Approaching the Sick Cat Who Needs Surgery

Cats differ from dogs in some key ways: they mask illnesses and are often debilitated by the time surgery is elected, they are often stressed by hospitalization, they are reclusive and can be difficult to assess postoperatively, and they often remain anorectic postop and are prone to hepatic lipidosis. Cats heal better than dogs, with the exception of axillary and inguinal wounds, which can be problematic. In general, they don’t bleed as much as dogs, with the exceptions of liver, biliary, and gastrointestinal (GI) surgery. It is very easy to underestimate their blood loss: a blood soaked 4x4 sponge contains 10 ml of blood, and a typical cat’s blood volume is about 300 ml.

Under anesthesia, cats are prone to hypothermia (because of their small body size), hypotension, and fluid overload (many cats have occult hypertrophic cardiomyopathy [HCM], and are predisposed to pulmonary edema). The risk of hypothermia can be minimized by insulating cats well (Bair Huggers—Arizant Helathcare—are great), avoiding inadvertent soaking of the skin during prepping or surgical flushing, placing a warm fluid bag on the anesthesia machine’s Y piece, warming IV fluids, and not wasting time while the cat is under anesthesia. Safe fluid rates are 10ml/kg/h in healthy cats and 5ml/kg/h in cats with heart disease. Prior to surgery, it is helpful to prehydrate old, stressed, or anorectic cats for 12–24 hours at 10ml/kg/h.

The gold standard for blood pressure (BP) measurement is direct measurement via an arterial line, but this is difficult in cats and rarely done. Indirect methods are much more practical, but, unfortunately, are relatively insensitive in cold or vasoconstricted cats. Doppler is more sensitive than oscillometric measurement, but only provides a systolic reading. Oscillometric measurement provides systolic, diastolic, and mean arterial pressure readings. There is wide variability in normal cat BP readings, but a systolic pressure of 125–160 and a mean of 100 are good approximations of normal. Elevated readings are common in struggling or stressed cats, but are believable in the face of renal disease, hyperthyroidism, or retinal changes. If a cat has good urine output, he is probably not hypotensive, regardless of the BP reading. BPs below 80 systolic or 60 mean are suggestive of hypotension—but during anesthesia, the trend is more important than the number. Hypotension is likely in any sick cat, and especially in cats undergoing biliary surgery.

A reasonable stepwise protocol for the cat who is becoming hypotensive during anesthesia is:

1. **Turn down the gas** (be careful—cats wake up easily). Consider a fentanyl or ketamine constant rate infusion (CRI), which will provide analgesia, let you turn down the gas, and support BP.
2. If that fails, **fluid bolus**, 3–10 ml/kg. Repeat once if needed.
3. If that fails, **colloids**, e.g., VetStarch, 1–5 ml/kg, titrate slowly, watching BP. Colloids are particularly indicated if albumin is < 1.5 or TP is <3.5.
4. If that fails, **dopamine**—8ug/kg/min up to 20 ug/kg/min. It’s best to figure out the dosing in advance so you don’t have to do it under pressure.

Cats have a poor tolerance for blood loss, and it is best to consider a **transfusion** early (e.g., packed cell volume [PCV] <20). **Blood types** in cats are A (most cats), B (rare, but especially purebreds), and AB (even more rare). Unlike dogs, cats have pre-formed antibodies to foreign blood types so must always be typed or crossmatched. Fresh whole blood is fine for most situations and can be purchased (Animal Blood Resources). In a pinch, canine blood can be given to cats, but the red blood cells (RBCs) don’t survive long (a few days), and the transfusion cannot be repeated after four days. A good starting amount of blood in most situations is 1 cat unit (~55 ml), which is an amount that can be safely taken from a donor cat. An alternative is ½ unit of packed cells. A good target PCV is 20%. If the cat is markedly hypotensive, correcting the BP should be prioritized over correcting the PCV.

A good checklist for sick cats going to surgery is:

- Is blood available?
- Will a feeding tube be needed?
- Is a pressor (dopamine or dobutamine) available and the dose calculated?
- Any need for a lumen catheter?
- Liver disease? (Vitamin K one day preparation if elevated prothrombin time [PT])
• Antibiotics needed? (Septic cats may not seem septic.)

**Gastrotomy**

Gastrotomy is most commonly performed for gastric foreign bodies. Most gastric foreign bodies in cats are the usual suspects, fabric, plastic, etc., causing nausea, vomiting, and occasionally weight loss and inappetance. Round objects will occasionally move in and out of the pyloric antrum, causing a history of intermittent vomiting. On rare occasions, cats may swallow either post-1982 pennies or multiple small, round magnets, each of which can cause unique problems:

• Pennies minted after 1982 have a zinc core surrounded by a copper outer ring—a step that was taken by the United States government to reduce the cost of penny production. The zinc can corrode in gastric acid, causing hemolytic anemia, acute renal failure, and gastric mucosal ulceration. The most important therapeutic measure is to remove the pennies, either endoscopically or surgically, as soon as possible. It is important to recognize that the penny's zinc core will degrade much sooner than its outer ring—so the penny may look like a ring, rather than a coin, radiographically.

