Intestinal surgery in the dog and cat: Part 2

Intestinal disorders requiring surgical intervention are commonly encountered in small animal practice. A thorough understanding of these disorders and their appropriate management is essential in order to optimise patient outcome. Part 1 of this article previously reviewed intestinal anatomy and healing, common surgical intestinal disorders and the diagnostic imaging of these patients. Part 2 will now provide an overview of the surgical techniques employed to manage the common surgical intestinal disorders in dogs and cats. Pre- and post-operative considerations for patients undergoing intestinal surgery and the potential complications that may be encountered will also be discussed.

**Key words:** Small intestine, large intestine, dog, cat, intestinal surgery, complications

### Pre-operative considerations

#### Antimicrobial use

Intestinal surgery involves entry into the intestinal lumen and therefore is considered a clean-contaminated procedure. Consequently peri-operative antibiotic use is indicated as a prophylactic measure. This should consist of the intravenous administration of a broad spectrum antimicrobial (e.g. a second generation cephalosporin such as cefuroxime) within one hour before the first incision and then every 90 minutes until the end of surgery.

Continued antimicrobial administration in the post-operative period is not necessary unless significant intra-operative contamination occurs, for example spillage of intestinal contents into the peritoneum. If significant intra-operative contamination does occur, the procedure is now classed as contaminated and the administration of antibiotic is continued into the post-operative period as a therapeutic measure.

#### Equipment

A standard set of surgical instruments is required for intestinal surgery and should include a scalpel handle with a selection of blades (number 11, 10 and 15), needle holders, Metzenbaum scissors, atraumatic forceps and suture cutting scissors. A pair of atraumatic bowel forceps (e.g. Doyen) are essential to prevent flow of ingesta out of an intestinal incision if an assistant is not available to manually occlude the intestine with fingers (Figure 1a).

Self-retaining abdominal retractors (e.g. Balfour, Gosset) are very useful as they improve visualisation and access to the abdominal cavity (Figure 1b). A change of gloves and a second basic surgical kit should be available for abdominal closure in order to avoid contamination of the abdominal incision if intra-operative contamination has occurred.

A number of laparotomy swabs, soaked in saline then well wrung out, should be available for abdominal closure in order to avoid contamination of the abdominal incision if intra-operative contamination has occurred.

### Figures

- **Figure 1a:** A pair of Doyen atraumatic bowel forceps. These should be placed proximal and distal to the intended intestinal incision site to prevent flow of ingesta and intra-operative contamination.
- **Figure 1b:** Balfour abdominal retractors. Self-retaining abdominal retractors aid visualisation and access to the abdominal cavity.
Suture material and pattern
An absorbable, monofilament suture material with a sufficient duration of tensile strength to last the healing process is used for intestinal closure. The author’s preference is polydioxanone (e.g., PDS II; Ethicon) due to its prolonged absorption compared to other absorbable suture materials which may be used for intestinal surgery. A nonabsorbable suture material is preferred over a multifilament due to the potential for wicking of intestinal contents and increased tissue drag with the latter. Typically, 1-5 metric (4-0) suture material is suitable for suturing the intestine in cats and most dogs. When suturing large intestine in dogs, or the small intestine of very large dogs, 2 metric (3-0) suture material may be preferable. The use of suture that is dyed violet improves the visibility of small gauge suture material. A swaged-on needle will minimise trauma to the intestinal wall and either a taperpoint or tapercut needle type is preferred for smooth tissue penetration. If a cutting element to the needle is present then this should be reversed (cutting surface on the convex side of the needle and the flat edge parallel to the incision) to reduce the risk of suture pull out at the edge of the intestinal incision.

Any spongy, single layer technique is the preferred method of intestinal closure in order to facilitate healing. Evertting and inverting patterns slow healing and should be reversed (cutting surface on the convex side of the needle and the flat edge parallel to the incision) to reduce the risk of suture pull out at the edge of the intestinal incision.

