Things that go bump in the night. Part 2

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This session will cover those types of colics that do not fit within the normal spectrum of surgical and medical colics, but clinically resemble them. Chronic colics are growing in importance and can be challenging cases. Peripartum colics put both the mare and foal at risk of poor outcomes and the need for prompt surgical treatment should is critical in such cases. Current trends in colic management will also be emphasized.

False Colics

A false colic is a rare disease with subtle clinical signs that could be mistakenly interpreted as abdominal pain. Any disease that causes sweating, excessive or abnormal movements, abnormal gait, reluctance to move, tachycardia, tachypnea, apparent agitation, weakness, depression, inappetance, and recumbency could be diagnosed as colic, especially by owners, trainers and lay personnel. History about changes in feed, management related changes, involvement of herdmates and recent treatment histories are critical.

Lameness and Musculoskeletal Diseases

A good history is critical in distinguishing many false colics of musculoskeletal origin from true colics, especially recent physical activity and specific clinical and laboratory findings. Examples are exertional rhabdomyolysis, hyperkalemic periodic paralysis (HYPP), exhausted horse syndrome (EHS), laminitis, equine motor neuron disease (EMND), seasonal pasture myopathy (SPM), trauma or fracture (compartment syndrome) and clostridial myositis or localized infection.

Urogenital Tract Diseases

Diseases of the female reproductive tract associated with pregnancy and parturition are discussed in an accompanying handout, and also included are rare diseases of ovarian origin, such as colic caused by ovarian activity. Diseases of the male reproductive tract that can be confused with colic are rare, usually confined to the testicles, and can be confused with inguinal hernia. Testicular torsion usually involves a 360o rotation of the affected spermatic cord, and causes abdominal discomfort and elevated heart and respiratory rates. The scrotum on the affected side is clammy and swollen, and the affected testicle is enlarged, firm, sensitive to palpation, and retracted dorsally. Testicular torsion of 180o places the tail of the epididymis in the cranial pole of the scrotum is not uncommon and does not represent an abnormal condition. Thrombosis of the spermatic artery and septic orchitis-periorchitis and epididymitis can cause clinical signs similar to an inguinal/scrotal hernia. Postcastration pain in large adult horses with well-developed testicles can cause overt signs of severe colic.

Cystic calculi cause a chronic disease, usually in geldings, characterized by intermittent mild colic, stranguria, pollakuria, and dribbling of bloody urine. The hind legs can be scalded and crusted along the inside from repeated soiling with urine dripping persistently from the penis. These horses can appear to be otherwise healthy and have normal heart rates and normal gastrointestinal tract function, defecation, appetites and attitudes while affected with this disease. A cystolith can be easily palpated in the bladder approximately a hand's length cranial to the anus. Unlike in humans, nephroliths and ureteroliths usually do not cause colic in horses.

Respiratory and Cardiovascular Diseases

History, chest radiographs and ultrasound examination should be used to distinguish between intrathoracic and intraabdominal diseases. Horses with large diaphragmatic hernias and peritoneopericardial hernia can be presented with signs of respiratory disease and poor exercise

tolerance rather than signs of colic, despite displacement of intestinal segments into the thoracic cavity. However, colic is a well-known complication of small diaphragmatic defects. Others are pleuritis, pleuropneumonia and pulmonary abscessation, fourth branchial arch defects (4-BAD)

Cardiovascular diseases that can present as colic are myocardial infarction, pericarditis, ventricular tachycardia, aortic-iliac thrombosis, vascular accident (rupture of the aortic ring, aorticopulmonary fistula, arterial rupture) can cause signs that could be confused with colic. Congestive heart failure from longstanding atrial fibrillation and atrial ventricular valve incompetence can cause chronic colic and mild diarrhea. Aortocardiac fistula is a defect in the right aortic sinus that forms a dissecting tract through the aortic ring to the right ventricle, and is an uncommon disease, mainly in mature breeding stallions (≥6 years). The wide spectrum of clinical signs could lead to diagnosis of colic. A characteristic continuous murmur in the right 4th intercostal space can be detected in association with bounding arterial pulses and rapid diastolic run-off. The heart rate can range from 40 beats/minute to 240 beats/minute.

