Abdominal Surgery: Complications and Costs (16-Dec-2003)

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Cost of Colic Surgery (USA)

The cost of colic surgery in the USA varies considerably between clinics, probably for reasons related to wealth of the clientele and value of horses in the practice area. Colic surgery in most clinics is the second most expensive surgery after repair of long bone fracture, and for good reason. It places enormous demands on personnel, time and resources, and is a life-saving procedure. Although costs of surgery and anesthesia can be standardized to some extent, the cost of aftercare is less predictable and can be altered considerably by development of complications. Complications increase cost through increased nursing care, technician salaries, prolonged treatment with antibiotic and other drugs, repeated laboratory analyses, and high-volume fluid therapy. Additional surgery, such as repeat celiotomy or repair of incisional complications, increases the cost considerably. Because none of these can be anticipated in most cases, a critical part of case management is complete discussion of expected and unexpected costs with the client. Clients need to understand that investment of money far in excess of the horse’s worth does not ensure a successful outcome from colic surgery, once difficult complications develop.

In many cases, the client will decide beforehand how far he or she wants to proceed with surgical treatment, but the decision can be difficult for some. Added to this is the feeling that many clients have of being trapped into continuing with the cost of aftercare once they have already spent close to their financial limit for surgery and anesthesia. The problem is further aggravated by the nature of the disease itself. It can arise with little warning and carries the emotional strain of threatening the life of an animal that may be valued more as a family member than for its commercial worth. Owners sometimes have to make decisions quickly, without the luxury of seeking advise from friends or family. Also, the decision against surgery can impose a feeling of unbearable guilt. Consequently, surgeons can find themselves in a complex and unpleasant position of trying to achieve a balance between satisfying the owner’s emotional needs while keeping the business aspects in perspective at all times. This becomes even more trying if the outcome is unsatisfactory or the owner finds the final bill to be beyond his or her limits.

In general, the cost of colic surgery in the USA starts at $4,000, but can double that for more difficult cases, such as those with strangulating lesions, severe endotoxemia, and intestinal resection. Some clinics start at a much higher basic rate than this. The University of Illinois is an example of how each clinic must modify its fee schedule to accommodate what the market can bear. We have a problem because of our geographic location in central Illinois, many miles from large urban areas where the most valuable horses and the wealthiest pool of clients reside. Crop farming is the main industry in the state and prime cropland surrounds the University. Most of our colic cases come from this farmland and each horse belongs to a very small herd or might be the owner’s only horse. In 1994, we operated on approximately 35 colics per year, which meant that our residency training program was faulted by the American College of Veterinary Surgeons for a deficiency in equine emergencies. To address this, we kept the overall cost as low as possible by streamlining our method of managing colics, without jeopardizing quality. We had an experienced faculty member with a strong interest do or oversee most colic surgeries. This reduced the prevalence of technical errors made by inexperienced surgeons (see below), which reduced aftercare and associated costs to the minimum. Large colon strangulations, with or without resection, were in a separate category because treatment of these is very expensive. Our current caseload of surgical colics is >100 horses per year.

The goal of our aftercare program is to encourage early resumption of gastrointestinal function and to discharge the horse from the clinic within a week after surgery. We do not use an indwelling stomach tube after surgery, but decompress the stomach if indicated by signs of pain and increased heart rate. Most horses can eat a very small handful of hay within 18 -
24 hours after surgery, even if they had a small intestinal resection. This can be repeated at 3- to 4-hour intervals, and the amount increased slowly to a full ration within 3 to 4 days. Refeeding requires great care and close observation, but can stimulate early return of intestinal function. Each horse receives potassium penicillin i.v. at 22,000 U/kg bwt every 6 hours and gentamicin at 6.6 mg/kg bwt i.v. every 24 hours for three days. Flunixin meglumine is given at 1.1 mg/kg bwt i.v. once or twice daily for two to three days after surgery, or as needed. Intravenous fluids are given at 1 to 2 L/hr to a 450-kg horse for the first 12 hours and the rate is adjusted for changes in PCV and total plasma protein during and after that interval. Specific prophylactic measures to prevent adhesions, reperfusion injury, and postoperative ileus (POI) are not used, and endotoxin antiserum is not given, except to critical cases of large colon volvulus. Prokinetic drugs are used as needed, but a very small number of horses require such treatment.

