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Diffuse kidney diseases: the role of diagnostic imaging before taking a biopsy

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ULTRASOUND

As for other organs, diffuse renal disease is much more difficult to diagnose with ultrasound than focal or multifocal disease. This is because not all diseases cause a change in the sonographic appearance of an organ. There are many instances in which renal failure is present, yet the ultrasound appearance of the kidneys is considered normal. This is currently one of the greatest limitations of ultrasound. Thus, it is important to remember that diffuse renal disease may be present without observed changes on the ultrasound examination. Although sometimes frustrating, it is a fact that ultrasound is much better at identifying focal or multifocal disease than diffuse pathology. It must further be emphasized that when ultrasound abnormalities are identified, the appearance is rarely specific for a particular disease process. Nonetheless, many forms of diffuse renal pathology do show themselves on an ultrasound examination. Further, the absence of observed ultrasound pathology in the face of renal failure can help the veterinarian develop a list of reasonable differential diagnoses, by excluding certain diseases, which do characteristically show ultrasound abnormalities.

Diffuse renal disease may cause increased cortical echogenicity with enhanced corticomедullary distinction or result in decreased definition between the cortex and medulla as a result of disease affecting both of these regions. Diseases diffusely affecting the kidney include acute and chronic glomerulonephritis and interstitial nephritis, bacterial infections (e.g., *Leptospriosis*), acute tubular necrosis from toxins (e.g., ethylene glycol toxicity), amyloidosis, end-stage kidneys and nephrocalcinosis. In the cat, lymphosarcoma, feline infectious peritonitis (FIP) and metastatic squamous cell carcinoma have been reported to cause hyperchoic cortices, with maintained corticomедullary definition. Reduced cortical echogenicity, or multifocal hypoechoic nodules or masses have also been described with lymphosarcoma. The size of the kidneys may be normal, enlarged, or small with diffuse renal disease. Acute nephritis, FIP, lymphosarcoma generally cause renal enlargement. As previously mentioned, determination of normal renal size for a particular patient is problematic. Therefore serial examinations may be necessary to detect renal size changes in response to therapy.

Ethylene glycol toxicity (antifreeze) often will produce extremely hyperchoic cortices and medullary tissue. Severe cases may produce complete acoustic shadowing. A rim of hypoechoicicity has been described at the corticomедullary junction in some cases of ethylene glycol toxicity. Concurrent peritoneal, retroperitoneal and subcapsular fluid may be observed. Subtle to moderate renal enlargement is present.

A general increase in renal echogenicity (cortical and medullary), with loss of the corticomедullary junction is noted in cases of acute and chronic inflammatory disease, amyloidosis, some types of toxicity and endstage kidneys in dogs and cats. Endstage kidneys are small, distorted, irregular, and may not resemble a kidney at all. Endstage renal disease may be seen in older patients, or in young or even juvenile patients, a result of congenital renal dysplasia. The appearance of the kidneys may be asymmetrical. This is seen regularly in cats with renal failure. The opposite kidney may appear normal and in fact hypertrophy in an effort to compensate for diminished renal function.

The renal medullary rim sign has been described in a number of disease processes, including hypercalcemic nephropathy (lymphosarcoma), ethylene glycol ingestion, pyogranulomatous vasculitis (feline infectious peritonitis), acute tubular necrosis of undetermined etiologies and chronic interstitial nephritis. It is often seen in dogs with portosystemic shunts. It is recognized as a very echogenic rim parallel to the corticomедullary junction and usually results from mineral deposits within the outer medullary tubular lumens or tubular basement membranes. In the case of FIP, mineralization is not seen histologically. It should also be noted that the medullary rim sign has been described in normal cats caused by a band of mineral within the lumens of the renal tubules. The medullary rim sign thus provides an ultrasonographic finding indicating primary renal disease in some, but not all patients. This rim sign is also frequently seen in dogs and cats without clinical or biochemical signs of renal disease. Thus, interpretation of this sonographic finding must be correlated with other pertinent data.

It has also been shown that the degree of cortical echogenicity is positively correlated to the amount of fat vacuoles in the cortical tubular epithelium of cat kidneys. Kidneys with a plentiful amount of fat vacuoles demonstrated a great difference between the hyperechoic cortical tissue and the hypoechoic medulla. The cortical echogenicity becomes similar to the highly echogenic renal sinus. Cats without a large number of cortical fat vacuoles had less echogenic cortices. Thus, the definition between the cortex and the medulla is less apparent, as the two regions of the kidney are more similar in echogenicity.
RENAL FINE NEEDLE ASPIRATES AND BIOPSIES

Definitive diagnosis of renal disease requires cytological or histological examination. Fine needle aspirates (FNA) are routinely used to diagnose lymphoma, mast cell disease and infectious nephritis (e.g., Leptospirosis), diseases very amenable to a definitive cytological diagnosis. Fine needle aspirates using 23-27 gauge needles, without suction, usually yield diagnostic samples. If a good smear is not made using a “pin cushion” collection technique, suction may then be applied. The use of suction to acquire a sample may dilute the sample with hemorrhage.

Rarely does a FNA contribute to the diagnosis of other diffuse diseases such as tubular or glomerular disease, feline infectious peritonitis, etc. In these cases, a biopsy is needed. Preferred is the use of an automated biopsy instrument, with 18-14 gauge needles. Renal biopsies are not without risk. Many times the primary clinician will elect not to perform a biopsy, reasoning that if the FNA was exclusive of the above mentioned diseases, the etiology of the disease is irrelevant, as treatment will be the same regardless.

While ultrasound guided FNA or biopsies are relatively safe procedures, they are not without risk. Care must be taken to avoid the renal hilus so that laceration of the renal artery and vein does not occur. Sampling the cortical tissue and directing the needle away from the mid-portion of the kidney will reduce risk. Many veterinarians sample the lateral cortical tissue, directing the needle parallel to the long axis of the kidney and abdominal wall. It should be noted that small, chronically diseased kidneys are at higher risk for hemorrhage. The risk vs. benefit of renal biopsies or FNA should always be considered.

COMPUTED TOMOGRAPHY (CT) AND MAGNETIC RESONANCE IMAGING (MRI)

In my experience, neither of these two modalities is used for primary assessment of renal disease. Certainly renal lesions have been observed when performing CT or MRI for other indications; these are usually focal or multifocal lesions.

Selected references