

# How to Manage Severe Colic in the Field

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## 1. Introduction

Criteria for referral to a hospital and for surgical intervention for horses with colic have been well established. However, the focus of this presentation is different and has been imposed on many of us by a harsh economy, specifically management of the colic patient when referral is not an option. Under these conditions, the challenge will be to clearly identify when to forge on and when to euthanize.

Most horses with colic can be treated medically on the farm, but we all can recognize when a horse should be referred to a surgical facility. When that point is reached and the owner declines referral, you must then establish some very clear guidelines for how to proceed. The following questions must be addressed:

Why is referral not an option? Possible answers are:

- (1) Colic surgery is rarely successful.
- (2) This is a pregnant mare and it will be impossible to save the mare and foal.
- (3) This is an old horse and old horses do not handle colic surgery well.
- (4) This horse is much loved/valued, but we cannot justify spending the money on colic surgery in our present financial circumstances.

Answers 1 to 3 are simply untrue. Answer 4 is a reality and probably one that all owners should con-

sider even before any horse they own develops colic. Even in a good economic climate, one must decide which horses in the barn warrant colic surgery and which ones do not. This is always a tough decision.

Once the owner elects treatment at home over referral, the following questions arise for the owner to answer:

- (1) How much am I prepared to spend? What is my financial limit on this horse? This is critical because you or your colleagues must be compensated for your services. Cases like this can drag on for days and entail several visits. Farm calls, drugs, and intravenous fluids all add up. Nonsurgical treatment at home could approach the cost of nonsurgical treatment at a referral hospital.
- (2) How much of my time am I prepared to commit to around-the-clock monitoring and care?
- (3) Can I handle watching a horse suffer, and what are my limits on that (property damage)?
- (4) Is my family supportive of this decision?
- (5) Will I change my mind or stay the course?

Once the owner elects treatment at home over referral, the following questions arise for the veterinarian to answer:

- (1) Do my colleagues and I have the time to devote to this case?

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## NOTES

- (2) How much time do we have to commit to around-the-clock monitoring and care?
- (3) Do we have the diagnostic capabilities to handle this case and assess its daily progress (ultrasonography, laboratory access with a rapid turnaround)?
- (4) Do we have the drugs and equipment needed to handle this case?
- (5) Can I handle watching a horse suffer, and what are my limits on that?

## 2. Specific Diseases and Recommended Approaches

Displacements that are occasionally treated by surgery, such as right dorsal displacement and impactions of the ileum, cecum, large colon, and small colon, can respond to medical treatment if managed appropriately and given enough time. Entrapment of the colon over the nephrosplenic ligament is usually treated nonsurgically (rolling or phenylephrine) at referral hospitals and could be managed in the same way at home. In very rare cases, large colon volvulus can spontaneously correct. On the other hand, some horses can start with an impaction that produces sufficient gas buildup to cause displacement or volvulus. Strangulating lesions of the small and large intestines are the challenge if surgery is not an option because these will not resolve medically and should be candidates for euthanasia as soon as the diagnosis is made.

Euthanasia should be considered early in the decision process for horses with evidence that supports a diagnosis of strangulating lipoma. Horses older than 10 years should be considered as having a strangulating lipoma, unless proven otherwise, and the likelihood of this diagnosis increases with increasing age. Supportive findings are small intestinal distention, reflux, congested mucous membranes, and increased heart rate. Pain can be absent or mild in older horses. It is not unusual for horses with this lesion, despite the severity of intestinal ischemia, to survive for 3 days or more with reflux and increased heart rate but little evidence of worsening in disease severity.

A horse that cribs is at risk of colic more than non-cribbers, especially strangulation in the epiploic foramen. Strongly supportive findings for this latter diagnosis are small intestinal distention, male horse <20 years old, and Thoroughbred; however, all other breeds and either sex can be affected. Pain can be highly variable in these horses, from mild to severe. Horses that meet these criteria should be under early consideration for euthanasia if all other findings support a diagnosis of small intestinal strangulation.

