

Ultrasonographic Examination of the Normal and Diseased Equine Pelvis

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A technique was devised to map the normal equine pelvis using ultrasonography, validated by computed tomography, magnetic resonance imaging, and frozen cadaver slices. A reference range was developed of measurements for each structure imaged. This technique was then used to diagnose fractures, hematomas, subluxations, and ligament damage in 25 clinical cases of lameness referable to the pelvis. Authors' address: Department of Clinical and Population Sciences, 225k Veterinary Teaching Hospitals, University of Minnesota, St. Paul, MN 55108. © 2000 AAEP.

Introduction

Diseases of the equine pelvis are most commonly diagnosed with a combination of clinical examination and imaging modalities. Clinical examination and history may often only suggest the pelvis as a source of lameness. Radiographic examination can be effective in imaging the bones of the equine pelvis, but gives minimal information about soft tissue injury.¹ It requires a machine with a high voltage capacity, not available to the average practitioner. The most effective method is to place the animal in dorsal recumbency under general anesthesia. However, recumbency and recovery from anesthesia can distract or compound a pelvic fracture. Nuclear scintigraphy can demonstrate active bone remodeling but cannot accurately determine the cause of the remodeling, may not be useful in assessment of early soft tissue injury, and is not always available.² Thermography may demonstrate active inflammation in an area but may not be specific in defining the etiology.³ Ultrasonography can be used to examine soft tissue and bone sur-

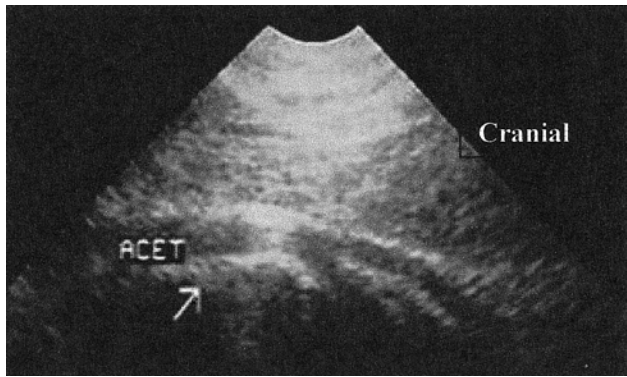
faces. Little information exists about the appearance of changes to the pelvis secondary to osteoarthritis or soft tissue injury.

Materials and Methods

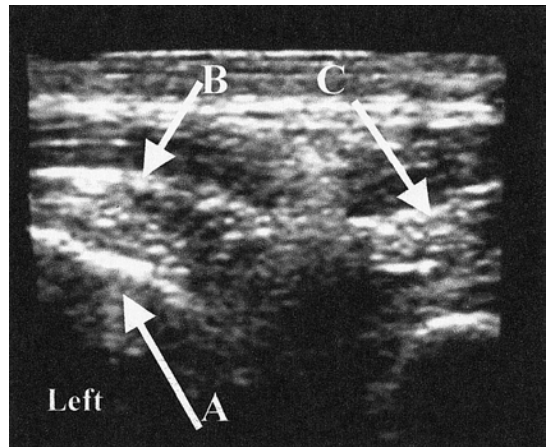
Sonographic anatomy of the equine pelvis was obtained from six normal ponies. Clinical evaluation was used to exclude hindlimb lameness. Ultrasonographic examination was performed in longitudinal and cross-sectional planes. A 7.5 MHz linear array transducer was used for the sacroiliac area, tuber coxae and tuber ischii, and rectal examination. The ilial wing, ilial body, and coxofemoral joints were imaged with a 3.5 MHz sector transducer. The ponies were euthanized and the isolated hindquarters were imaged with computed tomography (CT) and magnetic resonance imaging (MRI) producing 10 mm contiguous sections in longitudinal and cross-sectional planes. The same measurements were taken as for ultrasound. Cadavers were frozen and then cut into 10 mm transverse sections. Linear regression was used to determine the degree of correlation between mea-

NOTES

IMAGING



Normal acetabulum.



Subluxation of the left tuber sacrale (A). Note the increased density and thinning of the left dorsal sacroiliac (B) ligament as compared to the normal right (C).

surements obtained by ultrasound and the other imaging modalities (level of significance $p < 0.05$).

Six normal adult horses (3–10 years) weighing 450–550 kg were examined with ultrasound as described for the ponies. For each structure measured a mean, standard deviation, and range of values was calculated. A non-paired t test was used to test for differences between sides using the sonographic data from all animals.

