Surgery for Colic:

Success of small intestinal surgery in the horse is dependent on (1) identification and correction of the primary problem, (2) intraoperative decompression of distended small intestine, (3) resection of all abnormal intestine, (4) preservation of anatomic and physiologic continuity of the intestine, (5) rapid completion of the surgery with minimal trauma, (6) early return of intestine to normal function, and (7) appropriate postoperative support, including repeat laparotomy when indicated.

Preoperative Preparation

Once the decision to perform surgery has been made, induction of anesthesia may occur. An intravenous catheter should be placed to allow high-volume fluid replacement if necessary. The horse's mouth should have been washed out and a nasogastric tube placed that will remain for the duration of surgery. It is important to have stabilized the horse as well as possible preoperatively with intravenous fluids. Preoperative antibiotics and tetanus prophylaxis should be provided. The operating room with necessary supplies should be set up in advance to minimize wasted anesthesia time. Preparation of the ventral abdominal wall takes place under general anesthesia and is usually more efficient and safer than attempting to prepare the horse while still standing.

APPROACHES TO THE ABDOMEN

Ventral Midline Celiotomy

Ventral midline celiotomy (VMC) (Fig. 33-6) through the linea alba is the most common approach for equine abdominal surgery because it allows exteriorization of 75% of the intestinal tract (Fig. 33-7). The stomach, duodenum, distal ileum, dorsal body and base of the cecum, distal right dorsal and transverse colon, and terminal descending colon are the only segments that cannot be exteriorized. The VMC creates minimal hemorrhage, is easy to extend, and has strong fibrous tissue for closure.

The linea alba is a combination of the median fibrous raphe of the aponeuroses of the external abdominal oblique muscle, the internal abdominal oblique muscle, and the transverse abdominal muscle extending from the xiphoid process to the prepubic tendon. Histologically, the linea alba consists of dense connective tissue composed of sheets of collagen bundles and fibroblasts. The fibers of the sheets cross between one another, adding to its mechanical strength.

In horses, the thickness of the cranial part of the linea alba may reach 0.3 mm, whereas the caudal part reaches 1 cm. The midline incision is made as long as necessary to complete the exploratory surgery (averaging about 30 cm in the adult horse). The incision should be large enough to allow exteriorization of necessary viscera and not put excessive pressure on the intestine (which would increase the risk of iatrogenic tears). The time saved in the procedure and the increased safety of a larger incision more than compensate for the extra several minutes spent suturing a longer incision. The incision through the linea should begin at the umbilicus where it is the thickest and continue cranially, avoiding the rectus abdominis muscle.

Closure techniques of the celiotomy incision vary between surgeons and are usually a matter of personal preference. The optimal distance that a suture should be placed from the incisional edge of the linea alba in horses is 1.2 to 1.5 cm. Excessive tension on sutures causes microscopic tissue necrosis and is the most common surgical error made during closure of the linea alba.

Postoperative Management

Nonsteroidal antiinflmmatory drugs are administered at the end of surgery to decrease the immediate incisional (parietal) pain. Antibiotics and replacement fluids are used; the type and dosage depend on the particular surgical procedure. Additional drugs and supportive therapy may be necessary in patients with acute abdominal disorders. If a drain has been inserted, its patency must be checked regularly by applying negative suction to its end using a syringe. Bandaging is not used routinely, but a stent bandage may be indicated. Skin sutures or staples are removed in 12–14 days.

Complications and Prognosis

Incisional drainage is a common complication, including peri-incisional edema, abscessation, suture sinus, and dehiscence. Ultrasonographic evaluation of the incision postoperatively can be a useful means of identifying incisional complications. Herniation following ventral midline celiotomy are relatively low (15 to 16%). Horses that develop incisional drainage are more likely to develop incisional hernias than horses without incisional complications. Other factors that are believed to contribute to the development of hernias include uncontrolled exercise, violent postoperative recovery, and early failure or weakening of suture material.

Antimicrobial suture does not appear to limit the likelihood of incisional complications and may actually lead to potential adverse side effects. Horses that have an incisional hernia are less likely to return to use and performance, making client education regarding healing times post-surgery very important. There does not appear to be any increase in complications when performing a paramedian celiotomy incision.

Other complications include adhesions (which leads to more colic from just touching the gastrointestinal track), myopathy, ileus, thrombophlebitis, ischemia-reperfusion injury, diarrhoea, recurrent colic, adhesions, septic peritonitis, and laminitis (from endotoxemia).

