The Use of Rigid Endoscopy in Small Exotic Mammals

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Introduction

Endoscopy in general is a time-honored procedure used frequently in human medicine, and of increasing importance in veterinary medicine. Manufacturers now offer specialized equipment and instruments specifically for veterinary use. Smaller sized rigid or semi-flexible endoscopes are particularly useful in small exotic pet medicine, and new applications are continually reported. The use of endoscopy in small exotic pets requires proficiency in anesthetic techniques, and an excellent knowledge of anatomy in these species.

Equipment

Several manufacturers produce rigid endoscopic equipment small enough to be utilized by practitioners treating small exotic mammals. However, only a few manufacturers produce equally sized operating sheaths with instrument channels for biopsy forceps, graspers, scissors, needles or other instruments, and channels to supply air or saline for insufflation and/or irrigation, all adaptable for small exotic animal use[1]. Endoscopic telescopes of 2.7 and 1.9mm diameter are generally the most useful for small exotic mammals. The operating sheath also serves to protect the telescope from bending or other damaging forces. A light source is required to operate endoscopic equipment. Newer xenon light sources produce superior light intensity over older, incandescent bulbs. A light cable connects light source to telescope. An optional camera unit allows the image to be displayed on a monitor instead of forcing the operator to crouch or assume awkward positions while attempting to view directly into the scope during manipulation.[2] A printer or VCR, or digital capture unit allows the practitioner to document lesions to track progress, teach students or educate clients. Endoscopy can be performed with just the endoscope, light source and cable. However, the addition of the operating sheath, a variety of instruments, the camera, monitor and printer allows the practitioner to fully utilize all the advantages of endoscopy[3].

Several manufacturers also offer otoendoscopes, commonly marketed for thorough examination of the ear canal of dogs and cats. These endoscopes are considerable less delicate than rigid endoscopes, but larger diameter may preclude frequent use in smaller exotic species.

General Techniques

Rigid endoscopy is performed under general anesthesia to protect both the patient and delicate equipment. Anesthesia of small exotic mammals is discussed elsewhere, but is most commonly accomplished with inhalant isoflurane or sevoflurane, and/or injectable anesthetic protocols. Patients undergoing more invasive procedures, or procedures more likely to produce discomfort should receive appropriate analgesia.

Oral Endoscopy

One of the more common applications is complete examination of the oral cavity of rabbits, guinea pigs, chinchillas and other similar small mammals.[5,6] Dental disease is common in species with continually growing (elodont) teeth. Lesions of the oral cavity include uneven occlusal surfaces, sharp points and spurs of the lingual or buccal aspects of cheek teeth, abscesses, fractures, hair and other material trapped between individual teeth or between teeth and gingiva, and lesions of adjacent soft tissues. Endoscopy allows a thorough examination of all aspects of each tooth and of buccal and lingual soft tissues.[5-7] Simple anesthetic induction and maintenance with gas anesthetic delivered via face mask complicates oral endoscopy, as the mask must be continually removed for access and then reapplied when the patient begins to waken. Alternatives include: induction followed by use of a nasal mask or catheter for animals that are obligate nasal breathers, such as rabbits, guinea pigs and chinchillas; induction followed by entubation; and injectable protocols with supplemental nasal oxygen. Entubation is relatively easy in rabbits (blind technique) and ferrets (standard visualization, similar to feline entubation). However, some authors also describe successful entubation of guinea pigs and smaller mammals using a semi-flexible endoscope. The telescope is inserted directly into the endotracheal tube, which is carefully slid off into the trachea after identification of and introduction into the glottis.[8] This procedure is often impossible in smaller mammals using a true rigid endoscope, as this instrument cannot make the slight bend required for identification of an entry into the glottis.

Endoscopy has also been used to identify and biopsy oral masses, collect samples for culture and retrieve oral foreign bodies.

Tracheal Endoscopy

While smaller tracheal diameter may preclude tracheoscopy, it is possible to peer into the larynx and proximal trachea in larger species such as guinea pigs and rabbits. The position of the glottis and angle of the trachea often prevents introducing a rigid endoscope directly into the trachea. Rabbits are obligate nose breathers, and the epiglottis lies over the caudal aspect of the soft palate. Therefore, the soft palate and the ventral surface of the epiglottis prevent direct visualization of the glottis. The epiglottis can be deflected ventrally by pushing against it and the soft palate gently with the tip of the endoscope.[4,5]

Tracheoscopy can reveal traumatic damage, foreign bodies, debris, and inflammatory material. Excellent anesthesia is required. As anesthetic gas and oxygen are not delivered during the actual procedure, tracheoscopy must be completed quickly and efficiently. Alternatively, injectable anesthetic protocols may also be utilized. Tracheal endoscopy is facilitated with a mouth gag or speculum to keep the oral cavity open and steady and prevent biting damage to the endoscope. Several manufacturers produce speculums specifically for small exotic mammal use.

Otoscopy
A 1.9 mm endoscope can be used to directly visualize the tympanic membrane of mammals as small as a rat. In small exotic animals with vestibular symptoms, identification of fluid behind the tympanic membrane can aid in the diagnosis of otitis media. The operator must be familiar with normal anatomy and orientation of the ear canal of the exotic species in question. A complete examination of the ear canal of small mammals can identify infections, foreign bodies, or masses. The operating sheath channel can be used to introduce fluid or air to help aid visualization or to thoroughly flush the ear canal. Grasping forceps can be used to remove foreign material and collect biopsy, cytologic or culture specimens.

