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Gastrointestinal Surgery Mini Series

Session Three: Small Intestine

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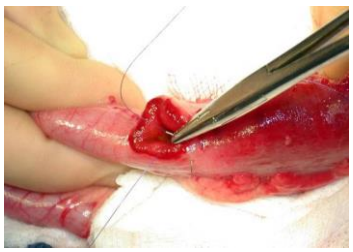

Gastrointestinal Surgery Mini Series

Session Three – Small Intestines

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Small Intestinal Surgery Techniques

Enterotomy incisions for foreign body removal are longitudinal and on the anti-mesenteric border. Indications for enterectomy and anastomosis include intestinal perforation, neoplasia, non-reducible intussusception or poor intestinal viability/necrosis. Handling of small intestine is performed with care, as inflamed or dilated intestinal wall may be more easily damaged than normal intestine.

The appearance of intestine can improve after relieving an obstruction, so a period of 10-15 minutes should be allowed before making definitive decisions on resection. Obviously necrotic intestine is dark purple, brown, black or white in colour, may be very thin, tears easily and does not bleed from cut surfaces. Given that failure to resect non-viable intestine will lead to wound dehiscence and septic peritonitis, it may be prudent to overestimate a length of intestine to be resected, unless there are concerns about short bowel syndrome.

For enterectomy, the jejunal arteries supplying the segment to be resected and the arcadial jejunal vessles are ligated. The intestinal contents are milked from the proposed enterotomy or enterectomy sites to reduce or avoid spillage. Prevention of spillage can be achieved by having an assistant occlude the intestine (which causes less intestinal trauma) or by placing intestinal forceps e.g. Doyen forceps (which are more secure). Two assistant hands or Doyen forceps are required for enterotomy. For enterectomy two additional pairs of clamps are needed to occlude the bowel to be resected, and these can either be intestinal forceps or crushing forceps, give that this tissue will be resected. The intestine is transected between each set of clamps orally and aborally. A cuff of tissue of at least 1cm is recommended between the clamp or assistant's fingers and the site of transection, as there is a tendency for retraction of intestine to occur and for the intestine to slip through the clamp or the fingers leading to spillage. The submucosa is the strongest layer of the intestinal wall and must therefore be incorporated by sutures to maximise wound healing. Sutures must be placed in viable intestine. An initial suture (or several sutures) is placed at the mesenteric border, as this is the most difficult location to effectively place the suture through the submuocsa. Placement of these sutures last is difficult to do as mesenteric fat obscures visualization of the intestinal cut edge and can result in a small gap in the suture line, which is difficult to repair, or may be missed. Simple appositional suture patterns are performed as they lead to good submucosal apposition and primary healing. A continuous appositional suture pattern for closure of enterotomy or enterectomy is a recognised alternative to simple interrupted sutures. Sutures are placed 3-5mm from the wound edge to ensure that sutures engage the submucosa and minimise the risk of sutures tearing through tissue, which will lead to dehiscence. Sutures are placed 3-5mm apart. A leak test can be performed after placing intestinal sutures by injecting enough fluid (using a 23g needle) to dilate the intestine until there is firm pressure on the wall. Additional sutures are placed as necessary. The mesenteric incision is closed with a continuous suture to limit the risks of entrapment.

Surgical stapling techniques have been described for resection and anastomosis of small intestine, as well as for anastomosis of small to large intestine. The main advantage over the sutured anastomosis is the ease in which intestine of different diameters can be anastomosed, for example when the oral portion is dilated after intestinal obstruction or when anastomosing small intestine to large intestine.

Disadvantages are similar to sutured anastomosis and regular staples cannot be used in smaller diameter intestines e.g. in cats and small dogs (small staplers are available). Cost may limit the use of staplers, although this may be offset by reduced surgical times, especially where there is luminal disparity.

The major complication of intestinal surgery is septic peritonitis due to intestinal dehiscence. In dogs undergoing intestinal surgery, 2-16% suffered intestinal wound dehiscence. Dogs may be at greater risk of dehiscence than cats. Other complications of intestinal surgery include ileus, short bowel syndrome and adhesion formation.