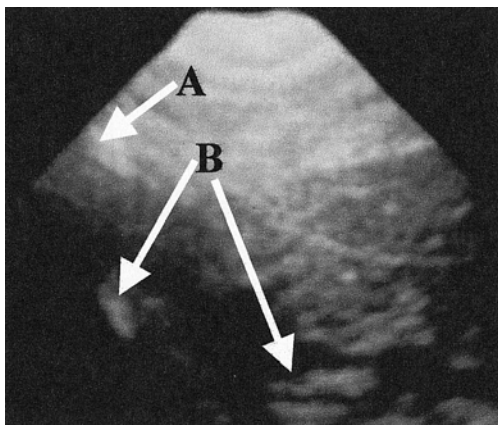
Ultrasonographic examination of the pelvis of 25 clinical cases with lameness attributable to the upper limb and/or back of a patient was performed (all lower leg problems were ruled out with a combination of physical examination and diagnostic anesthesia). Transducers ranging from 7.5–3.5 MHz were used. Measurements obtained were compared to normal reference ranges developed in the previous study. Other diagnostic imaging modalities (radiography, scintigraphy, and thermography) were also used and a comparison made.

The protocol was approved by the University of Minnesota animal care and use committee.

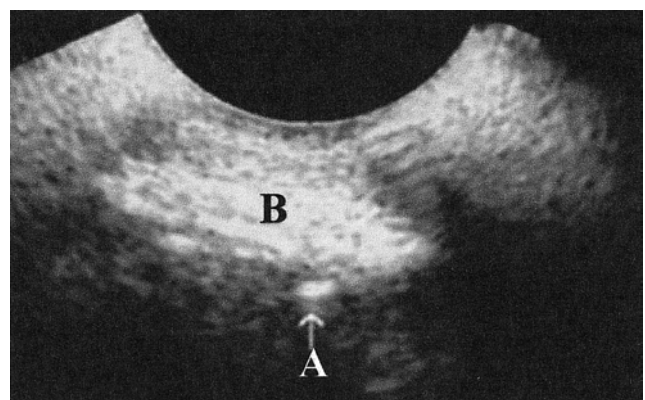
Results

Statistical analysis showed correlation ($r^2 = 0.9788$, $p < 0.05$) between the ultrasound and CT measurements in the ponies. There was also good correlation between ultrasound and MRI ($r^2 = 0.99$, $p < 0.05$). The difference between structures measured on each side was not statistically significant ($p > 0.05$). Data obtained from the horses was normally distributed. There was little variation and no significant change in size of structure associated with weight of the six horses ($r^2 = 0.0007$, $p > 0.05$).

Ligaments imaged and measured were the dorsal and ventral sacroiliac ligaments and the sacrosiatic ligament. Bone surfaces imaged included the dorsal spinous processes of the sacrum, tuber sacrale, wing and body of ilium, tuber coxae, acetabulum, the head and greater trochanter of the femur, and the ischium. The echo produced by the bone surfaces was smooth with the exception of the tuber coxae and the greater trochanters. Rectal examination enabled imaging of the sacroiliac joints, ventral sa-



Fractured acetabulum; acetabulum (A) and fracture fragments (B).



Chip fracture off the left tuber coxa (A); tensor fascia lata (B).

cranial foraminae, pubic symphysis, and the obturator foraminae. Of the 25 cases examined, 10 were diagnosed with dorsal sacroiliac ligament desmitis. Of these 10 cases, 8 had a chronic history of lameness in one hindlimb. The chronic cases had a decrease in ligament size on the affected side when compared with the normal ranges (mean \pm SE normal, 1.09 ± 0.07 cm²; mean \pm SE affected, $= 0.71 \pm 0.06$ cm²; $p < 0.001$). Little change occurred in the sonographic appearance after 2–4 months. Two of the 10 cases had an acute history of lameness. Hypoechoic areas and enlargement of the dorsal sacroiliac ligament was seen on the affected side. Ligament size fell outside the normal range but the numbers were too small for statistical analysis. Two cases were diagnosed with sacroiliac subluxation, one was associated with a sacral fracture.

The horse with the fracture was euthanized, and the findings confirmed at necropsy. Six horses were diagnosed with fractures of the pelvic body. In 2 of these cases that improved with stall rest, the fractures were confirmed with radiographs. The remaining 4 were euthanized and fractures were confirmed at necropsy. Five cases were diagnosed with fractures of the tuber coxa. Two horses had disease of the coxofemoral joint, one had septic arthritis, and the other a fractured capital physis.

Discussion

Previous studies have reported a significant proportion of lameness associated with the pelvis in horses.^{4,5} Ultrasonographic examination of the pelvis in this study aided diagnosis of ligament damage and displacement of bone surfaces. Ultrasound may also be useful in monitoring the progression of healing. Further study over a longer time period is indicated.

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