CHAPTER 27

INTERVENTIONAL ENDOSCOPY

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INTRODUCTION

Flexible endoscopy has a fundamental role in the treatment of specific diseases of the gastrointestinal tract. The most common therapeutic indication of endoscopy in small animals is the removal of gastrointestinal foreign bodies. Gastric and esophageal foreign bodies are frequently encountered in dogs and cats and endoscopic retrieval is currently considered the therapeutic procedure of choice for this condition. Endoscopical treatment is critical also for other less common lesions of the digestive tract such as esophageal strictures and gastrointestinal polyps, for which surgery represents an invasive option, often associated with a high rate of failure (eg, thoracic esophageal strictures, rectal polyps). A further therapeutic indication of endoscopy is the excision of precancerous mucosal lesions such as gastric intestinal metaplasia and mucosal dysplasia.

TREATMENT OF ESOPHAGEAL STRICTURES

Introduction

Esophageal strictures may be classified as benign and malignant and, based on their origin, as intramural and extramural. Endoscopic treatment finds its best indication in acquired benign intramural strictures. Congenital forms are extremely rare and may appear as fibrous rings or membranes rings at different levels in the esophagus [1,2,3,4].

An esophageal stricture may develop secondary to severe mucosal lesions or esophagitis of different origin extending to the submucosal or muscle layer of the esophagus [5,6,7,8,9,10,11,12]. The reparative process by intramural fibrosis leads to the stricture formation. Malignant strictures (squamous cell carcinoma and primitive or secondary esophageal sarcoma) are very rare in small animals and, unlike in men where palliative dilation is performed, are usually not treated due to their advanced clinical stage when clinical signs appear [13,14,15,16].

Treatment options for benign esophageal strictures include conservative and surgical procedures. Conservative treatment is based on mechanical dilation of the narrowing (bougienage, balloon catheter dilation) [6,7,9,10,11,17,18,19,20,21], endoscopic electrocautery incision of the fibrous tissue [6,11,22] and stent placement [9]. Surgery includes resection and anastomosis, esophagoplasty or reconstructive procedures (patch grafting), and is indicated when conservative treatment fails or in case of neoplastic or large strictures [23,24,25,26,27,28]. Conservative endoscopic dilation of esophgaeal strictures by bougienage or balloon catheter is preferred over surgical treatment. In veterinary literature a success rate of 50-75% for bougienage and as high as 85% for balloon catheter dilation is reported, while surgery is successful in less than 50% of cases [6,18,20]. Similar results have also been obtained by the author [29] who anyway did not experience major success differences between bougienage and balloon catheter technique, as reported in humans [30,31,32]. The main consideration in choosing between the two procedures appears to be, in author's thought, of financial order, as balloon catheter instrumentation is far more expensive than bougienage's; further, the pneumatic material of ballon catheter is far less durable than the rigid material of boogies.

Esophageal surgery is usually technically demanding and associated with a high frequency of complication such as stricture formation and/or leakage at the anastomosis site [17,23,26,29].

Bougienage

Bougienage involves the passage of progressively larger instruments through the stricture. Several bougienage techniques are available but the most diffusely used are semiflexible polyvinilic bougies with conic tips (Savary-Gillard, Stark, Celestin etc) and metallic olives (Eder-Puestow), both with progressively larger diameter and driven on a guide wire (Fig. 1). With bougienage, the longitudinal forces applied are transformed in radial forces which dilate the stenotic tract.

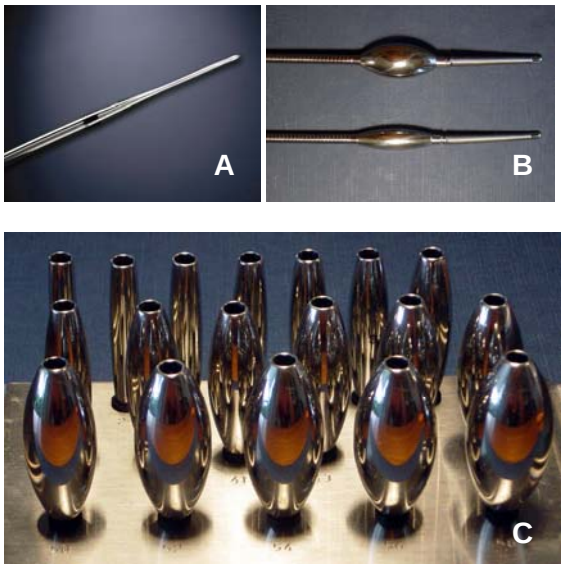

Fig. 1 – Bougienage A - Savary-Gillard dilator. These dilators consist of a range of polyvinyl tubes (5–20 mm diameter), each with a 20 cm tapered tip. A radio-opaque band at the widest point of the dilator aids radiological localisation (Courtesy of Cook®-Medical). B – Eder-Puestow dilator. Metal olives are mounted on a flexible shaft and moved on a guide wire. C - Series of graduated metal olives (6.6–19.3 mm diameter).

The dilation is performed with the patient under general anesthesia and after a complete assessment of the stricture site has been done. Probes are driven on a metallic guide wire to prevent the risk of perforation due to the blind introduction of the dilator through the stricture. The guidewire should be placed at least 20–30 cm below the lowest point of the stricture, usually in the gastric antrum. In the gastric cavity, the harmonic steel guide wire winds in coils assuring its stability in the stomach. Retrieving now the endoscope the guidewire it is left in situ and fixed externally to minimise the risk of internal displacement.

