Case File: Partial Carpal Arthrodesis

Signalment and History

- 6-year-old Missouri Fox Trotter Mare
- Presented for acute non-weight bearing lameness of the right forelimb
- The mare’s owner found her in the pasture reluctant to bear weight on the right forelimb and swelling around the carpal region. Her veterinarian attended to her at the farm and found that Amy had carpometacarpal joint luxation and biaxial proximal splint bone fractures. She was splinted with a caudal and lateral splint and sent to CSU-VTH for further evaluation and treatment.

Initial Examination, 02/02/12

On presentation, the mare was found to be grade 4 out of 5 lame, but willing to bear slight weight with the splint in place. Physical examination parameters were within normal limits, except for the noted tachypnea (60 bpm). She was immediately unloaded from the trailer and taken to radiology for further imaging. The distal carpal region was swollen with severe laxity noted in all directions. Radiographs confirmed biaxial comminuted proximal splint bone fractures as well as a sagittal fracture of the fourth carpal bone (Fig. 1). Stressed views demonstrated complete rupture of both medial and lateral collateral ligaments. A splint (Fig. 2) was applied overnight for stability and pain medication administered.

FIG. 1: Radiographs of the right carpus; arrows demonstrate fracture sites.
Proposed Treatment

Due to the severity of the mare’s injury, the only possible options were euthanasia or surgical arthrodesis of the carpus. Conservative management with splinting or casting was not a viable opinion as the severe instability would have prolonged or prevented healing of the fractures and associated soft tissues, and would have resulted in the subsequent development of severe osteoarthritis within the carpus.

Treatment

**SURGERY**

- Partial carpal arthrodesis was performed on 02/03/12.
- Carpometacarpal and middle carpal joints were arthrodesed with a 6-hole dorsomedially placed locking compression plate (LCP) and an 8-hole dorsolaterally placed locking compression plate (Figs. 3 & 4).
- A full limb fiberglass cast was placed (Fig. 5) and the mare’s recovery was assisted with head and tail ropes.
- Prevention of infection included: broad spectrum antibiotics, regional limb perfusion prior to surgery with Timentin and Amikacin, and periodic lavage with “bone juice” (saline with ampicillin, polymyxin B, and neomycin).

**FIG. 2:** Splint application pre-operatively. A caudal splint was applied from the ground to the elbow and a lateral splint from the ground to the withers.

**FIG. 3:** Intra-operative images: (A) Removal of articular cartilage via bone curette (B) Application of locking compression plates

**FIG. 4:** Post-operative radiographs
POST-OPERATIVE MANAGEMENT

- Pain management with Phenylbutazone, Butorphanol, Gabapentin, and acupuncture
- Omeprazole—preventive dose
- Systemic broad spectrum antibiotics
- Cast monitoring
- Application of a raised block with frog support on the contralateral limb
- Mare was initially kept tied to a wire to keep her from laying down

POST-OPERATIVE COMPLICATIONS

- Decreased fecal output: Large colon impaction was noted on rectal examination two days post-operatively and was treated with intravenous fluids, mineral oil, magnesium sulfate, and frequent administration of water/electrolytes via nasogastric tube. The mare was also kept on minimal food during the three days it took for the impaction to resolve.

- Increased digital pulses in support limb: The support (left fore) limb was closely monitored for any evidence of support limb laminitis. Although the mare appeared comfortable and was using the cast well, seven days post-operatively, increased digital pulses were noted in the support limb. P3 radiographs (lateral and DP) were taken and were within normal limits. Preventative treatments for support limb laminitis included removing the mare from the overhead tie and encouraging her to lie down, cryotherapy of the left limb, pentoxifylline. The increased pulses improved over the next five days and no other signs of support limb laminitis were noted.

COAPTATION

The full limb cast was maintained for four weeks (Fig. 5). At removal, there were minimal cast sores and the surgical incision had healed well. The full limb cast was replaced with a sleeve cast (Fig. 5). The sleeve cast was maintained for an additional two weeks. A full limb bandage with a caudal splint was applied after cast removal for two weeks. Due to increased lameness noted when the splint was removed, the mare had to be gradually weaned off coaptation over an additional four-week period with intermittent application (12–24 hours on and 12–24 hours off) of the splint as needed.

FIG. 5: Splint application pre-operatively. A caudal splint was applied from the ground to the elbow and a lateral splint from the ground to the withers.
Conclusion/Follow-Up

The mare was discharged on 04/06/12 with instructions of stall rest for an additional 2–3 months. Recheck was recommended before small paddock turnout. Follow-up radiographs were taken eight months post-operatively. At this time, the mare was sound at the walk and demonstrated reasonable range of motion (Fig. 6). Radiographs at this time revealed significant fusion of the carpometacarpal and middle carpal joint with healing of the splint bone fractures (Fig. 7). The mare has resumed normal turnout and is doing well.