Enteritis and Colitis

Examples are duodenitis and proximal jejunitis (DPJ) in the small intestine, and salmonellosis, clostridiosis, and Potomac Horse Fever in the large intestine. Laboratory changes include leukopenia with white blood cell counts below 3 X 109/L with neutropenia. Peritoneal fluid can be normal.

Plants that Cause Colic Signs

Signs of plant poisoning can be subtle and easily confused with colic. Fortunately, many owners can recognize toxic plants and horses find most toxic plants to be unpalatable. However, poisoning increases under poor management conditions, when lack of pasture or poor quality hay with a high weed content forces horses to eat toxic weeds. In suspect cases, samples of feed, pasture or hay must be examined closely for weeds and other contaminants. Other horses on the same premises should be examined for early signs of poisoning, and should receive different food until the suspect case is resolved. Post mortem diagnosis demands careful sampling of tissues and gastrointestinal tract contents, supported with a detailed history and clinical signs. Examples are cardiac-glycoside containing plants, such as foxglove and oleander, which have a digitalis-like action on the heart, and cause azotemia, cardiac arrhythmia, and colic. Colic and other signs (excitement, depression, mydriasis, and diarrhea) are caused by tropane alkaloids in plants of the Solanaceae family. Acorn toxicity (tannin or tannin metabolite) can cause hemorrhagic diarrhea and signs of colic with gas distension and colon displacement.

Plants that contain saponins, such as pokeweed, bouncing bet, corn cockle, and English ivy are unpalatable to horses, but can cause diarrhea and colic. Black walnut (Juglans nigra) in the eastern USA and Midwest causes severe laminitis from contact with shavings or sawdust from the wood.

Medications that Cause Colic Signs

A variety of drugs available for equine practice can be toxic if used in excessive doses or under inappropriate conditions or in horses that have an idiosyncratic sensitivity to them. Magnesium sulfate in repeated doses can cause weakness, collapse, and tachycardia from the magnesium ion, which is absorbed more readily if given with dioctyl sodium sulfosuccinate (DSS). Castor oil is an irritant laxative that can cause diarrhea. Linseed oil has been used as a laxative in horses, but raw oil causes watery diarrhea, colic, depression, and endotoxemia.

Phenylbutazone can cause colic, anorexia, depression, melena, diarrhea, weight loss, ventral edema, petechial hemorrhages and death. Pathological changes include gastric and colonic ulceration, right dorsal colitis, acute necrotizing enterocolitis, large colon impaction, cecal

impaction and rupture, edema, erosions, and ulcers in the cecum, ventral and dorsal colons, edema of the small intestine and erosions, ulcers, and rare venous thrombosis in the large colon, severe colonic ulceration with perforation, and renal papillary necrosis.

Miscellaneous drugs that cause signs indistinguishable from those of colic include atropine, clenbuterol, reserpine and fluphenazine decanoate is a potent phenothiazine neuroleptic used to treat humans with schizophrenia.

Feed Contaminants and Feed-Related Colics

Feed contaminants are particularly dangerous because they are introduced into hay, grain, or processed feed with little opportunity for horse owners to find them or for horses to avoid them. Examples are the carboxylic ionophores (salinomycin, monensin, and lasalocid). These are added to rations for poultry, swine and cattle as a coccidiostat to improve feed utilization. Horses are extremely sensitive to ionophore toxicosis, which can arise from mixing horse feed in processing equipment that is contaminated by ionophore-containing rations for other animals. Ingestion of blister beetles incorporated into alfalfa hay causes poisoning by cantharadin, a vesicant produced by male beetles. Blister beetle poisoning might be more common in the Southwest, but has been reported in most of the eastern part of the United States.

Chronic Colic

Despite advances in management of acute intestinal lesions in horses, recurrent or chronic types of colic remain a management challenge. Although surgery has to be considered at some point in many of these cases, it must be approached with full regard for limitations and consequences. Chronic colic is usually defined as colic signs observed daily over a period of days or longer. Recurrent colic can be 3 or more episodes of transient colic or of prolonged colic over periods of one month to one year or more.