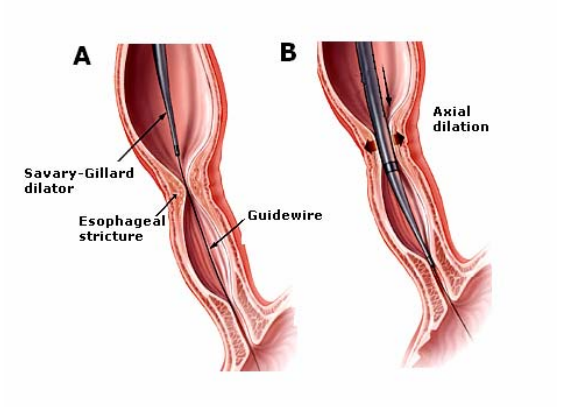

Fig. 2 - A – Esophageal dilation with Savary-Gillard device. The dilator is introduced on the guide wire and advanced until the stricture. B- The dilator is gently advanced trough the stricture. Wire guided dilatation gives greater assurance that the dilator is following the line of the esophageal lumen, thus reducing the risk of perforation.

When flexible bougies are used, a well lubricated bougie is introduced on the guide wire and is advanced to the stricture, which is passed by applying a gentle pulsion until a lower resistance of the fibrous tissue is felt. Crucial in this phase is avoiding excessive forces to prevent the severe complication of esophageal laceration. The bougie is passed forward and backward trough the dilated tract, then it is retrieved and the procedure is repeated with a larger bougie. Between dilations, repeated endocopies should be done to assess the evolution of the blind procedure. The introduction of progressively larger probes causes the distension and subsequent dilation of the stricture; the procedure should be repeated until an improved lumen diameter is obtained. A 1 cm diameter is usually appropriate for cats and small size dogs (≤10 kg). In larger dogs a 1,5-2 cm diameter could be required (Fig. 2).

Eder-Puestow device includes metallic olives with graduated diameter which are assembled on a flexible supporting pole. The metallic supporting pole with progressively larger olives is assembled on the guide wire and passed through the stricture repeatedly until an improved lumen diameter is obtained, as seen for semiflexible boogies (Fig. 3).

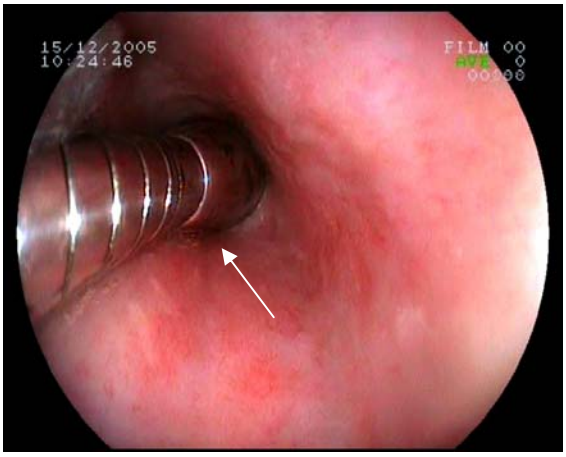

Fig. 3 – Esophageal dilation with Eder-Puestow device. A metal olive a few mm larger then the stricture is mounted on a flexible shaft and advanced trough the lesion.

Key for a successful outcome of the procedure is the accurate endoscopic assessment of the esophageal mucosa of the pre-steotic and stenotic tract before dilation. Pre-stenotic mucosa may show inflammation, erosion and even ulceration, while the fibrous tissue may be limited to the stenotic ring. A similar condition means that the lesion is still evolving since the inflammatory process underlying the condition and/or the healing scaring process has not completed ("active stricture"). Any dilatation procedure attempted in this phase induces an adjunctive trauma on a already altered and inflamed substrate (the esophageal wall). The consequence is a strong answer of the inflammatory tissue increasing the scaring process. When instead the scaring process has ultimate ("stable stricture"), the pre-stenotic mucosa appears whitish with an

irregular surface, sometimes cribrous and markedly thickened. The endoscopic assessment of these aspects is of great importance for therapeutic and prognostic purposes. Treatment of "stable" strictures results in fact, in author's experience [9,29], in a lower rate of early relapse compared to active lesions. For this reason, treatment of these forms should be delayed, if appropriate, of a 2-3 weeks, during which the patient can be fed by a gastrostomy tube and treated for the underlying disease (eg, gastroesophageal reflux disease). Regardless of the dilation device used, the procedure may be repeated at 7-15 days intervals until a lumen diameter large enough to allow adequate feeding is achieved. The total number of dilation procedures may vary from 1 to 7 and may be dictated by the severity of the stricture and the clinical answer to treatment (clinical signs of obstruction).

Balloon catheter dilation

In this procedure, stationary radial forces dilate the stricture in a centrifugal manner. Polyethylene balloon catheters (Wilson-Coock, Rigiflex Dilator; Microvasive Inc., Milford, MA) are available with different inflated diameters up to a maximum of 20 mm. (Fig. 4). Balloon catheters can be passed through a 2.8 mm accessory channel of the endoscope, or alongside the scope under direct endoscopic or fluoroscopic vision. The catheter of appropriate diameter (ie, based on the lumen diameter desired) is advanced until the lumen of the stricture is reached (Fig. 5A). Once positioned, the balloon is distended with air or filled with water (or contrast medium for fluoroscopy) to the pressure recommended by the manufacturer (usually 45-50 psi) (Fig. 5B). Balloon catheter dilation may be achieved by suitable devices.

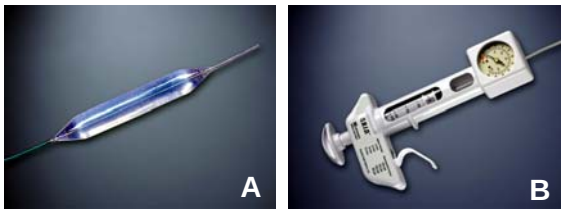

Fig. 4. **A** - Balloon catheter dilator. Aspect of the balloon when inflated. **B** - Inflation device. Used to inflate, deflate and monitor pressure of the line of balloon dilators during esophageal stricture balloon dilation (Courtesy of Cook®-Medical).

