Reno’s Not So Funny Bone

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Introduction

Equine fractures are a serious condition that can have deadly consequences if not treated appropriately. In a retrospective study done on 1,114 equine fractures, it was discovered that about 43.6% of fractures were the result of a kick from another equid.[2]. Fracture clinical signs can include extreme lameness, signs of shock including an elevated heart rate or respiratory rate, abnormal angle of the limb, swelling, and possibly bleeding. The initial mainstay of treatment is to keep the horse calm and prevent panic such as thrashing.[3]

When a horse presents with a possible fracture, the highest priority for treatment should be signs of shock and controlling pain. A fracture of a bone is less serious than any blood loss associated or severe signs of shock. Radiographs are the first diagnostic performed to determine the possibility and severity of a fracture. Stabilization is imperative until further interventions are done. Next it should be determined if the fracture is an open fracture or closed. Open fractures have a much poorer prognosis, and a closed fracture can become open if not stabilized correctly.[3] Open fractures have a much higher risk of bacteria introduction to the wound, and fractures caused by a kick are more likely to be open compared to other causes.[2]

It is important to recognize where a fracture has occurred so that treatment options and prognosis can be determined. One of the more specific clinical signs for an olecranon fracture is the appearance of a “dropped elbow” when the horse is standing. This stance appears as a semi-flexed carpus and fetlock with the elbow in an abnormally low position, which is due to disruption of the triceps brachii muscle. However, depending on the severity, these horses could have the ability to bear weight normally.[5] Considerations in these patients are age, occupation of the horse, severity of the fracture, location of the fracture, open fracture, and overall health of the horse. Both surgical and non-surgical treatment options can be viable in some cases, however

nonsurgical management is only recommended for non-articular and non-displaced olecranon fractures due to poor prognosis.[5] Most of these cases are treated surgically via internal fixation methods which will be discussed in detail.[5]

History and Presentation

An 18-year-1-month old Quarter Horse gelding who presented to the Mississippi State University College of Veterinary Medicine (MSU-CVM) Equine Emergency Service on January 27, 2021, for a right olecranon fracture. Two weeks prior to presentation, the gelding was kicked in the region of the elbow by a horse that had just been introduced to his pasture. The owner noticed frank blood coming from the elbow area from about a 1inch long laceration. This area bled for about 24 hours. The owner treated initially with cold hosing, dimethyl sulfoxide, or DMSO, and strict stall rest. The day of presentation, he was unintentionally turned out and his lameness quickly progressed. He was seen by his primary veterinarian earlier in the day where two doses of ceftiofur, one dose of gentamicin, and one dose of phenylbutazone was administered. The veterinarian took radiographs and diagnosed an acute olecranon fracture. A splint was placed on the right leg for stabilization by his veterinarian during the transport to MSU. The splint consisted of cast padding, a PVC pipe cut in half and placed on the caudal aspect of the antebrachium down to the fetlock, and duct tape.

On presentation the gelding was a grade 4/5 lame on the American Association of Equine Practitioners (AAEP) scale, meaning it was obvious at the walk. The temporary splint was still in place, and he was ambulating sufficiently enough to walk to his stall. He was bright, alert, and responsive and had an ideal body condition score of 5 out of 9. The radiographs were provided

by the referring veterinarian, which confirmed his fracture. The fracture could be described as a Type 4 right olecranon mildly comminuted complete open fracture with articular involvement. The olecranon was displaced proximally and laterally with a slight cranial rotation. This was believed to be due to the pressure from the triceps muscle. Although it had happened two weeks ago, radiographically the fracture lines were still sharp and considered acute in nature. Moderate intracapsular and extracapsular swelling was noted. Because he was stable on arrival and eating well, no diagnostics were run the night of arrival and the temporary splint was left in place. The following morning a catheter was placed in the right jugular vein in preparation for surgery. He was placed on the following intravenous medications prior to surgery: Flunixin Meglumine at 1.1 mg/kg q12h, Cefazolin at 11 mg/kg q12h, and Gentamicin at 6.6 mg/kg q12h.