Gastric Diseases

Gastric ulceration in adult horses can be clinically silent or cause signs similar to those of recurrent colic, such as poor appetite, performance, and body condition, and abdominal pain. The most common site of ulceration in adult horses is the squamous epithelium of the nonglandular mucosa, along the margo plicatus. However, glandular ulcers are also clinically relevant and require different treatments.

Gastric impaction is a disease of growing frequency in the US, mostly in warmlblood and draft breed horses. It causes very mild signs, usually of colic, but the disease is chronic and refractory to most treatments. Surgical evacuation of the impaction is necessary for treatment and diagnosis in many cases, but dietary management is critical because normal gastric function rarely returns.

Cecal Impaction

Cecal impaction typically presents as an acute disease, but can cause recurrent colic. Unfortunately, there are no hard and fast guidelines for indications for surgery, and most cases should be treated surgically if response to medical treatment is not satisfactory. The most devastating consequence of delayed surgery is cecal rupture.

Enteroliths

Enteroliths form as rocks around a nidus (pebble, stone, metal object, rope, cloth, other material). Alfalfa in diet has been implicated as creating a favorable environment for enterolith formation. This disease has a strong geographic distribution, and is more common in California and somewhat common in the Midwest, but is seen in all parts of the US. Signs of recurrent mild to

moderate colic are not uncommon presentations. Radiographic diagnosis can be helpful and surgery is the obvious treatment of choice.

Nonstrangulating Colon Displacements
Horses with large colon trapped over the nephrosplenic or renosplenic ligament can have pain of variable intensity and most present as emergencies with acute colic. However, it is not unusual to have a history of recurrent colic and even behavioral problems. Many horses require laparoscopic nephrosplenic space ablation, because they are prone to recurrent bouts. Right dorsal displacement of the large colon can cause pain of variable intensity and most present as emergencies with acute colic, and some can present with a history of low grade colic of variable duration. Prevention of recurrence requires either large colon resection .

Right Dorsal Colitis
Right dorsal colitis is an insidious disease caused by diffuse and superficial necrosis with scattered erosions and ulcerations attributed to NSAID toxicosis. Progression of this lesion to a chronic form has a high mortality from colonic stenosis, luminal impaction, and colonic rupture. Clinical signs are usually low grade pain and an overall change in attitude. Supporting laboratory findings are mild anemia (rare) and hypoproteinemia (common). Ultrasound examination can be informative, because it can demonstrate the thickening in the wall of the right dorsal colon. Recent research at the University of Florida has shown that PBZ-induced interference with an anion transport system involved in pH regulation in the right dorsal colon could be a factor in mucosal injury.

Treatment of right dorsal colitis is difficult because the pathogenesis of the disease is unknown, medical treatment can be slow and ineffective, and the lesion is often inaccessible for resection. NSAID administration should cease. The doses of NSAIDs required to induce right dorsal colitis are not high nor given for long in every case, suggesting that some horses are extremely sensitive to these drugs. However, restricted water intake could predispose to NSAID toxicity in horses.

Some success in treatment has been reported with a low-bulk, low-roughage diet, such as replacing hay with pellets to reduce colon fill and abrasion, and with concentrates fed in small and frequent meals. Psyllium mucilloid can be added to the diet to produce short-chain fatty acids in the colon to promote mucosal healing. Metronidazole can be given because anaerobes could infect the mucosa and exacerbate the tissue damage. Sucralfate has been proposed because of apparent benefits in human intestinal injury. Misoprostol is protective in acetic acid induced colitis in laboratory animals and also could be of benefit, but should be used in care with pregnant mares. Protected bicarbonate in the feed could offset the loss of the anion transporter possibly disrupted by PBZ.

Miscellaneous (Large Intestine)
Mural compression from an abscess, tumor, anomalous or inflammatory bands, adhesions, or hematoma, mesenteric anomalies (extremely rare), and inflammatory diseases, such as Salmonella-induced fibrosis, and eosinophilic enteropathy can cause low grade pain and recurrent colic. Intussusception (cecocecal, cecocolic, colocolic) can cause lowgrade chronic or recurrent colic. Sand impaction can also cause low grade colic that recurs intermittently in horses with a history of access to sand, as in sandlot pastures and sandy soil, and in young horses that eat sand because of curiosity.