In a recent study of 88 horses that recovered from general anesthesia for small intestinal lesions and that were managed by the above protocol (Freeman et al, 2000), 75 were discharged from the hospital (85%). Short-term survival for end-to-end anastomosis (92%; 23/25) and for no resection (94%; 30/32) were superior (P<0.05) to survival for jejunoocecal anastomosis (77%; 24/31). Most postoperative fatalities in this study were in the immediate postoperative period, and twelve months appeared to be critical, because there was little if any change in survival after that. Short term survival for large intestinal lesions was 91% during the same period. More than any other factor, early referral of cases has played the most critical role in improving survival after colic surgery, reducing the overall cost of surgery and aftercare, and in lowering the complication rate (Fig. 1).

Figure 1. Flowchart of the effects of promptness of referral on outcome and cost in a horse with a strangulating intestinal lesion. - To view this image in full size go to the IVIS website at www.ivis.org . -

**Specific Costs**

The cost of colic at the University of Illinois in 2003 starts at $2,500, and most are done for <$3,500. We assign costs to the surgical procedure according to the degree of complexity, and the cost of anesthesia will increase according to the time required for the procedure, starting at $172 for the first hour of anesthesia time and $70 for each subsequent hour or fraction thereof (Table 1). The charge increases slightly if isoflurane is used instead of halothane and decreases slightly for a foal (Table 1). Daily board is $30/day (which is considerably lower than many hospitals in the USA) and $66/day is added to that for intensive care, which is used for 2 to 4 days, depending on the case. We charge an emergency fee at admission of $155, which includes $25 for the resident. Anesthesia technicians charge an additional $50/hour during emergency hours. The cost of blood gas analyses, serum biochemistries, and complete blood counts range from $35 to $45/sample. Potassium penicillin G costs our clinic $15.12/20 million units and the client pays $25.20 for the same. Gentocin at a concentration of 100 mg/ml is $95.88/250 ml for us and $159.80 to the client. A 5L bag of lactated Ringer’s solution costs us $11.54 and the client $19.23.

In our clinic, students are responsible for intensive care, so there is very little cost to us, but many clinics must pay technicians for this service, and even provide a special intensive care facility, which can increase the cost considerably. In some clinics, the initial emergency fees include the cost of hiring a clinician dedicated to emergency services. Although we have a specific charge for an anastomosis for which we use Seprafilm (Table 1), we charge approximately 50% over cost for the use of stapling cartridges. The cartridges for the TA 90 and GIA 90 Premium cost us $208 and $215 each, respectively, and we therefore use these sparingly. The suggested professional price to purchase the TA 90 stapler (Unites States Surgical Corporation) is $964, for the GIA 90 Premium is $4,500, and for the LDS ligate divide stapler is $929. These prices are negotiable for universities and private practices and these instruments are for multiple use, so their costs can be distributed over many cases. It is also possible to rent stapling instruments, provided that a number of cartridges are purchased concurrently.
Complications of Small Intestinal Surgery

The most common complications of small intestinal surgery, such as anastomotic obstructions, postoperative ileus (POI) and adhesions, can be the products of the small intestine’s poor tolerance for technical errors. In a recent study on 74 horses that recovered from general anesthesia after small intestinal surgery (Freeman et al. 2000), technical errors were responsible for 8 of 14 repeat celiotomies (57%) and for 7 of 11 deaths during hospitalization (64%). Although some of these errors were mistakes in judgment, most were avoidable technical errors made by inexperienced surgeons.

Greater risk of postoperative complications after a jejunocecal anastomosis compared with a jejunojejunostomy (Freeman et al. 2000) can be explained by creation of a sharp transition between intestinal segments of dissimilar functions after jejunocecostomy. The jejunum must overcome intracecal pressure to empty without the coordinating mechanism of the ileum and the ileocecal valve. Also, based on evidence that viable small intestine proximal to an obstruction is subjected to sufficient distention to delay return of function, a jejunocecostomy could be at a distinct disadvantage compared with a jejunojejunostomy (Fig. 2). If the same length of jejunum is resected in two horses and one requires a midjejunal jejunojejunostomy and the other requires a jejunocecostomy, no more than half the remaining small intestine was distended preoperatively in the former, compared with almost all the remaining small intestine in the latter (Fig. 2). Also, small intestine proximal to the anastomosis is continuous with intestine of similar function in the jejunojejunostomy. Despite problems experienced in the short-term with jejunocecostomy, long-term results were similar to those for jejunojejunostomy (Freeman et al. 2000), possibly because the fixed position of the stoma might make it less sensitive to distortion from adhesions. Some horses can develop large intestinal colics during the first few months after a jejunocecostomy, possibly caused by altered delivery and composition of digesta delivered from the small intestine in the absence of an ileocecal sphincter.

