

Laparoscopy: Minimally invasive diagnostic tool and approach for selected treatments



Courtesy of Allison Wright, J Amer Vet Res.

Figure 1: Laparoscopic-assisted gastropexy is performed using two trocar sites. The antrum is grasped 5 to 7 cm orally from the pylorus and extract to the lengthened trocar incision. An incisional gastropexy is done to suture the seromuscular layers of the antrum to the transverses abdominus muscle.

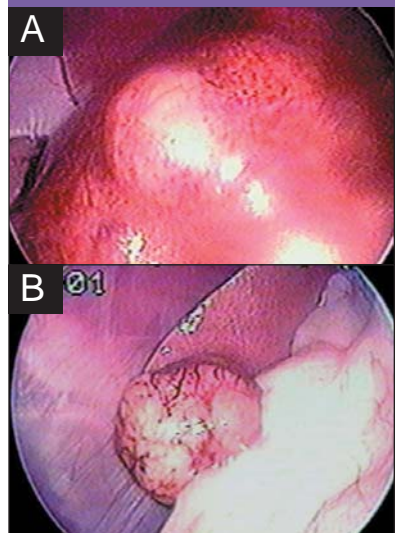
By Clarence A. Rawlings, DVM, Ph.D., Dipl. ACVS

Laparoscopy would be our choice if our surgeon gave us the option of having our gall bladder removed by laparotomy or laparoscopy. Laparoscopic cholecystectomy is considered the “Gold Standard” in human medicine as compared to the standard laparotomy approach. Although research studies have documented decreased stress responses when minimally invasive surgery is performed on people and on animals, we would request laparoscopy, or in the case of joint disease, arthroscopy, as we believe it to be less invasive. The surgeon also can see the diseased area better and can easily record these images. Minimally invasive surgical treatments have dramatically advanced patient care, and companion animal practice is beginning to follow this trend. Laparoscopy, briefly, performs procedures traditionally done as an open laparotomy.

Laparoscopy was introduced into both people and pets to examine the abdomen and collect biopsy tissue. These remain commendable indications, but the even greater impetus for laparoscopy has been the development of treatments traditionally reserved for open laparotomy. Diagnostic laparoscopy is used to view the surface of most of the organ and to selectively biopsy focal lesions. Multiple biopsies of an organ, or of multiple organs, can be safely taken and the severity of hemorrhage assessed. One of the most valuable uses is to diagnose and stage abdominal cancer. Few veterinarians enjoy performing euthanasia of a favorite client’s pet when confirming by laparotomy that an abdominal mass is a

non-operable cancer. The rationale for euthanasia is that the stress of recovery from a laparotomy exceeds the expected extension of a quality life. In contrast, two small incisions for laparoscopy are usually sufficient to confirm the same diagnosis and prognosis. The pet can then be recovered with much less stress (Photo 1). Veterinarians beginning to perform laparoscopy will find the transition from examination and

Photo 1: Laparoscopy was performed on a 10-year-old male castrated Springer who had had a liver lobectomy 11 months previously to remove a hepatic cell carcinoma. Ultrasonography had been used to identify a large mass in the left lobes. A) The large mass was seen in the left lobes. B) In addition a smaller mass was seen in the right lateral liver lobe. Both masses were biopsied and diagnosed as hepatic cell carcinoma. Laparoscopy was done through two 5 mm trocars, the dog recovered rapidly and was discharged the following day.



organ biopsy to some laparoscopic-assisted treatments only slightly more challenging. With these procedures laparoscopy is used to examine the abdomen and then grasp the desired area to partially exteriorize it. A small lengthening of a trocar site can be sufficient to perform surgery, such as a gastropexy (Figure 1, p. 22 and Photo 2, p. 24) or cryptorchid castration. This approach decreases surgical trauma.

■ Laparoscopic tools, training

New technology requires specialized equipment and training. The costs and expertise varies widely for each type of new technology. Fortunately, videoendoscopy equipment can be used to examine many areas of the body including ear, nose, bladder, reproductive tract, thorax, abdomen, other orifices (draining sinuses, prepuce, etc.) and can even be combined with flexible scopes. Specialized training during a residency or attending multiple “wet lab” continuing education courses, followed by repetitive practice, are required. It has been my experience that most veterinarians with an aptitude and developed skill in traditional surgery can learn to perform laparoscopy for diagnosis and laparoscopy-assisted treatments. Many courses are offered each year at the larger professional meetings and at selected universities. Information about courses can be made by contacting either Storz Veterinary Endoscopy (800-955-7832 or <http://www.-karlstorzvet.com>), or continuing education programs at the University of Georgia (706-542-1451 or skilgo@vet.uga.edu) and Colorado State University (970-491-1275 or vetce@colostate.edu). Just as a beginning veterinary surgeon becomes more proficient at performing and problem solving when performing an ovariohysterectomy, the experienced surgeon can rapidly become proficient at laparoscopy.