Muscular Hypertrophy of the Ileum
Muscular hypertrophy of the ileum causes recurrent colic but can also cause ileal impaction and acute signs. The disease is more common in mature horses (more than 5 years). There does not

appear to be a breed predilection. Most horses present with a history of recurrent, low grade colic of variable duration, with or without anorexia, and weight loss. The involved segment can be palpated per rectum in some horses. Bypass of the affected segment by side to side ileocecostomy or jejunocecostomy, with or without transection or removal of part of the ileum, is usually successful.

Small Intestinal Intussusceptions

Although typically regarded as a cause of acute colic in foals, this age group is less frequently affected than older horses and a more typical age predilection is weanling to horses ≤ 3 years. Short intussusceptions can cause a chronic disease in young horses characterized by weight loss, illthrift, and intermittent colic, usually postprandial colic. Gastric ulcers are usually secondary. Short jejunojejunal, ileoileal, or ileocecal are the different types and the latter is the most common. Ileocecal intussusception can form a short incomplete obstruction associated with a chronic disease, and tapeworms could predispose to this lesion.

Miscellaneous (Small Intestine)

Extraluminal or intramural obstruction in the small intestine can be caused by tumors, abscesses, hematomas, adhesions, anomalous bands, eosiniophilic enteropathies, granulomatous enteritis, inguinal hernia, and congenital anomalies. Gastroduodenal ulcer disease (GDUD) and stricture in foals (rarely older foals, weanlings and 2-year-olds) can cause signs of recurrent colic, associated with bruxism, salivation, gastric distention and reflux. Gastric bypass surgery is the treatment of choice for gastric outflow obstruction.

Peripartum Colic

Pregnant and postpartum mares can develop life-threatening colics with overlapping features between specific lesions in the gastrointestinal and genital tracts and normal periparturient events. These cases are a diagnostic and therapeutic challenge, with the mare and foal regarded as high risk patients.

Gastrointestinal diseases to which the peripartum mare is most prone are large colon volvulus, large intestinal impaction, diaphragmatic hernia, cecal rupture, rectal and small colon prolapse, avulsion of the mesocolon off the distal part of the small colon, evisceration through a vaginal or urethral tear, and strangulation of small intestine in the uterine broad ligament. Urogenital diseases that cause colic in the periparturient mare are stages of labor, uterine contractions, ruptured uterus, bladder prolapse through a torn vagina, hemorrhage into the broad ligament, retained placenta and its expulsion, dystocia, uterine torsion, periparturient genital injury, intraabdominal hemorrhage, uterine inversion, hydroallantois, and herniation of the abdominal wall through a prepubic tendon rupture or through the inguinal region. Severe internal hemorrhage from rupture of the uterine artery usually occurs during foaling. Pain can be caused by pressure from blood between the two layers of the peritoneum that form the broad ligament or a rupture into the peritoneal cavity. In these cases, treatment is directed to correction of hemorrhagic shock.

Uterine Torsion

Uterine torsion should be suspected in a mare in late pregnancy that is presented with signs of low grade abdominal pain. Unlike the cow, uterine torsion in the mare is rarely associated with parturition and usually involves the uterine body, not the cervix or vagina. In a study of 103 mares, stage of pregnancy at presentation was 236 to 368 days, with 4 mares presenting at parturition. The majority are presented at <320 days. Diagnosis is not always straightforward, although it can be made if the twist in the uterus can be palpated per rectum, cranial to the cervix, and one or

both broad ligaments can be felt following the direction of rotation (Fig. 1). The direction of the twist can be determined with the broad ligament on the side from which the dorsal part of the uterus is directed lying cranially, and the opposite ligament being more caudal. The degree of rotation varies from 180º to 540º and can be directed clockwise or counterclockwise (Fig. 1). It is questionable if a torsion of 180º or less is truly a clinical entity and requires treatment.

