Therapeutic Endoscopy

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Avian endoscopy is expanding from its traditional diagnostic role to a more complete tool used both in diagnosis and treatment of a variety of medical conditions. Endoscopic procedures provide improvement to some existing procedures by improving visualization and reducing pain as well as introducing procedures not possible without the access to minute spaces. Some of the therapeutic uses of endoscopy are described.

Introduction

Traditionally the rigid endoscope has been used primarily for diagnostic purposes in avian patients. It is well suited for this purpose and in the majority of companion birds, allows for direct examination of a wide variety of anatomical structures. In addition, using an operating sheath, collection of diagnostic specimens for cytology, culture, and histopathology has improved the ability to form a definitive diagnosis in many patients that otherwise would only have been diagnosed post-mortem.[1,2]

Endoscopy, however, has even greater potential. Not only can it be used to get a diagnosis, but it can also be used for therapeutic techniques. In some cases, the clinician can choose between an open surgical procedure and an endoscopic procedure. In other cases, the limited access only allows an endoscopic approach. Depending on the procedure, there is a substantial amount of skill development involved. These skills should initially be developed utilizing inanimate "patients", then with cadavers. These inanimate patients are simply boxes with a variety of materials placed inside that allow practicing manipulating, cutting, and dissecting under endoscopic visualization. The operator must learn depth perception and the ability to view the screen while maneuvering instruments. Initially an endoscopic approach may take longer than an open procedure. As skill develops, however, the endoscopic method can be comparable or better with regards to surgical time. The advantages are significant. Visualization is often improved over open surgery. The superior lighting and magnification display the surgical field in great detail. The incision size is reduced, speeding closure time and reducing post-operative pain. The fact that the wound seals tightly around the endoscope reduces loss of body heat and anesthetic gases.

Equipment

There is a significant requirement of equipment for rigid endoscopy. Karl Storz Veterinary Endoscopy sponsors many training programs and can supply most of the necessary instrumentation. Table 1 lists the equipment most commonly used in avian endoscopic surgery. The most obvious equipment requirement is the telescope. A 2.7 mm rod lens telescope with a 30 degree viewing angle is a versatile choice. While examinations can be performed directly through the eyepiece, a camera and monitor allow the examination to be done more ergonomically and allows the hands to be freed for using additional instruments. A protective sheath should be used to prevent damage to the delicate telescope. An operating sheath allows for suction, irrigation, insufflation, and introduction of instruments. Semiflexible 3-5 French grasping forceps, biopsy forceps, scissors, and radiosurgical electrodes allow minor, single puncture techniques. Semiflexible sheathed injection needles that can pass through the operating sheath channel are also

valuable. Additional 3 mm rigid forceps, scissors, and other tools, can be used when multiple entry sites are utilized. These instruments are available with monopolar radiosurgical connections. Ports are available that can be placed to facilitate introduction and removal. Additional supplies such as sterile catheters of various sizes, cotton tipped applicators (these may require modification by removing some of the cotton to narrow the tip so they fit through the entry site), probes, snares, or any other instrument that can fit through the entry site. Insufflation is not required when laparoscopy is performed on birds. When entering hollow viscera such as the cloaca or esophagus, saline is generally used for expanding the walls to allow a wider field. Occasionally, air insufflation of the gastrointestinal viscera is desired; in these cases a carbon dioxide insufflator or aquarium pump should be used. Carbon dioxide should never be used during laparoscopy in birds since it is going directly into the respiratory tract.