A dilation time of about 60 seconds seems to be adequate and the procedure is immediately repeated with progressively larger catheters. The choice of using water or air for distending the balloon catheter depends on stricture resistance and fragility of the esophageal wall. Owing to the physical principle of liquids incompressibility, water distention of the catheter induces a even pressure in any site of the balloon surface, being particularly suitable for the dilation of strong strictures. Catheters distended with air are characterized by higher deformability and are indeed better indicated for cats or young animals whose esophageal wall is thin and fragile. Balloon dilation technique and frequency of application is similar to bougienage but it is easier and faster and can be done under direct vision without a guide wire.

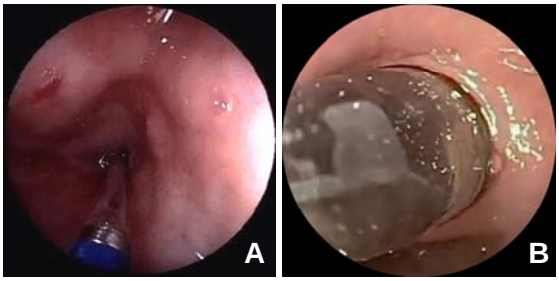

Fig. 5 – Balloon (hydropneumatic) esophageal dilation in a cat. **A** - The deflated catheter is positioned in the stenotic lumen. **B** - The inflated balloon catheter dilates the stricture.. Recommended inflation times range from 20 to 60 seconds but the optimum is unknown.

Endoscopic electrocautery incision

Dilation of some types of resistant annular stricture or tortuous strictures may be done by electrocautery incision [33,34] of the fibrous tissue followed by dilation, a technique developed in vererinary medicine by the author [22]. It requires a flexible endoscope, an electrosurgical unit, a needle knife and a dilation device (radial or axial) (Fig. 6).

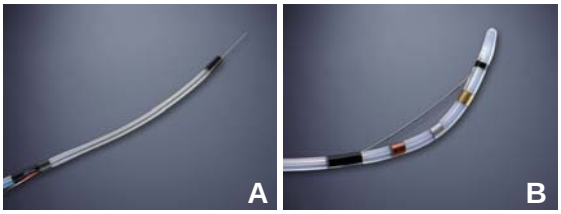

Fig. 6 – Electrocautery incision instruments. **A** - Needle knife. **B** - Sphincterotome. Both instruments are connected to an electrosurgical unit. (Courtesy of Cook®-Medical).

Before electrocautery, a 360° gentle palpation of the stenotic ring (annular strictures) is performed with an open biopsy forceps, assessing sites of greater resistance characterized by a deeper infiltration of fibrous tissue into the esophageal wall ("traction sites"). During stenotic ring development, traction induced by the developing fibrous tissue on the esophageal wall is not homogeneous. In fact, the healing response is influenced by the severity and deepness of the insult. As a result, traction will be higher in some areas (traction sites) and lower in others, even without change in the circumferential morphology of the stricture.

"Traction sites" are areas offering a greater resistance to the dilation procedure. After retrieving the biopsy forceps, a needle knife connected to the electrosurgical unit is introduced in the biopsy channel of the endoscope and three equidistant electrocautery incisions are made around the circumference of the stricture (Fig. 7).

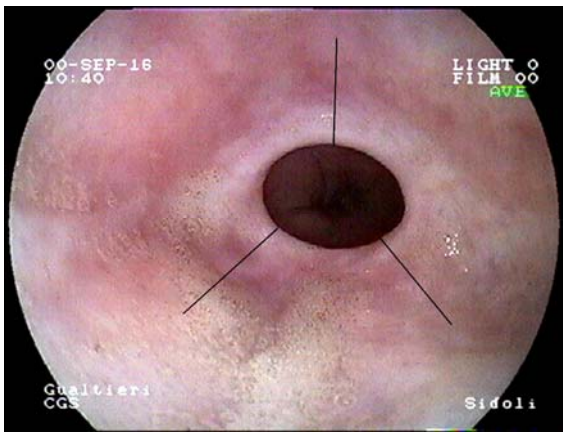

Fig. 7 – Esophageal annular stricture. The black lines indicate the sites of incision of the fibrous tissue of the stricture.

Alternatively to the needle knife a polypectomy snare partially extracted from the teflon sheat or a standard pappilotome can be used. The electrocautery incisions should be initially superficial and then deepened until an almost complete cut of the fibrous tissue is achieved.
This procedure should be made cautiously to avoid esophageal perforation. After electrocautery, dilation by bougienage or balloon catheter is conventionally done [35]. Electrocautery incisions alone without dilation are particularly useful for treating semilunar and mucous branches strictures (Fig. 8).

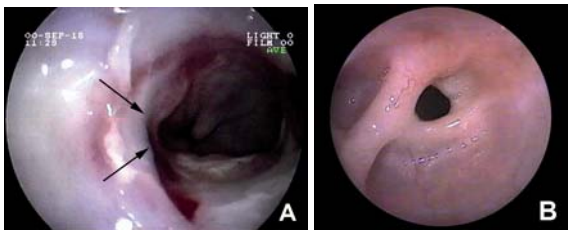

Fig. 8 – **A** - Semilunar esophageal stricture (dog): a white flap of fibrous tissue (arrows) occludes partially the lumen. **B** - Mucous branches stricture: the esophageal lumen is narrowed by a mesh of fibrous tissue occluding the organ.

When this technique is performed by an expert endoscopist, encouraging results may be obtained both as long term control of clinical signs and as definitive cure [6,9,11,22,29,33,34,35]. Dogs treated by the author with electrocautery did not require further procedures.
Strictures in the cervical tract of the esophagus may also be incised using standard or diathermic laparoscopy scissors. This instrument is introduced alongside the endoscope and allows to accurately incide the fibrous tissue under direct vision (Fig. 10).