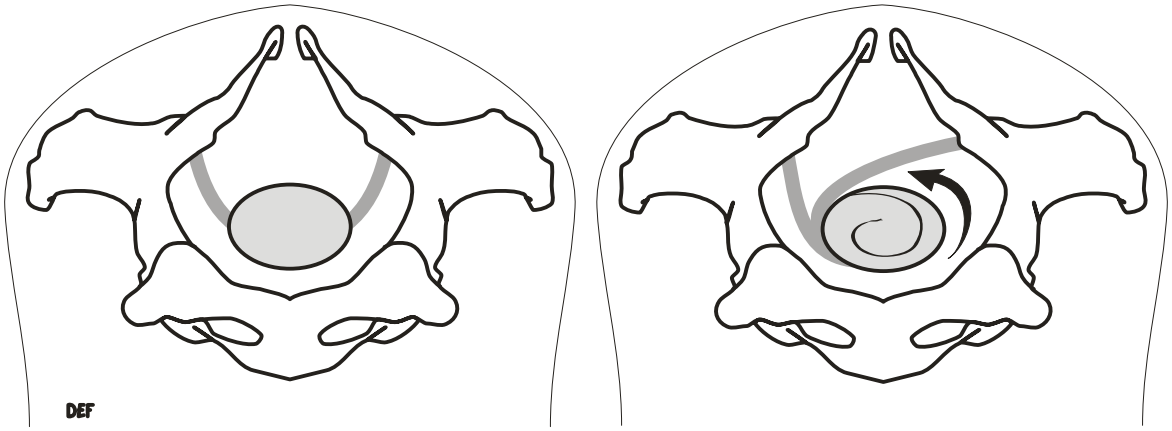

Figure 1. Rectal palpation findings in a normal mare (left) and in a mare with counterclockwise uterine torsion (right).

Rolling the mare can be considered if financial constraints preclude surgical treatment. This procedure is not recommended for mares in late gestation, because the fetal size increases the risk of uterine rupture.[3] The torsion is usually corrected through a flank incision on the side to which the uterus is rotated. In rare cases, two surgeons might have to work simultaneously through right and left flank incisions to correct the torsion. Generally, the uterus is not compromised, and slight discoloration and edema do not signify a poor prognosis for continued pregnancy. In very large mares, or in mares in which a concurrent gastrointestinal problem[2] is suspected or other complicating factors exist, a ventral midline approach is used. Uterine tears can occur prepartum as a complication of uterine torsion.

In a retrospective study, although overall mare survival was 53/63 (84%), survival was 97% when uterine torsion developed at < 320 days gestation, compared with 65% survival rate when uterine torsion developed at ≥320 days gestation. Mean heart rate was significantly lower for surviving mares than for those that died. Although overall foal survival was 54% (29/54), it was 72% when uterine torsion developed at < 320 days gestation, compared with 32% when uterine torsion developed at ≥320 days gestation. Foal survival was significantly better if uterine torsion was corrected by standing flank laparotomy than by ventral midline celiotomy. The prospects for subsequent fertility appear to be very good in mares that have had a uterine torsion.

A chronic form of uterine torsion has been described as a result of failure to diagnose the disease in its early stages, and can cause weight loss, anemia, fever and mild colic. Because the first bout of colic can be mild enough in some mares to escape detection during the initial presentation, a uterine torsion presumably is not considered or is not detected. Chronic uterine torsion can only be treated by ovariohysterectomy.

Torn Mesocolon and Small Colon Necrosis

Torn mesocolon and small colon necrosis should be suspected in a postpartum mare with mild colic, depression, and clinical evidence of peritonitis that persists during the first week after parturition. Usually the distal part of the small colon is affected, which can complicate access for resection and anastomosis (Fig. 2). This injury could be caused by blunt trauma from the foal during delivery or rectal and small colon prolapse. The prognosis is poor unless the necrotic segment is accessible for resection and anastomosis.

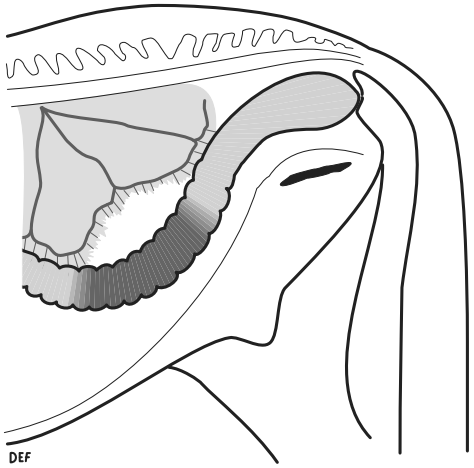

Figure 2. Torn mesocolon and infarction of the distal part of the small colon.