### Table 1. Costs of surgery and anesthesia for colic surgery at the University of Illinois (August 2003).

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Surgery fee (US$)*</th>
<th>Anesthesia fee (US$)**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Euthanasia on the table</td>
<td>476</td>
<td>172 (172/137)</td>
</tr>
<tr>
<td>Exploratory only***</td>
<td>953</td>
<td>242 (272/193)</td>
</tr>
<tr>
<td>Exploratory with correction</td>
<td>1,190</td>
<td>242 (272)</td>
</tr>
<tr>
<td>Enterotomy</td>
<td>1,310</td>
<td>242 (272)</td>
</tr>
<tr>
<td>Small intestinal resection</td>
<td>1,429</td>
<td>242 (272) – 312 (372)</td>
</tr>
<tr>
<td>Small intestinal resection with Seprafilm™</td>
<td>1,666</td>
<td>242 (272) – 312 (372)</td>
</tr>
<tr>
<td>Large intestinal resection (minor)</td>
<td>1,429</td>
<td>242 (272) – 312 (372)</td>
</tr>
<tr>
<td>Large intestinal resection (major)</td>
<td>1,786</td>
<td>312 (372) – 382 (472)</td>
</tr>
</tbody>
</table>

These fees are for surgery and anesthesia only and do not include other charges.
* The cost of any of these procedures could be reduced by 20 to 30% for a foal.
** The first number in parentheses is for isoflurane and the second number, when given, is for a foal.
*** An example of exploratory only would be for a lesion such as anterior (proximal) enteritis or for a horse in which a specific lesion could not be found, and with minimal treatment, such as needle decompression of a gas-distended viscus.

Seprafilm™ is a membrane of carboxymethylcellulose and hyaluronic acid applied to an anastomosis to prevent adhesions.
Anastomotic Obstruction -
The clinical distinction between anastomotic obstructions and postoperative ileus (POI) is difficult and each can contribute to the pathogenesis of the other. The first causes greater and more persistent signs of abdominal pain. Mechanical obstruction of a small intestinal anastomosis by anastomotic impaction, hematoma, or constriction, arises from errors in technique. In an overzealous attempt to prevent leakage, some surgeons invert intestinal edges excessively or apply more than one layer. Stomas of marginal size are prone to obstruction because they are further reduced by postanastomotic edema. Small intestinal volvulus may develop in distended jejunum and at points of small intestinal fixation, such as at a jejunocecal anastomosis. Risk of this complication is increased in a jejunocecal anastomosis by failure to decompress intestine during surgery.

Postoperative Ileus -
In one study, postoperative ileus was purely a function of the type of anastomosis, and did not appear to correlate with other findings (Freeman et al. 2000). Of the 16 horses that had gastric reflux after small intestinal surgery, 9 (56%) had a mechanical obstruction that required repeat celiotomy and/or euthanasia (Freeman et al. 2000). The remaining 7 of 16 (44%) were diagnosed as having a functional POI (10% of total). Of these 7 horses, 5 had a jejunocecostomy, 1 had no resection, and 1 had a jejunoleostomy. No horse that had a jejunolejunostomy had postoperative ileus, despite similar clinical presentations and lesions as horses that had a jejunocecostomy. Postoperative ileus can develop after handsewn anastomoses if the surgeon tries so hard to get a leakproof anastomosis that the lumen becomes constricted, especially if a continuous pattern or more than one layer is used. Even slight luminal constriction is poorly tolerated in equine small intestine and can increase resistance to flow. Although most horses probably do develop some degree of postoperative small intestinal paralysis, the tendency to focus on functional disturbances and treat them with prokinetic drugs runs the risk of overlooking other potential causes. If POI develops, feed is denied, a tube is passed as needed, disturbances in acid-base, hydration, and electrolytes are treated, and a prokinetic agent is given (Table 2). Response to prokinetic agents is inconsistent.

