Case Report

Standing removal of the proximal aspect of an olecranon fracture in a mature horse

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Summary

A 12-year-old 450 kg Argentine polo mare presented with a dropped elbow and an unwillingness to bear weight after being kicked by another horse on the lateral aspect of the upper left forelimb. The mare was subsequently diagnosed with a displaced olecranon fracture that did not readily conform to the standard classification systems. Referral for surgical treatment involving open reduction and internal fixation was declined due to financial constraints. Due to the mare being unsuitable for breeding, and conservative treatment of displaced olecranon fractures being deemed to have an overall poor prognosis for return to full athletic performance, another treatment option was sought. Given the fracture configuration, standing surgical removal of the large proximal fragment was performed. The mare returned to full athletic performance 12 months post operatively without lameness. This case report describes an alternative treatment option for selected olecranon fractures.

Introduction

The olecranon acts as a lever allowing the triceps brachii muscle to extend the elbow. The triceps brachii consist of 3 heads – long, lateral and medial – all of which insert together on the olecranon tuberosity [Watson and Wilson 2007]. Fractures of the olecranon in the horse are relatively common and often occur as a result of direct trauma; frequently a kick or a fall. Injured horses that have disruption of the triceps apparatus often have a ‘dropped elbow’ appearance and are unable to bear weight fully or extend the carpus [Denny et al. 1987; Watkins 2006].

Olecranon fracture configurations have been previously described and a commonly used classification system defines 6 categories: 1a, 1b, 2, 3, 4 and 5 [Donecker et al. 1984; Wilson and Riedesel 1985; Denny et al. 1987; Fackelmann 1999; Swor et al. 2003] (Table 1). Type 2 fractures are the most common type of olecranon fracture in the mature horse [Essley et al. 1982; Donecker et al. 1984; Denny et al. 1987]. In comparison, juvenile horses more commonly sustain type 1b olecranon fractures [Swor et al. 2003; Watkins 2006].

A variety of surgical techniques have been documented for the correction of olecranon fractures. Open reduction and internal fixation with the use of cerclage wire or a dynamic compression plate applied to the caudal aspect of the ulna is the current common standard for repair [Martin et al. 1995; Murray et al. 1996; Hanson et al. 1997; Swor et al. 2003, 2006; Watkins 2006; Jackson et al. 2011]. Surgical repair of olecranon fractures in mature horses has a good prognosis, with recent published success rates of 81.2% [Jackson et al. 2011] and 86% [Swor et al. 2003]. Conservative management of olecranon fractures can be a viable treatment option in certain fracture configurations that are nonarticular and nondisplaced such as type 1b and type 5 (Wilson and Riedesel 1985). The degree of disruption of the triceps apparatus, extent of fracture displacement, distraction, comminution and instability, along with the animal’s ability to bear weight on the limb are all key factors involved in the choice of conservative management. Case background, economical constraints as well as the horse being viable if it cannot return to full athletic performance are other factors also involved. Despite some fracture configurations such as those that are non-articular involving the growth plate only (type 1b) and those involving the distal semilunar notch (type 5) having a favourable prognosis of 70% becoming sound after conservative management, the overall prognosis for return to full athletic performance is often poor. In a study of 43 cases managed nonsurgically, the overall rate of return to soundness was 33% (Wilson and Riedesel 1985).

We report the management of an olecranon fracture in which the proximal fragment was removed via standing surgery and the subsequent successful return of the mare to full athletic performance 12 months post operatively without lameness.

Case history

A 12-year-old 450 kg Argentine polo mare playing low to medium goal polo was seen to be kicked by another horse on the lateral aspect of the upper left forelimb. The mare was unwilling to bear weight on the limb immediately after the trauma.

Clinical findings and diagnosis

Palpation and manipulation of the point of the elbow induced marked pain and moderate crepitus. A vertical 6 cm skin wound was located approximately 10 cm cranial to the point of the elbow. The mare was sedated with 0.009 mg/kg bwt

TABLE 1: Olecranon fracture categories (Swor et al. 2003)

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td>Nonarticular fracture involving the growth plate only</td>
</tr>
<tr>
<td>1b</td>
<td>Articular or nonarticular fracture involving the physeal plate and the proximal semilunar notch</td>
</tr>
<tr>
<td>2</td>
<td>Articular fracture involving the semilunar notch</td>
</tr>
<tr>
<td>3</td>
<td>Nonarticular fracture involving the metaphysis</td>
</tr>
<tr>
<td>4</td>
<td>Comminuted fracture involving the semilunar notch and body of olecranon</td>
</tr>
<tr>
<td>5</td>
<td>Articular or nonarticular fracture involving the ulnar shaft at the level of the radial physis and extending proximally to involve the distal semilunar notch</td>
</tr>
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detomidine (Equimidine)\(^1\) and 0.009 mg/kg bwt butorphanol (Torbugesic)\(^1\) and a mediolateral radiograph of the elbow was taken using a portable digital radiography machine (Eklin Mark IIG)\(^2\). The radiograph revealed a displaced nonarticular complete short oblique fracture of the left proximal ulna with minimal cranial displacement of the large proximal fragment. Additional radiographic views were not taken due to financial constraints.