Table 1: Avian Endoscopy Equipment[1]

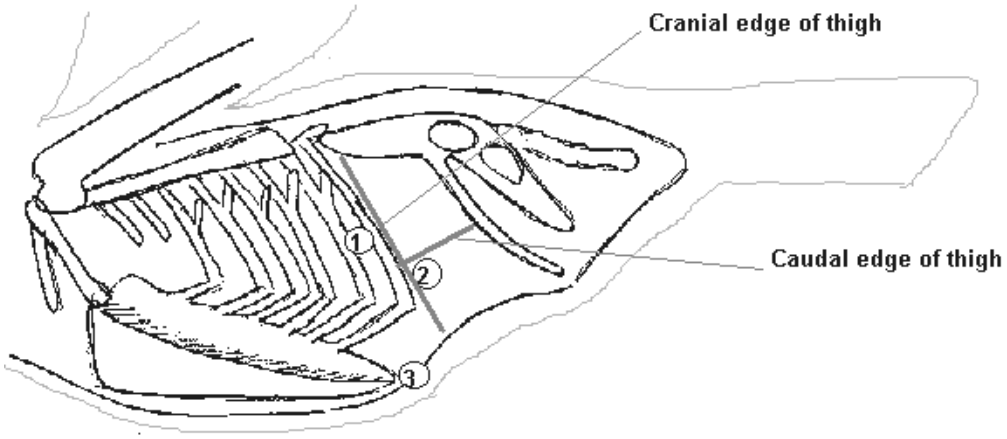
Rigid Avian Endoscopy System - Larl Storz Veterinary Endoscopy	
64018BSA	Hopkins telescope, 2.7 mm X 18 cm, 30º
67065CC	Taylor operating sheath, 14.5 Fr, 5 Fr instrument channel
64018US	Examination and protection sheath, 3.5 mm outside diameter
69117Z	Biopsy forceps, 5 Fr
67161T	Grasping forceps, 5 Fr
61071TJ	Grasping forceps, 3 Fr
62501EK	Single action scissors, 3 Fr
67071X	Aspiration and injection needle with Teflon guide
67772A	Radiosurgical needle electrode
26002M	Monopolar lead to connect to monopolar instruments
67159L	Polypectomy snare, flexible, 5 Fr X 32 cm, radiosurgery
201315-20	Nova xenon light source, 175 watts
495NA	Light guide cable, 3.5 mm X 230 cm
69235106	Veterinary video camera II
9213-B	Medical grade monitor
Pediatric Laparoscopy Equipment-Karl Storz Veterinary Endoscopy	
30114G1	3.5 mm graphite and plastic cannula with valve, stopcock, and trocar (2)
30321MDS	3 mm short curved monopolar Kelly grasping forceps, with ratchet
30321MWS	3 mm monopolar scissors with serrated curved jaws, without ratchet
30323ONS	3 mm monopolar atraumatic dissecting and grasping forceps with ratchet
26184HCS	3 mm Manhes bipolar coagulation forceps.
Radiosurgery Equipment-Ellman International Inc.	
SEMC	Surgitron 3.8 MHz radiofrequency unit with foot pedal
Laser Equipment-AccuVet Lumenis Inc.; SurgiMedics Inc.	
	AccuVet 25D 980 nm diode laser
	400 and 600 um conical and flat tipped fibers
	AccuVet High Power LX 20 SI CO_2 laser
	Long semi-rigid ceramic probe for use with 14.5 Fr. Taylor sheath

[1] Adapted from Advanced Exotic Animal Endoscopy: Reptile and Avian Endosurgery course: Veterinary Endoscopy Training Symposia University of Georgia USA.

Laparoscopy

Laparoscopy, or endoscopic examination of the ceolomic cavity, is the most commonly used endoscopic technique in avian patients. Initially pioneered for the determination of gender, laparoscopy allows for direct visualization and biopsy of virtually every ceolomic structure. This procedure can be one of the most powerful diagnostic tools available in avian medicine. The next logical step in utilizing this tool is to make use of the superb visualization for performing surgical therapy. There are several approaches that can be used for examination of various areas. Figure 1 shows the common laparoscopy approaches. These sites can be used on either side of the bird, depending on what organs or lesions are sought. In some cases, both sides are approached, either during single or separate procedures.