Nasal Endoscopy
The 1.9 mm telescope can be utilized to examine rostral portions of the nasal cavity of rabbits, and possibly some smaller mammals.[4] Granulomas, neoplasia or other abnormalities can be detected in this manner. Samples can be collected for biopsy, cytology or culture and sensitivity. The nasal cavity of animals smaller than rabbits is frequently too small to accommodate the 1.9mm telescope. Smaller endoscopes, including semi-rigid varieties are available, but often do not come with readily available or affordable diagnostic sheaths and instruments.
Nasal mucosa is delicate, and care must be used to avoid hemorrhage. Gentle saline irrigation can enhance visualization. Potentially fatal bradycardia has been noted in rabbits undergoing nasal intubation and may have implications for nasal endoscopy. The exact mechanism is uncertain, but in one case likely lead to the death of the patient[a]. In any case, careful monitoring of all patients undergoing endoscopy is critical.

Abdominal Endoscopy
Recently, techniques have been described for examination of abdominal structures with the rigid endoscope.[10] A good knowledge of anatomy of the species in question is necessary in order to select entry points. The patient is typically placed in dorsal recumbency, and right or left flank or ventral midline entry points selected based on the target organ to be visualized and to avoid organ puncture. Entry points are clipped and prepared as for sterile surgery. In smaller exotic species, the peritoneum is carefully entered with sharp and blunt dissection, rather than with the use of a trocar. Visualization of structures is facilitated by insufflation of the peritoneal cavity. Ideally, insufflation is created with medical grade carbon dioxide gas, which is less readily available. Room air has been used successfully, but carries the increased risk of air embolism. Creation of pneumoperitoneum can increase pressure on the diaphragm. For this reason, animals should be entubated, if possible, to provide respiratory support and ventilation.
Examination and biopsy of the liver is the most commonly reported application of this technique. It is often possible to identify and biopsy other abdominal structures such as bladder, kidneys and pancreas. Intra abdominal fat often makes the identification of other structures difficult.

Thoracic Endoscopy

Hernandez-Divers recently suggested the use of rigid endoscopy to examine and biopsy thoracic structures of the rabbit, in particular lung and masses.[4] Entubation with positive pressure ventilation is required throughout the procedure, which precludes its use in species that cannot be entubated. Entry sites are chosen depending on the size and anatomy of the species in question, as well as the location of the suspected lesion. The position of the heart and relative size of the thoracic cavity varies dramatically in exotic animal species. Target sites should be identified on radiographs, and then extrapolated carefully to the patient. Entry points are clipped and prepared aseptically. The skin incision is made 1-3 cm distal to the desired intercostal entry site. A hemostat is used to travel from the skin entry site and bluntly dissect through the intercostal muscle into the thoracic cavity. The operating sheath containing the trocar is then inserted into the entry site. The trocar is removed and replaced with the endoscope. Removal of the trocar will produce pneumothorax, which is overcome with positive pressure ventilation, preferably with a small mammal mechanical ventilator (figure). After the procedure is completed, an operating sheath channel is used to evacuate as much air as possible from the thorax. The sheath and endoscope are then removed from the thorax at the moment of maximum lung expansion. The position of the skin incision relative to the intercostal entry site usually prevents the addition of more air into the thorax. The patient must be monitored carefully after the procedure for signs of worsening pneumothorax.

Cystoscopy/Vaginoscopy

The 1.9 and smaller semi-flexible telescopes can be introduced into the vagina, urethra and bladder of female rabbits, guinea pigs, and ferrets.[11] The urethral orifice of most male exotic mammals is often too small to accommodate endoscopic equipment. Gentle saline infusion through the diagnostic sheath if available and if size permits, or from a catheter run alongside the endoscope helps distend the vagina, urethra and bladder to allow excellent visualization of the lumen of the urethra and bladder wall and contents. Care must be taken to prevent overextension of the urethra and bladder. Grasping forceps can help remove small stones or other samples for culture or analysis.

An excellent understanding or anatomy of the urogenital system is critical. The reproductive anatomy of the female rabbit is unique among placental mammal species. The uterus is bicornuate with two separate cervices, which open directly into a relatively large, flaccid vaginal body. The urethra opens into the ventral aspect of the vaginal body, and marks the division between the vestibulum, which is caudal to the urethral opening, and the true vaginal body, which is cranial to the urethral opening.

In rabbits, urine can be retained in the vaginal body. Retained urine can mix with blood from the uterus, complicating determination of the source of blood in rabbits with bloody discharge. Endoscopic access to the urinary and/or reproductive tract is accomplished in rabbits via the vaginal opening.

In rodent species, the urethra of the female animal opens outside the vagina, therefore two distinct openings are visible, the urethral orifice and the vaginal orifice. Unlike female rabbits, female guinea pigs possess an unpaired cervical canal, which opens into the vagina through the cervical opening. Since the urethral orifice opens outside the vagina, a vaginal vestibulum is not present, and the vaginal reflux of urine cannot occur.

The vaginal opening in guinea pig-like rodent species is normally closed, except during estrus. Endoscopic access is accomplished via the orifice of interest.
Cystoscopy and vaginoscopy are extremely useful to help determine the source of bloody discharge when bleeding is intermittent and can't be directly observed, and ancillary diagnostic testing to determine source is inconclusive. Cystoscopy can identify thickened, hemorrhagic bladder wall, the presence of stones and/or fine mineral accumulation, masses, or polyps. Vaginoscopy may identify the presence of blood clots, other evidence of hemorrhage, luminal masses or other abnormalities. Samples can be collected for cytology, culture and sensitivity or biopsy.

Conclusion
Rigid endoscopy is increasingly utilized in small exotic mammal medicine. The availability of very small endoscopes, operating channels and instruments make endoscopy a useful tool to aid in diagnosis. Proficiency in small exotic mammal anesthesia and knowledge of anatomical and size difference among species is critical for successful implementation and outcomes.

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