1. Introduction
Fractures of the pelvis are uncommon in horses, ranging from 0.9% to 4.4% of all equine lameness cases.\textsuperscript{1-4} There are few reports in the literature describing pelvic fractures in the horse. One study reported on 19 cases of pelvic fractures but none involved the tuber coxae.\textsuperscript{1} Another report described 100 pelvic fractures in horses, of which only 6 involved the tuber coxae.\textsuperscript{2} An additional study reported on scintigraphic abnormalities of the pelvic region in 128 horses, of which 25 had abnormal radiopharmaceutical uptake (ARU) of the affected tuber coxae; however, only in 6 of these 25 horses was the ARU associated with the primary cause of lameness. Follow-up information was only available on five of the six horses, and only one returned to racing.\textsuperscript{5} The purpose of this study was to determine signalment, history, clinical signs, radiographic, sonographic and scintigraphic abnormalities, treatment, and outcome in horses with fracture of the tuber coxae and to describe a radiographic technique for obtaining a dorsomedial-ventrolateral oblique projection of the tuber coxae portion of the ilium in standing horses.

2. Materials and Methods
Medical records of all horses examined at Texas A&M University between 1996 and 2007 with pelvic fractures located at the tuber coxae portion of the ilium were reviewed. Horses were included in the study if a diagnosis of fracture of the tuber coxae of the ilium had been made on the basis of history, physical examination findings, and radiographic, scintigraphic, or ultrasonographic abnormalities. Information obtained from the medical records included signalment, horse use, history, affected limb, severity and duration of lameness, radiographic, sonographic and nuclear scintigraphy findings, treatment, and outcome. Long-term follow-up information was obtained through re-evaluation of horses at the referral hospital and telephone conversations with referring veterinarians, owners, and
trainers. Follow-up information was obtained a minimum of 1 yr after injury.

Outcome was considered successful if the horse returned to its previous use or athletic soundness or, if untrained, was used for the specific activity intended by the owner. Outcome was considered unsuccessful if the horse was no longer fit for its previous use or was euthanized because of the injury or if follow-up information could not be obtained.

Radiographic Procedures

All radiographs of the tuber coxae taken with the horse standing were done using a 400 speed film/screen combination with a ceiling mounted X-ray tube. The mean KVP was 77 (range, 74–90 KVP), and the mean mAs was 27 (range, 20–40 mAs). The view is a dorsomedial-ventrolateral oblique view with a 36-in focal film distance (FFD). No grid was used. This radiograph was obtained with the horse in a standing position and bearing weight on the affected limb. This causes the pelvis on the affected side to shift dorsally, allowing for better radiographic evaluation. The X-ray beam is centered slightly off of midline (toward the affected side) at about a 50° angle from the dorsomedial to ventral lateral projection (Figs. 1 and 2). Horses that required sedation were given xylazine hydrochloride (0.40–1.50 mg/kg [0.18–0.68 mg/lb], IV).

Treatment

Horses with closed fractures were treated with phenylbutazone (1.1–2.2 mg/kg, PO) for 7–10 days after the injury. Horses were confined to stall rest or stall and a small run for 60 days, followed by various periods of pasture turnout before gradually returning to their normal exercise regimen. Horses having an open wound over the affected tuber were treated surgically under standing sedation.

Fig. 1. Radiographic view is a dorsomedial-ventrolateral 50° oblique with a 36-in FFD. No grid was used. To obtain the dorsomedial-ventrolateral view, the horse should bear weight on the affected limb. This causes the affected side (arrow) of the pelvis to shift dorsally, allowing the radiographer to obtain the correct view. The radiography tube is directed downward at a 50° angle centered on a point just lateral to midline. Photograph of the correct radiographic beam projection to obtain a 50° oblique dorsomedial-ventrolateral radiograph of the tuber coxae under standing sedation.

Fig. 2. The 14 × 17 cassette is positioned with an angle to match the X-ray beam. Fifty degree oblique dorsomedial-ventrolateral view of a horse with a fractured tuber coxae. Note a 14 × 17 radiographic cassette is positioned at an angle to match the X-ray beam.