Discussion Points

**Splinting:** Appropriate splinting was essential to the success in this case. Transportation without correct coaptation would have made the ability for surgical fixation impossible. Correct splinting of a caudal and lateral splint from the ground to the elbow was applied before transport. We extended the splint higher laterally once the patient arrived in an attempt to improve stability pre-operatively with the goal of extending the splint a joint “above” the fracture/luxation.

**Fracture fixation/arthrodesis:** Equine fracture fixation and arthrodesis can be met with many complications allowing for failure. The advent of locking compression plates (LCP) have helped to improve internal fixation in the equine patient. The LCP has a combi hole (Fig. 8) that allows for screws to be placed in either compression or in locking fashion. The locking screw has threads on the head allowing for it to “lock” into the plate, essentially serving as internally placed fixator. The fixed angle construct of the LCP is different from the conventional DCP plate, which relies on the plate-bone and screw-bone interface. Instead, friction in the LCP construct is localized to the threaded screw-plate interface. The overall result is a decrease in screw loosing and plate-bone failure which can occur with conventional constructs. The underside of the LCP also has scalloped undercuts that allow for limited contact for improved blood supply and decreased stress at the plate hole. The improved design of this plate allows for more rigid fixation and improved outcomes in fracture patients. In addition, providing a rigid fixation in this patient’s unstable carpus the risk of infection is always a concern and can weaken
even the most stable repair. The fractures associated with the luxation were closed which decreases the risk of infection; however, surgical procedure is invasive and risk of compromised blood supply due to excessive trauma of the soft tissue were possible in this patient. Therefore, multiple preventive measures were performed to prevent infection in this case. Regional limb perfusion with antibiotics prior to the start of surgery allowed for high concentrations of antimicrobials in the tissues, which are thought to be of a significant benefit in these cases.

*Support limb laminitis:* Development of support limb laminitis days-to-weeks after surgical fixation of fractures/luxations can be devastating to owners and clinicians. The best prevention for support limb laminitis is to maintain comfort in the affected limb. This patient appeared to be relatively comfortable in the cast, and pain was being managed through medication and acupuncture. However, the mare was initially tied to prevent her from having difficulties getting up and down in the casted limb. It was decided it would be better for her to lie down and decrease weight bearing in the support limb. Distribution of weight bearing forces of the support limb had been previously addressed via application of a block to even out her stance and frog support to increase the weight bearing surface, but were not enough to prevent the development of increased digital pulses. Although the exact mechanisms of support limb laminitis are unknown, inflammation has been well documented early in the development laminitis secondary to SIRS and focal inflammation secondary to trauma associated with fracture and soft tissue injury is suspected to play a role in the development of support limb laminitis. Therefore, in addition to adjusting weight bearing factors, preventative anti-inflammatory therapies (cryotherapy and pentoxifylline) were also initiated. Close monitoring of the patient’s comfort and making adjustment as needed are essential for successful post-operative fracture management.

**Questions regarding this case file may be directed to:** Britta Leise, DVM, PhD, DACVS.

*Special thanks to Claudia Nissley (owner) and Amy (patient) for allowing us to present this case, and to Dr. Dale Bowers for this referral.*
Equine News & Events

- **Tuesday, April 2 and Saturday, April 27**
  Join us for a **free** screening of the new CSU film documentary, “Horse Sense.” This film was created by Chapman University’s documentary film program and illustrates how CSU is helping advance equine health, support equine industry growth, and preserve the human-horse connection. Two dates are available in Fort Collins:
  - Tuesday, April 2 at 7:00 p.m. at the Lory Student Center Theatre on the CSU Campus. Click [here](#) to register.
  - Saturday, April 27 at Noon during the Legends of Ranching Sale at the B.W. Pickett Equine Center. Click [here](#) to register.

- **Friday, April 5**
  **Seminar**
  **“What Is Equine Sports Medicine and What Role Does It Play in the Life of the Equine Athlete?”**
  This seminar is part of the VTH Open House and will be held at the **Diagnostic Medicine Center, Room 101** starting at 7 p.m.

The seminar is presented by Dr. Melissa King, lead clinician for the [Equine Sports Medicine and Rehabilitation Service](#). Please call Katie Briggs if you have questions at 970-297-4266.

- **April 26**
  **Equine Reproduction Laboratory Grand Opening**
  The [Equine Reproduction Laboratory](#) invites you to the grand opening of its research, teaching, and clinical service flagship facility. The event begins at 4 p.m., with short remarks at 4:15 p.m. The grand opening features guided tours (until 5:15 p.m.) and refreshments. No reservations needed, just drop by and enjoy the hospitality of the new ERL.

- **April 27**
  **Legends of Ranching and Special Showing of “Horse Sense”**
  The annual [Legends of Ranching Performance Horse Sale](#) caps a trademark education program in CSU Equine Sciences. In the program, CSU students have the unique opportunity to train well-bred young horses, taking the animals from barely halter-broken to working calmly under saddle. Legends of Ranching is held at the B.W. Pickett Equine Center, on Colorado State University’s Foothills Campus. The event will feature a special showing of the documentary Horse Sense at noon, with introduction by Dr. Jerry Black, Director of the Equine Sciences Program and the Equine Reproduction Laboratory.