Musculoskeletal Ultrasound of the Foal

Katherine S. Garrett, DVM, DACVS-LA

How to Maximize the Use of Ultrasound in the Field

1. Introduction
Lameness in foals can be extremely frustrating when the source of lameness is not readily apparent. The clinical presentation of a traumatic insult can be similar to that of a septic process, so accurate and prompt diagnosis of the underlying problem is important to administer appropriate treatment to minimize morbidity and mortality. Proximal limbs are more challenging to assess, as soft tissue swelling and/or effusion can be difficult or impossible to palpate during a physical examination. Ultrasound examination of the lame foal can provide valuable information that assists with a definitive diagnosis of the cause of lameness using equipment that many practitioners have readily available to them.

2. Materials and Methods
If at all possible, the region of interest should be clipped to maximize image quality and diagnostic yield. The clipped area should be cleaned with isopropyl alcohol or soap and water and acoustic coupling gel applied. Sedation may be helpful if the foal is fractious. A linear tendon probe is generally appropriate for the distal limbs, stifle, elbow, and shoulder region. In younger or smaller foals, it may also be possible to image the pelvis with a linear probe. If a linear probe cannot provide the penetration required to image deeper structures, a lower frequency curvilinear probe may be necessary. The specific frequency, depth, gain, and other machine settings should be optimized for each patient and body region. A systematic approach is helpful for evaluating each body region. Specific anatomic structures to evaluate include the following: bony margins, physes, articular cartilage, synovial fluid, synovial membrane, tendons and ligaments, the subcutaneous tissues, and muscle layers. Particularly challenging areas in foals are any places where ossification has not been completed (e.g., physes, trochlear ridges of the distal femur, and proximal humeral tubercles). Comparing the limb of interest to the contralateral limb is extremely helpful for determining if a suspicious area is abnormal.

3. Results
Some general principles apply to ultrasonographic examination of the lame foal. A wide variety of abnormalities of a region can produce a similar clinical presentation, namely, lameness, soft tissue swelling, and sensitivity to palpation or flexion. The goal of the ultrasonographic examination is to identify specific abnormalities and therefore narrow down the list of differential diagnoses, while recognizing that additional tests (e.g., radiography, synoviocentesis and fluid analysis, and hematology) may be necessary as well. A region can be divided into the following four major categories: subcutaneous tissues/muscle, tendons and ligaments, synovial structures, and bones. One or more of these structures may be abnormal and provide clues as to the source of lameness. Generalized subcutaneous thickening is often a nonspecific finding. Lacy-appearing
subcutaneous edema may indicate a cellulitis (Fig. 1), and a focal encapsulated pocket may represent an abscess or seroma (Fig. 2). Foreign bodies may be identified in any layer of tissue even if a puncture wound is not immediately apparent (Fig. 3), and ultrasonography is more helpful than radiography in cases of nonmetallic foreign bodies. Although tendon or ligament injury is relatively uncommon in foals, it does occur (Fig. 4). The injury may be traumatic in nature or secondary to sepsis. Synovial effusion and synovial membrane proliferation are hallmarks of synovitis due to a variety of causes (Fig. 5). In foals, a septic synovitis is often the culprit. Echogenicity of synovial fluid is a poor predictor of synovial sepsis in horses, and any suspicious effusion should be further...
investigated via synoviocentesis with fluid analysis to determine if sepsis is likely present. Although joints are often the first synovial structures that come to mind, bursas and tendon sheaths should also be assessed and sampled accordingly (Fig. 6). Ultrasound is an excellent tool with which to assess bony margins. Areas of irregularity consistent with osteomyelitis may be identified readily with ultrasound, sometimes prior to abnormalities becoming apparent radiographically (Fig. 7).4 Widening and irregularity of physes due to septic physitis may also be observed (Fig. 8). Bony margin discontinuities consistent with fracture can be appreciated, which are particularly useful in areas that are more challenging to radiograph, such as the pelvis (Fig. 9). Osteochondrosis lesions of the distal femur may also be identified using ultrasonography, even when radiographic images are normal or equivocal.5,6 The presentation of early osteochondrosis can be identical to that of a septic joint, with lameness and large amounts of synovial effusion. The finding of normal synovial fluid analysis with an ultrasonographically identified osteochondrosis lesion can change the course of treatment in these cases.

4. Discussion

In the author’s practice, ultrasonography is routinely incorporated into the diagnostic approach for lame foals. It is readily available, noninvasive, and generally well tolerated by the patient (sometimes with the aid of sedation). The information gained often guides the subsequent diagnostic workup, which can efficiently focus tests that involve more invasive procedures on targeted sites of concern. For example, in a foal with diffuse fetlock region swelling, ultrasonographic findings can determine if a synovial structure is sampled, which synovial structure is sampled (e.g. fetlock joint, digital flexor tendon sheath, proximal or distal interphalangeal joint, or navicular bursa), or if an abscess or cellulitis is present in the absence of synovial effusion and synovial sampling is not indicated at the time but drain placement is indicated. As
with any new technique, it does require some practice to become comfortable with ultrasonographic anatomy of new areas. This is particularly challenging in foals, who are constantly growing and changing. Comparisons between the limb of interest and the contralateral limb are extremely helpful when trying to determine if a finding is a true abnormality or is normal for a particular foal at its current stage of growth. For example, the thickness and appearance of cartilage is variable, even between foals of similar ages, and comparison to the contralateral (normal) limb can prevent a misdiagnosis or allow recognition of a clinically relevant abnormality.

Fig. 9. Image of the ilial wing and tuber coxae. A step defect in the bony margin of the ilial wing at the fracture site is present (arrow). A fracture should not be confused with the normal physis present at the tuber coxae (arrowhead). TC, tuber coxae. Lateral is to the right of the image.

Acknowledgments

Declaration of Ethics
The Author has adhered to the Principles of Veterinary Medical Ethics of the AVMA.

Conflict of Interest
The Author has no conflicts of interest.

References