Statistical Analysis

Student’s paired t-test was used to compare time (mo) to return to previous use between horses with partial versus complete tuber coxae bone fracture.

3. Results

All horses had a traumatic event leading to an acute, unilateral lameness. All horses sustained a traumatic event before injury either witnessed by the owner or the horse had a wound or abrasions over the affected tuber coxae. Sixteen horses (56%) were observed to run into a gate, stall door, or pipe fence, three horses hit a barrel during a barrel racing performance, four horses fell on the affected side, two horses were kicked by another horse, and four
horses came in from pasture with a wound or abrasion on the affected tuber coxae. Twenty-four of 29 horses (83%) had pain and swelling on palpation of the affected tuber coxae. Eighteen horses (62%) had fragmented bone or crepitus palpated at presentation. A wound or abrasions were located on the tuber coxae in 6 horses, and in 24 of 29 horses (83%), there was a palpable asymmetry between the tuber coxae with the affected one being lower or flatter than the unaffected tuber coxae. Rectal palpation was performed in 10 horses, and no abnormalities were noted.

All horses were lame at the time of admission, with a mean lameness score of 3.6 (median, 4.0; range, 2–5) based on a scale from 0 to 5.16 Eighteen horses showed more severe lameness at the walk than at the trot, and 22 of 29 horses had an abnormal gait where the hindlimbs tracked off to one side of the forelimbs. Twenty-four of 29 had palpable and visual asymmetry between the affected and unaffected tuber coxae. All 29 horses had radiographs taken under standing sedation, and the 50° dorsomedial-ventrolateral oblique radiographic projection showed the fracture most reliably. Twelve horses (40%) had a partial fracture with fragments originating from the caudal aspect of the tuber coxae, of which eight of the fractures had the bone fragments displaced in a caudal-ventral direction, three of the fractures were minimally displaced, and one had cranial-medial fragment displacement. Two of these partial fractures were open. Five horses (17%) had fractures involving only the caudal, lateral aspect of the tuber coxae, and all fragments were displaced in a caudal-ventral direction. One horse fractured the cranial aspect of the tuber coxae, which displaced ventrally (Fig. 3). Five horses (17%) had complete transverse tuber coxae fractures that were displaced caudally. Five horses (17%) had complete oblique fractures through the tuber coxae, of which four were displaced caudal-laterally and one was minimally displaced. One horse (3%) had a longitudinal fracture of the tuber coxae that extended into the ilium and was displaced caudally.

Ten horses (34%) underwent scintigraphic evaluation of the pelvis and hindlimbs using standing sedation. On all horses, there was marked increased radiopharmaceutical uptake (IRU) within the affected tuber coxae (Fig. 4) at the initial examination. Three horses had sequential scintigraphic examinations to assess healing at 6-mo intervals. All three horses still had moderate IRU involving the affected tuber coxae, although it was less intense compared with the original scintigraphic image taken at the time of admission 6 mo previously. At 12 mo after injury, the IRU in the affected tuber coxae of these three horses was mild. In four horses, the area of IRU was associated with displacement of the tuber coxae fracture fragment, creating a shorter distance from the pelvic midline to the affected tuber coxae compared with the unaffected side.

Twenty-seven horses (93%) returned to athletic use. Horses sustaining partial fractures of the caudal aspect of the tuber coxae returned to previous use significantly earlier (3.5 mo) compared with horses with complete tuber coxae fractures (6.5 mo).

4. Discussion
Results of this study suggested that the majority of horses (93%) with fractures of the tuber coxae of the
ilium can return to athletic soundness after surgical or non-surgical treatment. Horses sustaining incomplete or partial fractures involving just the caudal, lateral, or cranial aspect of the tuber coxae were able to return to previous activity earlier—within 3.5 mo of injury—which was significantly earlier than horses sustaining complete fracture of the tuber coxae and ilium. This is a higher success rate than described by Davenport-Goodall and Ross in a nuclear scintigraphic study involving 128 horses, in which only 1 of 5 horses having IRU in the tuber coxae region returned to racing and the other 4 horses were retired. All four racehorses (three Thoroughbreds and one Quarter Horse) in this study returned to racing. It is feasible that these horses were not valuable as breeding animals and thus not retired or perhaps sustained a less severe injury compared with those in the previous study.

