RIGID ENDOSCOPY IN EXOTIC COMPANION ANIMALS: A NEW ERA IN MINIMALLY INVASIVE DIAGNOSTICS AND SURGERY!

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The majority of rabbits, ferrets, and rodents presented to practitioners weigh less than 2 kg, and given their small size, they are ideal candidates for minimally invasive diagnostic and surgical endoscopy. Indeed, in some situations the development of endoscopy has enabled many procedures to be performed for the first time, or with significantly reduced morbidity and mortality compared to traditional surgery. Considerable advances in exotic animal endoscopy have been made over the past 5 years, and further development and refinement seems assured.1-3

INSTRUMENTATION

Given the variation in size and the nature of the procedures that may be performed, a variety of different scopes and instruments are available. For most practices the 2.7-mm system (Figure 1) offers the greatest versatility, which can be built upon as individual practice caseload dictates. This system offers several advantages including single-entry procedures, ports for air or saline infusion, and an operating channel for the introduction of 1.7-mm instruments. In addition, the 1.9-mm telescope with integrated sheath and the 1-mm semi-rigid miniscope are extremely useful for smaller mammals. For multiple-entry endoscopy, the recent application of human pediatric 3-mm instruments to exotic animal endoscopy has enabled laparoscopy to become a reality (Figure 2).

PROCEDURES

In general, the approach to exotic mammal endoscopy is similar to domesticated dogs and cats, and much can be learned and applied from the domestic animal and human literature.4,5 However, in addition to the anatomic peculiarities, the exotic mammal endoscopist must be more precise given the confines within these species. It is therefore particularly important to use finger and thumb of the inferior hand to support the tip of the telescope to ensure accurate control at all times.

Otoscopary

With the anesthetized animal in sternal or lateral recumbency, a detailed evaluation of the ears can be undertaken. In cases of severe disease, superficial exudates and debris should be gently removed before employing sterile saline infusion and working within a fluid environment. Abnormalities can be sampled for histopathology and microbiology using the biopsy forceps, which tends to provide more precise results than introducing a culturette down the vertical canal. Depending upon the size of the animal, diameter of the scope, and nature of the aural disease, it is often possible to examine the vertical and horizontal canals down to the tympanum. It is especially important to examine the tympanum in rabbits and rodents as head tilt due to otitis media or interna is common. In ferrets, ear mites and aural neoplasia appear to be more common than bacterial infection.

Stomatoseopy

Dental disease is undoubtedly one of the most common presentations for rabbits and rodents, and stomatoseopy under general anesthesia ensures a far more detailed examination than can be achieved in the conscious animal in the examination room.6,7 This technique is covered in detail in another article in this issue.

Figure 1 (left). 2.7 mm telescope system. (A) 2.7 mm telescope housed within a 4.8 mm operating sheath, connected to a light cable and an endovideo camera. (B) 1.7 mm biopsy forceps inserted down the instrument channel and emerging directly in front of the telescope. (C) A variety of 1.7 mm instruments can be used through the operating channel, including retrieval forceps (1), biopsy forceps (2), remote injection/aspiration needle (3), and single-action scissors (4).

Figure 2 (right). Human pediatric 3 mm laparoscopy equipment. (A) 3 mm instrument (1) attached to a standard ClickLine handle (2). The instrument, attached to a radiosurgery unit via a connector on the handle (3), has been inserted through a 3.5 mm graphite/plastic cannula (3). (Insert) Instrument (1) and handle (2) can be quickly exchanged by pressing on the release button (arrow). The radiosurgical connection is also shown (3).
Endotracheal Intubation

Intubation is more difficult in rodents and rabbits, and the endoscope can serve as a useful aid for intubation prior to any prolonged diagnostic or surgical procedure. The endoscope can be used as a laryngoscope to provide visualization of the glottis to aid direct intubation. The author favors inserting the endoscope into the endotracheal tube, passing the endoscope through the glottis and then advancing the tube off the endoscope and into the trachea (Figure 3).

Tracheobronchoscopy

Small flexible bronchoscopes can be used to examine the trachea and bronchi or larger rabbits and rodents; however, small telescopes can also be used to gain access to the level of the tracheal bifurcation and beyond (Figure 4). It is vital that on entering the glottis, the head and neck are kept straight and extended to avoid mucosal damage as the telescope is advanced. Unless oxygenation can be maintained, tracheobronchoscopy evaluations are necessarily brief.

