Indications, Landmarks, and Procedures for Collection of Spinal Fluid, Liver Biopsy, Transtracheal Aspiration Biopsy and Abdominal Paracentesis

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While a thorough history and physical examination remain the foundation of clinical diagnosis, there are times when additional procedures are indicated for establishment of the diagnosis, differentiation of similar conditions/diseases or prognosis of an established diagnosis. Many of these procedures are not done routinely and thus, the veterinarian may be unsure of the technique. The purpose of this paper is to review the indications, landmarks and procedural techniques used to perform cerebrospinal fluid collection, percutaneous liver biopsy, transtracheal aspiration biopsy (tracheal wash) and abdominal paracentesis in cattle.

Cerebrospinal fluid (CSF) analysis is usually for the differentiation of CNS disease. Table I contains a list of some of the more common neurological diseases of cattle and the key features of the spinal fluid from each. While spinal fluid analysis is insufficient to establish a diagnosis, the combination of clinical symptoms and CSF analysis can help the veterinarian reach a definitive diagnosis.

TABLE 1

CEREBROSPINAL FLUID ANALYSIS

	CELLS/ul	CELL TYPE	PANDY RX	PROTEIN
NORMAL	<10	MONONUCLEAR	-	UP TO 40 MG
PEM	0-100	MONONUCLEAR	- TO +	5 - 50 MG
TME	>200	NEUTROPHILS	++	>80 MG
LISTERIOSIS	50-200	MONONUCLEAR	- TO +	20-150 MG
MENINGITIS	>200	NEUTROPHILS	+	>40 MG

Spinal fluid can be collected from either the cisterna magna or the lumbosacral junction. For practical reasons, the lumbosacral site is usually preferred because it does not require general anesthesia, it can be done on either a standing or recumbent animal and the procedure has minimal risk of producing cord injury since the spinal cord usually ends at L_4 -L_5 while the subarachnoid space continues posteriorally to the lumbosacral junction. The landmarks used to find the L-S junction are the wings of the ilium (tuber coxae) and the dorsal midline. An imaginary line connecting the tuber coxae will intersect with the midline either right at the space or immediately in front of the space. The lumbosacral junction can be palpated as a small depression between the dorsal spinous processes of the lumbar vertebrae and the bony sacrum. An area 6″ X6″ centered over this space should be clipped and scrubbed before CSF collection is attempted. For adult cattle, an 18 g. 6″ styletted spinal needle may be necessary to reach the subarachnoid space while young calves can usually be done with a 2-3″ spinal needle. The needle should be centered in the L-S space perpendicular to the midline. The needle will be advanced slowly with the operator watching for 'flinches', an indication that the arachnoid has been punctured. Periodic checks for fluid can be done by removing the stylette and wiping it across the gloved hand for the presence of moisture. Fluid will not readily flow in all animals because the pressure required to cause spontaneous flow from the 6″ needle may equal spinal fluid pressure; therefore, if all signs indicate correct needle placement, careful aspiration with a syringe can be done.

Occasional hemorrhage may occur due to puncture of the venous sinuses found running along the ventral surface of the spinal canal. If this occurs, spontaneous flow of a few milliliters of fluid may clear it of blood. If the fluid appears blood contaminated, centrifugation should result in a pellet of rbc's and clear spinal fluid if the hemorrhage is fresh (iatrogenic). If the hemorrhage is old (> 4 hours), lysis of the rbc's will occur and the fluids should remain red. Analysis of the fluid should be done as soon as possible following collection. There are a couple of tests which can be done right at the cow's side. Visual assessment of the fluid for turbidity will tell you if the cell count is high since turbidity is only evident to the human eye with count 300-700 cell/ul or greater. The Pandy test is a quantitation of CSF globulin protein. The only reagent required is saturated phenol which is added to a clean test/serum tube. The CSF is then layered over the phenol (CSF will float on the phenol) with care taken not to overly mix the 2 together. The interface of the CSF-phenol is observed for development of turbidity over a 5-10 min. period. The greater the turbidity the greater the concentration of globulin in the CSF. The test is usually scored : negative (no turbidity), + (small amounts of opacification at interface), + + (large amount of opacification).

Liver biopsies are usually done on cattle with evidence of hepatic lipidosis or other symptoms of liver failure. The most common test run on biopsies is the copper sulfate

buoyanc test for the estimation of hepatic fat. One precaution which should be taken before the biopsy is attempted is to make sure the animal has normal blood clotting. This is because the biopsy is obtained blindly and you don't want the cow bleeding internally.

