How to Perform a Complete Ultrasound Exam of the Equine Shoulder

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Abstract

Ultrasound of the equine shoulder is a valuable technique for identifying soft tissue and bony lesions of multiple structures of the shoulder joint. This procedure can be performed in the field with standard equipment that is available to equine ambulatory practitioners. Ultrasound is also useful in performing ultrasound-guided intrasynovial injections for the purpose of lameness diagnosis and injection of therapeutic agents.

1. Introduction

Upper limb lameness involving the shoulder joint often presents a diagnostic challenge for the equine practitioner in the ambulatory as well as the referral hospital setting. Diagnostic intra-articular intrabursal anesthesia can be used to localize the lameness to the shoulder joint or bicipital bursa. Radiographic evaluation may yield a definitive diagnosis in some cases; however, radiographs are primarily available only at referral hospitals. Where available, radiographs offer somewhat limited visualization of the bony surfaces of the shoulder and even less information on the soft tissue structures. Nuclear scintigraphy may also be used to localize the lameness to the shoulder, but a definitive diagnosis must still be made. The use of ultrasound to evaluate abnormalities of the bicipital bursa and biceps tendon has been described in several references [1-10]. Ultrasonographic evaluation of the normal shoulder joint, including the biceps tendon, bicipital bursa, and tendons of attachment of the infraspinatus and supraspinatus muscles and infraspinatus bursa, has also been described [11]. A complete ultrasonographic examination can be performed using standard ultrasound equipment available to the ambulatory equine practitioner. The purpose of this paper is to support the use of ultrasound to diagnose soft tissue and bony abnormalities involving all visible structures of the shoulder joint.

Indications for shoulder ultrasound include lameness that does not improve with distal perineural or intra-articular anesthesia. The examiner may consider ultrasound of the shoulder region before performing intra-articular anesthesia of the shoulder joint or bicipital bursa region. Introduction of blocking agents may be confused with effusion. If ultrasonographic abnormalities are identified, ultrasound guided bicipital bursa anesthesia may be performed at that time. The shoulder should also be evaluated in horses with a known history of shoulder trauma, including open wounds or lacerations. The shoulder region is also a relatively common location for draining tracts. Knowledge of normal ultrasonographic anatomy in these cases will assist the examiner in determining potential communication with synovial structures and/or bone. Radiographic or nuclear scintigraphic localization of the lameness to the shoulder region also warrants ultrasound evaluation.

2. Materials and Methods

A complete ultrasonographic examination of the shoulder joint should include the biceps tendon, bicipital bursa, humeral tubercles, infraspinatus bursa and tendons of attachment of the supraspinatus muscle, and infraspinatus muscle. It is important to remember that the shoulder does not have collateral ligaments. The bony surfaces of the scapula and shoulder joint should also be evaluated. Horses may be lightly sedated with either detomidine HCl [a] (0.004 - 0.008 mg/kg, IV) or xylazine HCl [b] (0.3 - 0.4 mg/kg, IV). The best images are obtained with the skin clipped with #40 clipper blades over the entire shoulder region. The skin should be washed, and ultrasound coupling gel applied. Alcohol saturation may be used in horses unable to be clipped. All structures should be evaluated with the highest frequency transducer available (ideally, 7 - 10 MHz) at a scanning depth of 4 - 6 cm. A rectal, curvilinear, or tendon linear transducer will all produce diagnostic images. The biceps tendon is followed distally from its origin on the supraglenoid tubercle of the scapula (Fig. 1) to its...
musculotendinous junction located distal to the humeral tubercles. Fat present within the proximal portion of the biceps tendon (between the origin and the humeral tubercles) causes this portion to be somewhat obscure to visualize. The biceps tendon then becomes bilobed as it courses over the humeral tubercles, where it demonstrates a solid echogenic appearance. The smaller, medial lobe is situated between the intermediate tubercle and the lesser tubercle (Fig. 2A). The larger, lateral lobe is situated between the cranial eminence of the greater tubercle and the intermediate tubercle (Fig. 2B). The medial and lateral lobes are connected by an isthmus at the level of the intermediate tubercle. Biceps tendonitis can be somewhat difficult to identify in mild cases because of the curvature of the tendon as it courses over the tubercles. This can result in hypoechoic areas in the normal tendon that can be misinterpreted as tendonitis. Suspect areas should be verified by identifying a disrupted fiber pattern on longitudinal axis views.