Generally, the prognosis for this procedure is good, and the complications are relatively mild. Most survival rates in the literature are a reflection of the severity of the disease that necessitated surgery.

Ventral Paramedian Approach

The ventral paramedian incision, the second most common approach used in colic operations, is made 10 cm lateral to the midline (see Fig. 33-6). The incision may be made on either the right or left of midline through the rectus abdominis muscle, which creates a thicker border to the incision than the ventral midline approach but does not significantly limit surgical exposure of the abdominal cavity. The deep and superficial epigastric vessels may be encountered during this incision and should be avoided if possible. The ventral paramedian incision typically hemorrhages more than the linea alba incision, but this does not seem to generate any clinical problems and the wound generally heals well.

Some surgeons favor the paramedian incision, particularly if wound healing is thought to be compromised, because fewer hernias are observed to be associated with this incision. Some surgeons prefer to use the paramedian incision when relaparotomy is required. It is better to avoid a previous linea alba incision if there are signs of excessive inflammation, infection, or possible adhesions. Closure of the paramedian incision involves suturing of the external fascia of the rectus abdominis sheath. Suturing of the muscle belly does not appear to contribute to the strength of the closure.

Flank Approach

A standing flank approach to the abdomen is easily performed but less easily applied to the correct clinical situation (Fig. 33-8). The small colon is the most accessible part of the intestinal tract approached from the flank. A nondistended large colon can be exteriorized through a flank incision but not if the viscus is edematous or filled with ingesta. A standing flank approach can also be used for surgical treatment of abdominal pain because of uterine torsion. The flank incision is made on the right side for a clockwise torsion, or vice versa. The exposure offered by a standing flank laparotomy is too limited for it to serve as a routine abdominal exploratory approach.

The most commonly used approach for flank laparotomy is the modified grid approach. The horse is restrained in standing stocks with the tail tied, and the flank region is prepared for aseptic surgery. A sedative-and-analgesic combination is administered, and local anesthesia is infiltrated subcutaneously and intramuscularly at the planned site of incision. The skin is sharply incised in a vertical line midway between the last rib and the tuber coxae, starting dorsal to the palpable dorsal edge of the internal abdominal oblique and continuing ventrally (see Fig. 33-8). The external abdominal oblique muscle is subsequently sharply divided. The

internal abdominal oblique and transverse abdominal muscles are bluntly divided parallel to their fiber direction, exposing the peritoneum, which is then punctured, giving access to the abdominal cavity. Closure of the incision is by muscle apposition with absorbable sutures for the deep layers and subsequent closure of the external abdominal oblique muscle layer for a second layer. The subcutaneous tissues may be included in this layer or sutured separately. The skin is sutured or stapled.

Postoperative Management

Post operation management is similar as above. Type of antibiotics are used depend on the individual case. The negative suction syringe is taped over the patient's back and is emptied regularly. The drain is removed when the volume of aspirated contents decreases (2–3 days). The skin sutures are removed in 12–14 days.

Complications and Prognosis

Complications are similar to those described above. The major advantage to this is that it can be performed in a standing position. This may improve prognosis by decreasing contamination and avoiding the risks associated with general anesthesia.

Inguinal Approach

The inguinal approach is used in conjunction with a ventral midline incision when operating on stallions with inguinal or scrotal hernias (see Fig. 33-6). The inguinal approach alone usually does not allow a thorough exploration and decompression of the nonherniated bowel. The inguinal herniorrhaphy often is combined with unilateral castration of the affected testicle. Most hernias are of the indirect type with the vaginal tunic intact. After repair of the intestinal lesion, the tunic can be ligated to bolster the inguinal closure. The external inguinal ring is closed using 2 or 3 polyglactin 910 in a simple-continuous or a simple interrupted pattern, with sutures placed 1.5 to 2.0 cm apart. The subcutaneous tissues and skin are closed as separate layers.

Alternatively, laparoscopy allows internal repair of the inguinal ring damaged by herniation through mesh secured by staples or laparoscopic suturing techniques.

Postoperative Management

Post operation management is similar as above. Type of antibiotics are used depend on the individual case. The skin sutures are removed in 12–14 days.

Complications and Prognosis

Complications are similar to those described above.