• The classic multiple magnet foreign bodies are “Buckyballs:” small, spherical magnets that, once swallowed, can attract each other across gastrointestinal walls, causing pressure necrosis, perforation, and bacterial peritonitis. This is a well-recognized problem in children, and it can occur in dogs and cats as well.

Many gastric foreign bodies can be removed endoscopically, and this technique, if available, should always be attempted prior to gastrotomy.

Gastrotomy is typically performed in on the ventral surface of the body of the stomach. An avascular area is chosen and isolated with stay sutures, and a longitudinal incision is made adequate to permit removal of the foreign body and inspection of the interior of the stomach. The stomach should be closed in two layers, although there are major inconsistencies between the major veterinary surgery textbooks regarding exactly what those layers should be. I prefer a simple continuous pattern in the mucosa followed by a second simple continuous pattern in the outer three layers. Neither layer is inverting, allowing the cut surfaces to be in apposition. In cats and small dogs, if the separation between the mucosa and the outer layers is not obvious, a single, simple continuous suture line may be used. I typically use PDS on a taper needle—4-0 material in cats and small dogs, 3-0 in medium and larger dogs, and 2-0 in very large dogs. Dehiscence of gastric incisions is very unusual.

**Enterotomy for Discrete Intestinal Foreign Bodies**

Discrete foreign bodies in cats are less common than linear foreign bodies, but do occasionally occur. They are generally easily identified on ultrasound. For cats that are not particularly ill and do not have protracted signs, administration of IV fluids may cause the foreign body to pass over a few hours. Emergency surgery should be considered for all other cats.

Once the foreign body has been identified, a longitudinal antimesenteric incision should be made just distal (aboral) to the foreign body. The intestine overlying the foreign body, and the intestine proximal to it, may have been compromised by the presence of the foreign body. The incision should be just long enough to allow the foreign body to be milked through it without splitting the ends of the incision. The incision may be closed with either a simple interrupted or simple continuous pattern. It is not necessary to close the incision transversely: the risk of stricture of either a longitudinal enterotomy incision or an anastomosis is negligible.

**Feline Linear Foreign Bodies**

Many intestinal foreign bodies in cats assume a linear configuration. These include string, thread, floss, ribbon, and other objects. One end of the foreign body becomes lodged beneath the tongue or at the pylorus, and the SI attempts to advance the other end. The intestine gathers proximally along the foreign body, producing obstruction. The foreign body may become taut and lacerate the mucosa or completely perforate the intestine at the mesenteric surface. The condition is diagnosed by radiography and/or ultrasonography, both of which demonstrate characteristic gathering of the intestine toward the pylorus and tear drop-shaped gas bubbles within the intestinal lumen.
Treatment involves gastrotomy, multiple enterotomies, and catheter-assisted technique.

Linear foreign bodies should always be considered surgical emergencies. Once anesthesia is induced, if the foreign body is lodged beneath the tongue, it is released by transecting it and removing as much of the oral portion as possible. A cranial midline laparotomy is then performed. If the foreign body is lodged at the pylorus, a gastrotomy is performed as described above, the foreign body is released from the stomach by transecting it where it emerges from the pylorus, and the gastric portion is removed. The gastrotomy is then closed. Multiple enterotomies are usually needed to remove linear foreign bodies that involve a significant length of the small intestine. Enterotomies are made with a 15 blade, and are oriented parallel to the long axis of the bowel, on its antimesenteric surface. Each enterotomy is approximately 2 cm in length. The most proximal enterotomy is made first, several centimeters distal to the proximal end of the foreign body. The proximal end of the foreign body is drawn through the enterotomy and transected. Enterotomies are closed with simple interrupted appositional sutures, placed as described above. The procedure is then repeated, working from proximal to distal. To limit the number of enterotomies, they are spaced as far apart as possible to permit withdrawal of the foreign body with minimal resistance. In cases in which the foreign body is deeply embedded in mucosa, enterotomies at close intervals—e.g. 10 cm or less—may be needed. Following foreign body removal, the bowel should be thoroughly inspected for perforations at the mesenteric border; perforated areas should be treated by resection and anastomosis (R&A).