Figure 1 Laparoscopic Entry Sites



Laparoscopic Approaches

1. Lateral recumbency, leg pulled backward, enter cranial to thigh
2. Lateral recumbency, leg pulled forward, enter caudoventral to thigh
3. Dorsal recumbency, ventral midline approach

Single entry techniques are relatively simple to perform and require the least amount of equipment. The operating sheath is used in these techniques, and the instruments are introduced through the sheath, which is technically much easier to master than introducing instruments through separate entry sites. Procedures that can be performed in this fashion generally involve excision of small lesions. Depending on the location of the lesion, endoscopic scissors, biopsy forceps, grasping forceps, laser probes, or radiosurgical electrodes can be used to dissect these lesions from the surrounding tissue and remove them. Salpingohysterectomy has been described in juvenile cockatiels using a single entry technique. In these young birds, the oviduct is small with minimal vasculature. The technique involves entry on the left side at site number 2 from Figure 1. The oviduct is grasped at the cranial extent, and gently peeled away from the underlying kidney all the way back to the cloaca. The oviduct is crushed with grasping forceps, and then cut cranial to the uterovaginal sphincter.

Multiple entry approaches allow for a much wider variety of procedures to be performed.[4] On the other hand, they also require a much greater amount of skill. With this method the instruments must be triangulated to the field of view which takes a significant amount of training and practice. A three-entry approach allows for two instruments and the telescope to be used at the same time. In this way, tissues can by manipulated with two instruments at the same time. This allows much more precise and complicated dissection to be performed. While this is a new field, there are some procedures that have already been described using multiple entry laparoscopies.[4]

Salpingohysterectomy is one of the most commonly performed visceral surgical procedures. Indications include chronic egg laying, egg-related ceolomitis, prior oviductal prolapse, recurrent egg-binding, salpingitis, or oviductal impaction. While it can be readily performed with an open approach, this requires cutting through layers of muscle and in most cases, through two ribs for adequate exposure. These incisions heal quite well, but as in other patients, incisions through bone and muscle add to the post-operative pain associated with the procedure. In addition, the body wall tends to pull closed and sometimes lighting and visualization is challenging. The endoscopic technique avoids all of these difficulties. It is not suitable for cases where there is an egg within the reproductive tract, or if the oviduct is extremely enlarged. If the surgery is elective, the hen can be prepared for surgery by administering leuprolide acetate or medroxyprogesterone acetate to shrink the oviduct and ovary, and reduce the vasculature. The patient is anesthetized, intubated, and placed in right lateral recumbency with the upper leg pulled cranially. A radiosurgical antenna plate is placed beneath the patient. The area from the fifth or sixth rib to the cloaca and from the ventral margin of the thigh to the dorsal edge of the sternum is plucked and prepared for surgery. Three skin incisions of about three millimeters in length are made. The most cranial is placed as far cranially as practical, between two of the ribs (somewhat cranioventral to site 1 on Figure 1). The second is in a triangular depression where the last rib meets the ventral musculature of the thigh (site 2 on Figure 1). The third incision is between the pubic bone and the cloacal opening. A mosquito hemostat is used to carefully penetrate the muscle and enter the caudal thoracic air sac through the middle incision. The telescope, protected with the examination sheath is introduced and placement confirmed by examining the surrounding structures. Instrument ports are placed through the muscle at the other two sites using internal visualization by the endoscope to avoid injury to viscera. The telescope is positioned to allow the best visualization of the ovary and cranial extent of the oviduct. It is held in this position either by an assistant, or by positioning aids. (Socks filled with rice work well for this purpose.) A pair of grasping forceps is placed into the caudal port and a monopolar radiosurgical scissor is placed in the cranial port. The cranial end of the oviduct is grasped with the forceps and gently lifted. This will stretch and expose the mesosalpinx membrane. There is a blood vessel in the cranial edge of this membrane. The lower blade of the scissors is placed below the membrane and the upper blade above the membrane. The electrode is activated to coagulate the blood vessels and the scissors are closed to sever the section of the membrane. The process of stretching, coagulating, and cutting, is repeated on the next segment of mesosalpinx as the oviduct is gradually pulled caudally. The end of the oviduct eventually exits the body through the port and traction can be applied with the surgeon's hand. It may be preferable at this point to remove the port. When the uterus, or shell gland has been exteriorized, a hemostatic clip or ligature can be placed below the uterus. The oviduct and uterus are then cut cranial to the hemoclip. The remaining stump is carefully tucked back in through the incision. After a final endoscopic scan for hemorrhage of other problems, the three incisions are closed with single sutures.