Adhesions -
Horses are not particularly prone to adhesion formation, but are extremely sensitive to them. Adhesions usually cause problems in the first 2 months after surgery, although they can develop at any time, are more likely after small intestinal resection and anastomosis than other procedures (Fig. 3), and are unlikely to develop after large intestinal surgery. Factors that could contribute to adhesions are postoperative ileus, ischemia, violations of Halstead’s principles of surgery, foreign material, serosal abrasion by towels, and use of large suture material. In our study (Freeman et al. 2000), prevalence of confirmed adhesions was 6%, although inclusion of deaths from colic yielded an estimated prevalence of 13%. This is higher than the 6% reported by Vachon and Fischer (1995).

Miscellaneous Complications of Small Intestinal Surgery -
Other reported complications are anastomotic kinks, persistent distention and pain from failure to decompress distended bowel, anastomotic stricture, mesenteric rents, anastomotic ischemia, and bleeding from mesenteric vessels (Vachon and Fischer 1995; Freeman et al. 2000). Anastomotic dehiscence and peritonitis are rare and usually caused by postoperative ischemia and technical error. Failure to effectively ligate mesenteric vessels can lead to postoperative hemorrhage. Fatal hemorrhage can be caused by tearing of the portal vein during extraction of strangulated bowel from the epiploic foramen. Life-threatening intraluminal hemorrhage is a rare complication of jejunocecostomy, characterized by passage of tarry feces.

| Table 2. Commonly used prokinetic agents for treatment of POI in horses. |
|---------------------------------|------------------|---------------------|
| Metoclopramide                  | 0.25 mg/kg, IV   | In 1 Liter of 0.9% NaCl, over 30 - 60 min |
|                                 | 0.04 mg/kg/hr, IV| Continuous infusion  |
| Lidocaine                       | 1.3 mg/kg, IV    | Over 5 - 10 minutes then infusion of 0.05 mg/kg/min in saline or LRS over 24 hrs |
| Erythromycin                    | 2.2 mg/kg, IV    | In 1 Liter of 0.9% saline or LRS |

Figure 3. A mature adhesion of bowel to mesentery at the site of an anastomosis. - To view this image in full size go to the IVIS website at www.ivis.org . -
and declining PCV, and is possibly caused by a large bleeding vessel on the cecal side. A rare complication of jejunocecostomy is obstruction of the cecocolic orifice by an ileal stump that has intussuscepted into the cecum and progressed into the right ventral colon (Schumacher and Hanrahan 1987).

**Repeat Celiotomy -**
Repeat celiotomy is a lifesaving procedure and can be required for 19% of small intestinal diseases (Freeman et al. 2000). Although distinction between postoperative ileus and mechanical obstruction can be difficult, horses with the latter usually demonstrate a greater amount of pain and have a progressive increase in heart rate. The disadvantages of a second exploration of the abdomen are the expense and risk of incisional infection. However, survival after a repeat celiotomy can reach 64% (Freeman et al. 2000), and the benefits of this procedure can outweigh the risks and disadvantages.

**Complications of Large Intestinal Surgery**
Complications of large intestinal surgery are different to those of the small intestine, and are usually related to the original lesion. For example, adhesions and postoperative obstruction are well known complications of small intestinal surgery, but are rare after large intestinal surgery. Recurrence of the original lesion, continued deterioration of ischemic bowel, endotoxemia, enterocolitis, and peritonitis are rare after small intestinal surgery but more likely after large intestinal surgery.

**Recurrence of Original Disease -**
Right dorsal colon displacement and entrapment over the renosplenic ligament can be treated by surgical and non-surgical methods, and have low morbidity and mortality rates, but can recur. Large colon volvulus has a high rate of recurrence, especially in broodmares (Hughes and Slone 1997), which is all the more important because of the high mortality associated with this disease. Colopexy of the ventral colon to the body wall is designed to prevent recurrence of colon displacements (Hance 1997), and the same goal is achieved by resection of most of the colon in horses that have a large colon volvulus and compromised colon (Hughes and Slone 1997). Open or laparoscopic closure of the renosplenic space can be used to prevent recurrence of colon entrapment in this structure.

Cecal impaction can be treated medically or surgically, the latter by typhlotomy alone or combined with ileocolostomy to bypass the cecum completely (with ileal transection) or incompletely (without ileal transection to preserve some ileocecal flow). This disease has a high rate of recurrence and carries the danger of cecal rupture, which explains why some surgeons use a bypass procedure.