Intestinal foreign bodies

The following tables show the incidence of complete/partial obstruction, solid vs linear FBs, FBs that are/are not palpable and survival in animals with foreign body obstruction

	Dogs	Cats
Complete obstruction	70%	42%
Partial obstruction	30%	58%

	Dogs	Cats
Solid FB	63-84%	67%
Linear FB	16-37%	33%

	Dogs	Cats
Palpable FB	76%	58%
Nothing palpable	24%	42%

	Dogs	Cats
Survival after solid FB	94%	100%
Survival after linear FB	80%	63%

Gastrointestinal foreign bodies in dogs and cats: a retrospective study of 208 cases

Objectives: To establish predilection sites of obstruction and to investigate clinical factors associated with a poor outcome.

Methods: A retrospective study of 208 consecutive cases over a 48-month period from first-opinion practice.

Results: Overall, 91 per cent of cases recovered with higher survival rates from discrete foreign bodies (94 per cent in dogs and 100 per cent in cats) as opposed to linear foreign bodies (80 per cent in dogs and 63 per cent in cats). English bull terriers, springer spaniels, Staffordshire bull terriers, Border collies and Jack Russell terriers were over-represented. In dogs, 63 per cent of obstructions occurred in the jejunum but foreign objects were encountered at all points along the gastrointestinal tract. A longer duration of clinical signs, the presence of a linear foreign body and multiple intestinal procedures were associated with significantly increased mortality. Neither the degree of obstruction (partial or complete) nor the location of the foreign body was shown to have a significant influence on survival.

Clinical Significance: Prompt presentation, diagnosis and surgical intervention improve the outcome of gastrointestinal obstruction by foreign bodies. At surgery, the minimal number of intestinal procedures should be performed to restore the integrity of the alimentary tract.

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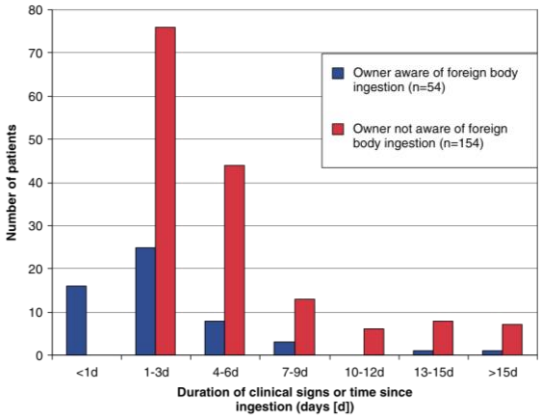
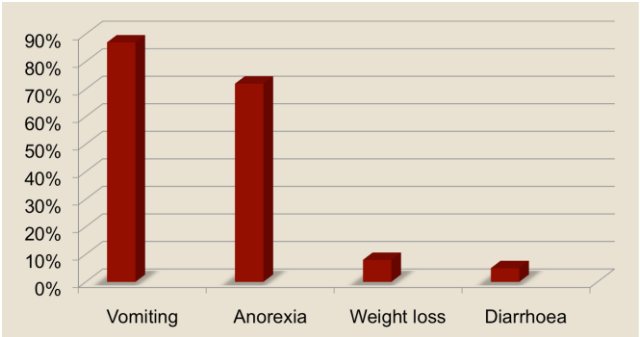
A paper by Hayes (above) examined clinical factors in dogs and cats with gastrointestinal foreign bodies in a UK charity practice. The tables beneath show clinical signs on presentation and the relationship between time on presentation to whether owners knew the animals had ingested foreign bodies. Survival times were better in this study than those from referral centres, suggesting a population of animals with less severe clinical disease. This information is therefore very relevant to practitioners in first opinion practice.





The history tends to be variable and non-specific, include vomiting, diarrhoea, inappetance, weight loss, history of having eaten a foreign body and sometimes a history of previous surgery for foreign bodies. For severe disease e.g. complete obstruction, there is more likely to be hypovolaemia and marked abdominal pain, which are signs consistent with an acute abdomen.

On physical exam animals may have abdominal pain, a mass or palpable abnormality, thickened intestines and /or malpositioned organs.

Dogs and cats can swallow very large objects as the oesophagus dilates markedly. Foreign bodies can occasionally be iatrogenic e.g. leaving dental swabs in the pharynx, cutting the tip off a gastrostomy tube prior to removal.