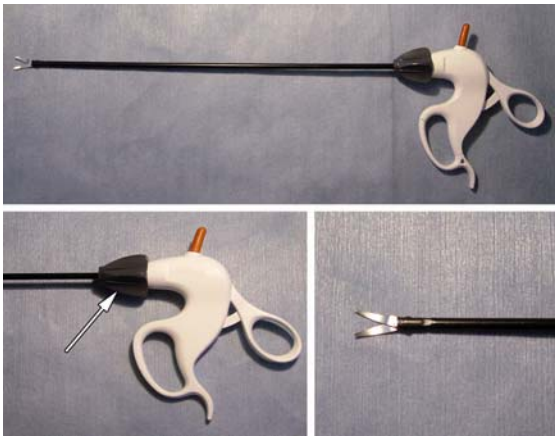

Fig. 9 - Laparoscopy scissors. The distal end can be 360° rotated on scissors' long axis by the nut ring on the handle (arrow), making the procedure easier and safer.

Fig. 10 – Incision of a mucous branches stricture (dog, cervical tract). Laparosopy scissors are introduced alongside the endoscope cut the fibrous tissue allowing the spontaneous relaxation and dilation of the stenotic tract.

Best results are obtained with 360° rotating shaft control scissors. Strictures located at a distance from scissors greater than 35 cm are not suitable for this technique as laparoscopy forceps are usually less then 40 cm long.

Postoperative care

Whatever the dilation technique used, medical treatment should be instituted as adjunctive therapy to dilation. A broad spectrum antibiotic (eg., ampicyllin, 20-40 mg/Kg TID) and prednisolone (0.5-1 mg/Kg BID IM, SC or PO) should be administer for 10-14 days. Prednisolone is used to diminish fibroblastic activity and fibrous connective tissue formation. Regardless of the dilation technique used, oral feeding may be

initiated after 6 hours, starting with single bites of raw meat of a size similar to the lumen diameter achieved by dilation, every 2-3 hours. The food bolus will help maintaining the dilation, together with standard nutrition that will be initiated in 24 hours. Key for the positive outcome of the dilation procedure is the diagnosis and treatment of the underlying disease (gastroesophageal reflux, hiatal hernia et.).

Esophageal stents

For strictures that fail to respond to repeated dilation procedures, that are too extended or not surgically treatable, palliative endoscopic stent placement to permit oral feeding and diminish the risk of aspiration may be considered. Esophageal stents are anyway rarely used in veterinary medicine due to the high rate of complication and elevated cost.
Esophageal stents can be plastic or self-expanding [9,36,37]. Plastic stents (Willson-Cook, Atkinson, Tytgat, etc.) are radiodense tubes of different length and diameter, with a tapered proximal end (Fig. 11). Before placement, the stricture must be dilated to the same diameter than the stent.
Stent placement can be accomplished by an appropriate device (pusher) or by endoscopy (Fig. 13 A).. Owing to the space occupied by the endoscope and the pusher, placement is better done under fluoroscopic instead endoscopic guidance With the pusher a mild force is applied to the stricture and the stent is released.

Fig. 11 - Esophageal plastic stents. These prosthesis are radiodense tubes of different length and diameter, with a tapered proximal end. Left to righ: Wilson-Cook, Tytgat, Atkinson, polyvinyl-homemade, Buess (Courtesy of Medscape®).

The healing response of the esophagus will help maintaining the stent *in situ*. After placement, a semiliquid diet should be exclusively fed to avoid stent obstruction.
Metallic stents are mainly used in human medicine for the palliative treatment of malignant strictures
Self-expanding stents (Z-stent, Esophacoil, Wallstent, Instent, Ultraflex, etc.) are metallic tubes characterized by strong radial forces (Fig. 12). Once placed, the stent expands until a predetermined diameter (up to 22 mm). They differ in their design (coils, mesh), material (stainless steel, nitinol) and physical properties.

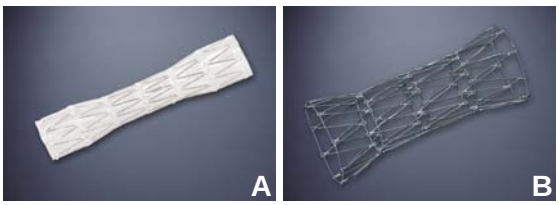

Fig. 12 - Self-expanding stents. A - Z-stent enveloped by a polyurethane skin. B - Unenveloped Z-stent (Courtesy of Cook®-Medical).

Metallic stents are mainly used in human medicine for the palliative treatment of malignant strictures (Fig. 13B), while this type of stents have never been used by the author due to the elevated cost and the difficult removal in case of wrong positioning or complications.

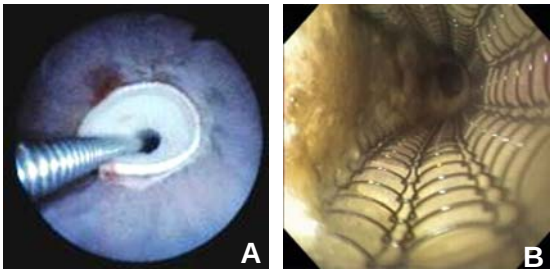

Fig. 13 – **A** - Positioning of a plastic stent (Atkinson) with a pusher in a esophageal stricture of a dog. **B** - A self-expanding metallic stent used to palliate an esophageal cancer in man.