Diagnostic Approach

When attempting to diagnose any kind of fracture, radiographs tend to be the first modality used. The anatomical location chosen to radiograph is dependent upon lameness, limb variation, swelling, and potential bleeding, as discussed earlier. The olecranon tends to be chosen to radiograph when the stay apparatus is disrupted. This apparatus is disrupted because the triceps brachii inserts on the olecranon process, so disruption of the olecranon means the triceps brachii is not able to extend the elbow. In a normal horse, extension of the elbow causes passive fixation of the joints below in a weight-bearing stance.[5]

Olecranon fractures in horses can be difficult to get good radiographic views due to severe swelling and the location of the olecranon. It is difficult to get the radiograph receiver plate high enough in the axilla to fully image the most proximal portion of the olecranon.[4] The

most rewarding view tends to be a partially flexed lateral view because the olecranon can be seen in its entirety, however other views to supplement can include craniocaudal and obliqued views. One must be careful when interpreting a flexed lateral radiograph because this view will reveal the irregular extra-articular surface of the radial head, which is a normal finding, but can be mistaken for new bone formation.[4] Another finding of consideration is an olecranon hygroma, which is a swelling over the point of the elbow. Although not a true bursitis, it can present in a similar manner and can be confirmed via ultrasound.[4] This is a normal variant and shouldn't be mistaken as swelling due to a fracture.

It is also important to note the classification of the olecranon fracture. Olecranon fractures have been separated into four different classifications as can be seen in Table 1.[6] The higher the classification of the fracture, the worse the prognosis, due to severity of the condition. Although hard to fully determine, it has been found that Type 2 fractures are the most common among equine olecranon fractures.[6] Once a diagnosis has been made, a treatment plan must be made with the considerations of severity, finances, and the well-being of the animal.

TABLE 1: Types of olecranon fractures

Type	Definition
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 proximal portion of the metaphysis
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 (at the radial-ulnar junction) and extending proximally to involve the distal semilunar notch

Pathophysiology

Fractures in horses can be attributed to many different causes including but not limited to kicks by another animal, falls, stress injuries, and working injuries. Older horses tend to be more prone to fracture of bones in general due to the micro-architecture of the bone aging over time, a

decrease in trabeculae, and an increase in the distance between trabeculae.[2] In regards to fractures due to a kick from another horse, it is not uncommon to lead to a fracture because the force of a kick from a single hoof can be as high as 9807 Newtons, and any kind of shoe placed on the hoof increases this number significantly.[2] It has been found that in most cases of olecranon fractures, the humeroulnar joint is affected and there is mild to moderate fragment displacement of the ulna with the fractures commonly being comminuted.[4] Although displacement can be moderate, most times they are not due to the "locking effect" caused by the anconeal process being located deep in the humeral recess which limits the amount of displacement that can happen in this area.[4]

Without immediate treatment, a complication to be worried about includes malunion of the fragments/bone. Malunion of an olecranon fracture can result in the horse not being able to fully extend the cubital joint, which can lead to lameness, muscle atrophy, and compensation.[4] Also to be of note: the physis is not always the first to fracture due to trauma, even though it can be a potential weak spot in the olecranon.[4] It is not uncommon to see spraining of the medial and lateral collateral ligaments following a kick to the olecranon, and even with proper repair, posttraumatic osteoarthritis can also occur.[4]

Unfortunately, since fractures due to a traumatic kick are commonly considered open, infections can and do occur. For this purpose, post operative infections (POI) will be focused on, as surgical intervention is the recommended treatment. Although many steps are taken to prevent post operative infections, they do occur and some common risk factors include increased age, female gender, a contaminated surgical procedure, greater than 90 minutes of time in surgery, and the administration of preoperative antimicrobial drugs.[1] The mainstay of both treatment and prevention of POIs are systemic antimicrobial therapy. The real challenge is implant-associated

infections because the bacteria will create a biofilm which protects it from the host's defenses and the defenses from the antimicrobial therapy.[1] In these situations, removal of the implant is usually warranted to resolve the infection and allow the healing process to continue.[1] It has been found that open fractures are 4.2 times more likely to become infected due to the bacteria already present in the wound from the initial trauma, and they were 4.5 times less likely to be discharged from the hospital compared to other similar fractures that were considered closed.[1] When bacterial cultures were performed, the most common Gram-negative bacteria was *Enterobacter cloacae* and the most common Gram-positive bacteria was coagulase-negative *Staphylococcus*.[1]