Orchidectomy is not commonly indicated in pet birds. This procedure is somewhat higher risk than salpingohysterectomy due the close proximity of the testes to the aorta and other large vessels. While removal of testicular tumors is certainly a valid indication, these are usually not suitable for an endoscopic approach. This technique is primarily used for reducing hormonally related

behaviors. Because of the risks, surgical orchidectomy should be a last resort. Prior to deciding on this course of action, it should be determined that the problem is indeed related to hormones. A bird that responds favorably to medroxyprogesterone or leuprolide acetate may also respond favorably to orchidectomy. Patient preparation, anesthesia and positioning are the same as described for salpingohysterectomy. However, once the left testis has been removed, the procedure is repeated on the right side. This can be done immediately or during a separate anesthetic episode. Likewise the port placement sites and techniques are the same for the left side as described for salpingohysterectomy. Once the ports are placed and the telescope is positioned in the center incision, the left testis is grasped at the cranial end and lifted up slightly. The monopolar radiosurgical scissors are placed across the mesorchium, activated and closed. The testis is lifted further, the scissors repositioned, and again activated and closed. This is repeated until the testis is freed from the supporting tissues. Any hemorrhage should be controlled by coagulation using available electrodes, direct pressure with trimmed cotton-tipped applicators, or with hemostatic gel applied using grasping forceps. When hemostasis is assured, the incisions are closed. Patient status should be assessed to determine if the second side can be done immediately, or if it should be postponed. The procedure is identical on the right side except everything is a mirror image. Chemical castration utilizing intratesticular injections of arginine neutralized zinc gluconate (Neutersol) was experimentally performed in pigeons. The injections were performed utilizing the Storz injection needle.[5]

Intralesional injections are sometimes indicated for treatment of granulomatous diseases or for neoplasia. Traditionally, intralesional therapy has been done on dermatologic lesions. Laparoscopy allows this to be done for intraceolomic lesions as well. Once the identified, the sheathed needle is passed through the instrument channel and into the lesion. The injection is then performed. Some drugs, such as chemotherapy drugs, are dangerous enough that the needle used to inject it should not be used again. Due to the cost of the sheathed endoscopic needle, an alternative approach can be used. With the endoscope in place, an external site is chosen for percutaneous, endoscope-guided placement of a disposable spinal needle. The needle is slowly introduced so that the tip can be identified as it comes into the air sac. The tip is then directed into the needle under endoscopic visualization. Following the injection, the needle can be properly packaged and discarded.

Endoscope-assisted procedures combine conventional surgery with the advantages of the endoscope. An example would be placement of a duodenostomy feeding tube. Duodenostomy feeding tubes are indicated for birds with temporary upper gastrointestinal disorders that inhibit normal passage of ingesta into the intestinal tract. The endoscope can be used to identify the duodenum and lift it to the right ventral body wall. At this point a jugular catheter can be inserted through the skin and body wall, and into the duodenum. The catheter is advanced into position. Sutures are then passed through the skin into the duodenal wall to secure the stoma site to the body wall. The external section of catheter is secured to the skin. A seal is allowed to form for 24 hours before the feeding tube is used. The tube should be left in place for no less than five days to allow an adhesion to form. When upper gastrointestinal function has been restored, the feeding tube can be removed. The stoma can be left open to heal by second intention.