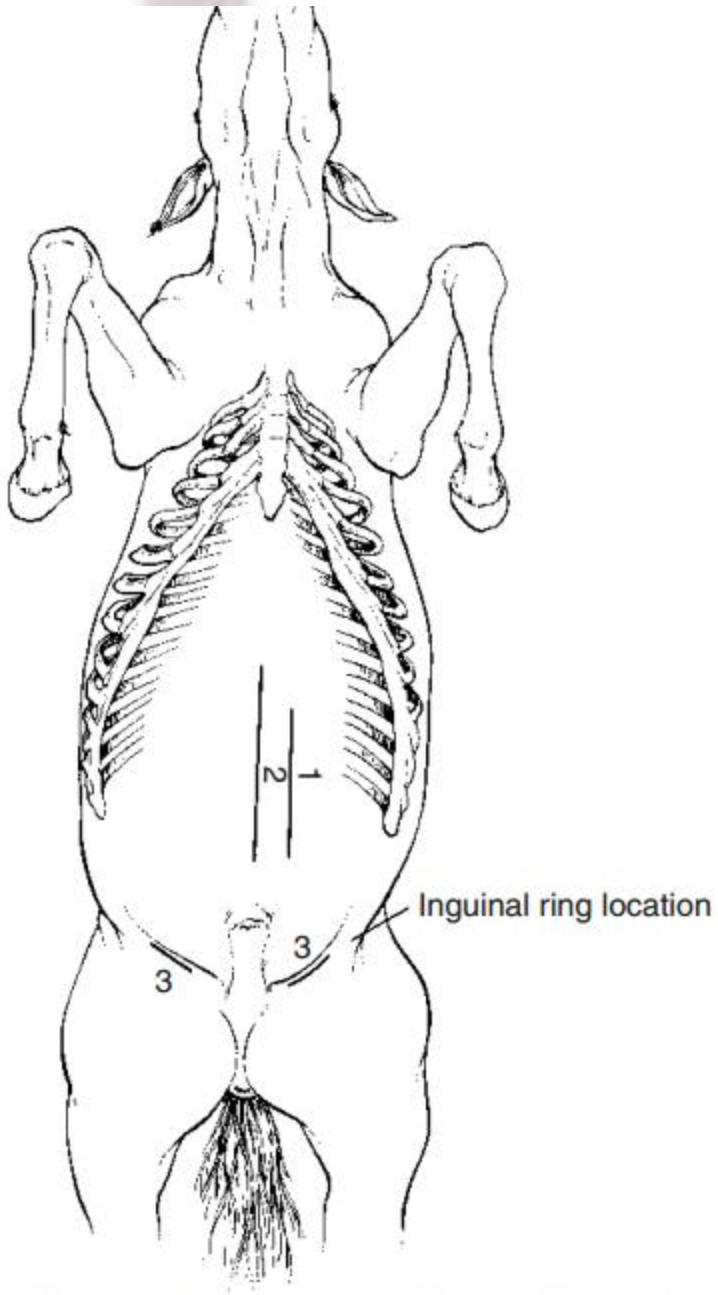

Figure 33-6. Abdominal approaches through the ventral abdominal wall: paramedian (1), ventral midline (2), and inguinal (3). (Redrawn from Adams SB: Surgical approaches to the equine abdomen, Vet Clin North Am Large Anim Pract 1982;4:89.)