Uterine Rupture

A postpartum mare with mild colic, peritonitis, and similar signs to those in a mare with a torn mesocolon could also have a ruptured uterus. Peritonitis would be evident on abdominal ultrasound and by abdominocentesis, and the tear might be palpated per rectum or through the uterus, although a tear near the tip of the horn would be out of reach. Abdominal ultrasound could be used to locate the tear and laparoscopy could be used for diagnosis and to guide peritoneal lavage. Tears can be managed by medical treatment of the peritonitis or by surgical repair, although the latter is preferable and the cost difference is small. Retained placenta could increase the need for surgical treatment.

Large Colon Volvulus

Strangulating large colon volvulus can account for 11-27% of surgical cases of colic, with the highest prevalence in postpartum mares. Recurrence can be prevented by large colon resection or colopexy. Colopexies are usually performed in young to middle-aged broodmares (5 - 12 years) because they are at a high risk of developing recurrent large colon volvulus because they are at an early stage in their lives as broodmares. Usually the procedure is performed at first recurrence.

Cecal Rupture

A 0.1% incidence of cecal rupture has been reported for mares during parturition. These mares are apparently normal in the preparturient period. Delivery of the foal is usually accomplished with assistance and then the mare shows clinical signs of acute peritonitis, gram-negative sepsis and cardiovascular shock. Death is within hours or mares are euthanatized immediately.

Diaphragmatic Hernia
Diaphragmatic hernias are uncommon causes of colic in the postpartum period. Possibly the expanding uterus could force abdominal contents through an existing defect in the diaphragm or stretch and tear the diaphragm during a traumatic event, such as a fall.

Cesarean Section – To Perform or Not
In the author's view, delivery of a foal by any method in a mare with colic, but particularly by cesarean section, is an avoidable error that is extremely difficult to justify. This error is made in the hope that correction of the intestinal problem will be facilitated if the uterus is empty. All intestinal lesions can be corrected without performing a cesarean section, and this applies to enterolith impactions, colon displacements and volvulus, small intestinal strangulating lesions, and others.

Colic Medications

Control of pain is crucial in horses with colic (flunixin meglumine and/or xylazine) and early or preemptive administration of analgesics prevents centralization of pain that prolongs it and increases the intensity . Pharmacologic control of pain can be supplemented, as indicated, by other procedures, such as decompression of the stomach by nasogastric tube and colon/cecum by enterocentesis (on extreme occasions and then with full regard for possible complications). Handwalking is used to prevent rolling and associated injury to the horse and others. Owners will walk horses endlessly because this interrupts the signs of colic and gives them the false sense of security that it is of benefit, when it is really only masking signs of a persistent or worsening problem. <u>All forms of pain control should be interrupted so that progress can be monitored repeatedly and frequently.</u> Persistent pain under any circumstances indicates a need for referral. The goals of pain control are (order of importance varies with each case):

Flunixin Meglumine
1. Flunixin meglumine (Banamine) is a nonsteroidal anti-inflammatory drug (NSAID) that blocks the production of prostaglandins.
2. Benefits are pain relief, inhibition of endotoxin effects, and improved cardiovascular status.
3. The dose of flunixin meglumine is 1.1 mg/kg IV (SID or BID).
4. Concerns about masking signs of surgical colic are valid and emphasizes the need for close observation of a horse with colic.
5. Flunixin meglumine should only be given IV. <u>The IM route is not recommended because it can cause severe and fatal myositis in the injection site.</u>
6. Recent studies have examined the recovery of intestine that was subjected to ischemic injury to determine if NSAIDs with a more COX-2 selective profile (e.g. firocoxib) could more effectively support repair of mucosal barrier defects compared with flunixin meglumine. There was no clinical evidence or outcomes to suggest that FM does inhibit barrier recovery compared with firocoxib and provided comparable analgesia.