The specialized endoscopy equipment includes surgical telescopes, camera, camera processing unit, a video capture or digital capture record to document images, monitor for viewing images, light source and cable, insufflation equipment to inflate the abdomen with carbon dioxide, suction, irrigation and electrocautery. Electrocautery can be either monopolar or bipolar. Other

energy sources include the harmonic scapel, “tissue sealing” bipolar electrocautery and various lasers. These provide hemostasis and dissection capabilities. Staples can be applied to individual vessels or be used to appose tissue. The light source and camera are attached to the telescope and insufflation line is connected to a side port on the trocar that is inserted into the abdomen. Its preferable to attach the insufflation line away from the telescope port to reduce fogging of the scope. Most telescopes are 5 or 10 mm in diameter, but arthroscopes can be as small as 1.7 mm. A 30 degree scope is used for “side-angled” viewing and a 0 degree scope for “straight-on” viewing. The 0 degree scope is used for most laparoscopies and the 30 degree scope for most thoraco-

scopies and more specialized examinations of the abdomen.

Laparoscopy requires the abdomen to be distended with an optical media (carbon dioxide gas) in order to illuminate and view the abdomen. To prevent carbon dioxide from escaping, air-tight trocars are used as portals for the telescope and surgical instrumentation. Instruments are either 5 or 10 mm in diameter. Biopsy core needles can be placed separately in similar fashion as when performing ultrasound directed biopsies, and do not require a trocar as their opening is small and does not permit gas leakage from the abdomen. A wide variety of terminal instrumentation can be passed through the trocars for dissection, tissue ma-

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nipulation, ligation, vascular clip application, cautery, suturing, biopsy and stapling.

■ Anesthesia and supportive care

General anesthesia is required for all laparoscopic, thoracoscopic, arthroscopic, cystoscopic, and gastrointestinal and respiratory endoscopic procedures. Although most endosurgery produces less postoperative stress, analgesia remains important. Assisted or controlled ventilation is essential during laparoscopy and thoracoscopy. Peritoneal insufflation with carbon dioxide applies pressure to the diaphragm, reducing lung vital capacity. In addition, the animal is positioned with the head down when surgery is focused toward the caudal region of the abdomen. This position decreases pulmonary compliance and in-

creases pulmonary arterial to venous shunting. Controlled ventilation should be started at 15 to 20 respirations per minute with tidal volumes of 15 ml/kg. The peak inflation pressure should be 12 to 15 cm water. Ventilation is adjusted based upon the end-tidal carbon dioxide and systemic arterial blood pressure. Carbon dioxide is absorbed from the peritoneal surfaces and exhaled through the lung. Because the increased intrathoracic pressure produced

by artificial ventilation can decrease venous return, blood pressure must be monitored. High oxygen content should be combined with the ventilation.

Other supportive care considerations are the same as for traditional anesthesia and surgery, except that the stress is usually less. Postoperative analgesia dosages may be lower than for traditional surgeries. Some trocar sites can be blocked with bupivacaine in order to provide local analgesia. Most patients resume normal body functions, such as eating, defecating and early activity, more quickly than after traditional laparotomy.

■ Laparoscopy as a diagnostic tool

Many patients with generalized liver dis-

ease and those with focal disease can be best biopsied during laparoscopy. Biopsies are larger and have a much greater diagnostic accuracy than those obtained with 16 g or smaller core biopsy needles. In addition, multiple biopsies can be taken with large biopsy cup forceps resulting in increased diagnostic accuracy. The ability to examine the surface of the liver provides the opportunity to selectively sample focal lesions. Although much of the liver surface can be examined, it is more difficult to palpate the liver or to determine reasons for dilation of the biliary system. Fortunately, it is seldom that much diagnostic information is gained by palpation of the liver. Dogs with bleeding tendencies are poor candidates for surgery and coagulograms are commonly performed prior to any biopsy.