Almost 60% of the horses in this study sustained the tuber coxae fracture while entering a stall door or gate. In other reports, a horse falling down was the most frequent cause of pelvic fracture. Falling down caused the tuber coxae fracture in only four of the horses in this study. Interestingly, four horses used for barrel racing sustained the fracture after hitting a barrel. Seventy percent of the horses fractured the right tuber coxae, which differs from the equal distribution of right- and left-sided pelvic bone fractures previously described. We cannot explain the high incidence of right-sided tuber coxae fractures in this study. One potential explanation is that horses are led from the left side and a misbehaving horse commonly bends their head to the handler as the hindlimbs sway to the right. Because trauma when traveling through a stall or door is a common etiology, this seems like a logical cause for more right-sided tuber coxae injuries.

All horses had radiographs obtained under standing sedation. The 50° dorsomedial-ventrolateral radiographic projection showed the tuber coxae fractures most reliably in all horses. Radiography techniques currently used for diagnosing pelvic fractures or abnormalities of the coxofemoral joints are ventrodorsal radiographs obtained with the horse in dorsal recumbency and under anesthesia or ventrodorsal radiographs in the standing sedated horse. More recently, the usefulness of a standing lateral oblique radiographic projection has been described in evaluating horses with pelvic injuries. The standing lateral oblique projection allows visualization of the caudal half of the ilial shaft, greater trochanter of the femur, the femoral head, the acetabulum, and the coxofemoral articulation on the side closest to the cassette; however, the ilial wings, tuber sacral, sacroiliac joints, and tuber coxae cannot be visualized. To the author’s knowledge, this is the first report of obtaining a 50° dorsomedial-ventrolateral oblique view of the equine pelvis in the standing horse. This technique is easy to perform, is non-invasive, and provides an invaluable diagnostic tool in horses suspected of having tuber coxae or ilium fractures. In addition to the complications related directly to anesthesia, horses with suspected pelvic trauma or fracture may be subject to additional risks when radiographs are obtained under general anesthesia. The 50° dorsomedial-ventrolateral radiographic projection of the tuber coxae and ilium should be considered in horses sustaining injury to this area.

Ten horses underwent scintigraphic evaluation of the pelvis and hindlimbs using standing sedation. There was marked IRU within the affected tuber coxae, which was expected. Three of these horses had sequential scintigraphic examinations at 6 and 12 mo after injury and, although the horses were sound and back to previous exercise, there was still a moderate IRU at the affected tuber coxae. These three horses had incomplete tuber coxae fractures. At 12 mo after injury, the IRU was minimally visible.

It seems that increased pharmaceutical uptake in the region of the tuber coxae must be interpreted with caution, especially if the history and clinical exam do not support injury to this area. In addition, in this study, sequential scintigraphic examinations of the fractured tuber coxae was not useful in determining when the horse could return to previous use.

Horses with partial fractures of the caudal-lateral aspect of the bone returned to previous use in a significantly shorter time period (3.5 mo) compared with horses sustaining complete tuber coxae fractures (6.5 mo). The majority of horses in this study did have muscle atrophy or abnormal bony flattening over the affected tuber coxae. Horses with tuber coxae fractures have an excellent prognosis for returning to athletic use but will most likely have a permanent blemish associated with the area.

5. Conclusions and Clinical Relevance

Results suggested that horses with fractures of the tuber coxae of the ilium can return to athletic soundness after extended periods of rest and emphasized the need for obtaining a 50° dorsomedial-ventrolateral oblique radiographic progression in horses suspected of sustaining injury to this region.

References and Footnotes


*Kodak X-OMatic cassette, Eastman Kodak, Rochester, NY.

*Coll-M150, Varian Power Grid and X-ray Tube Products, San Carlos, CA.*