Complications

Gastric hyatrogenic overdistension can be a common complication of endoscopy in animals with strictures, since air inflated with the endoscope cannot be aspirated if the stricture precludes passage of the endoscope in the stomach. During stricture assessment and dilation air inflation should be careful and moderate. If not promptly recognized, gastric distension can cause severe circulatory (caudal vena cava compression, hypotension and bradycardia due to vagal stimulation), respiratory (respiratory failure) and gastric (wall ischemia) problems. Stomach decompression should be done wit a 18G needle.
The most severe complication of stricture dilation and stent placement is esophageal laceration or perforation. Regardless the technique used, during the dilation procedure the esophageal wall may suddenly rupture, especially if the stricture is in active phase or in cats, where the organ wall is thin and fragile. An inadequate assessment of the lumen diameter to achieve or excessively powerful procedures are often responsible of this complication. Electrosurgical instruments

(polypectomy snare, sfinterotome, needle knife) can also induce complications such as perforation

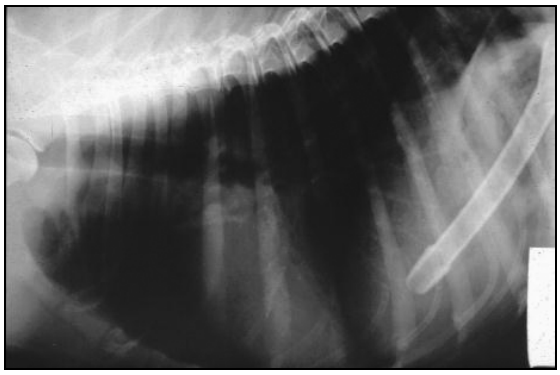

Fig. 14 – Complication after placement of a esophageal plastic stent (Atkinson) in a dog with cervico-thoracic stricture. The stent is dislocated in the stomach.

or cardiac interference (arrhythmias, cardiocirculatory arrest).
A esophageal stent may be occluded by coarse food, dislocate in the stomach (Fig. 14) or cause mechanic compression (Fig. 15) and/or fistulisation of the esophageal wall.

Fig. 15 - – Gross aspect of the cervico-thoracic tract of the esophagus of a dog with stricture. The distal part of the esophageal plastic stent (Atkinson) caused compression and trauma to the point of passage between the cervical and the thoracic portion of the esophagus, causing proliferation of the esophageal wall and impingement of the stent.

TREATMENT OF GASTROINTESTINAL POLYPS

Introduction

Although uncommon, polyps of the gastrointestinal tract have been diagnosed more frequently in the last decades in dogs and cats, probably due to the increased use of endoscopy in approaching gastrointestinal disease. Unlike small incidental lesions, large polyps or polyps located close to sphincters can cause severe clinical signs as vomiting, diarrhea and haemorrhage, depending on the gastrointestinal tract involved. Treatment is mandatory in these cases and current options are endoscopical or surgical polypectomy. Due do the possible malignant nature of polyps, also small and clinically silent polyps should be removed. The precancerous nature of some benign polyps in men stimulate a deeper knowledge of these lesions also in animals.
The term polyp describes any circumscribed lesion protruding from the gastrointestinal mucosa without specifying the nature of the lesion. Used alone, polyp is a purely descriptive term, while the specific nature of the lesion is defined by histopathology [38,39]. Most commonly, polyp refers to a process involving the mucosa (epithelial polyps), but it also indicate submucosal lesions [40,41].
Polyps of the gastrointestinal tract are rarely observed in small animals, although their incidence is probably higher, since they can be clinically silent and often incidentally diagnosed (particularly in the esophagus, stomach and duodenum) during endoscopy or necropsy [42,43,45]. Polyps can be pedunculated, sessile or have a large base of implant (intermediate form). The most common histologic types encountered in dogs and cats are the adenoma/adenocarcinoma and the hyperplastic polyp [43,44]. Inflammatory and hamartomatous polyps have been also reported in dogs [15,38,45]. In dogs, GI polyps are mainly located in the rectum [41,42,43,44,45,46,47,48,49,50,51] rarely in the stomach [40,45,52,53,54,55] and exceedingly rarely the duodenum, esophagus, colon and ileum [45,56,57,58]. The occasional reports of GI polyps in cats include mainly duodenal adenomatous polyps [45,58,59].

Endoscopic polypectomy

Endoscopic polypectomy can be considered as the procedure of choice for gastrointestinal polyps; features that influences the choice of the therapeutic procedure are the size and location of the lesion and the presence or absence of the stalk. A coagulation panel should be done before polypectomy to minimize the risk of bleeding.

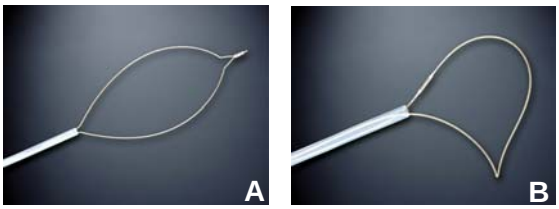

Fig. 16 – Polypectomy snares **A** - Standard polypectomy snare and **B** - asymmetrical polypectomy snare (Courtesy of Cook®-Medical).

The technique differs based on the presence or absence of a stalk. Endoscopic polypectomy of pedunculated polyps requires a flexible endoscope, a polypectomy snare and an electrocoagulation unit. With the patient under general anesthesia, the polyp is visualized, the polypectomy snare (standard or asymmetrical) (Fig. 16) is advanced through the operative channel of the endoscope and connected at the handle to the electrocoagulation unit. The snare is opened and the polyp surrounded at the base.

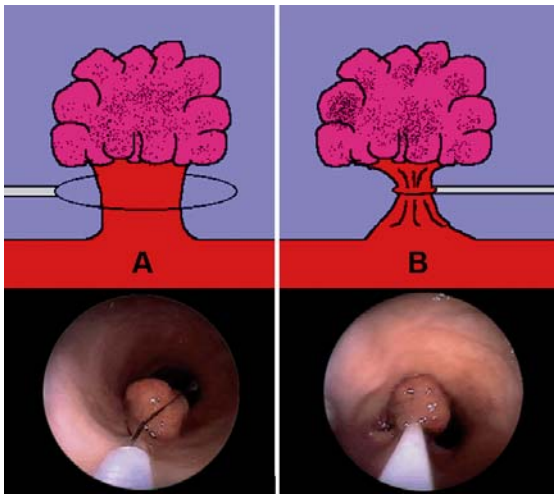

Fig. 17 - Standard procedure for polypectomy of pedunculated polyps (scheme and endoscopic view). **A** - The snare is opened and the polyp surrounded at the base. **B**. The snare is tightly closed around the base of the lesion causing hemostasis. The head of the polyp is pulled at the centre of the organ lumen to avoid energy dispersion and burns.