Both kidneys can be safely biopsied using laparoscopy. The diagnostic quality is greater than that performed with ultrasound guidance. There is a much greater number of glomeruli obtained when laparoscopy is performed with 14 g core biopsy needles. The ability to selectively biopsy the more superficial cortex increases the likelihood of obtaining good glomeruli samples and avoids arcuate vessels. Focal lesions can also be biopsied.

■ Laparoscopy as a staging tool

Laparoscopy can be a quick, low-stress method to obtain a histologic diagnosis and determine spread of an abdominal mass. In patients that can be identified as having a non-treatable cancer, it is frequently possible for the patient to recover from a minimally invasive evaluation and enjoy a short period of good quality life. It is usually possible to obtain a biopsy using two 5 mm trocars. If the mass appears to be potentially respectable and there is no evidence of obvious spread, laparoscopy can be converted to laparotomy for tumor resection. One trocar is for a 5 mm laparoscope and the other a biopsy cup forceps. An alternative is to use the second 5 mm trocar to pass a manipulating instrument to aid in positioning abdominal contents in order to use a 14 gauge core biopsy needle. The best method of activating the biopsy needle is with a double spring-fired device. Multiple biopsies should be obtained from the primary tumor and samples should be taken from the lymph nodes most likely to provide lymphatic drainage. Some lymph nodes, such as the medial iliac lymph nodes, are commonly used sentinel nodes and should be routinely biopsied in patients with pelvic masses or suspected prostatic cancer. Liver, spleen and kidneys should always be examined in an attempt to identify tumors on their surface. Patients with effusions, especially when being present in both the pleural and the peritoneal cavities may be candidates for mesothe-

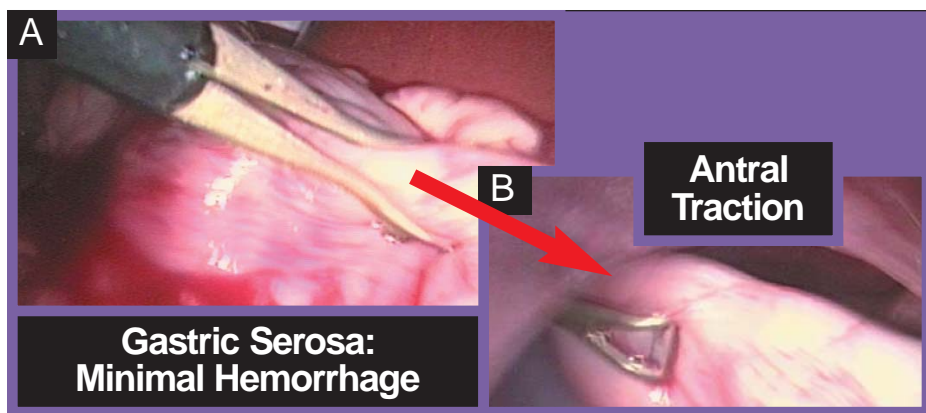


Photo 2: Laparoscopy was performed in a 12-year-old female spayed standard poodle with gastric dilatation-volvulus. Following Hasson placement of the laparoscopic trocar, the stomach was found to be dilated with gas and rotated 180 degrees clockwise. A) A stomach tube was placed to decompress the stomach, the stomach repositioned. B) The antrum pulled to a gastropexy site on the right abdominal wall. Recovery was uneventful, the dog was discharged two days after surgery and rapidly resumed its daily activities.

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lioma or carcinomatosis. Multiple biopsies should be taken from serosal surfaces.