Alpha$_2$ Agonists and Sedatives Facts
1. Xylazine (0.2-1.1 mg/kg IV or IM) is sufficient for most colic cases and detomidine (5-20 micrograms/kg IV) might be required for severe pain.
2. Xylazine can be give repeatedly in low doses as needed.
3. Xylazine has a short duration of effect - allows almost continuous assessment of progress.
4. Also xylazine might relieve spasm, which could help with removal of the impaction.

Opioid Analgesics
1. Butorphanol (Torbugesic, 0.02 to 0.08 mg/kg IV) is usually used with xylazine.

2. At recommended doses, side effects include inhibition of motility.
3. The duration of effect is short and its effects on motility appear to be site and dose-dependant.
4. Side effects can be minimized by continuous infusion of 23.7 µg/kg/hr, after a loading dose of 17.8 µg/kg.
5. Morphine or meperidine should only be used only in extreme cases.

Mineral Oil

1. Mineral oil (half to 1 gallon to a 450-kg horse) is an effective fecal softener.
2. Its presence on the perineum, tail, and hind limbs, usually 12 to 24 hours after administration, indicates that the intestinal tract is partly or completely patent.
3. The concern that mineral oil can pass around some obstructions without softening them is erroneous. This nonsense is demonstrated with fecal balls immersed in water or mineral oil in fecal cups overnight. The water penetrates the feces, oil does not. Contrary to a popular misconception, it can permeate impactions in the live horse, and the feces in a fecal cup is a poor model. At surgery, oil can be found deep within the impacted mass, whereas water might be absorbed by the colon and not reach the impaction in the volume infused.
4. Mineral oil can be given to a horse that might go to surgery because current methods for emptying the colon are very effective and clean.
5. Mineral oil has been advocated as a cathartic in cases of cantharadin intoxication, but may be contraindicated because it can increase the absorption of cantharadin.
6. Careful attention must also always be paid to placement of the nasogastric tube prior to delivery, as deposition of mineral oil in the lungs can cause a fatal lipoid pneumonia.

Magnesium Sulfate

1. Magnesium sulfate is a saline laxative, assumed to increase fecal bulk and water content through an osmotic response to the poorly absorbed magnesium ion.
2. Magnesium sulfate at a dose of 1 mg/kg (1 lb to a 1000 lb horse) reflexly stimulates equine colonic function, possibly through the gastrocolonic reflex.
3. Can be given once or twice daily for 2-3 days with little risk of a toxic effect.
4. Repeated doses can cause weakness, collapse, and tachycardia from the absorbed magnesium ion, especially if it is administered with DSS.

Psyllium Hydrophilic Mucilloid

1. Psyllium hydrophilic mucilloid is a bulk laxative used to remove or prevent a sand impaction.
2. The dose is 1 g/kg or 500 g in 6 to 8 L of water through a nasogastric tube 2-3 times daily.
3. Difficult to administer because it has a tendency to gel.
4. When fed routinely (50-100g daily), fermentation of psyllium by intestinal bacteria produces short-chain fatty acids that might benefit healing of the colonic mucosa in horses with right dorsal colitis.

There is conflicting evidence as to efficacy of psyllium to remove a sand impaction. More recent work showed that horses given psyllium (0.5 kg q12h) in addition to mineral oil (2L q24h) had increased sand clearance relative to those administered mineral oil alone (51.0% vs 26.1% total sand removal) suggesting that psyllium may improve sand clearance. There is some concern that colonic flora will degrade psyllium after chronic exposure, thus decreasing any laxative properties. This has led to the common practice of only feeding psyllium for one week out of every month for sand prevention in endemic areas.

Psyllium pellets should be fed with great regard for guidelines for feeding. Exceeding recommended intakes lead to formation of pharmacobezoars and pyloric and duodenal impaction.

Intravenous Fluids
Intravenous fluid therapy is a lifesaving treatment that replaces essential water and electrolytes in horses with diarrhea, colic, shock, hemorrhage, dehydration, “tying up,” kidney failure, and a variety of other diseases. Intravenous fluids are expensive, require an indwelling intravenous catheter with the associated risk of thrombophlebitis, and may be impractical in many settings. Most available evidence indicates that IV fluids are unlikely to hydrate and soften an impaction, even in a hospital setting. Horses with severe colic should not receive IV fluids before being transported to a referral hospital for possible surgery. This only adds to the delay in referral and to overhydration and electrolyte abnormalities. Concerns about overhydration and its affects on intestinal function are real and need to be considered.

