Best use of abdominal ultrasound imaging

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Ultrasound is a commonly used and essential diagnostic test for many diseases but we are often left with non-specific findings in which the clinical significance may be difficult to determine. Ultrasound has many benefits that have led to increased demand and use in a clinical setting. Ultrasound provides a real-time assessment of organs in a minimally invasive manner and it is relatively quick to perform with immediate interpretation. Ultrasound has become more readily available whether it's an in-hospital exam, a traveling sonographer or a close referral center. In spite of there are still many limitations of ultrasound that need to be considered. Recognizing and understanding the limitations of an abdominal ultrasound will help the primary clinician interpret the results as well as not be setup for failure and unreal expectations with the clients.

Limitations of abdominal ultrasound

Ultrasound is a very user-dependent diagnostic test. Currently there are no standards in veterinary medicine in regard to who is performing ultrasounds. There are many day or weekend courses intended to familiarize and educate veterinarians with abdominal ultrasound, but does this qualify all individuals to perform these tests? It requires thousands of ultrasounds to become proficient at scanning the many different breeds we work with and recognize and differentiate between various normal and abnormal findings. Understanding disease physiology and pathophysiology is critical for the sonographer when interpreting the ultrasound findings. It is important to recognize that user skill and experience can be a major limitation of ultrasound and realize how this may affect the use of this diagnostic test in your practice.

The major limitation of ultrasound examination is that it lacks specificity. Ultrasound is a great diagnostic test for recognizing focal disease but the ability to recognize benign versus malignant lesions is often limited. Providing a single differential diagnosis for a lesion seen on abdominal ultrasound is often a misrepresentation of the case and will often lead to misdiagnosis. However, it is also of no clinical benefit to provide extensive lists for every lesion seen on ultrasound examination without attempting to interpret them together. Often times there will be numerous abnormalities in different organ systems which may make it challenging to determine the clinical significance of these lesions. Ultrasound findings should be interpreted in conjunction with signalment, history, physical examination findings, relevant clinical pathology, other ultrasound findings, and experience. This allows for a more specific list of differential diagnosis to be generated and a more appropriate plan for either further

diagnostics or treatment. Histopathology or cytology is needed for definitive diagnosis and ultrasound can be used to obtain accurate samples of the lesion in question.

There can also be limitations on what anatomy we are able to see on ultrasound. This may be influenced by the skill of the sonographer, the patient, or the ultrasound equipment (i.e. probe, machine, settings). Numerous artifacts may be encountered during an ultrasound examination and although some of these can be helpful but other artifacts are undesirable as they will significantly affect the image seen. Artifacts from gas or food in the stomach, fecal material in the colon, gas in the small intestine, or gas trapped in hair along the abdomen can all partially obscure an image and prevent complete evaluation. Attempts can be made to scan the anatomy from different imaging planes or with the patient in different positions; however, sometimes these things cannot be avoided. We can also be limited by the compliance of our patients. Recognizing which animals may be stressed, painful, or anxious and giving appropriate sedation and/or analgesics is important for an accurate and complete examination. Patient size can also affect image acquisition and quality. The distance the sound wave travels is inversely proportional to the frequency of the ultrasound probe. Larger dogs may require the use of lower frequency probes which many in-house machines may not have. The lower the ultrasound probe frequency the less detail the image has. In addition, the more anatomy we have on one image the harder it may be to identify small lesions.

Common uses of ultrasound in evaluation of abdominal abnormalities

Abdominal ultrasound

There are many cases that an abdominal ultrasound is very helpful with and even though it may not be specific it can help refine the list of differential diagnosis. Some examples of these types of cases are included in Table 1. However, there are other cases that ultrasound may be limited in diagnostic performance (Table 2) and other diagnostic tests may be needed in conjunction with or instead of ultrasound. It is important for the clinician to recognize this prior to requesting an examination as it is frustrating to request a diagnostic test for a specific purpose only to be told when it is done that the question being asked cannot be answered. This does not mean ultrasound doesn't have a role to play in these cases. It is often important to rule out other diseases that could cause similar clinical signs, physical examination, or clinical abnormalities, as well as to ensure no significant concurrent disease is present.

Table 1: Examples of common cases that abdominal ultrasound is useful for

Pancreatitis	Origin of abdominal mass
Small intestinal obstruction	Abdominal effusion
Lymphoma	Presence of non-radiolucent cystic calculi
Hydronephrosis	Acute versus chronic kidney disease
Biliary disease	Urinary bladder masses
Portosystemic shunts	

Table 2: Examples of cases that abdominal ultrasound may be limited in assessment

Gastric foreign bodies when stomach is filled with gas
Pelvic canal mass or perineal masses
Assessment of function of gastrointestinal tract
Megacolon or severe constipation
Small hernias

AFAST

More recently one of the most common uses of ultrasound has been the bed-side focused ultrasound examination in the emergency setting. In animals abdominal focused examinations, AFAST, have been described and studied for the use of identifying free fluid and the presence of free air. These can be used to trend things such as abdominal hemorrhage following vehicular trauma or presence of fluid following abdominal surgery. This is a great use of an abdominal ultrasound machine in general and emergency practices; however, a recognition of the difference between this focused scan and a complete abdominal ultrasound needs to be recognized and communicated to our clients appropriately. The focused ultrasound examination is intended to answer specific question and there is often still need for a full abdominal ultrasound with evaluation of the abdominal organs for completeness.

Tips for getting the most out of your ultrasound study

The ultrasound examination may be more useful if you are trying to answer specific questions. If you have a specific concern than ultrasound can be interpreted with this in mind. This does not mean a complete abdominal ultrasound examination is not performed or is not useful but allows for the sonographer to attempt to put the 'entire story' together. Most older dogs have numerous abnormalities and correlating with vague clinical signs can be challenging for the interpreter but also for the clinician who then needs to relay these findings to the owner. When performing an abdominal ultrasound it is beneficial to have a short list of differential diagnosis for the patients history, physical examination findings and clinical pathology results already in mind. For example, approaching an abdominal ultrasound from a standpoint of wanting to rule in or rule out pancreatitis and evaluate for secondary changes (e.g. extrahepatic biliary obstruction, duodenitis, gastric distension, abdominal effusion, pancreatic abscesses) is useful to help interpret the overall findings. Another good use of an abdominal ultrasound is to rule out enlargement of the draining lymph nodes with neoplastic disease (e.g. enlargement of medial iliac lymph nodes with anal sac adenocarcinoma). Approaching an examination in this way you can prioritize the major findings and attempt to answer the questions that may be most clinically relevant. Also consider some other factors you may want to evaluate in each case. For instance, in the case of a suspected gastric foreign body where gastroscopy is considered, abdominal ultrasound may still be warranted to rule out any foreign material in the small intestine that may not be seen on endoscopy. You may also want to use an abdominal ultrasound as a screening or staging test to ensure there are no significant abnormalities prior to another procedure such as a large mass removal.

Conclusions

Recognizing the limitations of an abdominal ultrasound can aid in choosing the appropriate diagnostic test and realizing which questions may or may not be answered with ultrasound. Having a more refined differential diagnosis lists or a list of clinically relevant questions that you wish to answer with ultrasound can help to prioritize the ultrasound exam findings. This can help to guide the most appropriate diagnostic course for our patients while limiting redundant testing or testing that may not aid in treatment decisions.