Radiographs are often the first diagnostic tool used in first opinion practice. It is possible to see radio-opaque FBs. Dilated loops of small intestine filled with gas or fluid will occur with complete obstruction and are more obvious for FBs present for some time and in a more distal/aboral location. They are less obvious if the FB is very proximal/oral but in these cases the stomach or duodenum may be obviously dilated. The upper limit of normal small intestinal diameter is 1.6 times the height of the body of L5 at its narrowest point, with a >80% chance of obstruction if the diameter is >1.95 times the height of L5. Partial obstruction may look like ileus or enteritis and can be further assessed by ultrasound or a contrast study.

The prognosis for solid foreign bodies is good with 94% survival. Hayes showed that factors affecting mortality after surgery included longer duration of clinical signs, the presence of a linear FB and the need for multiple intestinal incisions. This study showed no effect on mortality of the degree of obstruction or the location in the intestine.

Linear foreign bodies occur due to ingested long foreign material. Cats are more likely to ingest thin material, which tends to anchor under the tongue (63%), while dogs often eat wide linear foreign bodies of which 67-78% of foreign bodies anchor at the pyloric antrum. Due to the anchored site, the intestine becomes bunched up around the foreign material when peristalsis occurs. The length of intestine involved reflects the length of the foreign body and the time since ingestion. Radiographic and ultrasonographic findings include intestinal plication and tapered gas bubbles. Pathophysiological consequences include partial or complete intestinal obstruction, perforation (often multiple) along the mesenteric border of the small intestine and adhesions.

The foreign body is removed via gastrotomy and as many enterotomy procedures as necessary. The more firmly embedded the FB is in the intestinal mucosa, and the longer the length of intestine involved, the more incisions are typically required to remove it. Repair of small defects can be performed. Enterectomy is required for large areas of perforation or adhesions that leave the small intestines plicated even after foreign body removal (the latter is very rare). The prognosis is good for cats with no complications and perforation in cats is uncommon. Dogs have a worse prognosis, and in one study >30% had suffered perforation and >40% required resection.

Small Intestinal Neoplasia

Intestinal tumours are rare. In dogs they are less common in the small intestine than the large intestine, except lymphoma, which is more common in the stomach and small intestine. Most tumours are malignant of which adenocarcinoma, leiomyosarcoma/ gastrointestinal stromal tumours (GIST) and lymphoma are the most common tumours of dogs. Benign tumours include leiomyoma and have an excellent prognosis if resectable.

Adenocarcinomas have different histological classifications, although they all have similar clinical behaviour. They tend to arise in the duodenum and grow intraluminally. Metastatic rates of 50-80% are reported to regional lymph nodes, as well as the liver, spleen and peritoneal surface (carcinomatosis).

In one study of small and large intestinal adenocarcinoma, examination of the local lymph nodes and abdominal organs with ultrasound led to a diagnosis of lymphadenopathy and/or nodular mesentery/omentum in 12 of 21 dogs.

Canine leiomyosarcoma tends to arise from the jejunum and grow extraluminally rather than intraluminally. Recent studies have been able to reclassify them as smooth muscle or gastrointestinal stromal tumours (GIST) using immunohistochemical techniques. A report of their reclassification did not demonstrate a difference in survival between different tumour types, with reported 1 and 2 year recurrence-free periods of 80% and 67%. Metastasis is most common to the liver and is reported in up to 50% cases.

The small intestine, especially the jejunum, is the most common site for gastrointestinal neoplasia in the cat. Lymphoma is the most common tumour (75%). Masses are localized or diffuse and often palpable. Visceral mast cell tumour is a separate entity to systemic mastocytosis affecting the spleen. It shows early metastasis to lymph nodes and the liver. Adenocarcinoma often presents as a partial or complete obstruction, due to annular constriction of the intestine. Metastatic rates in cats are >70% at diagnosis, to the peritoneal surface, lymph nodes, liver and lungs. Duodenal adenomatous polyps are reported.

Clinical signs are vague and include weight loss, diarrhoea, vomiting, lethargy and anorexia, and less frequently melaena and anaemia. Clinical signs are more common than with large intestinal tumours as they interfere with normal gastrointestinal function. Animals may present with signs of obstruction or perforation with peritonitis. The mass is palpable in more than half of cases, especially cats (50-85% cats vs 20-50% dogs).

