

Practical use of Equine Ultrasonography

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Introduction

Ultrasonography has become a valuable diagnostic tool in equine practice, for reproduction as well as the clinical evaluation of the medical, surgical and lame patients. Unfortunately, due to the expense associated with purchasing a machine and the necessary transducers, the use of ultrasonography in the past has been limited to university and referral institutions. However, as technology and competitive pricing improves ultrasonography is becoming a welcomed addition to the field clinicians' diagnostic arsenal. Having the capability to diagnose problems more completely in the field gives the practitioner the ability to treat the problem more quickly and efficiently, providing better patient response, greater client service and necessitating referral of only the critically intensive animal or the unknown. As with the initial use of ultrasonography in reproduction, the skepticism of the client as well as their additional expense can be justified by their ability to visual and understand the situation better as well as monitor the treatment progression. It is limited only by the practitioner's willingness to use it and the knowledge of normal anatomy. The more ultrasonography is used by a practitioner the more comfortable and profitable the venture will become. This presentation will discuss the different areas that ultrasonography can be of benefit in the field, as well as review normal and abnormal images.

Basic Principals and equipment

The various shades of grey seen on an ultrasound image correspond to interfaces between tissues of different acoustic densities that reflect ultrasound waves back towards the transducer. Air and bone cannot be penetrated by ultrasound and therefore appear as bright (hyperechoic) white lines. Fluid is easily penetrated and generally appears dark (hypoechoic), except if cellular material is present. A large variety of ultrasound equipment is available. The type of machine necessary to fulfill your practice needs is depended on the emphasis of your practice. Larger machines with numerous capabilities including color-flow Doppler will be more appropriate for referral institutions with severe cardiac cases, while the smaller more portable machine will be more practical for everyday farm use. It is important, however, to remember that although a machine may be small with the availability of different transducers they can perform a variety of very specific functions. Ultrasound transducers convert electrical energy into mechanical energy that produces an image. Transducers vary in frequency and shape. The frequency of the transducer determines the depth at which the focal point of the image may be obtained; the higher the frequency the less the imaging depth. For instance, a 10MHz probe will get good resolution to approximately 6cm; 5 MHz probe has a maximal penetration of 12cm, while 3.5 MHz transducer can visualize structures up to 25-30cm.

Therefore, for more superficial structures, such as tendons, higher frequency transducers are used while transabdominal ultrasound requires a 2-3.5MHz transducer.

Potential applications of ultrasound

Reproduction

Ultrasonography has opened up new realms of reproduction in the past few decades allowing not only early pregnancy diagnosis but aiding in the diagnosis of infertility in the mare and stallion, fetal sexing, evaluation of late stage pregnancy for fetal growth and placentitis. Transrectal ultrasonography of the cervical star region using a linear array 5 MHz transducer provides objective information of the combined uterine/placental thickness, placental separation and exudate allowing routine and prognostic evaluation. This information can be further supplemented by transabdominal ultrasonography with a 3.5MHz sector probe diagnosing fetal developmental abnormalities, presentation, heart rates and placental abnormalities/separation. Ultrasonography can also contribute in the diagnosis of ruptured/torn prepubic tendons and hydrops allantois.

The adult horse

The use of ultrasound is only hindered by the practitioner's knowledge of anatomy. Almost all of a horse's body can be ultrasounded.

Body/Abdominal wall

A 5MHz linear array transducer can be used in most instances to differentiate skin neoplasia, abscesses from hematomas, hernias, trauma, and incision infections.