Before closing the snare, its correct position should be assessed to make sure that the gastrointestinal wall has not been included in the snare and avoid the risk of perforation.
The snare is then gently closed around the base of the polyp until a mild colour change in the polyp head is observed, indicating a certain degree of ischemia. The snare is now tightly closed. Before activating the current, the polyps is pulled at the centre of the organ lumen to avoid the contact with the wall and secondary energy dispersion or burns (Fig. 17). The current is now activated and the polyp excised.
The site of excision is assessed to exclude hemorrhage, then the polyp is retrieved with grasping forceps and submitted *in toto* to histopathology to characterize the histologic nature and the completeness of excision. In experienced hands, this technique is usually followed by recovery and a low incidence of complications [45], anyway is better used with ≤ 3 cm polyps. For larger polyps (3-6 cm in diameter), the lesion can be excised in smaller multiple pieces (piecemeal resection) lowering the risk of burn and hemorrhage (Fig18).

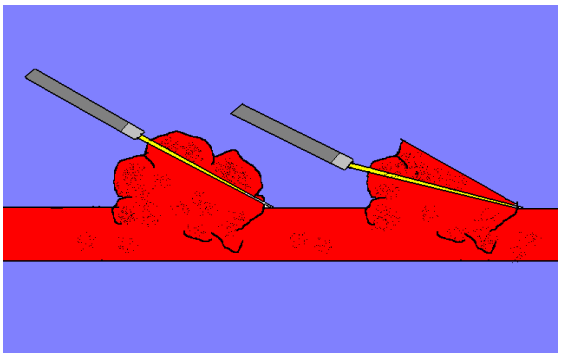

Fig. 18 – Polypectomy, piecemeal technique. Partial portions of the head of the polyp are repeatedly removed until the base of the lesion can be completely excised with the snare.

This technique is useful when the large size of a peduncolated or sessile polyp hinders the assessment of the correct positioning of the snare around the base of the lesion. Partial portions of the head of the polyp are repeatedly removed until the base of the lesion can be completely excised with the snare.

Complications

Complications of endoscopic polypectomy are usually due to improper technique, inexperience and inobservance of contraindications. Possible complications are mainly bleeding and perforation.
Bleeding after endoscopic polypectomy may originate from incomplete coagulation of blood vessels of the stalk or of the base of the polyp. If bleeding is not severe, a systemic hemostatic treatment and, when necessary, blood transfusion may be curative. If bleeding does not stop, surgery is recommended.
Perforation during polypectomy is not common and can be due to operator's hazardous maneuver or inexperience. Avoiding including the organ wall in the polypectomy snare is key to minimize the risk of perforation. Consequences of perforation depend on the organ involved.

ENDOSCOPIC MUCOSECTOMY

Endoscopic mucosectomy is a procedure well described in men [60,61,62,63] and that, in author's experience, may be useful also to treat some pathological conditions in dogs and cats. Mucosectomy involves the removal of a portion of the gastrointestinal wall including the mucosa, muscolaris mucosae and submucosa. It is a therapeutic procedure which may be useful for the excision of benign sessile or peduncuated polyps difficult to excise with a polypectomy snare or of metaplastic or diplastic areas of the mucosa which could evolve in malignant forms (Fig. 19).

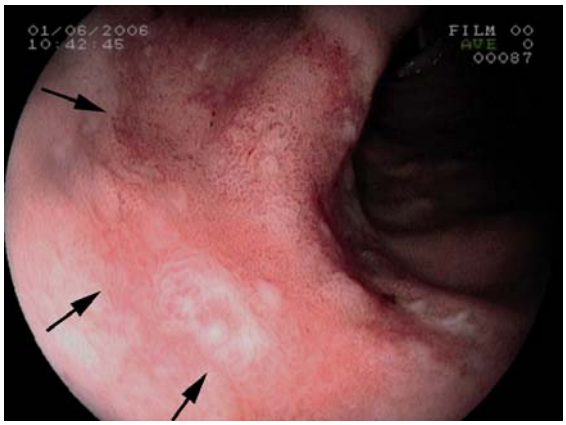

Fig. 19 – Intestinal metaplasia of the gastric mucosa. Arrows indicate an area of the gastric small curvature lined by hyperaemic and villous mucosa.

The multiple technical variants used in human medicine require specific and expensive instruments (dual-channel endoscope, elastic ligature unit, plastic hood, etc.) which are currently not justified in veterinary medicine, due to the different clinical significance of the lesions. A simple and not expensive technique that can be used in animals is the *saline lift technique*, useful for the excision of sessile polyps that are difficult to remove with a snare due to their localization (sphincters, gastric angulus, tubular organs), morphology (villous polyps) or size (small polyps); another indication of this technique is the excision of a portion of pathologic mucosa. Besides a standard endoscopic polypectomy set, instruments needed are a sclerosing needle (Fig. 20), saline solution and methylene blue. The needle is introduced in the operative channel of the endoscope and the lesion-bearing mucosa is submucosally injected with saline in multiple sites, so that the lesion is lifted on the organ wall. The amount of saline used depends on the degree of lifting desired and on the size of the lesion (5-30 cc).