Enteral Fluids
Fluids by nasogastric tube are effective means of rehydrating horses with impaction, and may reflexly stimulate colonic secretion and/or motility. One to 1.5 gallons BID or TID is recommended if the horse's stomach has the capacity to hold these volumes. Fluids delivered by nasogastric tube can reach the cecum and large intestine within 1-2 hours in most normal horses. Also intermittent bolus delivery can increase the volume delivered to the colon as it will overwhelm the small intestine’s capacity for absorption. Nasogastric administration may also stimulate the gastrocolic reflex, thus increasing motility.

Enteral fluids are considerably less expensive and easier to prepare than IV fluids as they do not need to be sterile. Enteral fluid therapy is also slightly more forgiving than intravenous fluids. However, large volumes of plain water or hypotonic solutions may cause marked electrolyte abnormalities including hyponatremia, hypokalemia, and hypocalcemia, and a mild hemodilution. Most average size horses can tolerate 6-10L/h of intragastric fluids, although some show signs of discomfort when large volumes (>5L) of fluid are administered. Many horses treated with enteral fluids for an impaction will develop self-limiting diarrhea due to excretion of fluids as the impaction resolves. Cecal rupture has been reported, most likely when the cecum is impacted.

A balanced electrolyte solution containing 5.27g NaCl, 0.37g KCl, and 3.78g NaHCO3 per 1 liter of water produces a solution with 135 mmol Na/L, 5 mmol K/L, 95 mmol Cl/L and 45 mmol HOC_3^-/L. In normal horses, a balanced electrolyte solution and sodium sulfate resulted in the best hydration of RDC contents, while sodium sulfate, magnesium sulfate, and balanced electrolyte solution resulted in the most hydrated feces. Sodium sulfate caused hypocalcemia and hypernatremia, while plain water caused hyponatremia leaving the balanced electrolyte solution as the safest and most effective option.

Postcolic Feeding

Horses with colic are not fed to prevent aggravating the obstruction or adding content to an impaction. After surgery, feed is slowly introduced to stimulate motility and regain a favourable energy balance. However, prolonged feed deprivation creates problems for horses with metabolic syndrome or for minis, ponies and donkeys, often severe enough to be fatal. Hyperlipemia and hypo- or hyperglycemia can be fatal complications of even a mild colic in these horses. We see a growing number of horses with equine metabolic syndrome (EMS), a term officially adopted to describe any horse or pony with chronic insulin resistance. Affected horses have the following:
1. Insulin resistance
2. Obesity and/or regional adiposity
3. Prior or current laminitis (evidence of founder rings or rotation of P3 on radiographs) –can be insidious in onset and owners may not recognize subtle changes.
4. The horse is an “easy keeper.”

Any horse suspected of this disease or minis, ponies and donkeys with colic should be managed with some form of forced nutrition and monitoring to prevent severe metabolic complications.

The Abdominal Wall

After two to three months from surgery, it is not unusual to feel small weak spots in the body wall along the original suture line. These are well tolerated, even in athletes and broodmares. Large hernias that involve part or all of the incision can be repaired by suture closure or by inserting a plastic mesh. These are expensive treatments, although usually successful. Untreated hernias are rarely life-threatening, and many can be left unrepaired without any adverse effects, even during pregnancy. The decision to repair and the method chosen will vary from one case to another, and should be determined by consultation with an experienced surgeon. The most important issue for you as owner is to be aware that hernias can develop in months (2 to 6) after the surgery in a body wall that was apparently healing well to that point, and definitely are more likely after an infected incision. Approximately 6% of horses develop some form of hernia after colic surgery.

The CM or hernia belt is a conservative and often effective method for preventing a hernia or halting its progression. When combined with light exercise at 3 months after surgery, many such hernias will regress, possibly in response to increased muscle tone in the ventral abdomen. There is growing awareness that Core abdominal rehabilitation exercises can be safely performed by horses after colic surgery and may hasten convalescence and improve performance.