

Ultrasonography in Horses

Equine practitioners use ultrasound machines to help diagnose a number of physical abnormalities

Overview

The equine industry has enjoyed and benefited from the introduction of multiple diagnostic imaging techniques. One of the more common of these is ultrasonography. Ultrasound exams or “scans” are becoming almost as commonplace as radiographs (X-rays) for diagnosing any number of physical abnormalities that can occur in horses.

How It Works

An ultrasound machine generates high-frequency sound waves in the range of 2 to 18 MHz (megahertz), frequencies that are hundreds of times higher than the human ear can detect.

Ultrasound waves are generated by the hand-held probe and are directed into the body at the desired location. Wherever the ultrasound waves meet a “layer” between two different structures or organs in the body with different densities, some of the waves are reflected back to the probe. For example, blood, fat, liver, kidney, spleen, connective tissues, and muscle each have different densities, therefore reflect ultrasound waves differently.

Based on these reflections or “echoes” that are detected by the probe, a digital image of the internal structures or organs in the area being scanned is created and visualized on the ultrasound machine’s monitor. Each tissue, due to the inherent differences in density, appears more or less bright on the monitor: Bone is bright white, fluid-filled structures are black, and all other tissues lie somewhere between these two limits.

The higher frequency probes (up to 18 MHz) provide better detail than the lower frequency probes, but they cannot penetrate very deeply into the body. Therefore, in horses, lower frequency probes are commonly employed (5 and 7.5 MHz, down to as low as 1.5-3.5), which provide relatively



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good detail and are capable of imaging structures deeper in the body (e.g., uterus, ovaries, etc).

How is it Performed?

Horses are usually not sedated for an ultrasound examination; however, proper restraint is essential, particularly when imaging hind limbs or the reproductive tract when the images are obtained transrectally (the probe is placed inside a protective sleeve inside the rectum).

For certain applications, such as imaging of superficial tendons in the distal limb, for example, the hair is sometimes shaved. This removes debris and potential artifacts and also improves contact between the ultrasound probe and the horse’s skin. In some situations (i.e., show horses) it is not desirable to remove the horse’s hair. In those situations simply wetting the hair with 70% isopropyl alcohol is preferred.

Ultrasound gel (a water-soluble, non-greasy, non-staining, and hypoallergenic gel) increases the conduction of the ultrasound waves and echoes between the ultrasound probe and the body. The use of ultrasound gel during an examination is essential.

Pros and Cons

An ultrasound is noninvasive, does not use radiation or require injecting radioactive isotopes, and provides real-time images. Ultrasonography is particularly useful for tendons and ligaments, showing the structure of internal organs and identifying diseased or abnormal organs, and performing biopsies. It is a widely available, rapid, and inexpensive technique particularly compared to other advanced imaging techniques such as magnetic resonance imaging (MRI). There are no known side effects associated with ultrasonography.

That said, ultrasound technology is limited in some regards as the ultrasound waves are not able to penetrate bone or gas. Therefore, it is not useful for evaluating the internal structure of bones or the lungs, and it cannot be used to assess structures inside the skull. In addition, a successful ultrasound examination is highly dependent on the operator. Only trained and skilled ultrasonographers are capable of generating and interpreting high-quality images.

Common Uses of Ultrasonography

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Reproductive tract Likely one of the most common uses of ultrasound technology is in pregnancy diagnosis. An ultrasound can detect pregnancy earlier than rectal palpation, and it can assist in identifying twins and fetal loss. In addition, ultrasonography can provide detailed information on the structures of the reproductive tract, including the uterus and ovaries, and determine the stage of the estrous cycle to help determine when to breed (particularly in mares that are difficult to get in foal).

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Stallions also benefit from this technology as it can be used to assess elements of both the internal (e.g., urethra, vesicular gland) and external (penis, scrotum, testicle, spermatic cord) reproductive tract.

Musculoskeletal system While the use of ultrasonography for imaging soft tissues of the musculoskeletal system was not one of the more common uses when this technology was first introduced to equine medicine, ultrasound examinations of the distal limb are now commonplace and an essential part of a veterinarian's arsenal for performance horses. Lesions in the superficial or deep digital flexor tendons, suspensory ligament, and sesamoidean ligaments, among others, are all commonly imaged.

GI Tract Ultrasound is commonly used to evaluate the position, contents, and motility of intestinal structures in colic cases. This has been an important advancement to differentiating surgical and non-surgical cases and pinpointing cause of colic.

Cardiovascular system Echocardiography, the ultrasonographic examination of the structure and function of the heart, is an important tool for evaluating the equine cardiovascular system. It can, for

example, detect defects in one or more valves of the heart. Normally the valves ensure that blood is pumped in only one direction through the heart. If the valves do not function properly, then blood can regurgitate (flow backwards) through the heart. Echocardiography is aided by advanced technologies such as M-mode ultrasound and Doppler ultrasound, which can measure range of motion and blood flow, respectively.

Respiratory system Ultrasound is used often to evaluate the respiratory tract and to help determine the extent of damage in the lungs as well as location of masses or lung tissue consolidation.

Miscellaneous Ultrasound examinations can also be performed on the respiratory system (e.g., to assess pneumonia or pleuritis), other internal organs, the eye (e.g., to diagnose cause and extent of ocular trauma), and to perform ultrasound-guided biopsies, and it is important in neonatal medicine.

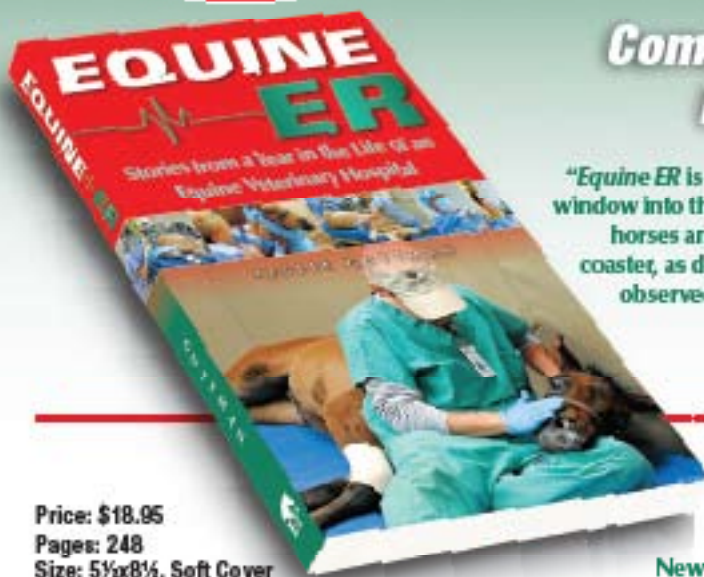
In human medicine ultrasound can also be used therapeutically, and therapeutic applications have been introduced into equine practice on a limited basis. ◀

FAST FACTS

- An ultrasound exam is a medical technique that uses high-energy sound waves in the range of 2-18 MHz to image or view internal structures.
- Sound waves are emitted by a hand-held probe placed on the horse's body. Structures inside the body with different densities (e.g., ligaments, tendons, bone, and fluid) reflect some of the sound waves back to the probe. These reflections are used to create a digital image of the structures being scanned.
- Bone appears white, fluid appears black, and all other structures lie somewhere along a gray scale in between these two limits.
- Ultrasonography can be used to image virtually any anatomic structure in the body except bones, structures encased in bone (e.g., the brain), and air-filled structures (the lungs).

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