Thoracic inlet approach

Occasionally there is an indication for examination or access to the ceolomic structures cranial to the heart. With the standard laparoscopic entry sites these structures are inaccessible. However, they can be approached from the cranial end. The patient is anesthetized and placed in dorsal recumbency with the head higher than the body. The skin over the crop and thoracic inlet are plucked and prepared for surgery. The skin incision must be large enough to allow the crop wall to

be identified and deflected out of the field. The scope is then inserted and advanced into the thoracic inlet. A 360 degree view can be obtained by rotating the telescope to change the viewing angle. The thyroids, great vessels, cranial heart, trachea, and proximal primary bronchi are available through this approach. The narrow access allows only single puncture techniques to be performed. Extreme caution must be used when manipulating structures because the carotid arteries, and other large vessels traverse this area.

Gastrointestinal

While in most mammalian species, gastrointestinal endoscopy requires longer, flexible endoscopes, in most companion birds, the rigid endoscope can reach all of the accessible sites just as easily and with superior optics. The intestinal lumen is generally not accessible except for the terminal section leading into the cloaca. As previously mentioned, wet field examination using warmed saline is usually preferred for examination of the gastrointestinal tract. Most commonly, gastrointestinal endoscopy is used for diagnostic purposes, such as specimen collection and direct visualization, but it can also be useful for foreign body retrieval.

Ingluvioscopy, or endoscopic examination of the crop, is a relatively simple and non-invasive procedure. While the crop is easily palpated, and to some extent can be visualized externally by wetting and separating the feathers over it, endoscopy can allow detailed examination of the mucosal surface. Additionally, foreign bodies may rest in the crop if they are very recently ingested, or if they are too large to enter the thoracic esophagus. The patient is properly anesthetized and placed in dorsal recumbency, preferably with the head elevated somewhat and directed toward the endoscopist. The patient should be intubated and the choana packed with gauze or cotton to prevent aspiration of refluxed fluids. The telescope is gently inserted into the mouth and slid down the esophagus to the crop. Generally a sheath should be used to protect the telescope; an examination sheath if visualization is all that is needed, an operating sheath if more is to be attempted. Air or saline can be infused into the port of the sheath to open the walls of the esophagus and facilitate examination. If a foreign body is seen, it may be grasped with forceps, and the entire apparatus slowly removed. Rarely will the object fit through the sheath. Foreign bodies that lodge in the crop are often large and may or may not be readily grasped with the minute forceps that can be passed through an operating sheath. Additionally, care must be taken not to traumatize the esophagus as these objects are pulled out. Sometimes the object can be manipulated up the esophagus and grasped with a hemostatic forcep when it enters the mouth.

Proventriculoscopy, or gastroscopy is the endoscopic examination of the proventriculus, isthmus, and ventriculus. This procedure may be done non-invasively via an oral entry in small to medium sized psittacids, but requires an entry through an ingluviotomy incision in larger birds. The patient is prepared as in the ingluvioscopy. When an oral approach is used, the scope is passed from the mouth to the crop as described. At this point, the entry into the thoracic esophagus is sought. The scope is gently manipulated into this entry and advanced into the proventriculus. The procedure for birds requiring ingluvioscopy has the bird in the same position but the area overlying the crop is prepared for a surgical incision. A small incision is made in the skin and the crop wall and the telescope and sheath are inserted. From this point the procedure is the same as in the oral approach. Saline insufflation aids in examination. The proventriculus is often filled with ingesta, and other detritus which can make examination more difficult. Lavaging the contents can improve visualization. This can be done with a large bore catheter or using the endoscope sheath as described below. The interior of the proventriculus and ventriculus are examined, any diagnostic specimens collected, and any foreign bodies removed. The instruments are removed, and if necessary, the ingluviotomy and skin incisions are closed.