A postpartum mare with extreme pain and worsening abdominal distention probably has a large colon volvulus. Such cases respond poorly to analgesics, and euthanasia is warranted early in the disease course.

Male intact Standardbreds, Tennessee Walkers, and Saddlebreds are at risk of inguinal hernia and

therefore must be examined for this lesion, as should all intact male horses with colic. Although most affected horses are treated with surgery, this condition can be managed by anesthetizing the horse, placing it in dorsal recumbency, and manually reducing the hernia by external massage along the cord as it is stretched taut. Alternatively, the intestine can be drawn away from the vaginal ring per rectum with the horse anesthetized and in dorsal recumbency, although this carries a high risk of intestinal or rectal injury.

American Miniature Horses are prone to fecaliths in the small colon and typically present with marked abdominal distension. Colic in these horses can be very complicated because food deprivation is recommended as part of treatment but can cause hyperlipidemia, liver disease, and death. Euthanasia is recommended in these horses with colic of any cause once signs of hyperlipidemia develop (icterus, depression, lipids in serum) when referral is not an option.

In general, enteroliths might be indistinguishable from an impaction with digesta, based on clinical signs. Arabian horses in California on alfalfa hay are at risk of developing enteroliths, and this should be high on the list of differential diagnoses for such cases. Radiographs of the abdomen can be helpful, although the absence of supportive radiographic findings are not conclusive.

A foal or weanling that appears parasitized and has a history of recent worming or worming with ivermectin only could be at risk of having an ascarid impaction. All available evidence that supports a diagnosis of small intestinal obstruction should be sought in such cases (reflux, ultrasound examination). Although typically treated by surgery, medical treatment with laxatives should be worth trying.

Foals can have all the same surgical lesions as adults except for strangulating lipoma. Foals are notoriously difficult to assess because they can alternate between periods of violent colic and periods of depression. Inability to perform a rectal palpation in foals complicates their examination, although the ability to perform a more complete ultrasound and abdominal radiographic examination compensates for this.

Horses with proximal enteritis can have a fever and leukocytosis and a greater volume of gastric reflux than horses with other small intestinal diseases. Horses with proximal enteritis may have severe abdominal pain initially, and this progresses to depression and less pain than in horses with strangulation obstruction. After gastric decompression, horses with proximal enteritis usually improve in overall attitude and heart rate decreases, but this is not always reliable. On palpation per rectum, tightly distended loops are suggestive of strangulating lesions, whereas distension is milder in horses with proximal enteritis. These horses often require large volumes (60 to 120 L/d) of intrave-

Table 1. Examples of Peritoneal Fluid From Horses With Various Abdominal Diseases

Disease	Color	Turbidity	Total protein (g/dL)	RBC (cells/ $\mu$ L)	WBC (cells/ $\mu$ L)	Cytologic Findings
SI strangulation obstruction	Serosanguinous	Opaque	4.5	200/000	35,000	Degenerate neutrophils
Peritonitis from abscess	White with pink tinge	Opaque	6.1	120,000	175,000	Degenerative neutrophils with rare intracellular cocci
Intestinal necrosis and leakage	Orange	Opaque	6.3	3000	240,000	Cellular, mostly neutrophils with many intracellular and extracellular bacteria
Proximal enteritis	Yellow	Slightly cloudy	5.1	27,200	5400	Numerous RBCs, neutrophils not degenerate

SISO indicates small intestinal strangulation obstruction.

Modified from Adams SB, Sojka JE. Abdominocentesis. In: Colahan PT, et al. (editors). *Equine Medicine and Surgery*. 5<sup>th</sup> edition. St. Louis, MO: Mosby Co., 1999:586–589.

nous fluids to maintain hydration and provide cardiovascular support, which may be a challenge to accomplish in a field setting.