■ Laparoscopy as assisted approach to surgical treatments

Laparoscopy is very useful to diagnose, but its appeal to clients and veterinarians is when patients can be treated in a minimally invasive fashion. We all want to reduce patient stress following surgery with the use of analgesic drugs. It is equally important to reduce postoperative stress by reducing surgical insult with minimally invasive surgery. Treatment procedures are being developed for clinical disease. When dissection and suturing is performed within the abdomen during laparoscopy, considerable laparoscopic skills are required. In contrast, the beginning laparoscopic surgeon can quickly learn many laparoscopic-assisted procedures. During laparoscopic-assistance, laparoscopy is used to partially extract the surgical site through a lengthened trocar site. An excellent introductory technique is to use two 5 mm trocars for identification and extraction of an abdominal cryptorchid testicle through the trocar site for castration. The spermatic cord is ligated and returned to the abdomen. The same trocar site can be used to remove a second testicle if it is also retained. Incisional gastropexies are performed through two 10-12 mm trocar sites. (Photos 2 and 3) This technique is strong, easy to perform, and provides a long-term gastropexy. Similar laparoscopic-assisted techniques are used for colopexy, cystopexy, placement of enterostomy feeding tubes, cystoscopic removal of calculi, and gastroscopic removal of gastric foreign bodies. Other treatments for laparoscopic-assisted surgery will surely be developed. When contemplating a laparoscopic-assisted treatment, the client should always be requested for permission to convert to a traditional laparotomy if the surgeon determines that laparoscopy provides inadequate exposure to complete the procedure.

■ Introducing laparoscopy into practice

When the equipment has been purchased and the training begun, the practice must

start actively performing endoscopic surgery. Several practice management procedures can be useful to ensure that patients benefit from improved care as a result of endoscopic surgery, and to avoid having expensive equipment exiled to a seldom visited closet. First, the equipment's representative must provide an "in-service" to ensure that the equipment is working and appropriately integrated. Training of both veterinarians and staff in the proper use and care of equipment is essential. We encourage that technicians also attend the same continuing education courses as the practitioner in order to learn proper care and application of endoscopic equipment.

One of the best methods to acquaint the entire hospital with surgical endoscopy is to use the same equipment for video otoscopy. This will ensure that the equipment is used nearly daily. Any dog in which the owner comments about signs of ear disease, any dog with veterinary detected ear signs (odor, discharge, pain), any older dog undergoing a geriatric examination, or any dog belonging to a breed commonly affected by chronic ear disease should be examined with a video otoscope. Dogs with many chronic skin conditions have similar diseases within the ear. Once all veterinarians and staff see the improved viewing of normal and diseased ears, other uses of rigid endoscopy are immediately considered. Since this technique can be performed in front of the owners and front office staff, the "word" gets out that video endoscopy is being performed in the practice. Showing the infected ear to the client will increase compliance for both treatment and recheck examinations. Images of normal and diseased ears, as well as those from laparoscopy, can be posted in the hospital and be used as educational material.

The best types of cases to start applying endoscopic surgery are to document liver or kidney disease, obtain biopsies of abdominal masses, and to perform laparoscopic assisted cryptorchid castration or incisional gastropexy. These techniques can typically be performed following "wet lab" training courses. As when learning how to spay a dog, multiple procedures need to be performed before the surgeon develops the confidence required to cope with ei-

ther minor distractions or significant complications that can develop with any surgery. It can be helpful to provide a service to animal control groups or humane organizations, by castrating dogs or cats that are cryptorchid. If the animal is a large dog, the additional service of a gastropexy will benefit both the patient and the surgeon. Some practitioners might find that polishing additional skills will require more advanced continuing education training or the "in-practice" assistance of a surgeon more experienced in laparoscopy.

The rigid scope should not be reserved for otoscopy and laparoscopy. Two widespread uses are for urethrocystoscopy and rhinoscopy. Most nasal discharges and sneezing can be diagnosed with rigid rhinoscopy using a 30 degree scope. The diagnostic procedure of choice for urethral and bladder masses, ectopic ureters, and renal hematuria is urethrocystoscopy. Practices providing reproductive services will find vaginoscopy very useful for transcervical insemination of frozen semen in the standing female dog.

Once the fundamentals of rigid endoscopy are learned, only a few more endoscopes and terminal instruments are required to expand endoscopic diagnostic and treatment potentials to many other body regions and specialties. **DVM**



Dr. Rawlings is a small animal general surgeon at the University of Georgia. He is past president of the American College of Veterinary Surgeon and directs Veterinary Endoscopic Training Symposia at the University of Georgia. In addition to his clinical practice, he has conducted basic and clinical research into several areas including heartworm disease, abdominal surgery, and emergency care. His current research and clinical emphasis involve urinary incontinence and minimally invasive surgery.

Suggested reading

- Conle TL, Center SA, Flood SN, et al: Diagnostic comparison of needle and wedge biopsy specimens of the liver in dogs and cats. *J Am Vet Med Assoc* 2002; 220: 1483-1490.
- LJ Freeman. *Veterinary Endosurgery*. St. Louis: Mosby, 1998

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