**Endotoxemia -**
Large colon volvulus can rapidly cause ischemia and extensive colon necrosis. If resection is not performed, as in a colon that has suffered a mild enough ischemic insult to survive, progressive mucosal damage after surgery can result from continued vascular occlusion and reperfusion injury. If the colon is resected, all affected tissue might not be accessible to allow anastomosis, and any remaining mucosa that sloughs postoperatively can cause endotoxemia, peritonitis and anastomotic leakage. Removal of as much strangulated colon as possible could reduce endotoxin access to the circulation by reducing transmural leakage across a large bulk of necrotic mucosa.

Endotoxemia is treated with intravenous fluids and flunixin meglumine, but additional treatment is often warranted (Barton 2003). Such treatment includes Endoserum (Immvac Inc. Columbia, Mo), a hyperimmune serum from horses vaccinated with *Salmonella typhimurium* Re mutant. At a dose of 1.5ml/kg body weight and at a cost to our clinic of $148/500 ml ($233.72/500 ml for the client), each treatment costs us $222 for a 500-kg horse ($350.58 for the client). Polymixin B is a cationic polypeptide antibiotic that can bind and neutralize endotoxin and is given to horses for this purpose at a dose of 1000 to 6000 IU/kg body weight intravenously every 8 to 12 hours. The risk of kidney damage with this drug could be increased by existing damage or dehydration. The cost of this drug is $12.23/500,000 units for our clinic and $20.38/500,000 units to the client. Although a crystalloid fluid, such as lactated Ringer’s solution, Plasmalyte A, or Normosol-R, is the mainstay of treatment for fluid and electrolyte deficits caused by endotoxemia, plasma or Hetastarch might be required to increase colloid oncotic pressure in horses with total plasma protein concentrations below 5g/dl. Complications of endotoxemia are laminitis, disseminated vascular coagulopathy, catheter-related sepsis and thrombosis, renal disease, abortion, respiratory disease and myocarditis (Barton 2003).

**Peritonitis -**
Peritonitis is very rare after colic surgery, but leakage of an anastomosis in non-viable colon after resection for large colon volvulus is one of the more common causes. Equine peritoneum can handle intraoperative contamination that is removed at
surgery, but even slight leakage from a suture line is poorly tolerated. Enterotomies are often indicated for large colon
diseases, such as removal of enteroliths, impacted foreign materials, and feed impactions, but dehiscence of the suture line is
extremely rare and usually results from a surgical error (Fig. 4). Intraoperative contamination during surgery is usually well
contained and removed by copious lavage, and even severe contamination of exteriorized bowel rarely causes peritonitis.
Rectal tears that extend through the mucosa and remaining layers, with or without penetration of the serosa or mesentery,
can cause severe peritonitis and even fecal contamination of the abdomen. Although not a direct complication of surgery, it
can result from a preoperative rectal palpation, and should always be considered as a possible cause of peritonitis in the
postoperative period.

Figure 4. Dehiscence of pelvic flexure enterotomy after part of the suture line broke (courtesy of Dr.
Lance Bassage). - To view this image in full size go to the IVIS website at www.ivis.org. -

The surgical procedure that carries the highest risk of peritonitis is colotomy in the right ventral colon for reduction of a
ceccolic intussusception, whether or not the necrotic cecum is resected through the colotomy. The severe contamination
from this procedure can be difficult to contain during surgery, but can be prevented through careful isolation of the
colotomy site by drapes or a sterile plastic sheet sutured around the proposed incision.

A focal small colon impaction with an enterolith or dehydrated feed material can cause transmural pressure necrosis.
Although the vascular changes at the impaction site are recognizable, it is not unusual for the impacting material to have
undergone repeated impaction and spontaneous correction at more proximal segments of small colon. These sites can
progress to full-thickness mural necrosis after surgery and cause peritonitis. Therefore careful intraoperative inspection of
the prestenotic segment of small colon is recommended to prevent this mishap.

Miscellaneous Complications of Large Intestinal Surgery -
Complications of enterotomy are very rare, but the most common is hemorrhage from the incision edges, which can be
severe enough to cause melena and hemorrhagic shock. There is some evidence that an enterotomy, but not a small
intestinal resection and anastomosis, can increase the risk of postoperative incisional infections and other incisional
problems in the body wall (Honnas and Cohen 1997). Possibly, the high bacterial burden in the colon increases the chances
of contamination to the edges of the body wall incision. Obstruction of an enterotomy is possible if the lumen is reduced by
excessive inversion, which is why the author places a pelvic flexure enterotomy in the widest part, closer to the left ventral
colon.