### 3. Diagnostic Procedures

Palpation per rectum, repeated as needed, is a critical procedure in a horse with colic to detect distended loops of small intestine, tight bands, impactions, and other findings that could indicate life-threatening changes. Ultrasonography is very useful for diagnosis of intestinal strangulation (distended, thick-walled intestine), peritonitis (increased volume of peritoneal fluid and decreased intestinal motility), intussusceptions (jejunojejunal, ileocecal, and cecocolic), displacements, renosplenic entrapment of the large colon, peritoneal effusion, diaphragmatic hernia, cholelithiasis, ruptured bladder, ascarid impactions, inguinal and scrotal hernias, and abdominal neoplasia.<sup>1</sup> However, transabdominal ultrasonography can be difficult to interpret if you have limited experience with this diagnostic modality.

The horse's abdomen is prepared by spraying it with alcohol to improve acoustic coupling, and both sides of the horse are examined systematically from the line of the diaphragmatic reflection to the ventral midline. A low-frequency probe (2 to 3.5 MHz) is used in adult horses to demonstrate deeper structures, although the resolution is low. Higher-frequency probes (5 to 10 MHz) can be used in small horses and foals for more detail, but with less depth of penetration.<sup>1</sup> Ultrasonography is more accurate than abdominal palpation per rectum for identification of early small intestinal strangulation. It can also allow assessment of quantity and nature of fluid in the abdomen so that peritonitis and rupture can be detected. The normal small intestinal wall thickness is 3 mm or less, and ultrasonography can be used to detect small intestinal movement, mural thickness, and dilation. The strangulated, fluid-

filled segment of small intestine is usually identified in the ventral abdominal cavity.<sup>1</sup> Small intestinal intussusception will also gravitate toward the ventral abdomen, where it can be identified by ultrasonography. Large colon torsions can be diagnosed by imaging the large colon from the ventral abdomen, with a high degree of accuracy and reproducibility.<sup>2</sup> A colon wall thickness  $\geq 9$  mm can accurately predict large colon torsion with a sensitivity of 67% and can correctly predict absence of torsion with a specificity of 100%.<sup>2</sup> Although diagnosis of LCV has been made on the basis of ultrasonographic detection of a colon segment that lacks sacculations,<sup>3</sup> this approach has not been adequately tested. Ultrasonography is less useful for the detection of enteroliths because of their location and because the acoustic echo from a stone and a gas shadow are similar.

Although abdominocentesis is useful in diagnosis of a strangulating small intestinal lesion and ruptured viscus, visual assessment of the fluid is not recommended for this purpose, despite some support for this approach. Normal-appearing fluid does not rule out these lesions, and laboratory assessment is needed, including cytological examination in some cases, and this might not be feasible in all field situations. An 18-gauge, 1.5-inch needle, a teat cannula (7.5 cm), or female canine urinary catheter is inserted into the abdominal cavity on the midline or just to the right of midline in the most dependent part of the abdomen, behind the xiphoid cartilage. Restraint by twitch is usually sufficient, although local anesthetic is required for the cannula methods. Abdominal ultrasonography can identify fluid pockets to be sampled and help avoid enterocentesis.

Fluid from most horses with nonstrangulating lesions is normal on gross inspection, but fluid from horses with strangulated small intestine is usually serosanguinous (Table 1). A fluid sample from horses with a ruptured viscus is cloudy and green-

**Table 2. Comparative Biochemical Analyses of Venous Blood and Peritoneal Fluid From Horses With Colic, Using a Portable Analyzer and an In-House Analyzer**

Treatment	Horses (n)	Mean PF	Range PF
		Lactate (mM)	Lactate (mM)
Medical	27	1.3	1.0-2.2
Nonstrangulated surgical lesions	14	2.0	1.0-3.5
Strangulated lesions	10	6.0	5.2-8.7
Ruptured viscus	5	3.3	2.4-5.9

PF indicates peritoneal fluid.

Modified from Saulez MN, Cebra CK, Dailey M. Comparative biochemical analyses of venous blood and peritoneal fluid from horses with colic using a portable analyzer and an in-house analyzer. *Vet Rec.* 2005;157:217–223.

tinged but can be normal if diluted out by a large volume of peritoneal fluid or if intestinal contents are entrapped by omentum or intestine close to the site of rupture (hence the importance of cytological examinations).

