Abdominal access is a prerequisite to any laparoscopic procedure. Safe introduction of the laparoscope and other instruments is an important basic skill: competence increases confidence and markedly reduces the risk of inadvertently damaging the abdominal wall vasculature and abdominal organs.

Portal Location and Abdominal Access
Most laparoscopic procedures are performed with the horse either (1) anesthetized in dorsal recumbency, via ventral or ventrolateral portals, or (2) sedated and standing, via one or both of the para-lumbar fossae. Various portal locations can be used for ventral and para-lumbar approaches; the location frequently depends on the procedure. Safe access and avoidance of injury to the underlying viscera (as well as adherence to the principles of triangulation and optical-coaxial alignment discussed in part one) are necessary at any location.

Abdominal Access Techniques
Paralleling human laparoscopic practices, two general methods of abdominal access in horses have been described: (1) closed (blind) access involving insufflation of the abdomen with subsequent placement of the telescope portal and (2) open access to the abdomen through a mini-laparotomy, followed by telescope placement and insufflation. The latter method is frequently called the Hasson technique, which is named after Harrith Hasson, MD, who popularized open laparoscopic access. Regardless of the method used, abdominal access is the first crucial step in any laparoscopic procedure and may be the part of the procedure in which complications most frequently occur. Attention to detail during abdominal access can minimize complications, and a plan for dealing with inadvertent abdominal injuries should be developed before laparoscopic surgery.

The Ventral Midline Closed Technique
A number of variations of the closed technique exist; however, most adhere to the same general principle. A needle or cannula is introduced into the peritoneal cavity, followed by insufflation to the desired intraabdominal pressure; then a primary trocar is placed via a small incision. Various purpose-manufactured needles are available for insufflation (e.g., a Veress needle), but conventional catheters and teat cannulae function quite satisfactorily.

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retrievable with subsequent attempts at aspiration (FIGURE 2). If intestinal content is aspirated, an unintended visceral puncture exists and should be repaired promptly, generally by a small laparotomy and primary repair.

Once the correct location has been established, the teat cannula is connected to the insufflator (which should have a reading near 0), and the desired intraabdominal pressure is created. Once pneumoperitoneum is established, a pyramidal-tip trocar can be used to create telescope and instrument portals with minimal risk of injury to abdominal organs if there are no pathologic adhesions to the ventral body wall (FIGURE 1).

Once initial access is achieved, additional portals can be created under direct visual control. Intended sites can be identified by observing the body wall excursions through the laparoscope while applying external pressure. Appropriately sized incisions in the skin and external rectus sheath are made, and the trocar-cannula assembly is advanced into the abdominal cavity (FIGURE 3).

**Modified Hasson Technique**
A safe and effective alternative to the closed technique is the modified Hasson technique, which takes advantage of the unique separation of the parietal peritoneum from the underside of the equine abdominal wall fascia. For this technique, an appropriately sized skin incision is created through the full thickness of the linea alba, allowing access to the retroperitoneal space (FIGURE 4). A laparoscopic cannula with a blunt trocar is introduced through the incision and safely advanced into the abdominal cavity by blunt perforation of the parietal peritoneum (FIGURES). At this point, it is advisable to introduce the telescope into the abdominal cavity and rule out accidental damage to intraabdominal viscera before insufflation to the desired intraabdominal pressure. Additional portals are created as described previously.

**Paralumbar Fossa**
Access techniques for creating a telescope portal in the paralumbar fossa parallel those used to access the ventral abdomen. For procedures involving an approach through both paralumbar fossae,
it is typically recommended that the left side of the horse be accessed first to reduce the risk of perforating the cecum—a potentially worse complication than superficial laceration of the spleen.

A closed approach can be used by introducing an intravenous catheter and a stylet, verifying that the location is correct, and insufflating to the desired intraabdominal pressure. This degree of distention typically allows safe introduction of a pyramidal-tip trocar-cannula assembly. An open approach, mirroring the ventral midline technique, is not usable in a horse's flank because of the depth of the abdominal wall musculature in the area. Nonetheless, after creation of an appropriately sized skin incision, a trocar-cannula assembly can be advanced through the body wall musculature to the level of the peritoneum (FIGURE 6A). The trocar can be removed, the telescope inserted, and the depth into the body wall layer assessed visually. Without prior insufflation, the trocar-cannula assembly can be incrementally advanced until the peritoneal cavity is accessed (FIGURE 6B). An alternative—albeit expensive because of its single-use design—is to use an optical trocar: a cannula with a clear obturator through which a laparoscope can be advanced while abdominal wall penetration is simultaneously observed. A popular version of the optical trocar is the Visiport (Covidien, Norwalk, CT), which is equipped with a crescent-shaped blade that makes a shallow incision with each squeeze of the trigger (FIGURE 7). Although an optical trocar can be used with a 30° laparoscope, the progress of the obturator is best viewed with a 0° telescope.