When foreign bodies are in the proventriculus and ventriculus, very often they are multiple small foreign objects. These objects frequently affect the motility of the gastrointestinal tract and gastric emptying. Consequently, the stomach is filled with a large amount of detritus and food, along with the foreign bodies. Identification and removal of these foreign objects one at a time can be prohibitively time consuming. Even when an open proventriculotomy or ventriculotomy is performed, it can be very difficult to remove the entire contents of the stomach. A procedure called Endoscope-assisted Gastric Lavage (EAGL) is often helpful in these cases.[6] The procedure initially is identical to the procedure described above. Once the scope is in place within the proventriculus, however, the table is tilted so that the head is lower than the body. At this point, higher volumes of warmed saline are infused into the port of the sheath. The fluid is allowed to escape around the instrument, carrying with it the debris from the proventriculus and ventriculus. The fluid is caught on a clean white towel so that foreign objects can be identified readily. In some cases, the fluid does not escape easily around the sheath, and in these cases, the telescope can be intermittently removed from the sheath to provide an escape channel for the fluid and foreign material. The infusion and drainage is continued until the fluid escaping from the stomach is clear and no further debris is noted. If an ingluviotomy incision has been made, the area should be lavaged prior to closure.

Cloacoscopy, or examination of the cloaca, provides access to the lower digestive tract, the urinary tract, and the reproductive tract. Generally this is a diagnostic procedure, but there are some innovative approaches to some common problems. Generally, cloacal endoscopy employs saline infusion for examination.[7] Cloacal papillomas, common viral induced lesions in Amazon parrots and macaws, will float into the visual field, resembling sea anemones. These floating lesions can be biopsied using standard biopsy forceps passed through the channel in the operating sheath. These lesions are much easier to identify with the extensive magnification offered by the endoscope. If available, diode lasers can be used in the wet field to ablate the lesions as well. Occasionally, concretions of urate salts will become lodged within the cloaca. These can be observed during cloacoscopy, and in some cases, they can be crumbled and removed using grasping forceps.

Egg bound hens sometimes require ovocentesis and extraction of the egg to relieve pressure applied to surrounding structures. While ovocentesis can be performed through the body wall and oviduct wall, there is an increased risk of oviductal laceration. An alternative approach is to enter the oviduct endoscopically through the cloaca, and place the sheathed needle into the egg, apply suction to remove the contents. After collapsing the egg, the shell and membranes can sometimes be grasped and extracted.[8]

Respiratory

The respiratory tract has numerous endoscopic applications. The small size of pet birds limits access in certain areas. In addition, some areas may be examined with an endoscope but there is no room for introduction of instruments. However, with some modifications of technique, many procedures are possible.

The choana can be examined more thoroughly than can be done with gross visualization. With the patient anesthetized, the scope is placed into the mouth and inserted into the choanal slit. The scope is then rotated so that the viewing angle is directed rostrally into the nasal cavities. There is limited ability to manipulate instruments in this area, but it allows identification of lesions and debris, which can be removed by flushing.

Tracheoscopy, endoscopic examination of the trachea, can be performed on patients of about 150 grams body weight or more, using the 2.7 mm telescope. Indications for tracheoscopy include tracheal foreign bodies, tracheal granulomata, tracheal stenosis, or membrane formation. For smaller patients, smaller telescopes must be used. Often, the need for small diameter precludes the use of the operating or even the examination sheath. When no sheath is used, extra care must be used to prevent damage to the telescope. If instruments are to be introduced, the lumen of the trachea serves as a sheath to direct them to the proper location.