Peritoneal fluid with nucleated cell counts >1500 cells/ $\mu$ L should be considered elevated in foals, whereas the normal adult can have up to 5000 cells/ $\mu$ L. Peritoneal fluid protein is within the same range in foals as in adults, usually <2.0 g/dL. Cytologic evaluation should detect degeneration of cells and bacteria (in rupture) and allow classification of cell populations. Interpret with awareness in that many horses with a surgical lesion, such as large colon volvulus, can have normal peritoneal fluid. The presence of different varieties of bacteria suggestive of enteric origin in a sample with otherwise mild changes indicates enterocentesis and resultant contamination of the sample. There appears to be widespread agreement that abdominal fluid analysis cannot be used alone in the evaluation of horses with colic.

Peritoneal fluid lactate can be a better predictor of intestinal ischemia secondary to a small intestine strangulating obstruction (SISO) than blood lactate and therefore could be used for early detection of such lesions and even rupture.<sup>4,5</sup> Horses with SISO had a higher peritoneal lactate value (8.45 mmol/L) than those with nonstrangulating obstruction (2.09 mmol/L). Factors with the strongest correlations with the presence of SISO were changes in the gross appearance of the peritoneal fluid and values of peritoneal fluid chloride, pH, and log<sub>10</sub> lactate.<sup>4</sup> A portable analyzer (i-STAT) can be suitable for biochemical analysis of samples of blood and peritoneal fluid from horses with colic and provides comparable lactate measurements as an in-hospital analyzer<sup>5</sup> (Table 2).

#### 4. Medical Treatment: Visceral Analgesia

Control of pain and restraint play a crucial role in the management of horses with colic, and for most

colics, the drugs of choice are flunixin meglumine and/or xylazine. All forms of pain control should be interrupted so that progress can be monitored repeatedly and frequently.

Flunixin meglumine<sup>a</sup> is the most popular nonsteroidal anti-inflammatory drug (NSAID) for treatment of colic because it provides some analgesia, inhibits endotoxin effects, and improves cardiovascular status without adversely affecting intestinal motility. The dose is 1.1 mg/kg IV, once or twice a day. The intramuscular route is not recommended. Renal toxicity with this and other NSAIDs could be exacerbated by the dehydration that complicates many colics, and adherence to the recommended dosing schedule is therefore critical. Recent research findings that flunixin meglumine and other nonselective cyclooxygenase inhibitors can impair recovery of jejunal mucosa from ischemic injury do not appear to be clinically relevant and do not apply to the equine colon under experimental or clinical conditions.

Xylazine (0.2 to 1.1 mg/kg IV or IM) and detomidine (5 to 40  $\mu$ g/kg IV) are valuable analgesics for colic. Both drugs are especially useful in extremely painful and unmanageable horses. On clinical assessment only, the beneficial effects of xylazine appear to outweigh any harmful effects on intestinal blood flow and motility, and its short duration of action allows repeated assessment of the horse's progress.

N-butylscopolammonium bromide<sup>b</sup>, (NBB; 0.3 mg/kg IV) has anticholinergic and antispasmodic effects and has been commercially available in Europe (in combination with hyoscine) for the treatment of horses with spasmodic colic for many years. It has been approved (without hyoscine) for similar use in the United States. NBB has a brief analgesic effect, which is not the primary purpose for its use, and a transient negative effect on cecal contractions and duodenal motility.<sup>6</sup> NBB causes tachycardia and visceral antinociception of short duration (15 to 20 minutes).<sup>6</sup> Its transient effects on gastrointestinal motility provide relief from intestinal spasm and allow rectal examinations under difficult conditions.

