LAPAROSCOPIC DIAGNOSTIC TECHNIQUES
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Key Points
- Laparoscopy provides direct observation of organ biopsy.
- Laparoscopy provides direct evaluation of the biopsy site to evaluate post-operative complications.
- More accurate diagnosis are often available when performing laparoscopic evaluation.

Organ biopsy has long been considered the gold standard for diagnosing suspect disease processes. Prior to the use of ultrasound, biopsies were generally performed “blindly” (without visualization), or during open surgical procedures. Transcutaneous ultrasound allowed the viewer in some cases to evaluate the organ parenchyma and determine the precise location to biopsy. In this way, the biopsy was more likely to include clinically significant tissue. In a multicenter retrospective study of renal biopsies in horses, there was an 11.3% complication rate, with hemorrhage and signs of colic being the most commonly observed. Treatment was required in 3% of the cases, and fatality rate was less than 1%. Renal biopsy is valuable in the diagnosis of renal carcinoma in the horse. Laparoscopy has the benefit of direct observation of affected organ and the ability to view the organ after biopsy to monitor for complications. Direct observation of the descending colon and rectum can offer a realistic prognosis, and help to guide horse owners in determining appropriate therapy. Laparoscopic-guided ultrasound is becoming more commonly used in human laparoscopy and may have a role in equine laparoscopy.

Indications
Laparoscopic organ biopsy is indicated in horses with suspect liver, kidney, or splenic disease where histopathologic diagnosis would be helpful in the treatment of the disease process. Laparoscopic bowel biopsy is indicated in cases of gastro-intestinal disease where an accurate diagnosis/prognosis and therapy can only be achieved with histopathology. A good example is the workup of chronic inflammatory bowel disease in the horse where definitive diagnosis is only possible by histological analysis. Laparoscopic-guided ultrasound should be considered when structures deep in the abdomen, or structures generally surrounded by bowel would limit the use of transcutaneous ultrasonography.

Contraindications
Biopsies in horses with abnormal coagulation parameters may lead to hemorrhage and possibly death due to severe hemorrhage. However, direct observation of the biopsy site with the possibility of coagulation, is more obtainable with laparoscopic-guided techniques, and could possibly reduce the likelihood of significant morbidity or mortality.

Standing Surgery
For standing surgery, the horses are held off feed for 12-18 hours, but allowed free choice water. Horses should receive NSAID medication prior to surgery, and can be given antibiotics if deemed necessary. Broad-spectrum antibiotics should be given prior to bowel biopsy. On the day of surgery, the horse is placed in a standing stocks, sedated with 0.3 mg/kg Xylazine HCL intravenously, and an intravenous catheter is placed. Butorphanol tartrate at 0.02 mg/kg can also
be given intravenously. Twenty milligrams of Detomidine HCL is added to a 1-liter bag of polyionic replacement fluids and attached to the IV catheter and a slow drip is begun and the sedation titrated to effect. The appropriate flank or both flanks, are clipped and aseptically prepared. It should be noted that each side of the abdomen is most easily accessed from the ipsilateral flank, i.e. the left kidney is best accessed from the left side of the abdomen.

The portal sites are infiltrated with 15-20 ml 2% carbocaine. In general 3 portals can be created in each flank, with an additional portal possible in the 17th intercostal space. An 11mm incision is made at portal 2 through the skin and external abdominal oblique fascia. An 11 mm diameter, 15-20 cm long cannula with a blunt obturator is placed perpendicular to the skin and inserted through the incision, flank muscles and peritoneum in one slow but continuous motion.

The telescope is placed into the cannula to confirm placement within the peritoneal space. The cannula is connected to a CO2 insufflator, and the abdomen insufflated to 12mmHg. Additional cannulas are placed as needed. In some cases, for example the liver from the right side of the abdomen, only two portals are necessary.

The kidneys are located retroperitoneal, and in an obese horse, the fat surrounding the kidney can make identification of the kidney difficult. The right kidney is more difficult to identify than the left kidney.