Ultrasonography is a more sensitive diagnostic tool than radiography for identifying a mass and can be especially helpful in staging and obtaining ultrasound-guided aspirates or biopsies. Ultrasound has proven useful in differentiating neoplastic from non-neoplastic intestinal disease. Metastasis is usually abdominal, including lymph nodes (especially adenocarcinoma), liver (especially leiomyosarcoma) or omentum/mesentery. Thoracic radiography or CT is also performed to look for pulmonary metastasis although this is less common than abdominal metastasis.
Endoscopy can be useful to obtain biopsies, although it will only detect mucosal lesions, so is less helpful for smooth muscle or stromal tumours. Ultrasound guided fine needle aspirates can be obtained, although this is hard to do in large or obese dogs. Ultrasound guided biopsy is not recommended due to the risk of perforation. If non- or minimally-invasive diagnostic tests fail to obtain a diagnosis, laparoscopy or exploratory coeliotomy may be indicated. Examination of the intestines may identify a mass lesion, which can be resected, or allow surgical intestinal biopsies. The latter are more likely to be diagnostic than endoscopic biopsies, as they incorporate all layers of the intestine.

With the exception of lymphoma, surgical resection is the primary treatment for intestinal tumours. Margins of at least 4-8 cm are required to remove tumour cells from grossly normal intestine and mesenteric and omental adhesions are also resected. Local lymph nodes should be assessed and aspirated or biopsied if enlarged. Decisions regarding euthanasia are not made on surgical assessment of lymph nodes alone, as there is a poor correlation with histological findings. Additionally, metastatic lesions are not always very aggressive and long survival times have been reported in some cases even in the face of large mesenteric masses. Post-operative chemotherapy is reported. Whilst lymphoma is classically treated with chemotherapy, many intestinal lymphomas are surgically excised, both as a palliative measure and to avoid the risk of intestinal perforation sometimes seen with chemotherapy.

For animals with no evidence of local or distant metastasis, long-term survival is possible, although some patients may go on to develop metastasis. The overall survival time in dogs is 10 months with a one-and two-year survival rate of 40% and 33%. In the presence of metastasis from adenocarcinoma or leiomyosarcoma the median survival in dogs is three months and the one-year survival rate 20%. There is no statistically significant difference in survival times between dogs with adenocarcinoma and leiomyosarcoma, nor GIST and leiomyosarcoma.

Cats with adenocarcinoma can have prolonged survival, and this will be improved significantly with surgery. Median survival of up to 27 months has been reported, with a shorted median survival of 13 months if there is metastasis. Other reports show shorter survival times in cats. Cats with mast cell tumour have a poor prognosis and there is a high metastatic rate (>70%).

Intussusception

Intussusception is the invagination of a portion of intestine (the intussusceptum) into the lumen of another (the intussuscipiens). It is normally in a normograde direction into small or large intestine, with most involving the enterocolic junction in dogs and the small intestine in cats. Most cases (75%) are in animals of less than one year old. Predisposing causes cannot always be established and most cases are idiopathic, although it may be seen with intestinal masses, parasitism or gastroenteritis. Animals typically present with vomiting, haemorrhagic diarrhoea and abdominal pain, with clinical signs being worse in proximal, complete obstruction, if there is intestinal ischaemia or if perforation or stasis have led to peritonitis. Diagnosis is based on clinical examination findings of a palpable abdominal mass and imaging findings (radiographic signs of an intestinal mass and/or intestinal obstruction, a target-like mass on transverse ultrasonography, multiple hyperechoic or hypoechoic parallel lines on longitudinal ultrasonography). Spontaneous resolution may occur in young animals, therefore repeat ultrasound is recommended after anaesthesia but before surgery.

At surgery, reduction is attempted by pushing the intussusceptum from the intussuscipiens. Pulling can lead to tearing. Recent intussusceptions can be manually reduced but must be examined for viability of the intestinal wall and blood supply. More chronic intussusceptions have adhesions between the serosal surfaces, along part or all of their length, and cannot be reduced. Resection and anastomosis is therefore necessary in the majority of cases. Underlying causes, such as a mass, must be ruled out. Recognition of underlying intestinal disease can be improved by submitting additional intestinal biopsies at the time of surgery. Recurrence rates, reported as 10-30%, are no different between reduced intussusceptions and those undergoing resection, nor between regions of bowel segment removed. Recurrence usually occurs in idiopathic cases at another site, usually more oral than the first, whereas recurrence is not expected if there is a cause such as a mass. Prognosis for survival is good.