Butorphanol<sup>c</sup> (0.03 to 0.1 mg/kg of body weight IV) is a synthetic opiate analgesic with agonist-antagonist properties that can be combined with xylazine to improve analgesia and used to reduce behavioral effects.<sup>6</sup> Visceral analgesia provided by butorphanol is inferior to and of shorter duration than provided by xylazine (approximately 90 minutes) and detomidine. Administration of butorphanol by continuous rate infusion (CRI, loading dose, 17.8  $\mu$ g/kg; infusion dosage, 23.7  $\mu$ g/kg/h for 24 hours) reduces the adverse effects on gastrointestinal tract motility and behavior, while providing analgesia.<sup>7</sup> In horses that had colic surgery, butorphanol CRI significantly delayed time to first passage of feces, which could be undesirable in horses with impaction colic.<sup>8</sup>

Recent interest in lidocaine has focused on its use as an agent that could enhance gastrointestinal tract motility in horses after colic surgery and thereby prevent postoperative ileus (POI).<sup>9</sup> For this purpose, lidocaine (2% solution) is given as a bolus of 1.3 mg/kg IV slowly over 5 minutes, followed by 0.05 mg/kg/min in a balanced electrolyte solution<sup>d</sup> for 24 hours, at an infusion rate of 5 mL/kg body weight/h. Although a bolus of 2 mg of lidocaine/kg followed by a CRI at a rate of 50 µg/kg can provide somatic analgesia, the same dose had no effect on visceral pain induced by duodenal and colorectal distention.<sup>9</sup>

Although the widespread use of lidocaine after colic surgery was initially based on the presumption that it was a prokinetic agent,<sup>9</sup> this does not appear to be the case. Systemic administration of lidocaine to clinically normal horses did not affect myoelectrical activity,<sup>10</sup> contrary to what would be expected of a prokinetic agent.<sup>9</sup> In fact, lidocaine might inhibit normal motility. In a study on gastrointestinal passage of particulate markers in normal horses, a CRI of lidocaine appeared to delay gastrointestinal transit.<sup>11</sup> Therefore, any clinical benefit of lidocaine is attributable to other mechanisms of action, possibly an anti-inflammatory effect on neutrophils, which requires a concentration that is less than the concentration necessary to block sodium channels.<sup>9</sup>

### 5. Medical Treatment: Laxatives

Mineral oil (0.5 to 1 gallon or 2 to 4 L per 450 kg body weight) is an effective fecal softener in horses, and its presence on the perineum, tail, and hind limbs, 12 hours or more after administration, indicates that the intestinal tract is partly or completely patent. Magnesium sulfate (0.5 g/kg and 1.0 g/kg in 2 to 6 L of water) is assumed to increase fecal bulk and water content through an osmotic response to the poorly absorbed magnesium ion. At 1.0 g/kg, magnesium sulfate increases fecal water and frequency of defecation in 6 to 9 hours through a gastrocolic reflex.<sup>12</sup> Although it can be given once or twice daily for 2 to 3 days with little risk, repeated doses can cause weakness, collapse, and tachycardia from effects of the absorbed magnesium ion, complications that would seem more likely if it is administered with dioctyl sodium sulfosuccinate. Treatment of toxicosis is diuresis with intravenous fluids and intravenous calcium.

Dioctyl sodium sulfosuccinate (10 to 20 mg/kg) is of questionable value for horses, even at a dose of 50 mg/kg. It is an anionic surfactant, classified as a wetting agent, irritant laxative, or fecal softener, with a putative ability to permeate impactions and disperse and emulsify their contents.<sup>12</sup> It probably should not be given with magnesium sulfate because this increases magnesium ion absorption and consequent toxicosis (collapse and weakness).

Although large intestinal impactions can be treated with intravenous fluids, enteral fluids are

less expensive and also appear to be effective for impactions (60 L of fluids administered continuously at 10 L/h through a nasogastric tube). However, such therapy can increase abdominal distension and pain.<sup>13</sup>

### 6. Adjunctive Treatments

Some relief can be achieved in selected cases by decompression of the distended cecum. This procedure is risky and can cause life-threatening peritonitis but can also be valuable when financial constraints preclude surgery. For cecal tympany, decompression is through a 14-gauge catheter (at least 10 to 12 cm long) through the right paralumbar fossa, after the site has been prepared for aseptic surgery and infiltrated with local anesthesia. The catheter is connected to an intravenous tube immersed under water below the level of centesis so that gas egress can be continually monitored and air ingress is prevented. A small volume of gentocin should be flushed through the catheter before withdrawal to remove any aspirated intestinal contents that could drain into the abdominal wall.