The landmarks used for liver biopsy in cattle are the right tuber coxae and the top of the right elbow. The site used is the 10th intercostal space on a diagonal line connecting the elbow and tuber coxae. The biopsy site should be clipped, prepped and blocked for the introduction of the biopsy needle. Either a Tru-Cut disposal needle or Vim-Silverman biopsy needle will work satisfactorly. The needle is advanced to a depth of about 2" as it passes through the intercostal muscles. A 'pop' is usually felt by the operator as the needle passes through the peritoneum. The needle is then advanced cautiously until additional resistance is met. This should be the liver. A sharp jab is then made with the biopsy instrument in order to penetrate the liver's capsule. The biopsy compartment is then opened, the biopsy cut and the needle withdrawn and the contents examined. If everything works as it should, approximately 40-50 mg of liver tissue can be taken. Repeated biopsies from the same site have been taken with no demonstrable decline in the cow's condition.

Transtracheal aspiration biopsy/tracheal wash is done to obtained samples of cells and bacteria seated deep in the lung without the contamination of the upper airway. This procedure is often done to identify offending organisms causing pneumonia as well as determining the antibiotic sensitivity of these organisms. Cytological examination of samples can be useful in unusual cases of respiratory disease by identifying the type of inflammation present which may suggest an etiologic agent (eosinophils with parasitic or allergic conditions).

When the procedure is to be done, the animal should be restrained in a head gate with a halter so that the animal's head can be snugly secured to one side. The upper to middle 1/3 of the trachea can be palpated and a region of trachea selected which can be grasped and held easily. The site should be clipped and scrubbed and a few milliliters of local anesthetic injected over the site to be punctured. To facilitate the passage of the needle or cannula through the skin, a small stab incision can be made. A 14 g. thin-walled nondisposable needle is then placed through the stab incision and introduced between the tracheal rings. A 3' length of sterile polyethylene tubing (P.E. 160) is fed through the needle with the point of the needle directed down the neck. This insures that the tubing will not be coughed up into the back of the throat. At least 18" should be passed down the trachea before the wash fluid is introduced. For adult cattle, 60 ml of isotonic saline or sterile water for injection (not containing any antibacterial compounds) is rapidly injected. This usually induces some mild coughing which is good because this tends to loosen up exudate and promote a successful recovery. Vacuum is applied and a small amount of fluid should be recovered. To facilitate recovery, a 3-way stopcock is placed on the syringe to allow the operator to expel aspirated air without losing fluid still residing in the tubing. A normal recovery for a 60 ml injection would be < 5 ml.. The sample can then be divided between culture and cytology as the veterinarian sees fit.

There are a couple of pitfalls with this technique. First, if the animal is coughing violently as the tubing is introduced, there is some chance that the tubing will be directed upward and a pharyngeal wash done. Second, occasionally the PE tubing may be cut off by the needle and left in the trachea or lung. This has never caused us any problems because, in all likelihood, the tubing is probably coughed up. To prevent this problem from occuring, the cannula needle can be pulled out of the trachea before fluid is injected, however, without the cannula the tubing may become kinked or blocked by the rings. Usually a little manipulation of the tubing will alleviate the problem.

Abdominal paracentesis is often indicated in animals showing abdominal pain or with vague digestive signs. The idea here is to determine what's going on in the abdomen without exploratory surgery. One of the greatest pitfalls of this procedure would be to put too much stock in a negative tap. This is because of the cow's tremendous ability to wall off infections. A negative tap is like a negative salmonella culture...it doesn't rule out a problem while a positive tap is confirmatory of something abnormal occurring in the abdomen.

Depending on what the veterinarian thinks may be going on in the abdomen, the tap site is selected. If hardware is the prime differential diagnosis then the left side of the cow is selected. If signs of perforating ulcers, abomasal impaction, liver abscesses are present, the right side would be selected. In some cases, both sides may be tapped. The site used is 3-4" behind the sternabrae and 3-4" off the midline. When done from the left, this puts the operator in the area of the reticulum while on the right, this is just behind the liver and close to the abomasum.

The site to be tapped should be clipped, prepped and scrubbed as previously mentioned. Care should be taken to avoid large superficial veins on the skin surface. The skin and subcutaneous tissue should be blocked with a small amount of local anesthetic. The skin is then stabbed with a #10 blade to facilitate introduction of a side-opening teat cannula. The cannula is sharply jabbed through the rectus abdominus m. and peritoneum. The operator should be prepared to collect any fluid after the cannula is in place. If no fluid flows freely, a syringe-full of air can be blown through the cannula to clear any omentum which may be covering the openings. Any fluid recovery may be significant, even if the volume is small. We generally prefer to use a blunt teat cannula over a disposal needle to avoid penetration of abdominal viscera which can occur with the needle.