There are two primary ways that the procedure is performed. The first is used simply to identify or confirm the presence of foreign bodies or obstructive lesions. In this case, the patient is anesthetized by mask induction and placed in sternal recumbency with the head higher than the body. Once the bird is deep enough to allow intubation, the mask is removed, and the endoscope is rapidly passed into the trachea. The scope is passed to the level of the bifurcation, or as far in as it will fit, and then removed immediately. The entire examination should be completed in a matter of 10-20 seconds. If it takes longer, the patient will start to wake up, or could become hypoxic from the scope obstructing the trachea. The second method is used when a more thorough examination is required or when surgical manipulations are planned. In this case, the patient is anesthetized, and an air sac breathing tube is placed. The anesthesia is then administered through the air sac tube. This method allows for adequate anesthesia and oxygenation during more prolonged procedures. The telescope is introduced to the level of the lesion. At this point, various instruments can then be introduced. For foreign bodies, a grasping forcep is used to grasp the object and carefully remove it from the trachea.[9] While this sounds quite simple, the process can be very difficult and can take multiple attempts before the object can be grasped securely enough to remove it. Granulomata can be removed piecemeal using biopsy forceps. Some of the material should be reserved for diagnostic purposes. A sheathed needle or small catheter can be used to bathe the area of the lesion with appropriate antimicrobial therapeutic fluid if necessary. Constricting membranes can be excised using any of several methods.[10] The fine endoscissors can be used to cut away the membrane, a long semiflexible electrode can be used to radiosurgically incise the membrane, or a fine semiflexible laser probe can be used to ablate the membrane. Crushing injuries occasionally leave a compressed segment of the trachea. These can sometimes be expanded using a Foley catheter placed to position the balloon within the crushed segment. The balloon is then inflated, expanding the tracheal segment.

Cockatiels occasionally present with millet seeds stuck within the trachea or syrinx. These birds present acutely with profound dyspnea, voice changes, and cyanosis. This condition has become somewhat of a “Holy Grail” for avian veterinarians. Considering the infrequency of occurrence, it is hardly a scourge but perhaps it galls veterinarians to have such a simple problem that they cannot resolve. The condition has an extremely high mortality rate and numerous treatment approaches have been attempted with variable success. An air sac tube is placed for the cockatiel to breath temporarily. The cockatiel is usually too small for both an endoscope and an instrument to be passed within the tracheal lumen. This leaves blind grasping and tracheotomy as the remaining options. The seeds typically lodge at or just cranial to the syrinx which is well within the thoracic inlet. There is a certain amount of flexibility in the trachea and bronchi, but excessive traction can tear the bronchi out of the bird. Another approach to tracheotomy is utilizing the thoracic inlet endoscopy approach. The entry is as described above. Usually the seed can be seen through the translucent tracheal wall. If so the semiflexible scissors are passed through the operating channel and used to cut a vertical incision through the wall of the trachea over the seed. The seed is removed using one of several methods including “picking” it out with a bamboo skewer passed alongside the endoscope, pushing it out with a skewer passed within the lumen of the trachea, or

removing with grasping forceps. The tracheotomy incision is left open. The spring of the tracheal rings actually keeps the incision relatively closed.

Generally the lungs are approached from the caudal aspect, from the caudal thoracic or the abdominal air sacs. In larger birds, the scope can be advanced into the primary bronchi via the ostium. Biopsies of the lungs can be performed from this approach. There is a membrane between the air sac and lung, which may require incision before biopsies can be taken. Small lesions on the caudal aspect of the lung may be dissected away using endoscopic instrumentation.

Any time a laparoscopic examination is performed in a bird, the air sacs are evaluated. The air sac system provides the space within the bird for movement and visualization. With the typical lateral approaches, the scope enters the caudal thoracic air sac. From there, the scope can penetrate the membranous air sac walls into the cranial thoracic air sac or the abdominal air sac. Air sac granulomata are common consequences of air sac infections, especially aspergillosis. While medical therapy of these diseases is critical, occasionally a larger granuloma will remain even following effective therapy. These lesions may be removed using various instruments.[11] Depending on the lesion size and location, a single puncture or multiple puncture technique can be utilized. If the lesion is very large, one of the puncture sites may have to be enlarged to allow for removal.

Discussion

Avian veterinarians, by necessity, tend to be innovative. As more become involved with therapeutic endoscopy, the range of possibilities is likely to widen greatly. Existing methods will be modified or abandoned and new techniques will be developed. In some cases, conventional surgical procedures may remain the ideal approach, while in other situations, endoscopic techniques will become the gold standard.

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