Rhinoscopy

The endoscope has proven to be extremely useful for the evaluation of the nasal cavity. This topic is covered in detail in another article in this proceedings (Diagnostic Approach to Chronic Rhinitis in Rabbits), and will not be included here.

Vaginoscopy and Cystoscopy

Hematuria is not uncommon in rabbits and rodents, and can be related to diseases affecting the urinary or reproductive systems. With the animal in dorsal recumbency and the perineum close to the table edge, a small 30° sheathed telescope can be inserted through the vulva and into the vagina. Using sterile saline infusion, it is certainly possible to evaluate the vagina, urethra, bladder, and the surface of the cervices of animals as small as 500 g.

Gastroscopy and Colonoscopy

Gastrointestinal disease is especially common in ferrets; however, there has been a noticeable absence of endoscopy in the pursuit of definitive diagnoses. This is unfortunate because ferrets and other small mammals >1 kg can often accommodate the smaller flexible gastroscopes, while the stomach can often be reached using telescopes in animals <1 kg (Figure 5). The ability to confirm the presence of gastric ulceration and collect mucosal biopsies for cultures and histology should be considered routine in the investigation of gastric diseases in ferrets (Figure 6, A,B). Unfortunately, the stomach of small herbivores is never empty which can make endoscopic evaluation near impossible.

Rodent colonoscopy recently became important because researchers were looking for a means of following the progression of human colon cancer in a rodent model. The 1.9-mm sheathed telescope has been used to examine the rectum and descending colon of mice as small as 20 g. The ability to infuse methylene

Figure 3 (left). Rabbit intubation. (A) Normal resting position of the epiglottis engaged over the caudal edge of the soft palate in an obligate nasal breathing rabbit. (B) Following induction and with the head and neck extended, the endoscope is used to displace the soft palate dorsad to free the epiglottis. (C) With the epiglottis now lying ventrad in the oropharynx, the glottis can be clearly seen. (D) Following the application of local anesthetic, the endotracheal and stylet are inserted into the trachea.

Figure 4 (right). Rabbit tracheobronchoscopy. Telescopic views of the normal anterior trachea (A), bifurcation (B), bronchus and secondary bronchi (C). (D) Flexible endoscopic view of the bifurcation with a foreign body lodged in a primary bronchus (arrow).
blue and other chemical markers via the operating sheath has further improved the ability to identify colonic cells undergoing early neoplastic transformation using so-called chromoendoscopy (Figure 6, C,D). The same system and technique can be employed in companion rodents, with the animal in sternal or lateral recumbency and the perineum close to the table edge.

Laparoscopy

For a detailed discussion of methodology the reader is referred to the dedicated laparoscopy literature as only small mammal specifics will be highlighted here. Laparoscopy has been shown to offer significant advantages over traditional surgical options, both in human and veterinary medicine. In particular, laparoscopy is, with practice, faster, less traumatic, and results in less postoperative pain and faster return to normal function. Until the advent of 3-mm human pediatric equipment, laparoscopy was limited to a single-entry system using the sheathed telescope. However, multiple-entry techniques are now possible and practical for animals over 500 to 1000 g. Indeed, laparoscopic ovariectomy is now the author’s sterilization method of choice for female rodents and rabbits because it involves less tissue manipulation and results in less postoperative discomfort, and faster return to normal feeding and behavior.

Single-entry laparoscopy has been used most extensively for the collection of visceral biopsies from rodents and rabbits. In general, a 3- to 4-mm surgical approach is made through the umbilicus or at some other convenient point along the linea alba (Figure 7). Following insertion of the sheathed telescope, a mattress suture can be tied to create an air tight seal; however, this is seldom necessary if the incision through the linea alba is small. For larger rabbits and rodents CO₂ insufflation is required; however for small rodents it is often possible to simply attach a syringe containing air to one of the sheath ports, and manually inject air into the abdomen. Risks associated with air embolism have not been observed in rodents but should be considered. Single-entry techniques are simply and easy to perform but the variety of instruments is limited and so tissue manipulation and endosurgery are rudimental. Nevertheless, visceral evaluation and biopsy is practical even in small rodents (Figure 7, B-D).