Figures 2: Full thickness intestinal biopsy technique.
A. The region of intestine to be biopsied is isolated from the remainder of the abdomen with moist laparotomy swabs to minimise contamination. In this example a section of jejunum has been isolated.
B. Intestinal contents are milked away prior to closure, to ensure that no swabs are left in the abdomen.
C. Attraumatic bowel clamps, or an assistant’s fingers, are placed either side of the intestinal incision site to prevent backflow of ingesta. Care is taken when positioning the bowel clamps in order to avoid damage to the delicate jejunal blood vessels within the mesentery.
D. A longitudinal, full thickness incision is made in the anti-mesenteric border of the intestine with a number 11 scalpel blade.
E. A second incision is made 3-5mm from the first with the ends joining, creating an elliptical tissue biopsy.
F. A circular biopsy punch can be used to obtain a full thickness intestinal biopsy. It can be challenging to gauge the degree of penetration through the intestinal wall with this technique and care should be taken to avoid penetration of the opposite, mesenteric wall of the intestine.
G. Mucosal eversion may occur at the biopsy site. The excised mucosa can be trimmed with Metzenbaum scissors to aid closure of the first suture.
H. The site is closed longitudinally in a single layer with either a simple interrupted or simple continuous suture pattern. This photo demonstrates placement of the first simple interrupted suture. The sutures are placed full thickness to ensure inclusion of the submucosa with every bite. Needle entry should be 3-5mm from the edge of the incision and simple interrupted sutures should be placed 3-5mm apart. Note that the forces are used within the incision to guide suture placement rather than to grasp the edges of the incision which may compromise the tissue.
I. An instrument is used to create a square knot creating gentle apposition of the incision edges, over tightening of the knot will cause ischaemia at the intestinal edges increasing the risk of dehiscence. The second suture is then placed 3-5mm from the first.
J. The completed simple interrupted sutures.
K. Saline distension ‘leak test’. The author prefers to ensure accurate and consistent suture placement during closure to be confident that the repair has been performed appropriately. The exact physiological pressure that the intestinal repair has to withstand are not known and challenging to accurately reproduce. Consequently, the application of subjective volumes of saline and pressure is helpful to test the repair and is a poor substitute for careful suture placement.

A full thickness intestinal biopsy can be obtained using either a scalpel blade or a circular biopsy punch. The technique is described in Figure 2A-K.

Enterotomy
Enterotony (incision into the intestinal lumen) is most commonly indicated for removal of a focal, intra-luminal foreign body. Multiple enterotomies may be required for linear foreign body removal in order to avoid compromise of the mesenteric border of the intestinal wall (Figure 3). The decision to perform an enterotomy over enterectomy (resection of a portion of the intestine) is based on the viability of the intestine. Intra-luminal foreign material causing marked distension of the intestine, particularly if present for several hours or more, may cause focal pressure necrosis of the dark wall. This typically appears as dark discoloration (purple to black) and thinning of the wall. If there is any doubt over the viability of the intestine then enterectomy should be performed as compromised intestine left in situ is susceptible to necrosis and perforation leading to septic peritonitis. It is worth noting that the appearance of the intestine may improve once reperfusion has occurred after relief of the pressure. In the scenario where the intestinal wall is moderately discoloured, enterotomy may be performed to remove the foreign material followed by a five to ten minute period of observation to allow for reperfusion. If the intestinal wall returns to a normal colour during this period and the cut edges are bleeding then closure of the enterotomy site is indicated. If uncertainty remains regarding viability, enterotomy should be performed to remove the intestinal segment in question.

The surgical principles are as for intestinal biopsy with the segment of intestine isolated, packed and occluded with clamps or fingers prior to incision. A longitudinal incision is made in the anti-mesenteric border of the intestine with a number 11 scalpel blade. The incision is ideally located a few millimeters aboral (distal) to the foreign body as the intestine in this location has not been subject to distension or damage from the presence of the foreign material. Often it is not possible to milk a foreign body further distal than the site at which it has fixed and in this instance the incision should be located directly over the cranial aspect of the foreign body. Often the enterotomy incision can be made shorter than the length of the obstruction by incising over one end of the obstruction and then manipulating the foreign body through the enterotomy; it is important to proceed with caution at this point as aggressive manipulation in the region of inflamed intestine can lead to intestinal tearing, often towards the mesenteric border, which will result in challenges during closure. A full thickness, single layer closure with either a simple interrupted or simple continuous suture pattern is performed as for the closure of an intestinal biopsy site. As before, needle entry should be 3-5mm from the edge of the incision and simple interrupted sutures should be placed 3-5mm apart.

The submucosa is the strength holding layer of the intestine, lack of inclusion is highly likely to lead to catastrophic failure of the intestinal repair so a full thickness suture pattern that penetrates all layers of the intestinal wall is preferred.

Figure 3: Multiple enterotomies are performed to remove a linear foreign body (pair of tights) from a dog’s jejunum. This approach is preferable to the application of excessive force via a single enterotomy which will likely result in damage to the mesenteric border of the intestine at the point of resistance to traction.