The fracture line propagated from the caudoproximal surface of the left olecranon tuberosity of the ulna to the craniodistal aspect of the proximal surface of the anconeal process. Relative to the distal ulna, the large proximal fragment was minimally displaced cranially (Fig 1). The fracture configuration did not readily conform to the standard classification systems (Fig 2). Surgical referral was offered to the owner but declined due to financial constraints.

An alternate treatment was sought in order to return the mare to full athletic function as she was deemed unsuitable to be preserved as a broodmare. The mare was confined to a box and treated with prophylactic antibiotics consisting of gentamicin (6.6 mg/kg bwt i.v. q. 24 h; Genta Equine 10\%)\(^3\) and procaine penicillin (22,000 iu/kg bwt i.m. q. 12 h; Duphapen)\(^1\) as well as phenylbutazone (4.4 mg/kg bwt per os q. 24 h; Equipalazone)\(^3\) for 3 days. After this time, the small skin wound had sealed over, swelling within the region had resolved and the mare, although unwilling, was able to bear weight on the limb and extend the elbow.

The authors believed that standing removal of the fragment would be viable at this stage as it was evident that there was still function of the triceps apparatus.

**Surgical treatment**

Preoperative antibiotics consisted of gentamicin and procaine penicillin along with phenylbutazone, all at previously mentioned dose rates. Prior to surgery, standing sedation was achieved with 0.013 mg/kg bwt detomidine (Equimidine)\(^1\) and 0.013 mg/kg bwt butorphanol (Torbugesic)\(^1\). Sedation was maintained with one additional dose of 0.009 mg/kg bwt detomidine (Equimidine)\(^1\) mid-way through surgery. Surgery time was approximately one hour.

The region was aseptically prepared for standing surgery. Mepivacaine (Intra-Epicaine)\(^1\) was injected subcutaneously in a vertical line over the lateral aspect of the elbow directly over the fracture line. Mepivacaine was also injected into the deeper muscle layers and around the fracture.

A vertical skin incision was made centred over the fracture line and subcutaneous tissues were bluntly dissected to allow for direct palpation of the fracture. Approximately 60% of the tendinous insertion of the triceps brachii muscle was attached to the proximal fragment. This was detached by sharp dissection as close to the bone of the fragment as possible to allow for removal of the fragment (Fig 3). Several blood vessels were encountered during dissection of the fragment attachments. Haemorrhage was controlled by application of direct pressure and was not of significant concern.

The surgical site was thoroughly lavaged with sterile saline prior to the deeper tissue layers being closed with a monofilament absorbable size zero suture (poliglecaprone, Monocryl, size 0)\(^4\) using a simple continuous pattern. A Penrose drain was placed subcutaneously and the skin then closed.
with a nonabsorbable monofilament suture (nylon, Ethilon, size 1) using a simple interrupted pattern. The distal 2 cm of the incision was left open to allow for egress of the Penrose drain. The mare was confined to a box post operatively. Procaine penicillin, gentamicin and phenylbutazone were continued at the previously mentioned dose rates for a further 7 days. The mare was then treated with trimethoprim/sulfadiazine (30 mg/kg bwt per os q. 12 h; Norodine Granules) for another 10 days. After 7 days, the dose of phenylbutazone was reduced (2.2 mg/kg bwt per os q. 24 h; Equipalazone) and maintained for a further 14 days.

The Penrose drain was removed after one week. Sutures were removed 2 weeks post operatively, at which point the surgical incision had healed with a good cosmetic appearance.

One single lateral radiograph of the surgical site was taken 3 days post operatively. This radiograph revealed a small fragment that was not visible prior to surgery (Fig 4). The authors speculate that this fragment may have fractured off the larger fragment during surgery, or was potentially missed initially as only one radiograph of the fracture was taken. It was not deemed necessary to remove it as the fragment did not appear to be articular and was considered unlikely to cause ongoing lameness.

**Outcome**

The mare was confined to a box for 5 weeks prior to being turned out into a small paddock. At this point of time the mare was 2/5 lame at the trot (AAEP lameness grading scale – Anon 1999). The mare was re-examined again 8 weeks after surgery and found to be sound at the trot. A firm round smooth fibrous mass of a proximately 10 × 10 cm in size had developed on the lateral aspect of the elbow. The mass was not painful, nor did it hinder free movement of the limb. The cosmetic appearance of the leg was good (Fig 5). The mare was then turned out into a larger paddock for another 16 weeks prior to commencing a graduated ridden rehabilitation programme.