The humeral tubercles should demonstrate a smooth cortical surface. Fractures of the humeral tubercles can be identified by step defects or cortical disruption (Fig. 3). Fractures of the humeral tubercles may be difficult to visualize on radiographs and are often seen easily with ultrasound. The bicipital bursa is also evaluated at this level. The bursa is located between the humeral tubercles and the biceps tendon. Septic bicipital bursitis may appear as a severely distended bursa with anechoic to hypoechoic fluid (Fig. 4A). Fibrinous clumps may be seen floating in the fluid. The synovium of the septic bursa is often markedly thickened. Non septic bicipital bursitis can be recognized by increased fluid within the bursa. This is best visualized at the synovial reflection near the lateral lobe of the biceps tendon (Fig. 4B).

The supraspinatus tendon emanates from the central portion of the supraspinatus muscle, which arises from the supraspinous fossa of the scapula. This muscle can be located by placing the transducer cranial to the scapular spine in transverse fashion and following the muscle belly distally toward the point of the shoulder. The lateral tendon of attachment demonstrates a triangular shape as it inserts on the cranial part of the greater tubercle just lateral to the lateral lobe of the biceps tendon (Fig. 5). The medial tendon of attachment inserts onto the lesser tubercle; however, this tendon is quite small and is somewhat difficult to visualize.
The infraspinatus tendon emanates from the center of the infraspinatus muscle belly, which arises from the infraspinous fossa of the scapula. The infraspinatus muscle and tendon are located by placing the transducer caudal to the scapular spine in transverse fashion and following the tendon distally. The tendon is somewhat rectangular in shape at its musculotendinous junction. The tendon demonstrates a trilobed appearance at the level of the caudal part of the greater tubercle (Fig. 6), and then, it flattens on its insertion onto the cranial-lateral aspect of the humerus proximal to the deltoid tuberosity. Infraspinatus tendinosis may be found with fractures and/or osteomyelitis involving the caudal part of the greater tubercle (Fig. 7). The infraspinatus bursa is located between the infraspinatus tendon and the caudal part of the greater tubercle. The normal bursa is usually not clearly visible. Septic infraspinatus bursitis can appear similar to that described for the bicipital bursa (Fig. 8).

The bony surfaces of the scapular spine, supraspinous, and infraspinous fossae as well as the scapular neck can be evaluated in horses with suspect scapular fractures. The bony surfaces of the scapula are generally smooth. Fractures can be identified as bony congruities or step defects. Comparison to the contralateral limb should be performed to avoid misdiagnosis. The caudolateral aspect of the shoulder joint may also be evaluated sonographically by placing the transducer caudal to the infraspinatus tendon at the level of the greater tubercle (Fig. 9). This requires an increased depth of 6 - 8 cm to evaluate the bony surfaces and joint capsule of the scapulohumeral articulation. This is especially helpful in cases with suspect septic arthritis or degenerative joint disease.
there may be multiple tracts and/or foreign bodies. Ultrasound can also be used to identify communication of these draining tracts with the synovial structures of the shoulder joint.

3. Results
Records were reviewed of all horses presented to the Large Animal Ultrasound Service of the University of California, Davis Veterinary Medical Teaching Hospital (UCD-VMTH) from August 1999 through March 2003. Ultrasonographic evaluation of the shoulder region was performed in 61 horses for a total of 81 examinations during this time period. Abnormal findings were found in 43 horses. The most common finding was bicipital bursitis in 19 horses. Septic bicipital bursitis was seen in three horses. Severe non-septic bursitis was seen in two horses. The remaining 14 horses demonstrated mild to moderate bicipital bursitis. Thirteen horses demonstrated evidence of bicipital tendinitis. Five horses were severely affected. Two horses demonstrated moderate tendinitis, and six horses demonstrated mild tendinitis.

Irregularities of the humeral tubercles were seen in several horses. Mild to moderate irregularity of the intermediate tubercle of the humerus was seen in 13 horses. Many of these horses demonstrated evidence of bicipital bursitis. Mild to moderate irregularity was noted of the cranial eminence of the greater tubercle in three horses and of the caudal eminence of the greater tubercle in two horses. The lesser tubercle was mildly irregular in one horse. Osteomyelitis of the cranial eminence of the greater tubercle was seen in one horse and of the caudal eminence of the greater tubercle in one horse. Fractures of the caudal eminence of the greater tubercle were seen in two horses. Multiple fractures of the humeral tubercles were seen in three horses.