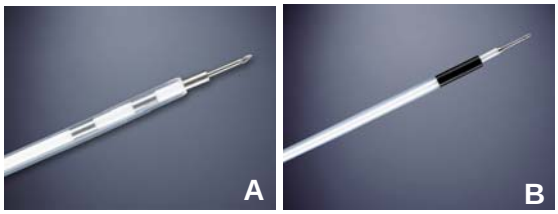

Fig. 20 **A** e **B** – Devices used for endoscopic injection into gastrointestinal mucosa (Courtesy of Cook®-Medical).

Epinephrine (1:10.000) to minimize bleeding and methylene blue to better delineate the lifted area from the healthy tissue may be diluted in the saline. With a polypectomy snare is now possible to grasp all the lifted tissue and excise the lesion with standard polypectomy technique or other techniques.

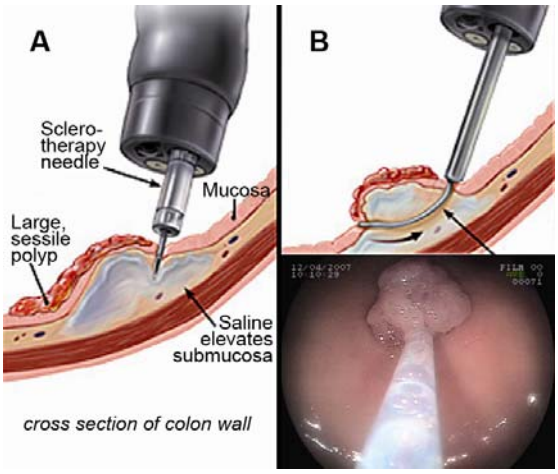

Fig. 21 – Saline lift technique. A - The needle is introduced in the operative channel of the endoscope and the lesion-bearing mucosa is submucosally injected with saline in multiple sites, so that the lesion is lifted on the organ wall. B - With a polypectomy snare is now possible to grasp all the lifted tissue and excise the lesion.

Endoscopic mucosectomy can be used also to obtain large biopsies for diagnosis. This technique is however indicated only for biopsy of intraepithelial lesions since the submucosal injection of saline modifies the normal anatomy of the submucosal layer, hindering histopathologic examination.

Complications

The complications of endoscopic mucosectomy are similar to that seen for endoscopic polypectomy.

ENDOSCOPIC REMOVAL OF GASTROINTESTINAL FOREIGN BODIES

Introduction

Gastrointestinal foreign bodies are quite common in small animals and they are much more frequent in the stomach than in the esophagus or in other tracts of the alimentary canal [9.66,67]. They are more common in the dog than in the cat, due to the different feeding behaviour of the two species. The variety of foreign bodies that can be encountered in the digestive tract is infinite, but they may be distinguished in sharp, pointed, smooth, linear and toxic. Retrieval technique could be surgical or endoscopical and depend on the anatomic site and type of the foreign body [66,67,68]. Endoscopic retrieval should be considered the elective procedure for treatment of most esophageal and gastric foreign bodies, either symptomatic or clinically silent. A number of ancillary instruments exists for removal of different objects and from different locations [67] (Fig. 22). In most cases

endoscopy allows a non traumatic retrieval of foreign bodies, except when the extended contact time with the gastric fluid modify their physical state (from soft

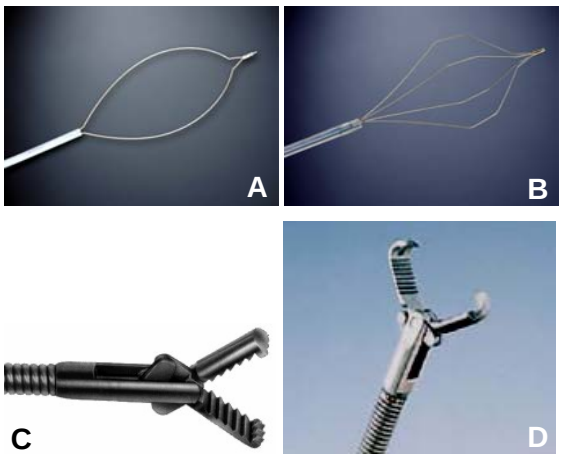

Fig. 22 – Most commonly used flexible grasping instruments for foreign body removal. **A** - Oval grasping snare. **B** - 4 wires basket (Courtesy of Cook®-Medical). **C** - Alligator-jaw grasping forceps- **D** - rat-tooth grasping forceps.

to rigid) or for linear objects (ropes, wires, clothes etc.) extending in the duodenum.

Esophageal foreign bodies

An esophageal foreign body should always be promptly removed since the likely of complication depends on the duration of contact with the mucosa. Foreign bodies in the cervical esophagus can also cause dyspnea secondary to tracheal compression. In no cases an esophageal foreign body should be observed for its passage in the stomach. Since it is usually successful, endoscopic removal should be considered as the first approach to esophageal foreign bodies [7,9,67,68,69,70]. Surgery should be considered when endoscopic removal fails or when there is evidence of esophageal perforation [68].
The technique used for removing a foreign body varies with the type and size of the object ingested. Rigid or flexible grasping forceps can be used based on the foreign body location (proximal or distal respectively) and the size of the patient. A laparoscopy rigid instrument is passed alongside the endoscope to firmly grasp large proximal and well anchored objects (Fig. 23). The length of rigid instruments (40 cm max) limits this use as foreign bodies in the thoracic esophagus of medium or large size dogs cannot be reached in this way. Flexible forceps are instead inserted in the working channel of the endoscope. Once the object has been grasped, if no resistance is felt both the endoscope and the forceps are withdrawn simultaneously, paying particular attention to the passage trough the upper esophageal sphincter. To facilitate this passage, the endotracheal tube cuff is deflated. The removal of acuminated or sharp bones should be done with particular care and gentleness.

Fig. 23 – Endoscopic removal of an esophageal foreign body (bone fragment occluding the lumen) in a dog. The object is removed using a laparosopic grasping forceps introduced alongside the endocope.