For larger animals multiple-entry techniques using 2- and 3-mm human pediatric instruments are preferred and provide greater opportunities for endosurgery. There is a wider equipment selection for 3-mm instruments, and these are used with click-line interchangeable handles, connected to a radiosurgery unit for hemostasis. Access to the abdomen is achieved using lightweight 3.5-mm (for instruments) and 3.9-mm (sheathed telescope) threaded graphite cannulae. Cannula placement is determined by the organ of interest, preference of the surgeon and anatomic nature of the animal in question (Figure 8). CO₂ insufflation using a dedicated endoflator is essential for multiple-entry techniques. Some prefer the use of a Veress needle, while others, concerned at the risk of damage to internal viscera (especially the voluminous gastrointestinal tract of small herbivores) prefer to surgically place the initial cannula or telescope. An ability to rotate the animal from dorsal into either lateral can greatly assist with the location of ovaries, kidneys, and other dorsolateral structures.

For procedures involving dorsolateral structures (eg, oophorectomy), the telescope is inserted through the umbilicus with two additional cannulae placed 2 to 3 cm cranial and caudal to the telescope, along the linea alba. In this way the instruments can be directed to one lateral (Figure 9 and 10). When required to examine the other lateral, the surgeon simply moves around the table. It is...
Figure 7 (left). Single-entry rodent laparoscopy. (A) Rat intubated, positioned in dorsal recumbency, and prepared for laparoscopy. The linea alba is indicated and the preferred insertion point is the umbilicus (arrow). (B) View of the right cranial quadrant illustrating the pancreas (1) and duodenum (2) of a guinea pig. (C) Normal rabbit kidney (1) partially obscured by retroperitoneal fat (2). Obesity is commonly encountered and complicates laparoscopy. (D) Biopsy forceps (1) harvesting a liver (2) sample from a rat.

Figure 8 (right). Multiple-entry laparoscopy in a ferret. The telescope (1) has been inserted through the umbilicus, cranial to the Veress needle (2) and CO2 insufflation line. A 3 mm instrument (3) has been inserted through one of two 3.5 mm cannulae (4).

Figure 9 (left). Multiple-entry laparoscopic ovariectomy in a rabbit. The telescope is flanked on either side by two 3.5-mm threaded cannulae. All instrument insertions are along the linea alba.

Figure 10 (right). Laparoscopic oophorectomy in a rabbit. (A) Threaded cannula entry into the insufflated abdomen. (B) The ovary, grasped and elevated using forceps, is elevated to allow bipolar forceps to coagulate the mesovarium ligaments and blood vessels. (C) The ovary is dissected free using monopolar scissors. (D) The freed ovary is then removed via the cannula hole, after first sliding the cannula up the shaft of the forceps.

Often helpful to have a second slave monitor located on the other side of the operating table rather than move the entire endoscopy tower.

For access to the liver, gastrointestinal tract, spleen, pancreas, and bladder, the telescope is again passed through the linea alba or umbilicus, but the instruments are inserted transversely across the abdomen rather than longitudinally. In this manner, the telescope and instruments can be advanced into the cranial abdomen for access to the liver, stomach and intestinal tract, liver, spleen and pancreas, or advanced caudally towards the large intestine and bladder. It is important to aspirate all abdominal gas following surgery as the presence of
residual gas is a source of postoperative discomfort. Cannula holes are closed using a single suture.

COMPLICATIONS
The major complications encountered are typically associated with anesthesia, and related to issues of debilitation, poor ventilation, lack of vascular access, and hypothermia. The importance of a thorough pre-operative evaluation, endotracheal intubation, intravenous or intraosseous catheterization, and warm air/water blankets cannot be over-emphasized. Hemorrhage following rhinoscopy or tissue biopsy is common but seldom severe, although it is wise to have hemostatic agents available. Most endoscopy issues are related to operator error until experience and ability have been gained. To facilitate endoscopy caseload without compromising clients or patients, it is recommended that the surgeon retains the option to convert to a traditional surgical approach if required.

REFERENCES