Ultrasound-guided fine needle aspirates and cystocentesis – skills and pointers

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Categories : Vets

Date : June 25, 2012

Alana Rosenblatt, Natalie Webster discuss the use of ultrasound to help the practitioner carefully steer needles when performing organ aspiration and cystocentesis

Summary

Ultrasound guidance can be used to facilitate cystocentesis and fine needle aspirates (FNAs) in companion animals. Visualisation of internal structures afforded by the ultrasound probe allows a more accurate and safer collection of fluid or tissue samples for pathological testing. There are many indications for the use of ultrasound in assisting these procedures that are outlined in this article. The ultrasound-guided aspirate will proceed smoothly if the required equipment is at hand and prepared ahead of time, appropriate patient selection is made, the patient is adequately prepared, and the operator has the necessary skills and experience to undertake the procedure. In this article, a step-by-step approach to collecting the desired sample has been outlined, with some tips from the authors to optimise the chances of success. Lastly, the reader is made aware of the potential pitfalls or adverse effects of the procedure so they can ensure the owner of the patient is well informed about the test and can give informed consent to proceed. The use of ultrasound guidance to perform cystocentesis and FNAs is a well-tolerated, accessible and very useful tool in companion animal medicine.

Key words

ultrasound, guided, cystocentesis, FNA

UTILISING ultrasound to assist your fine needle aspirates (FNAs) and cystocentesis can make performing these procedures significantly easier. Additionally, aspirating some internal organs in a safe and effective way would not be possible without ultrasound guidance.

It takes some practice and finessing of your ultrasound skills, however, especially when attempting to aspirate small structures, such as lymph nodes. This article provides tips and tricks to make the process easier and more rewarding.

Indications

A cystocentesis is performed when a sterile urine sample is required. This can often be done blind through palpation. However, animals with a small bladder make it very difficult to obtain the desired sample – for example, patients with urinary tract infections often exhibit dysuria, making it almost impossible to obtain a cystocentesis sample, as their bladder never fills sufficiently. In these situations, ultrasound comes into its own. The visibility afforded by the ultrasound image allows precise positioning of the needle into the urinary bladder to obtain the urine sample (Figure 1).

You may also decide you would like a sterile urine sample after examining the urinary tract ultrasonographically. Find ings that could indicate the need for urinalysis with culture and sensitivity include:

• urinary sediment, particularly hyperechoic crystals or shadowing urinary calculi;

• a thickened bladder wall, either diffusely or focally;

• findings of ureteral stasis (dilated ureters), fluid in the renal pelvis of the kidneys; or

• other renal changes that may be suggestive of ascending infection/pyelonephritis.

Alternatively, you may wish to make use of the ultrasound machine solely to obtain your urine sample without performing a full abdominal ultrasound.

There are many indications for performing an ultrasoundguided FNA to obtain a tissue sample for cytological examination. Alternatively, you may need to aspirate fluid that is free within a body cavity or contained within a structure.

More specifically, reasons for wanting to perform an ultra-sound-guided FNA include:

• to obtain a cell sample of an identified mass, or diffusely abnormal organ within the abdomen (Figure 2);

• to take a sample of peritoneal, pleural or pericardial effusion (Figure 3);

• to obtain a sample of a peripherally located pulmonary mass, or cranial mediastinal mass;

• to aspirate a subcutaneous mass/structure with accuracy;

• to aspirate a gland – for example, thyroid, lymph node or other anomaly in the neck;

• to take a synovial fluid sample from a joint;

• to drain an abscess or cyst; and

• to aspirate a lymph node as a step in metastasis staging (Figure 4).

Required equipment

Of course, the most essential piece of equipment is the ultrasound machine. Ideally, you would choose to use a probe of the highest frequency possible to facilitate good image resolution, while providing adequate depth penetration for the region of interest.

It is a good idea to get comfortable with a particular probe shape (for example, convex or linear), as the probes are all a little different when it comes to using them to guide a needle into an internal structure.

The next requirement is the needle – patient size and the depth of structure you are trying to aspirate will determine the gauge and length of the needle required. Generally, a 23G X one-and-a-half-inch needle is suitable for most aspirates. If a mass is not exfoliating easily, or thick fluid cannot be aspirated (for example, purulent fluid), a larger gauge needle may be indicated.

Occasionally, the structure you need to take a sample of is too deep to be reached with a one-and-a-half-inch long needle, and so a spinal needle may be used. When using a spinal needle, leave the stylet in place until the needle is within the structure of interest. However, spinal needles can be harder to position and manipulate, given their extra length.

Additional requirements are syringes and extension sets. If you are collecting a fluid sample, you may choose to use a 5ml or 10ml syringe, depending on how much fluid you wish to obtain. For general tissue FNAs, a 5ml syringe will generally suffice to provide adequate suction. Attaching an extension set with a syringe on one end to your needle can be useful to free up your hands when positioning the needle in a difficult location, as you can utilise another person to do the suctioning while you maintain control over the probe and needle placement.

If a large volume of fluid is to be removed, consider using a three-way tap and a 20ml or 50ml

syringe to facilitate evacuation of the fluid by an assistant while you keep control over the needle location.

Lastly, you will need slides and containers to store the samples. Get your slides prepared before starting, and lay them out on to something light in colour, such as a paper towel, as this will make it easier to see your sample on them. Sterile containers are generally used for liquid samples.

