Color Flow Assisted
Ultrasound-Guided Biopsy

What Structures Can Be Biopsied?

Ultrasound-guided biopsy is precise, histologically accurate and atraumatic. With the proper equipment and technique, the procedure is very safe in both dogs and cats. Serious complication rates of less than 1 in 1000 patients (with 3 to 8 tissue cores being obtained from each patient) are presently occurring. Targets the size of a pea, 8 cm from the skin line may be sampled. Small cirrhotic livers may be biopsied via a trans-intercostal approach without pneumothorax or gall bladder trauma occurring. Cysts, abscesses and gall bladders may be aspirated without subsequent spillage. Pancreatic masses can be biopsied without trauma. Suspected hemangiosarcomas and diseased spleens may be biopsied without causing significant hemorrhage. Sclerotic kidneys 2 cm in length can be biopsied without great vessel trauma. Prostatic and para-prostatic cysts and abscesses may be drained percutaneously. Pulmonary and mediastinal masses may be biopsied.

Introduction

Many situations occur in internal medicine in which an accurate diagnosis can only be made by tissue biopsy. Oftentimes the patient is suffering from some organ system failure and is incapable of withstanding a surgical exploration of the abdominal cavity. Sometimes, the likelihood of a malignancy or metastatic disease prevents an aggressive approach, yet without a tissue biopsy of some kind, a definitive diagnosis is unobtainable. In these situations, an exploratory for diagnosis may shorten the patient’s life expectancy. Advanced age may cause a surgical exploratory to be equally unpalatable and not be in the patient’s best interest.

We experience these situations commonly at The Animal Ultrasound Clinic and present to you a safe biopsy technique we have developed, color flow assisted ultrasound-guided biopsy. In our experience, almost no patient is too ill to withstand this procedure, as it may be performed with little or no anesthesia and without significant discomfort or trauma to the patient.

The following is a description of our biopsy method. A detailed list of the tissue diagnoses we have obtained appears in our Reference Binder and also on our site at www.animalultrasound.com in the section reserved for our referring veterinarians. More detailed information on the specific diagnoses, patient followup and long term survival of the animals with these pathologies will be presented in future newsletters. The causes, relative incidences, and survival of cats with liver disease and icterus will be discussed in the next newsletter issue.
Pre-Operative Safety Issues

The blood pressure, prothrombin time, and platelet count are evaluated immediately prior to the biopsy procedure. Bleeding time is sometimes checked if thrombocytopenia or VWD is possible. The current acceptable values which we believe will allow for a kidney biopsy without significant risk of hemorrhage are: peak systolic blood pressure of less than 175 mmHg (measured with a Doppler flow detector), prothrombin time no more than 3.0 seconds above high normal, and the platelet count of at least 75,000/ul. The majority of dogs and cats are mask induced with isoflurane and maintained just deep enough to allow the procedure. Total anesthesia time is typically 5 to 7 minutes. IV fluids are administered during the procedure.

Figure 1
This is the left kidney of a six-year-old Miniature Schnauzer with acute onset of abdominal pain, anorexia and lethargy. Chemistry profile showed BUN=37 (N<25), creatinine=3.2 (N<1.6), urine sp. gr.=1.015 and inactive urine sediment. The medulla is more hypoechoic than is usually seen in a dog of this age. Acute renal failure was suspected.

Figure 2
This is the same kidney as Figure 1 imaged with the color system activated. An unexpectedly large number of blood vessels become visible. Blood flow direction toward the transducer is encoded in red, flow away from the transducer is encoded in blue. These vessels can be spared from the biopsy needle by choosing an appropriate biopsy path.
Technical Considerations and Method

The target area and all structures between the target and the skin surface are imaged. The color flow system is activated and the image is optimized to detect arterial and venous blood flow. An entry site is chosen which will result in a needle path that will avoid any detectable vascular structures. Routinely, three to five tissue cores are obtained from each patient, depending on the quality of the samples and the anticipated possible diagnoses. The Biopty® needle handle permits very quick and atraumatic biopsies. The needle enters the organ, obtains the tissue, and is retrieved within a fraction of a second, timed between breaths.

Figure 3
This is the left kidney of a 90 lb. 2-year-old Labrador Retriever who became PU/PD, anorexic, isosthenuric and mildly azotemic post general anesthesia for a laceration repair. The sonogram revealed an 8.5 cm long left kidney. The right kidney could not be located and is likely sclerotic. Though not evident on the plain sonogram, this kidney is hypervascular.

Figure 4
This is the same kidney as Figure 3 now imaged with the vascular transducer and the color activated. The biopsy path can be positioned so that a safe approach to the deep medulla is possible. The large blood vessels are avoided during the biopsy.
Equipment

Color flow assisted ultrasound-guided biopsy requires sophisticated and specialized equipment. We are currently using a Hewlett-Packard SONOS 2000 Imaging System with a 7.5/5.5 MHz trapezoidal vascular transducer for most biopsy procedures. The system is capable of detecting minute arterial and venous flow. A custom designed biopsy guide is employed with Bard biopsy needles and a Bard Biopry® automatic firing handle. The size of the needles available ranges 14 ga. to 20 ga. The sample tissue is approximately 1 mm diameter by 10 mm to 15 mm in length.

Figure 5

Traditionally, the deep medulla is avoided when performing a needle biopsy of the kidney to prevent traumatizing the larger renal vessels. Several conditions, e.g., pyelonephritis and medullary amyloidosis, however, require biopsy and culture of deep renal medulla. This is the left kidney of a 14-month-old female Bassett hound which had been PU/PD since puppyhood. The two biopsy needle paths illustrate where a tissue core has been removed. Acute neutrophilic interstitial nephritis was the pathologic diagnosis. The PU/PD resolved with 6 months of antibiotic therapy. (See JAVMA, 392, 3, 2001.)