How to Ultrasound the Normal Pelvis for Aiding Diagnosis of Pelvic Fractures Using Rectal and Transcutaneous Ultrasound Examination

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1. Introduction
Pelvic fractures do not occur frequently in horses, and reports of incidence range from 0.9% to 4.4%. Despite this low incidence, many equine practitioners will, at some point in time, be faced with determining a diagnosis, a prognosis, or formulating a treatment regimen based on their impressions of fracture severity. Because the equine pelvis is a complex anatomic structure, the diagnosis of pelvic fractures is often one of suspicion because of the extensive musculature coupled with size of the horse. Furthermore, swelling and crepitus that may be appreciated in long-bone fractures may be more difficult to recognize.

Diagnosis often involves ventrodorsal pelvic radiographs that require that the horse be placed under general anesthesia. However, this method of diagnosis has inherent risks because of the potential of fracture displacement and/or internal hemorrhage caused by laceration of the iliac arteries on recovery.

More recently, a detailed description of the pelvic-ultrasound anatomy has been reported in normal horses, and two studies incorporate the use of ultrasound to help diagnose pelvic-bone abnormalities. The purpose of this abstract is to describe our approach to the ultrasonic evaluation of the equine pelvic region and its use in determining whether or not fractures have occurred in the pelvis or associated structures such as the head and/or neck of the femur. Examples of clinical cases in which fractures were diagnosed will also be presented.

2. Methods
A thorough clinical examination should first be performed to assess lameness, swelling, crepitus, and/or asymmetry of the pelvic region. A thorough rectal examination should also be performed under moderate sedation using detomidine hydrochloride at 0.02 mg/kg. A 7.5-MHz linear transducer should then be used rectally to assess the integrity of the pelvic bones. Beginning at the pubic symphysis, the division between left and right pubic bones and left and right ischium should be visualized (Fig. 1). The examination should progress past the obturator foramen laterally over the dorsal aspect of the acetabulum and then dorsally to visualize the smooth ilium as the probe is passed laterally and dorsally (Fig. 2). The probe is...
flipped dorsally to visualize the sacrum, the ventral sacroiliac ligament, and the joint (Fig. 3). After thorough evaluation of one “hemi” region of the pelvis, the contralateral side is evaluated in a similar manner. Little to no difference should be appreciated between the left and right side in terms of symmetry, smoothness of bone surface, and sacroiliac-ligament thickness.

The coxofemoral and iliac region are then prepared by clipping the hair and applying a generous amount of ultrasound gel. Palpation of the greater trochanter should be performed which is then used for a landmark. A 3.5-MHz probe is used transcutaneously. Figure 4 depicts the region of transcutaneous ultrasound and the coinciding bony structures. The head of the femur creates an obvious convex line in close apposition with the acetabulum. After the femoral head, neck, and acetabulum are visualized, the probe is passed laterally and dorsally to visualize the body of the ischium, the tuber coxae, and the tuber sacrale, respectfully. Similar to the rectal portion of the ultrasound examination, the ilium, tuber coxae, and tuber sacrale should exhibit symmetry, smooth periosteum, and an absence of defects in the body of the ischium.

3. Results

Currently, our method of assessing horses with suspicious pelvic-bone fractures includes a thorough physical examination and a detailed ultrasound evaluation both rectally and transcutaneously. A normal pelvic examination will reveal symmetry and smooth surfaces of the ilium, ischium, and pubis. We have performed pelvic ultrasound evaluations in five sound horses of various ages and have found little variation from the normal bone structure. Thorough ultrasound examinations have allowed us to diagnose various clinical cases of pelvic-bone fractures without the
need to anesthetize these patients and place them at risk for compounding the fracture or causing catastrophic hemorrhage. At this time, we have not had any cases where we have missed a fracture on ultrasound and later found it on a radiograph or subsequent ultrasound.

Fig. 3. (A) To image the sacrum, the ventral sacroiliac ligament, and the joint, the linear probe is now rotated 180° from the position used to image the pubis. (B) The coinciding ultrasound on the right reveals an angled but smooth bone (the arrow is pointing to the sacroiliac joint). Complete symmetry should be appreciated between the left and right side.

Fig. 4. (A) The 3.5-MHz probe is used transcutaneously to reveal the dorsal surfaces of the ilium, acetabular joint, greater trochanter, and neck of the femur. (B) The bone surfaces imaged are depicted on the right. (C) Ultrasound images. The red arrow is pointing to the acetabular joint, and the yellow arrow is pointing to the neck of the femur.
4. Discussion

We have found that rectal and transcutaneous ultrasound examination has been an invaluable tool in assessing horses with suspicious pelvic fractures. We have had several cases in which general anesthesia was not pursued because of the risk of catastrophic hemorrhage or further compounding effects on the fracture. Ultrasound examination of these cases revealed detailed evaluation of the character of the fractures so that a treatment plan and prognosis could be determined. Other suspicious cases of pelvic-bone fractures were presented in which the owners could not afford the cost of general anesthesia and radiographs. Ultrasound was also extremely beneficial in these cases because of the minimal costs associated with performing an ultrasound examination.

A study by Tomlinson et al. reports a high degree of correlation between measurements obtained with ultrasonography of the pelvis and measurements obtained by magnetic resonance imaging (MRI), computed tomography (CT), and gross sectioning in normal horses and ponies. Furthermore, in this study, very little variability was detected between individual horses, and the majority of the bone surfaces examined appeared to be smooth. We agree with these assessments and find that ultrasound images that deviate from this general appearance usually suggest pathology. Recovery rates of horses with pelvic fractures have been reported from 50–77%. A positive outcome of 77% was reported by Rutkowski and Richardson when 100 cases of pelvic fractures were reviewed. These percentages combined with the ability to thoroughly assess pelvic fractures using equipment that many practitioners now have available should encourage the pursuit of accurate diagnosis with ultrasound examination.

References and Footnote


*Dormosedan, Pfizer Animal Health, Exton, PA 19341.