Twelve months post surgery the mare was back in full work and playing polo at the same level prior to injury without lameness. Follow-up radiographs were not taken due to financial limitations. The mare was sold to another polo player approximately 18 months post injury. A full 5 stage prepurchase examination was completed prior to sale.

**Discussion**

To the authors’ knowledge this is the first case report describing the surgical removal of a fractured olecranon fragment in a standing horse. The prognosis for olecranon fractures with both surgical repair and conservative management is well documented (Donecker et al. 1984; Wilson and Riedesel 1985; Denny et al. 1987; Swor et al. 2003, 2006; Jackson et al. 2011). Recent published success rates for surgical management are 81.2% (Jackson et al. 2011) and 86% (Swor et al. 2003), whilst conservative management shows an overall return to soundness of all types of olecranon fractures collectively being 33% (Wilson and Riedesel 1985). An accepted method of classification for olecranon fractures (Swor et al. 2003), describes 6 types of fracture configuration. This classification method is useful for the most commonly seen fractures, but can be inflexible in its ability to describe fractures such as the one presented in this case study. Fractures in juvenile horses frequently involve the physis and usually result in predictable configurations. Fall-induced fractures also create predictable fracture configurations due to the pronounced tension forces associated with the olecranon caused by the triceps. By contrast, kick-induced fractures involve variable forces that are not all tension related, with the direction of the external force being able to originate from any angle. The variability of this external force can result in kick-induced olecranon fractures being less predictable and less able to conform to the standard classification method.

Veterinarians, when presented with a fractured olecranon, currently have 2 reasonable treatment options: conservative or surgical management. The current accepted standard of surgical repair of an olecranon fracture involves open reduction and internal fixation using dynamic compression plates to counteract the tension forces. The use of tension

![Fig 3: Proximal fragment after surgical removal.](image1)

![Fig 4: Lateral radiograph post operatively. Note the small fragment (red circle).](image2)
band wires is a viable surgical option but is limited in relation to fracture fixation strength, as such is only recommended for horses under 250 kg (Martin et al. 1995). Internal fixation using orthopaedic plates results in the best prognosis for return to athletic performance (Donecker et al. 1984; Denny et al. 1987; Jackson et al. 2011). Persistent sinus formation, implant failure, contralateral limb break down and re-fracture during recovery from anaesthesia are all recognised complications of surgical repair (Donecker et al. 1984; Denny et al. 1987; Jackson et al. 2011). In a recent study (Jackson et al. 2011) of 12 type 2 fractures treated with locking compression plates, 4 horses experienced post operative complications. Two were subjected to euthanasia, another remained chronically lame, whilst the fourth required plate removal due to persistent sinus formation.

Financial limitations often dictate chosen diagnostic procedures and treatments in equine veterinary medicine and surgery. The case presented in this report was performed on a very strict budget. In order to remain within this budget, additional radiographic views at the time of initial examination, intraoperative radiographs, post operative radiographs and follow-up radiographs were not performed. The authors recognise that it was less than ideal and would certainly encourage others to obtain full radiographic series if presented with similar fractures. The challenges of financial limitations in equine veterinary medicine and surgery are well highlighted when presented with a horse that has an olecranon fracture. Based on our results, standing removal of the proximal aspect of the olecranon, in certain specific configurations of fractures, could potentially be a viable alternative to the currently available surgical techniques. It has the advantage of not requiring general anaesthesia or the use of implants, thus eliminating some of the inherent costs and complications.

It must be emphasised that this surgical technique is not suitable for all olecranon fracture configurations. In order for this technique to be a suitable option it is essential that there is a functional triceps apparatus. In our case, we assessed this by observing the mare being able to extend the elbow to a reasonable degree and although unwilling, the mare was able to bear weight fully on the leg. The authors recommend that surgery is delayed until the functionality of the triceps apparatus is absolutely confirmed.

This case demonstrates that with appropriate case selection and by careful retention of remaining triceps function during dissection, a mature horse can be successfully returned to athletic performance with this procedure.

Conclusion
This paper reports the successful removal of the proximal fragment of an olecranon fracture in a standing mare that resulted in return to full athletic performance. With conservative management it is unlikely that this could have been achieved. This paper may prove useful to other veterinary surgeons presented with similar fracture configurations where finances are limited.

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Authors’ declaration of interests
No conflicts of interest have been declared.

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3 Dechra Veterinary Products, Shrewsbury, Shropshire, UK.
4 Johnson & Johnson Medical, Livingston, West Lothian, UK.
5 Norbrook Laboratories, Newry, Down, UK.

References

Fig 5: Close up of affected leg showing good cosmetic outcome.