Horses with abdominal pain should be allowed to roll at will if they are considered to have a colonic displacement, contrary to owner's desires to keep them walking. They might need to be placed in a round pen or paddock for this purpose to minimize the risk of injury. Although unsubstantiated, the impression is that vigorous rolling can correct some colonic displacements.

Horses with the large colon trapped over the nephrosplenic or renosplenic ligament can have pain of variable intensity and mild to moderate abdominal distension. Treatment by "wait and see" approach, phenylephrine injection, or rolling the horse while anesthetized with short-acting intravenous anesthetic are successful, depending on severity. The spleen can be effectively reduced in size by phenylephrine at 3 µg/kg/min for 15 minutes. The horse is then lunged for 10 to 15 minutes or rolled. Lunging is less effective than rolling under anesthesia, and phenylephrine does carry a small risk of fatal hemorrhage in old horses.<sup>14</sup>

### 7. Basic Guidelines in Pain Assessment and Prognosis

Pain is the most important indicator of colic severity, but it must always be assessed with full regard for certain caveats, the most important of which is for you and the owner to avoid anthropomorphism. Typically, this results from applying perceived predictions to the affected horse about its individual tolerance to pain and its degree of stoicism. Severe pain is severe pain and should be regarded as such, but there are some guidelines:

- (1) Young horses, especially those of racing breeds, tend to manifest pain more severely and persistently than draft breeds with similar lesions. Pain can be mild or even absent

in old horses, smaller breeds, Tennessee Walking Horses, American Miniature Horses, draft breeds, and horses with severe endotoxemia. With the last three, the prognosis is poor.

- (2) Pain, cardiovascular status, and abdominal distension should be used in combination as measures of the severity of colic. Worsening abdominal distension is always a concern. An adult horse of average size with increasing heart rate or a heart rate persistently above 60 beats/min (12 to 24 hours) generally has a poor prognosis. Draft horses are prone to all types of colic but are very difficult to assess. Even with mild lesions, they will have very high heart rates and might not demonstrate pronounced signs of pain. Normal or mild elevation in heart rate can be found in some horses with a surgical lesion, including strangulating lesions of the small intestine. With time, these would be expected to develop an increase in heart rate.
- (3) Response to analgesics, such as flunixin meglumine or xylazine, is extremely important in assessing pain. If pain is severe enough to require repeated analgesics or response to analgesics is poor, the prognosis for survival is poor.
- (4) Do not repeat analgesics without assessing the horse's progress when their effect is diminished. Do not underestimate the degree of improvement in pain and cardiovascular status brought on by medication. Flunixin meglumine can improve cardiovascular condition and color of membranes considerably, and toxic membranes can represent an advanced stage in the disease and may indicate that euthanasia should be considered.
- (5) Horses with self-inflicted trauma from violent pain with colic typically have strangulating lesions and should be considered for euthanasia if all other supportive evidence can be established.
- (6) Horses with persistent reflux and small intestinal distension, with or without pain but with mucous membrane congestion and other signs of endotoxemia, are candidates for euthanasia, especially if they do not respond rapidly to fluid therapy and flunixin meglumine. Even if these horses have proximal enteritis, the cost of treatment for that disease can approach that for colic surgery quite rapidly.
- (7) Horses that meet the above criteria but without evidence of endotoxemia and have a history of eating coastal Bermuda grass hay can be managed conservatively, as many of these will resolve with medical therapy.

- (8) Finally, it should be made clear to the owner that if referral is a possible option, it should be performed early in the disease process.....not after all other medical treatment options have been exhausted and the horse's cardiovascular status has begun to deteriorate.

#### References and Footnotes

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<sup>a</sup>Banamine, Schering-Plough Animal Health Corp., Union, NJ 07083.

<sup>b</sup>Buscopan, Boehringer Ingelheim Vetmedica, Inc., St. Joseph, MO 64506.

<sup>c</sup>Torbugesic, Fort Dodge Animal Health, Division of Wyeth, New York, NY 10017.

<sup>d</sup>Normosol-R, Hospira, Inc., Lake Forest, IL 60045.