Complications in the Abdominal Incision
Complications can develop in the abdominal incision in 40% of horses (Wilson et al. 1995), with incisional drainage in 32 to
36%, dehiscence in 3 to 5%, and hernia formation in 6 to 17% (Freeman et al. 2002).

Incisional Swelling -
Postoperative edema, usually in large plaques to both sides of the midline, is usually most obvious at 5 to 7 days after
surgery. Although severe cases signify a slowly developing infection, edema alone could be harmful by decreasing local
oxygen tension in the incision (Galuppo et al. 1999), putting tension on suture lines, weakening the tissues, reducing blood
supply, and separating any bacteria in the incision from the immune system.

Incisional Infection -
Focal drainage of serum, fibrin strands, or mucopurulent material from an incision, with or without fever, is evidence of
incisional infection (Wilson et al. 1995). The mean time to incisional drainage is 17 days after surgery (Galuppo et al. 1999).
Ultrasonography should be used for early diagnosis because it is sensitive and can be used to evaluate integrity of the
infected body wall and to locate abscesses. Risk factors for incisional infection and related complications are horses older
than 1 year and that weigh more than 300 kg (Wilson et al. 1995), enterotomy, increased fibrinogen concentration in the
peritoneal fluid, use of polyglactin 910 to close the linea alba (Honnas and Cohen 1997), use of a far-near-near-far suture
pattern in the linea alba (Kobluk et al. 1989), incisional contamination in the recovery stall, high numbers of bacterial CFU
obtained after anesthetic recovery, poor intraoperative drape adherence, high numbers of CFU obtained from surgery room
contamination, preexisting dermatitis (Galuppo et al. 1999). Treatment of infection involves removing some skin sutures to
establish drainage, and cleaning the incision as often as needed with a dilute antiseptic soap, with or without systemic antibiotics selected by culture and sensitivity testing of exudate. An abdominal bandage and topical antibiotics can be applied if the infection is extensive, but the bandage must be replaced frequently.

**Dehiscence of Body Wall Incision -**
Dehiscence of the body wall, with or without eventration, is the most serious wound complication following an exploratory celiotomy. The main reasons for wound dehiscence include loss of strength in absorbable sutures, breakage of sutures, knot failure, and tissue failure. Good surgical technique, decompression of all distended bowel, and smooth anesthetic recovery can reduce the risk of partial or complete wound disruption. Severe incisional infections can delay healing and cause tissue necrosis and dehiscence in as little as 5 - 7 days following surgery (Kobluk et al. 1989; Wilson et al. 1995). Delayed disruption of a ventral midline incision (3 to 8 days after surgery) is usually preceded by copious drainage of peritoneal fluid and gap formation in the linea alba, followed by prolapse of omentum or bowel. In such cases, the horse should be anesthetized, all suture material removed, and the incision repaired by secondary closure. Acute dehiscence in the recovery stall is more catastrophic because there is little warning, the horse is not easily controlled, and a large amount of bowel is usually prolapsed (Freeman et al. 2002). Despite the extensive contamination, intestinal bruising, and venous congestion associated with evisceration, resection is rarely needed and the prognosis for full recovery is good, provided self-inflicted trauma is prevented. However, extensive self-inflicted damage to bowel and disruption of mesentery can be grounds for euthanasia.

**Hernia Formation -**
Horses with incisional complications have an increased risk of developing hernias, especially those incisions that become infected (Fig. 5). Hernias may appear weeks to months after the initial surgery (Fig. 5). Hernia repair should be postponed for approximately 3 to 4 months after the first surgery to allow inflammation and infection to fully resolve and for the hernial ring to become firm and well organized. Large hernias can be repaired by suture closure or by mesh.

![Figure 5. Appearance of a mature incisional hernia at 4 months after intestinal surgery. This was repaired successfully by suture closure.](www.ivis.org)

**Miscellaneous Postoperative Complications**
Postanesthetic rhabdomyolysis, long bone fracture during recovery, colitis, laminitis, and septic jugular thrombophlebitis are other life-threatening complications of colic surgery. Laminitis and septic jugular thrombophlebitis can be secondary to endotoxemia. Gastric ulcers are rare, but could be expected secondary to fasting and treatment with nonsteroidal anti-inflammatory drugs. Some minor weight loss is not unusual for weeks after colic surgery, but chronic weight loss is rare, except after excessive small intestinal resection (>70% of small intestine removed). Poor appetite and liver disease can contribute to this complication.
References


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