Septic infraspinatus bursitis was found in two horses. Both horses demonstrated evidence of infraspinatus tendinitis secondary to irregularity of the caudal eminence of the greater tubercle (one fracture and osteomyelitis case described above). Both horses had a history of wounds to the shoulder region. Severe infraspinatus tendonitis was also noted in another horse with a fracture of the caudal eminence of the greater tubercle. Mild non-septic infraspinatus bursitis was noted in three horses. The lateral tendon of attachment of the supraspinatus muscle was mildly affected in four horses. Dystrophic mineralization of the surrounding musculature of the shoulder joint, especially the brachiocephalicus muscle belly, was seen in 16 horses. Evaluation of the scapulohumeral joint revealed joint effusion in two horses, and evidence of osteophyte formation or degenerative joint disease was found in four horses. Evaluation of the scapula revealed a midbody scapular fracture in one horse, a marked irregularity of the scapular spine in two horses, and a scapular sequestrum in one horse. A fracture of the supraglenoid tubercle was also seen in one horse.

Seven horses that presented for evaluation had wounds and draining tracts in the shoulder region. The source of infection was identified in six of seven cases and included osteomyelitis, foreign bodies, and abscesses. In the case where a source of drainage was not found, the draining tract was followed deep to the scapula but not to its full extent. Twenty-nine ultrasound-guided procedures were performed during this time period. All but four involved injection and/or aspiration of the bicipital bursa, either for injection of intrabursal anesthesia or therapeutic agents. The remaining four procedures involved ultrasound-guided aspiration and standing lavage in one of the horses with septic infraspinatus bursitis.

4. Discussion
The results of this study strongly support the use of ultrasound to diagnose soft tissue and bony abnormalities of the entire shoulder region. Positive findings were found in 43 of 61 (70%) horses. The biceps tendon and bicipital bursa were the most commonly affected structures in this report, similar to that reported in the literature [2-10]. However, ultrasound was instrumental in the diagnosis of many soft tissue and bony abnormalities not involving these structures. Lesions of the infraspinatus tendon and bursa, including septic infraspinatus bursitis, have not yet been reported. One horse with septic infraspinatus bursitis was successfully treated by using standing, ultrasound-guided, through-and-through lavage. The second horse was recently diagnosed, and follow-up was not available at the time of abstract submission. Accurate diagnosis was critical in these cases and could only be obtained through the use of ultrasound. In addition, ultrasound guided procedures were critical in the successful treatment of this horse and other cases in which it was used.

Ultrasound is also heavily used at the UCD-VMTH for guidance into synovial structures, especially the bicipital bursa for injection of either anesthesia or therapeutic agents. Verification of needle placement into the bicipital bursa or other synovial structure is critical for the accurate placement of these agents. Ultrasonographic evaluation of the shoulder is readily performed with equipment available to the equine practitioner. Although the best images are obtained with 7 - 10 MHz linear transducers, diagnostic images may also be obtained using a 5 - 6 MHz rectal transducer common to many practices. Initially, evaluation of the above-described structures in the shoulder may prove overwhelming to the beginning ultrasonographer. This should not deter veterinarians from learning to evaluate the shoulder. Initially, practitioners may choose to focus on the biceps tendon, bicipital bursa, and humeral tubercles, because they are the most commonly affected structures. When comfortable with these structures, additional structures can be added to the routine examination of the shoulder.

This information should encourage the equine practitioner to consider ultrasonographic evaluation in horses presenting with
upper forelimb lameness that can be localized to the shoulder region. More importantly, it should encourage practitioners to expand their evaluation beyond the biceps tendon and bicipital bursa. The technique for evaluation of the entire shoulder region is exceptionally well described by Tnibar et al., [11]. The author highly recommends using the technique described in that study to perform ultrasound of the shoulder region. The addition of this technique to your practice may prove beneficial in diagnosing challenging upper forelimb lamenesses.

Footnotes
[a] Dormosedan, Orion Corporation, Espoo, Finland.

References


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