Inveterate or acuminated objects that are firmly impinged in the esophageal wall can be gently pushed/pulled (in retroversion maneuver when the foreign body can be overcome) and rotated to grasp the object on its distal side (Fig. 24). If the object does not move with these attempts, a flexile overtube with a smooth end and a diameter slightly larger than the foreign body may be introduced in the esophagus and the endoscope is passed inside the tube.
The tube will mildly dilate the esophageal lumen facilitating the dislodgment of the foreign body under direct endoscopic visualization. Of prominent importance in the author's thought is the preanesthetic administration of high dose atropine (0.04 mg/Kg IM) to prevent or reduce the vagal stimulation induced by the manipulation during retrieval.

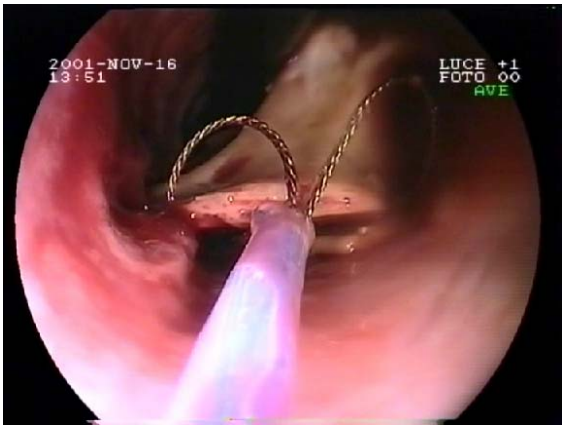

Fig. 24 – Endoscopic removal of an esophageal foreign body (vulnerating bone fragment) in a dog. The object is firmly grasped with a snare. The snare is gently pushed/pulled and rotated on its long axis to free the bone from its site and retrieve it through the mouth.

Cardiac-circulatory arrest is possible during this procedure, especially for foreign bodies located at the cardial region. When a esophageal foreign body

Fig. 25 – Removal of a fish hook from the esophagus of a dog. With a flexible grasping forceps the object is unhooked from the esophageal wall and oriented with the pointed end distally. Keeping the acuminated end close to the endoscope tip, the object is retrieved with no risk of sticking.

cannot be retrieved, it can be pushed in the stomach and removed by gastrotomy. Bones foreign bodies can be left in the stomach as they dissolve rapidly in the gastric cavity, but check abdominal radiographes should be taken to confirm the dissolution. Pointed objects such as fishhooks should be first dislodged from the esophageal wall and then should be turned with the pointed end towards the cardia, to avoid further anchoring to the wall during retrieval (Fig. 25).
A overtube should be used to remove sharp objects such as razor blades or bone laminas to protect the esophageal mucosa and the larynx (Fig. 26).

Fig. 26 – Technique for removing a sharp foreign body (razor blade). A plastic overtube is introduced in the esophagus and the endoscope is inserted in the tube until the object is reached. The grasped foreign body can now be pulled inside the plastic tube and retrieved together with the it, avoiding lesions to the esophagus and larynx.

The residual foreign body's site and the proximal esophageal mucosa (hyatrogenic lesions) should always be assessed after removal.

Esophageal perforation should be radiographically ruled out in case of pointed and sharp objects or chronic foreign bodies; sometimes in fact, the foreign body plugs the perforation and clinical signs manifest only after its retrieval.
Postoperative treatment is based on the administration of a broad spectrum antibiotic (ampycillin, amoxicillin-clavulanic acid, cefazolin) and treatment of possible complications.

Gastric foreign bodies

Best strategy to remove a foreign body from the stomach is to grasp as firmly as possible the object so that it can be moved retrograde through the lower esophageal sphincter (LES), the esophagus and the upper esophageal sphincter (UES).
Passage of the object through the LES is the most difficult phase of this procedure [67,68,70,71] (Fig. 27).
Long foreign bodies (long bones, skewers etc) should be grasped from the distal end to minimize resistance to the passage of the LES. Removal of blunt objects (stones, small balls, toys etc) may benefit of a reduction of gastric distension (air deflation) so that the Hiss angle (angle formed by the entrance of the esophagus in the stomach) becomes less acute. Simultaneously the tip of the endoscope should be slightly deflected to the left to allineate it with the cardial canal. Rarely foreign bodies located in other portions of the gastrointestinal tract are suitable for endoscopic removal. Linear foreign bodies (ropes, socks, clothes) can be found in the duodenum but they are better removed surgically to avoid the risk of intestinal invagination. A gentle attempt to remove endoscopically a duodenal foreign body is anyway justified. Even if rarely, foreign bodies that successfully traverse the upper gastrointestinal tract can be encountered in the distal intestinal tract and the rectum (pointed bones fragments, glass fragments, needle etc). Because of anal spasm induced by pain and trauma, these objects may not be passed out with normal defecation and removal with a rigid or flexible endoscope can be attempted.

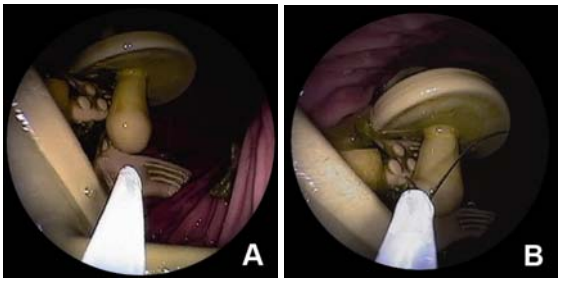

Fig. 27 – A- Multiple foreign bodies (3 rubber dummies) in the stomach of a dog. B- The objects are singularly grasped wit a flexible snare and retrieved. When inveterate, rubber objects can become fragile and brake down during removal, requiring time and patience for complete retrieval.

Complications

Complications of foreign bodies removal are infrequent and endoscopy can be safely used in most cases by a trained operator. Possible complications are laceration/perforation, gastric overdistension and sphincter neurologic dysfunction.

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