The catheter technique allows linear foreign bodies to be removed with fewer enterotomies. Following gastrotomy or the first enterotomy and transection of the foreign body, the new proximal end of the foreign body is sutured to one end of a soft rubber catheter, e.g., a 5–6 inch segment of an 8 or 10 French red rubber catheter. The catheter is passed through the enterotomy and into the distal intestine, and is milked down the intestine, pulling the foreign body with it. This process peals the foreign body out of the mucosa rather than sliding it out. If possible, the catheter can be milked all the way through the intestinal tract and out the anus, allowing the foreign body to be removed with a gastrotomy or single enterotomy. If this is not possible, the catheter can be milked as far as possible and additional enterotomies can be performed as necessary.

**Intestinal R&A**

The most common indications for intestinal R&A in cats are bowel compromise or perforation due to an intestinal foreign body or trauma and intestinal tumors.

Loss of intestinal viability can be difficult to assess during surgery. Useful parameters include bowel color and thickness. Red bowel is inflamed, but likely viable. Black or deep purple bowel is nonviable. Lighter purple bowel is questionable. Palably thin bowel is potentially necrotic, particularly in combination with deep purple discoloration. There should be very fine jejunal artery pulsations visible in the mesentery adjacent to viable intestine. If the bowel is malpositioned or contains a foreign body, the primary problem can be corrected before making a final assessment— the bowel may “pink up” within 5–10 minutes once the underlying problem is addressed. Whenever bowel integrity is uncertain, R&A should be performed.

The majority of surgically managed intestinal tumors in cats are adenocarcinomas. These tumors have a metastatic rate of approximately 75%, and carcinomatosis is fairly common. Typical clinical signs are cachexia, vomiting, and diarrhea. Siamese cats appear to be predisposed.

Intestinal lymphoma in cats is increasing in incidence, and surgery occasionally has a role in the diagnosis or treatment of the disease. Partial thickness biopsies often does not reliably distinguish small cell lymphoma from inflammatory bowel disease, and full thickness biopsies obtained at surgery are more accurate. Cats with lymphoma in the form of an intestinal mass lesion can experience intestinal perforation when chemotherapy is given, and mass excision prior to chemotherapy should always be a consideration in these cats. Many cats with mass lesions have large cell lymphoma, which has a worse prognosis than small cell lymphoma. Surgery is also indicated in the treatment of cats that present with intestinal perforation, ultrasound evidence of imminent perforation, or obstruction. Although intestinal lymphoma is almost invariably diffusely present throughout the bowel, cats undergoing full thickness intestinal surgery for the disease do not appear to be at greater risk of intestinal dehiscence than cats undergoing intestinal surgery for other conditions (Smith et al. 2011).
When intestinal R&A is being performed for intestinal cancer, lymph node biopsy should be performed first to avoid contamination of the lymph node with intestinal contents. A small wedge of mesenteric lymph node adjacent to the tumor is obtained with a 15 blade, taking care to avoid cutting nearby jejunal vessels.

Wide margins of normal bowel should always be taken when R&A is performed for intestinal neoplasia. At least 5 cm of grossly healthy bowel can be removed on either side of the lesion without difficulty in most cases. The mesenteric arcadial vessels feeding the segment of bowel to be excised are double ligated. Atraumatic forceps (Doyen forceps or bobby pins) are placed transversely across the intestine to occlude the cut ends of the segments to be preserved. Traumatic forceps such as Carmalts may be used to occlude the segment to be removed. The intestine is transected at either end, using scissors or a blade. To assure that blood supply to the cut ends is preserved, the transection may be performed at a slightly oblique angle. The intestine is sutured with a simple interrupted appositional pattern using a small (4-0) synthetic slowly-absorbable monofilament material such as PDS or Maxon, on a small taper needle. To the degree possible, eversion of mucosal edges through the anastomosis should be avoided. Excess mucosa should be trimmed prior to suturing. Mucosa can be inverted by placing the initial surgeon’s throw of each knot immediately adjacent to the previous knot, tightening it somewhat, then sliding it into position. The integrity of the anastomosis may be checked by gently injecting saline into the lumen of the bowel using a syringe and needle. The completed anastomosis should be wrapped in omentum, which encourages the early phases of healing.

R&A can also be performed with stapling equipment in cats, although stapling equipment is not at all essential. It can be helpful when there are disparate lumen sizes, because the anastomosis created is side-to-side. A GIA stapler is used to create the side-to-side anastomosis, and a TA stapler is used to close the resultant open lumens.

Unfortunately, little information is available concerning the prognosis for cats with intestinal adenocarcinoma. In one study, of 23 cats undergoing surgery (Kosovsky et al. 1988), the MST for cats that survived to discharge was 15 months, and cats with nodal metastases often survived well over one year.

References