As mentioned previously, systemic, and sometimes local antimicrobial therapy is the mainstay of treatment for POIs. The most used antimicrobials were aminoglycosides and beta lactams, however there was no difference in discharge rate in correlation to the antimicrobial regimen used.[1]

Treatment and Management Options

As with any fracture, the two main treatment options are medical management versus surgical correction and fixation. An overall poor prognosis has been associated with non-surgical medical management, so this option should only be elected in the following circumstances: severe financial constraints, the fracture involves only a small fraction of the semilunar notch, or when comminution of the fracture is so severe that surgery may not be an option.[5] Since there are instances where a horse may not be severely lame from a fracture, the owners may not bring the animal to the veterinarian right away. Some horses' fractures are so minor in the olecranon that

the lameness is not evident at a walk. In cases like this, the best advice to give the owner is to put their horse on stall rest and return to work very gradually after being rested for at least a month.[5]

With medical management generally not being the recommended option, most olecranon fractures are treated utilizing an internal fixation technique with a bone plate being applied to the caudal aspect of the bone.[5] A dynamic compression plate, or DCP, seems to be the most commonly utilized method of repair, however other methods of internal repair can include tension band plating, hook plates, and tension band wires.[5] If surgery is elected as the treatment of choice, the owner must be made aware of potential complications and cost of those complications. Some complications that can be seen with internal fixation include POI, the plate or screws breaking in the future, and possible fracture of another area when the horse is waking up from anesthesia. Horses that sustained fractures that required plate fixation were associated with a higher risk of POI, however no difference was found when using a dynamic compression plate versus a locking compression plate.[1]

Case Management and Treatment

Due to the severity of the fracture sustained and the financial ability of the owner, it was elected that the patient would undergo surgery for an open reduction and internal fixation. General anesthesia was pursued, and the horse was placed in left lateral recumbency for the procedure. The right limb was clipped and prepped in a sterile manner prior to the incision being made. The fractured olecranon was visualized by making an incision caudal to the elbow and separating the soft tissues, ulnaris lateralis, a portion of the triceps, the ulnar head, and the deep digital flexor. His fracture was manually reduced utilizing both physical manipulation and bone

clamps. An 8-hole narrow dynamic compression plate was placed at the caudal aspect of the ulna. Intraoperative radiographs were used to place the first screws to reduce the fracture in lag fashion. Intraoperative radiographs were utilized throughout the procedure to ensure proper placement of the screws and proper alignment of the fracture. The surgical site was copiously flushed with saline mixed with 500mg Amikacin. The incision was closed in three layers with PDS suture material. The skin was then covered with laparotomy sponges that were held in place with a tie over bandage using PDS and umbilical tape. A cast was placed that covered his hoof and went up to about 5 inches above the carpus to stabilize the leg.

Due to the risk of injury during recovery, he was placed in the full body sling. Large ropes were placed on his halter and his tail to aid in stability when he was ready to stand. Once he was extubated and began to try to get up, he was lifted in the sling until he was able to rotate so his feet were underneath him. He remained in the sling to help relieve some of his body weight until he was steady enough to stand on his own. Recovery was uneventful and as soon as he was fully awake, the sling was removed so that he could ambulate unassisted. Medical treatment for this case is as follows: Flunixin Meglumine at 1.1 mg/kg IV q12h, Cefazolin 11 mg/kg IV q12h, and Gentamicin at 6.6 mg/kg IV q24h. Fluoxetine was started the following day at 100mg PO q24h, along with Acepromazine at 2cc as needed IV due to showing signs of stress and anxiety.

Three days following surgery, the bandage slipped off and he began to run a fever of 103 degrees Fahrenheit. He was vaccinated the day prior with Eastern and Western Encephalomyelitis, West Nile, and a Tetanus toxoid IM. He was also switched to chloramphenicol as an antibiotic at 50 mg/kg PO q8h. Due to a combination of the fever, an increased respiratory rate, and subcutaneous emphysema around the incision site, a complete

blood count (CBC) and chemistry was running. His CBC was within normal limits apart from a mild stress leukogram with the following results: Segmented neutrophils 84 % (22-72), lymphocytes 7% (17-68), and monocytes 999.9 (0.0-800). His chemistry revealed a mildly increased glucose at 152 (60-122), a mildly low BUN and creatinine at 8 (10-24) and 1.05 (1.2-1.9) respectively, a low phosphorous at 0.8 (2.4-4.0), a low osmolality at 260 (270-300), and a low magnesium at 1.0 (1.6-2.5).

