alternative classification system for ulnar fractures in horses has been described and has created some confusion when referring to the different types of ulnar fractures in the literature. The differences primarily involve types 1 through 3; types 4 and 5 are consistent between both classification schemes.

This report of a comminuted ulnar fracture illustrates an infrequent type 4 fracture configuration resulting in a separate anconeal process osteochondral fragment. A similar complication has been reported previously in one horse in a series of cases of comminuted ulnar fracture; similar to the horse in this report, that horse did very well after fragment removal and repair of the fracture. However, anconeal process fragmentation appears to occur more commonly with articular type 1b fractures in young horses than with type 4 fractures in mature horses. In a recent report of type 1b fractures, secondary anconeal fragmentation was diagnosed in four of 24 fractures on preoperative radiographs. This emphasizes the importance of obtaining good lateral-to-medial radiographs of the elbow that clearly demonstrate the anconeal process in all horses with ulnar fractures, especially young horses with physeal fractures (Figure 1). This can be difficult in foals that are in pain and resist proper limb positioning and in larger horses that have severe soft tissue swelling. In addition, the anconeal process is often obscured by overlap of the humeral epicondyles (Figure 1) or may not be visible due to underexposure of the film. If the comminuted ulnar fracture in this report had been repaired without addressing the anconeal process fragmentation, it is unlikely that the horse would have had a successful outcome. Granted, the anconeal fragment could have been removed after the ulnar fracture had healed, if it had not been identified on the initial radiographs.

I have identified secondary anconeal fragmentation in a few horses with olecranon fractures but have not seen a fragment as large as the one in this report. These smaller anconeal fragments were removed at the time of surgical repair of the ulnar fracture through the same caudal approach to the ulna, not through a separate arthrotomy. The anconeal fragments were removed either through the fracture line by displacing the fracture fragments or from the lateral aspect of the proximal ulna after elevating the soft tissues along the side of the ulna (open lateral approach to anconeal process). The approach along the lateral aspect of the ulna permitted access to the proximal humeroulnar joint and the anconeal process in those fractures that were not severely displaced. In a report of type 1b fractures, all anconeal fragments were removed by opening the fracture line and exploring the joint before fracture fixation. Alternatively, these anconeal fragments could have been removed arthroscopically either at the time of ulnar fracture repair or after the ulnar fracture had healed using the caudoproximal approach to the elbow joint. In most cases, however, anconeal fragments associated with ulnar fractures should be able to be removed through the approach used to repair the fracture, eliminating the need to perform a separate arthrotomy or arthroscopic procedure.

Due to its large size, the anconeal fragment in the horse in this report may have been very difficult to remove through the caudal incision used to repair the fracture or with the arthroscope. Either of these techniques could have been attempted in the hope of avoid-
ing a separate arthrotomy. However, the arthrotomy most likely facilitated easier removal of the fragment and better inspection of the fracture bed than could have been achieved through the caudal incision. Also, the arthrotomy did not appear to cause any postoperative morbidity and did not limit the athletic performance of this horse. In my opinion, most articular anconeal fragments associated with ulnar fractures should probably be removed, regardless of the technique used (separate arthrotomy, same caudal incision as fracture repair, or elbow arthroscopy). This is supported in the literature, which reports that removal of anconeal fragments had no effect on the prognosis for soundness of young horses with type 1b ulnar fractures\(^1\) and that another horse with a type 4 fracture returned to full performance after anconeal process removal.\(^2\)

Another complication I have identified that was related to the anconeal process involved a proximal articular ulnar fracture (type 1b) that was repaired with cortical bone screws combined with tension band wiring (Figure 2).\(^4\) Type 1b fractures usually involve the anconeal process (without fragmentation) and, if they are not properly reduced (rotated medially or laterally), can cause incongruency between the anconeal process and the humeral epicondyles. One young horse I treated with cortical screws and tension band wiring remained lame after surgery, was unwilling to keep the carpus extended, and developed a flexural deformity in the

Figure 2. Lateral radiographs of the elbow of a 6-month-old quarter horse filly.

The fracture was repaired with screws and wires, and the reduction looked very good on the postoperative radiograph. However, the filly remained lame on the leg after surgery and was unwilling to lock the carpus in extension. The lameness persisted, and postmortem examination 3 months after surgery suggested that the anconeal process was malaligned and impinging on the medial humeral epicondyle.

The preoperative radiograph showed a proximally displaced type 1b ulnar fracture.
affected limb (Figure 2). No surgical, radiographic, or clinical cause for the continued lameness could be detected, and there was no response to a variety of treatment protocols. Postmortem examination 3 months after surgery revealed that the anconeal process was “rubbing” on the caudal aspect of the humeral epicondyle within the trochlear groove. This was theorized to be due to rotation of the proximal fracture fragment during the repair process, resulting in the anconeal process contacting the humeral epicondyle when the elbow was locked in extension. The anconeal process normally glides between the humeral epicondyles, and correct positioning is important to prevent contact with the humerus. This uncommon complication is yet another reason that internal fixation of very proximal ulnar fractures is more difficult than that of more distal fractures. In addition, malalignment of the proximal fragment seems more likely to occur with the intramedullary pin/bone screw and tension band wiring technique than with the dynamic compression bone plate technique because of the greater possibility of rotation of the proximal fragment when the implants are placed during the repair process. Based on this case and the very good results recently reported with plating type 1b ulnar fractures, dynamic compression plating would be my treatment of choice for type 1b fractures in most horses.

The repair of the ulnar fracture in the presented case appears to be consistent with the current recommendations for horses with comminuted ulnar fractures. However, a broad dynamic compression plate is usually recommended in horses weighing more than 1,100 lb (500 kg) and could have been used in this horse (523 kg). Using 5.5-mm cortical bone screws throughout the implant improved the stability of the fixation and would be recommended by most surgeons for this size of horse, particularly when a narrow dynamic compression plate is used. Some surgeons might have attempted to further reduce and compress the fracture, as it appeared to be minimally fragmented, by loading at least one screw on each side of the fracture line. However, overcompression of minimally displaced fractures with comminution at the articular surface may result in fragment displacement. Compression of extensively fragmented comminuted ulnar fractures is not recommended because fracture collapse is likely. Compression of the fracture was obviously unnecessary in this horse because the fracture healed well without it and osteoarthritis did not develop in the elbow joint.

It appears unlikely that the screw that was removed from this horse contributed to the prolonged period of lameness after surgery. I agree with Dr. Jansson that a more rapid improvement in lameness would have been expected after screw removal had the screw been impinging on the humeral condyle and articular surface. However, it is probably safer in most cases to remove excessively long screws if there is any suspicion that they may be damaging the elbow joint surface. As illustrated in the horse in this report, isolated screws can usually be removed from dynamic compression plates in horses with ulnar fractures without severely compromising the stability of the fixation. However, the empty screw hole creates an area of stress concentration in the plate, and cyclic fatigue would most likely break the plate at that location. Factors that are particular causes for added concern include large patient size, removal of a screw early in the healing period, and recovery from anesthesia; any combination of these factors multiplies the risk of plate failure. In selected cases, it may be possible to remove isolated screws from standing horses to avoid the risk of recovery from anesthesia resulting in implant failure.

In summary, this report reinforces the need to closely evaluate the anconeal process in all horses with ulnar fractures. Anconeal fragmentation, if not addressed, may lead to continued lameness, and anconeal fragments should most likely be removed, either through an arthrotomy, through the same caudal approach as fracture repair, or with the arthroscope. In most cases, removal of the anconeal process should not reduce the prognosis for soundness in horses with ulnar fractures.

**REFERENCES**