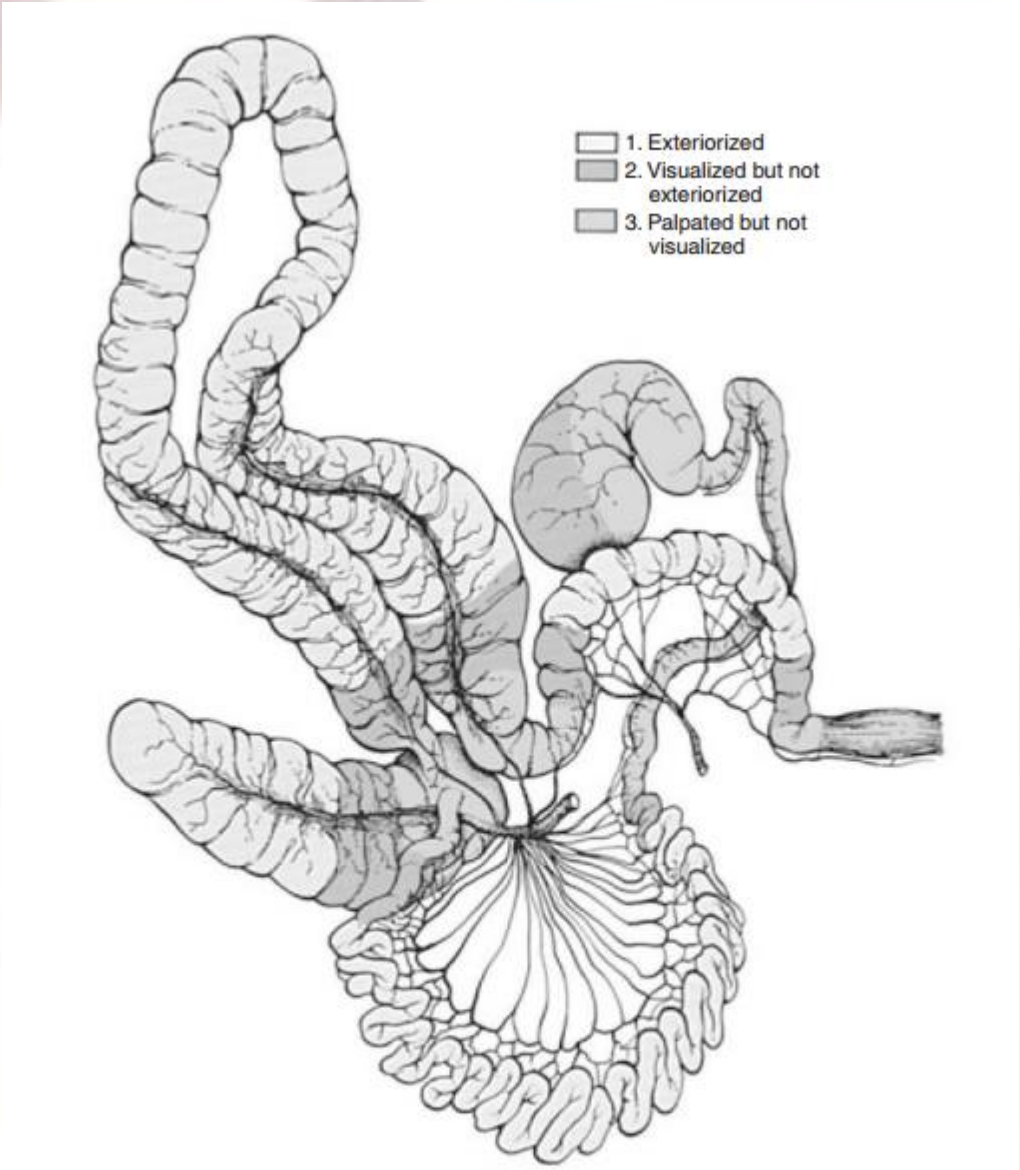

Figure 33-7. Anatomic drawing of the equine intestinal tract. Differential shading (KEY) indicates the portions that may be (1) exteriorized, (2) visualized and palpated but not exteriorized, and (3) palpated only via a standard ventral midline celiotomy approach. (Redrawn from Sack WO: Guide to the Dissection of the Horse, Ann Arbor, 1977, Edwards Brothers.)