Patient preparation

The patient needs to remain still while you perform the procedure; the use of sedation or general anaesthesia is recommended in most patients unless they are extremely compliant. A heavily panting patient also proves challenging when trying to accurately place a needle into a target organ.

It is worth considering your patient selection for this procedure. As a general rule, performing aspirates is safe and does not require a coagulation profile to be performed beforehand. However, it is recommended to check the coagulation times of your patient if there are any concerns regarding their ability to clot. This is a must if you are considering performing ultra-sound-guided tru-cut biopsies (this procedure is not covered in this article).

The area should be clipped of hair prior to performing the aspirate for sterility. However, this is not usually necessary for a simple cystocentesis.

Collecting the sample

Veterinarians differ in regard to which hand they aspirate with. Some prefer to hold the probe with their dominant hand while advancing the needle with the other, whereas others feel more comfortable manipulating the needle with their dominant hand and switch the probe over to their non-dominant hand. There is no right way. Both options require steady hands and fine motor skills.

Generally, the patient is placed in dorsal or lateral recumbency for a cystocentesis, but for FNAs, place them in whichever recumbency allows best access to the lesion.

You will need one or two assistants to help gently restrain the patient during the procedure. Keeping the pet as calm and comfortable as possible is key – make use of a mattress on your ultrasound table to ensure the patient is comfortable.

All the ultrasound gel should then be cleaned from the skin and the footprint of the probe – these areas are then prepared with alcohol. Alcohol is a sufficient medium to facilitate image acquisition in this scenario; regular ultrasound coupling gel is not sterile and, hence, should not be used. Additionally, you do not want to introduce gel into the body cavity or tissue of the patient you are aspirating.

The first step is to position the probe over the area of interest so you have the best possible image of the structure on the screen. Make sure there is not an important structure (for example, large blood vessel or loop of intestine) more superficial to the target that you would need to pass the needle through to get to it. Once found, this probe position must be maintained.

Whenever you perform any ultrasound examination, the protocol is to orientate the marker on the probe cranially when scanning in a longitudinal plane. Next, the needle is positioned at the cranial aspect of the probe, so it is close to the probe, but not touching it, as this would negate any sterility. The needle should be introduced at a 45 degree angle to the skin. One of the most important things to be careful of is to make sure the needle is exactly in line with the middle of the probe. This can be identified by the marker that identifies one side of the probe from the other used for orientation (Figure 5).

Remember, the ultrasound beam is a thin slice, so it has thickness and the needle needs to be advanced in line with the beam to allow visualisation of the needle on the screen. This is key to using ultrasound as a guiding tool, and it is definitely worth taking the time to line things up at the beginning before you introduce the needle.

Next, gently pass the needle through the skin and watch it advance on the ultrasound monitor. When it has entered the urinary bladder, or lesion/ organ of interest, you can aspirate the sample by your preferred method – depending on whether it is fluid or tissue. Once the sample is taken, make sure you have released any pressure on the syringe plunger and withdraw the needle in a straight direction at a moderate speed. Empty the sample into a container or on to a slide.

To improve your hand-eye coordination, and increase your expertise in using this tool, consider practising on ultrasound phantoms or cadavers. Practice really is the best way to improve your skills and confidence. A phantom can be made by filling a drip bag with gelatine, for example, and putting in olives or fluid-filled small balloons to practice aspirates and cystocentesis (Figure 6). References on how to make a more complex phantom are at the end of this article.

Potential pitfalls and adverse effects

Ultrasound is not a fail-safe tool. Small bladders, for example, are difficult to aspirate, even with the aid of visibility that ultrasound affords. The near bladder wall will collapse in towards the far wall as you attempt to pierce it with your needle, enticing you to push harder. Take care. It is easy to penetrate through the far bladder wall and potentially cause a uroperitoneum.

As a beginner performing ultrasound-guided FNAs or cystocentesis, it is common to visualise the needle in the near field of the screen, but then lose sight of the needle as it is advanced. If this occurs, stop advancing the needle and look at the probe position in relation to the needle – you may find the probe is no longer in line with the needle. If this is the case, reposition the probe so it is in line with the needle.

It is tempting to wiggle the needle from side to side to try to visualise it – this should be avoided. Instead, fan the probe side to side to try to locate the needle. Sometimes the best course of action is to withdraw the needle and start again.

Some structures cannot be reached, even with the help of the probe. These might include structures nestled between large blood vessels. Additionally, some aspirates should only be attempted by those experienced with ultrasound use. These might include aspirating the gall bladder, fluid in the renal pelvis of the kidney, or the intestinal wall.

Adverse effects are rare – however, they must be recognised, and owners need to give informed consent for this procedure. Adverse effects could include:

• bruising;

• haemorrhage;

• urine/fluid leakage;

• bladder rupture (potential complication in blocked cats);

• vagal stimulation can cause transient side-effects (retching, panting, collapse); and

• tracking of neoplastic cells from the lesion origin to other body cavities or tissues.

Summary

Everything considered, ultra-sound-guided cystocentesis and FNAs are generally safe and well-tolerated procedures in companion animals, and are often an optimal way of obtaining desired samples for diagnostic testing.

References for ultrasound phantom recipes

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