Since the gelding continued to try to lay down in his stall, he was cross tied at night to keep him in one place where food and water were still readily available. His cast was also replaced with a tube cast. Seven days following surgery, the cast was removed, and a splint was made using half of the original cast. Serosanguinous fluid was noted within the incision site, so an aerobic and anaerobic culture and sensitivity was performed at the surgical site. Although no anaerobic bacteria were cultured, the aerobic organism *Pseudomonas aeruginosa* was shown to have moderate growth. It was susceptible to the following antibiotics: Amikacin, Ceftazidime, Gentamicin, Imipenem, and Ticarcillin. Cefazolin powder was applied topically once and Poloxamer gel was injected into the olecranon bursa. Eleven days following surgery, the antimicrobial plan changed, and he was on the following medications: Flunixin at 1.1 mg/kg IV q12h, Trimethoprim/Sulfadiazine at 30 mg/kg PO q12h, Fluoxetine at 100 mg PO q24h, and Amikacin 500mg with Poloxamer gel 10mL subcutaneously at the surgical site. Recheck radiographs at this time revealed mild implant motion at the fifth orthopedic screw with no evidence of osteomyelitis. Otherwise, the fractures are healing appropriately. Two stitches were removed the following day and the Trimethoprim/Sulfadiazine was discontinued due to the horse still running a fever. He was then put back on Gentamicin instead at 6.6 mg/kg IV q24h. Sixteen days following surgery, the patient was discharged from the hospital, and was on the following

medications: Fluoxetine at 100 mg PO q24h, Gentamicin at 6.6 mg/kg IV q24h, Flunixin meglumine at 1.1 mg/kg IV q24h, Firocoxib 57 mg tab PO q24h, Probio 5g PO q12h.

At the 6 weeks post operative recheck and there was still some draining present from his incision site. Recheck radiographs revealed that the fractures were healing appropriately, however there was some implant motion of the second, fourth, and fifth screws. Although osteomyelitis was not seen at this time, it was not fully ruled out.

At the 8-week postoperative recheck appointment, draining was still noted from the incision site. He was now a Grade 4/5 lame on the AAEP Lameness Scale with draining tracts noted. Previously, he had been ambulating appropriately for his time following surgery. Radiographs revealed that the orthopedic implants had not changed location, however there is focal smoothly marginated irregularly shaped lucent areas surrounding the second and third screws. Due to the radiographic findings and sudden decline in ambulation, he underwent standing surgery to remove the second and third orthopedic screws, which was successful. He was sent home on the following medications: Firocoxib at 57mg tab PO q24h, Probio at 5g PO q12h, Fluoxetine at 100 mg PO q24h, and Trimethoprim/Sulfadiazine at 30 mg/kg PO q12h.

The patient would not make another visit to MSU-CVM until 15 weeks following his first surgery.

Case Outcome

At the last recheck, which was 15 weeks following his initial surgery, he was doing great at home. He had no lameness at the walk and was no longer taking any analgesics. The surgical site had no more draining tracts and there was normal scar tissue present. The scar tissue did cause him to have a slightly shortened phase of stride when walking, however he was

compensating well. He was then released to slowly go back to exercising in hopes of a full recovery long term.

Conclusion

Although any equine fracture can be traumatizing to both the horse and the owner, if managed properly the horse can have a good prognosis to return to full function. The main things to remember are to stay calm when a fracture is suspected and to call the primary veterinarian for further instructions specific to the situation. Knowing how to properly stabilize a suspected or confirmed fracture as quickly as possible is extremely important.[3] All fractures are different and handled in different ways however, it is important to remember the different variables that go into fracture causes, repair, and prognosis including age of the animal, weight of the animal, severity, location of the fractures, open versus closed, and interaction with joints.[2] Overall, a poor prognosis has been associated with medical management of olecranon fractures in equids, so surgical treatment should always be considered and options explained thoroughly to the owner.[5] Keeping in mind of the factors and considerations of every situation, most fractures in horses can be treated and some potentially have the chance to go back to full work in the future if handled properly.

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