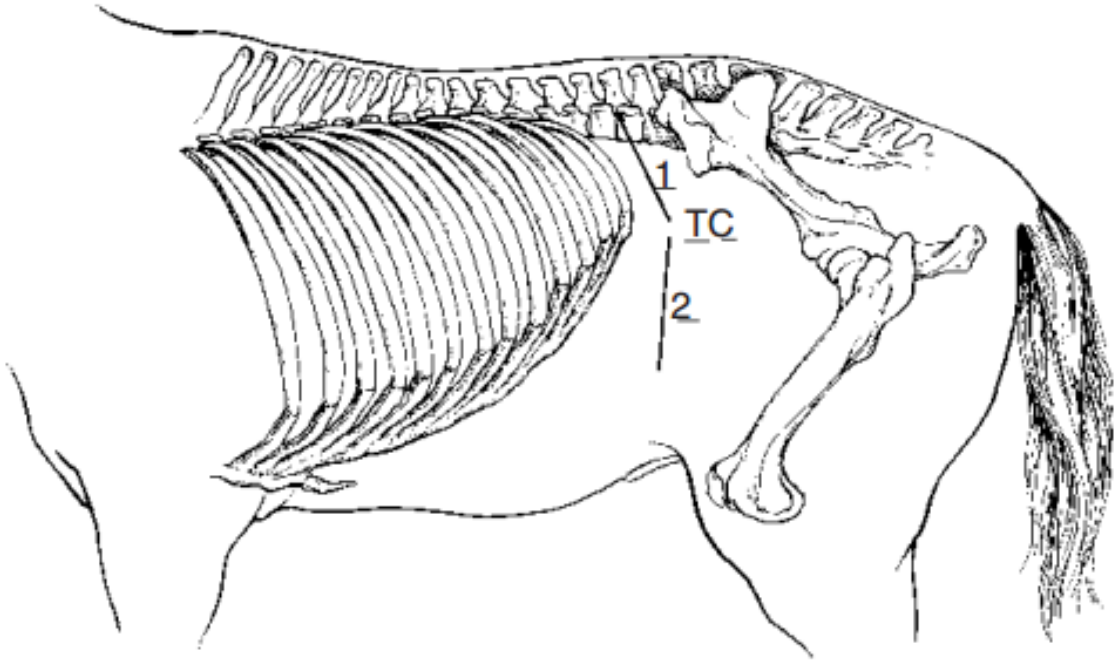

Figure 33-8. Abdominal approaches through the flank: paralumbar incision (1), transverse flank incision (2). TC, tuber coxae.
(Redrawn from Adams SB: Surgical approaches to the equine abdomen, Vet Clin North Am Large Anim Pract 1982;4:103.)

Post Operation Success:

The pattern of survival after surgery for horses with small and large intestinal colics follows a triphasic pattern. Most deaths occur during the first 10 postoperative days, with 69% during the first 100 days after surgery and a slower decline in death rate after that. A study on horses that had small intestinal surgery confirmed this observation and also demonstrated that the risk for death from surgery-related problems diminishes markedly after 12 months.

Factors that may influence success of surgery/Association between severity of pain, faecal production, heart rate, capillary refill time and gut sounds at admission with short term survival.

Survival after surgery has improved from 20–30% percent in the 1970s and 1980s to 80–90% in some practices where early recognition is combined with adequate post-operative care.

Preoperative findings and short-term survival: There was no significant association between age, breed, sex or use and survival. There was no significant association between duration of colic and survival. Statistically significant differences in short-term survival were found for the following preoperative features: severity of pain, faecal production, heart rate, capillary refill time and gut sounds (Table 4). The recovery rate was lower for horses with normal faecal production compared to those with reduced faecal production.

Rapid recognition of surgical conditions, early surgical intervention, and enhanced critical care have all improved the prognosis for horses with severe colic. Strangulating lesions and associated endotoxic shock and ileus are still cited as the chief treatment challenges after surgery.

The most notable prognostic indices are heart rate, PCV, and plasma lactate, creatinine, and glucose concentrations. These indices reflect the level of pain and the patient's cardiovascular status which are related to the extent of intestinal damage and likely the duration of illness.

Unfortunately there are still some horses and foals with colic that are euthanized without treatment. The most common reasons for euthanasia are (1) financial limitations to treatment imposed by the owner and (2) the perception that the horse would not do well with surgery.

TABLE 4: Association between severity of pain, faecal production, heart rate, capillary refill time and gut sounds at admission with short-term survival

	Total no.	No. (%) surviving	95% CI
Severity of pain score			
1 (mild)	72	53 (73.6%)	0.62–0.83
2 (moderate)	140	109 (77.9%)	0.70–0.84
3 (severe)	88	49 (55.7%)	0.45–0.66
Faecal production			
Normal	4	3 (75.0%)	0.19–0.99
Reduced	110	92 (83.6%)	0.75–0.90
Absent	186	116 (62.4%)	0.55–0.69
Heart rate (beats/min)			
30–39	24	22 (91.7%)	0.73–0.99
40–49	91	76 (83.5%)	0.74–0.90
50–59	57	44 (77.2%)	0.64–0.87
60–69	60	40 (66.7%)	0.53–0.78
70–79	29	13 (44.8%)	0.26–0.64
80–89	27	14 (51.8%)	0.32–0.71
>90	12	2 (16.7%)	0.02–0.48
Capillary refill time (secs)			
<2	150	121 (80.7%)	0.73–0.87
2–3	121	78 (64.5%)	0.55–0.73
>3	29	12 (41.4%)	0.23–0.61
Nature of gut sounds			
Normal	46	34 (73.9%)	0.59–0.86
Reduced	130	105 (80.8%)	0.73–0.87
Absent	124	72 (58.1%)	0.49–0.67