Similar instruments are used for diagnostic biopsies as for other standing procedures. The only additive instruments are basket biopsy forceps. Needle holders are necessary when performing open full thickness, intracorporeal, organ biopsies. If using endoscopic linear staplers, a 12 or 15 mm diameter portal is necessary.

Liver and splenic biopsies are performed in a similar manner. Horses do not respond to biopsies of these organs, negating the need for local anesthesia. The dorsal aspect of the spleen is accessed the left side of the abdomen, and the caudal lobe of the liver is most easily accessed from the right side of the abdomen. The area of interest (dorsal spleen, or caudal liver) is identified by direct observation, and the biopsy forceps is advanced and one to multiple biopsies are taken. The liver can be challenging to biopsy in a horse with a wide pelvis as getting the appropriate angle with the rigid biopsy forceps can be challenging. While bleeding does occur at the biopsy site, it is rarely a problem. Applying pressure at the biopsy site with the biopsy forceps will generally provide hemostasis. Endoscopic electrosurgical devices can also be used for hemostasis. Gel foam can be applied to the site. Sutures are rarely beneficial as they usually pull through the capsule.

Renal biopsies require incising the peritoneum over the kidney. Each kidney is approached from the ipsilateral side. Local anesthetics (10-20 ml 2% lidocaine ore carbocaine) should be injected into the peritoneum at the proposed site of the incision. A laparoscopic scissors is introduced into the abdomen, and the peritoneum over the area of interest is incised. It is not always possible to access the areas of interest for renal biopsy. The peritoneum is bluntly dissected from the kidney with either the end of the scissors, an atraumatic biopsy forceps, or the biopsy forceps. One or multiple biopsies are taken. Similar to the liver and kidney, hemorrhage is not generally a problem. The peritoneum is not sutured.

Bowel biopsy can be performed using various techniques; extracorporeal or intracorporeal, or if intracorporeal; open using scissors and needle holders/endoscopic suturing devices, or closed using an endoscopic linear stapler. Extracorporeal biopsies are performed by placing the portals as previously described, identifying the bowel of interest, grasping the bowel with an atraumatic grasping forceps, or by passing a long suture through the bowel wall, bringing the bowel up to the body wall, increasing the incision, and exteriorizing the bowel. Using this
technique, there is no contamination of the peritoneal space, but the body wall incision must be enlarged. The bowel must also be moveable enough to exteriorize. A standard approach is used to remove a section of bowel, and to close the remaining bowel. Care must always be taken to not reduce the lumen of the bowel when closing.

Open, intracorporeal, endoscopic bowel biopsy is performed completely within the abdomen. The bowel segment of interest is identified using atraumatic-grasping forceps. The small intestine, cecum, and right colon are generally best evaluated from the right flank, the left colon from the left flank, and the descending colon from either flank. The large colon and cecum are difficult to manipulate endoscopically, limiting the ability to identify specific locations within the bowel for biopsy. When the area of interest is identified, the bowel is stabilized with atraumatic grasping forceps. The biopsy area is incised using endoscopic scissors, and the open bowel closed using needle holders or an endoscopic suturing device such as the EndoStitch. Care must be taken to limit contamination. A suction lavage device can be very helpful in these cases to limit contamination spread. Open, intracorporeal, endoscopic bowel biopsy provides the surgeon with a minimally invasive technique to attain biopsies, but there is an increased possibility of peritoneal contamination.

Closed, intracorporeal, endoscopic bowel biopsy similarly is performed completely within the abdomen. Similar to open, intracorporeal, endoscopic bowel biopsy, the bowel is identified and stabilized with atraumatic grasping forceps. The area of interest is incorporated into an endoscopic linear stapler is advanced through a cannula into the peritoneal space and incorporates the desired section of bowel. The stapler is fired, placing staples in both sides of the stapling device, keeping the bowel lumens closed, limiting contamination. Closed biopsy techniques allow for a minimally invasive approach, but require a larger cannula, and are more expensive owing to the cost of the stapling device and cannula.

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