Internal organs

The thoracic and abdominal cavity can be easily evaluated in the field using both a 5MHz linear array and 3.5MHz sector or linear transducer. Common situations necessitating its use include: Colic- to evaluate position (nephro-splenic entrapment, diaphragmatic hernia), thickness of the small intestine, cecum, large intestine walls, degree of distention (gas or fluid) and motility (enteritis, ileus, intussusception, obstruction) and peritoneal cavity (peritonitis, hemorrhage, fluid-urine vs. ruptured viscous. Postpartum complications- uterine artery rupture vs. peritonitis from possible uterine tear or viscous rupture. Post surgery-adhesions, peritonitis. Ultrasonography can image and assist in biopsy of the liver, spleen, kidneys and lungs. The liver can be visualized with a 5MHz linear array probe, but only superficially. The 3.5 sector reveals the homogeneity of the parenchyma, normal vasculature and bile ducts. Conditions such as hepatic abscesses, tumors, calculi, metastasis and hematomas can be more easily diagnosed. The kidneys can be also imaged with a 5MHz linear or 3.5 sector probe. Hydronephrosis, calculi, edema, hemorrhage, and masses among others can be differentiated with ultrasonographic use. The urinary tract in particular the bladder is best evaluated transrectally with the 5MHz linear transducer. Calculi, sediment, distention, wall

thickness and integrity can be evaluated. The adult lungs are quickly and easily evaluated with merely the 5MHz linear array or 7.5MHz probe. Ultrasound does not penetrate air, therefore only the lung surface is visible in normal lungs. The straight white hyper echoic lines across the screen are due to the reverberation of the ultrasound waves bouncing back and forth between the lung surface and the transducer. Abnormalities evident with its use include: pneumonia, abscessation, consolidation or atelectasis, pleural effusion, fibrin deposition, diaphragmatic hernias and pneumothorax. Cardiac abnormalities can be evaluated and diagnosed with ultrasonography although it is a highly specialized field, and is best dealt with in a referral institution and specialist as opposed to in the field. Progression or resolution of all of the above diseases can be established by serial ultrasonographic examination, this makes its use invaluable in the treatment and prognosis.

Musculoskeletal system

Ultrasound has vastly improved the diagnostic capabilities in equine lameness associated with soft tissue and bony lesions. Its most common use is in the lower limb in the diagnosis and management of superficial and deep digital flexor tendon, the suspensory and distal check ligament injuries. Additionally, peri-articular and intra-articular structures associated with the shoulder, elbow, carpus, fetlock, pastern, coffin joint, coxofemoral joint, stifle and hock can be evaluated. Preparation of the area to be ultrasound should be clipped and cleaned before ultrasound gel is applied. The back and pelvis, which have historically been difficult areas to diagnose problems, can be evaluated easily in the standing patient. This can alleviate potential consequences to anesthesia and radiology.

Ocular Ultrasonography

Ultrasound has opened a new window into the back of the eye when corneal edema or extreme swelling hinders the evaluation. By placing the probe on closed eyelid after using an auriculopalpebral nerve block detached retinas can be detected.

The neonate

Ultrasonography has made its greatest impact in the early diagnosis and treatment in the neonate, in which time is of the essence and can mean the difference between life and death. Any reproductive field veterinarian with the capability of ultrasounding pregnancies has the equipment necessary to accomplish this due to the foals thin body wall and small size. Pneumonia with or without abscessation or atelectasis can be distinguished before it is evident on auscultation or blood profiles. Severity and number of fractured ribs can be ascertained. Gastrointestinal disorders causing colic, to include enteritis, ileus, meconium impactions and intussusceptions can be differentiated allowing for early treatment and progressive monitoring. Uroperitoneum from ruptured bladders can be distinguished from hemorrhage due to viscous rupture or ulceration. Origin of sepsis can be determined by evaluating the umbilical remnants- the 2 umbilical arteries that extend caudally towards the bladder and the umbilical vein that extends cranially

towards the liver. Usually the foal can be evaluated standing unless it is too weak. No clipping is necessary since good contact can be made using isopropyl alcohol.

The ease and importance of ultrasound use can not be stressed enough. With early diagnosis, repetitive imaging and practice differentiating normal and abnormal this diagnostic tool is not only irreplaceable but allows the client to visualize the abnormalities present becoming more inclined to initiate therapy and accept recommendations.

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