**Portal Site Selection**

**Ventral Midline**

While access can be safely and effectively obtained at various locations, the ventral midline approach using the relatively avascular linea alba is familiar to surgeons who have performed open surgery. Once safe access has been established on the ventral midline, a telescope can be introduced and subsequent portals made under direct observation. Supplementary portals can be situated to suit the specific procedure, with the following caveat: avoid the superficial and deep epigastric vasculature, which is situated at the lateral margin of the rectus abdominis muscle and provides much of the circulation to the ventral body wall. Interruption of these principal vessels and their main branches can result in serious or even fatal hemorrhage. In humans and companion animals, these principal vessels and their main branches can be identified by transilluminating the body wall with a laparoscope; however, they are not typically visible using this method in adult horses. The paths of these vessels and branches can be followed internally for a short distance by examining the abdominal wall near the pelvis; however, they cannot be traced cranially under cover of the transversus abdominis fascia. Therefore, it is recommended that accessory portals in the ventral body wall be situated to avoid the lateral half of the rectus abdominis muscle (FIGURE 8). In certain circumstances, a tamponade effect created by the presence of the cannula can result in delayed recognition of vascular damage, possibly...
resulting in unanticipated hemorrhage. Consequently, bleeding from the epigastric vasculature can be relatively insidious, so it is wise to inspect the internal aspect of instrument portal sites at the conclusion of any procedure to ensure that internal hemorrhage is not occurring. Accidental penetration of this vasculature is usually easily managed by ligation, typically by placing mattress sutures in the body wall at one or both extremities of the incision. Ligation can usually be accomplished with conventional instruments, although purpose-manufactured devices are available.

Paralumbar Fossa

Various procedures can be performed in standing, sedated equine patients by accessing the abdomen via the paralumbar fossa. For the ventral abdomen, specific portal placement depends largely on the procedure, and some variability in portal placement is common and acceptable. Many equine laparoscopists initially access the abdomen by introducing the telescope cannula in the middle of the paralumbar fossa, immediately dorsal to the crus of the internal abdominal oblique at the level of the ventral extent of the tuber coxa (FIGURE 9). Avoiding creation of a portal dorsal to this landmark obviates the placement of a trocar-cannula assembly in the retroperitoneal space. Because the parietal peritoneum is not tightly fixed to the underlying body wall at one or both extremities of the tuber coxa, some clinicians prefer to initially access the abdomen at the 17th intercostal space (also at the level of the ventral extent of the tuber coxa). At this location, the parietal peritoneum adheres somewhat more tightly to the underlying musculature, and this tenting phenomenon is less problematic. For the ventral approach, subsequently placed portals can be created under direct visualization.

Anatomic Considerations

Thorough familiarity with the topographic arrangement of the abdominal viscera is a prerequisite to efficient laparoscopic surgery. The development of laparoscopic techniques has allowed surgeons to see areas of the equine abdomen that were previously visually inaccessible; however, the arrangement of the abdominal organs precludes complete examination of the abdominal cavity via a single approach or even via a pair of approaches. Therefore, a working knowledge of the laparoscopic anatomy of horses is essential for preoperative planning. Anatomic considerations play an important role in patient preparation. These considerations include the duration of fasting; positioning and preparation (i.e., left and/or right) of the paralumbar fossae; and, for laparoscopy of a dorsally recumbent horse, the necessity for head-down (Trendelenburg) or head-up (reverse Trendelenburg) positioning. Instrument portal placement should be considered to optimize intraabdominal manipulations. Attention to detail regarding these elements of the procedure can greatly enhance the efficiency of laparoscopic surgery in horses. Excellent descriptions of the intraabdominal anatomy of foals and adult horses are available and should be reviewed by clinicians interested in equine laparoscopy.2–5

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References