Gastrointestinal Obstructive Causes

TRICHOBEZOARS

Intraluminal obstruction of the intestinal tract of cattle, sheep, and goats is most commonly caused by a trichobezoar, phytobezoar, or enterolith. These foreign bodies form in the rumen or abomasum and may pass into the intestinal tract where they become lodged within the small intestine or spiral colon. Hair balls (trichobezoar) are caused by frequent ingestion of hair. This is seen most commonly in cattle infested with lice or mange, or during the spring when shedding of the winter hair coat occurs. Phytobezoars and enteroliths form around undigested materials (e.g., nylon fibers, cotton fabric).

Clinical signs

Animals affected with ruminal or abomasal bezoars may be observed to have decreased appetite, weight loss, decreased faecal production, lethargy, and apparent depression. Multiple bezoars present in the rumen or abomasum of calves, sheep, and goats may be found during transabdominal palpation or on abdominal radiographs. When an obstruction of the small intestine or spiral colon occurs, affected animals initially show clinical signs of abdominal pain (restlessness, kicking at the abdomen, lying down and getting up frequently, arching the back, stretching out of the legs while standing) and progress to recumbency and apparent depression. Progressive bloat or abdominal distention and lack of faecal production are noted.

Clinical pathology

Serum biochemistry analysis reveals hypokalemic, hypochloremic, and metabolic alkalosis, the severity of which depends on the duration and location of the lesion. These changes are most severe with proximal intestinal obstruction and become more severe with increasing duration. If ischemic necrosis of the intestinal wall has occurred, an inflammatory leukogram with increased numbers of immature neutrophils may be seen. As peritonitis develops and organic acids are released into the bloodstream, the serum biochemistry changes to a metabolic acidosis with relative hyperkalaemia. These changes are consistent with a poor prognosis. Perforation of an abomasal ulcer or rupture of the intestine and contamination of the abdomen with ingesta carries a poor to grave prognosis.

Diagnosis

In affected cattle, serum biochemistry changes are consistent with intestinal obstruction. Rumen chloride concentration may be elevated (rumen Cl O30 mEq/L). The cause of intraluminal obstruction is rarely palpable per rectum, but small intestinal distention may be palpable. Ultrasonographic examination of the abdomen may be useful in calves and small ruminants. Intraluminal intestinal obstruction should be suspected in cattle with recurrent rumen tympanites, which is transiently responsive to decompression and is associated with minimal faecal production.

Differential diagnoses include intussusception, vagus indigestion syndrome, intestinal lymphosarcoma, fat necrosis, intestinal entrapment around anomalous fibrovascular bands and volvulus of the jejunoileal flange.

Treatment

When obstruction of the duodenum, jejunum, or spiral colon is suspected, a right paralumbar fossa celiotomy and exploration of the abdomen should be performed. The foreign body is found by exteriorizing a segment of normal or distended intestine and tracing this segment oral, or aboral respectively, until the obstruction is found. This segment of intestine is exteriorized from the abdomen, isolated using moistened surgical towels, and an enterotomy performed. After removal of the foreign body, the enterotomy is closed with absorbable suture material (e.g., #2-0 olydioxanone,
polyglactin 910) using two lines of an inverting suture pattern. The enterotomy may be closed transversely to maximize the lumen of the affected segment of intestine and minimize the tension endured by the suture line during contraction of the intestinal wall. When the perceived economic value of the affected cattle is high; surgery may be performed with the patientunder general anaesthesia. This minimizes the risk of ingesta contamination of the abdomen during surgery. Intravenous fluid therapy is based on the clinical estimate of dehydration, severity of intestinal lesions identified at surgery, and severity of serum biochemistry changes. In general, cattle should receive 20 to 60 L of isotonic saline, intravenously, over 12 hours. I routinely add calcium (1 mL of 23% calcium gluconate per kg body weight) and dextrose (to create a 1.25% solution) to the intravenous fluids. Nonsteroidal anti-inflammatory drugs (flunixin meglumine, 1 mg/kg body weight, intravenously every 12 hours for 3 days) and antibiotics (for 3–5 days) also are administered.

Prognosis

The prognosis for return to productive use is based on the animal's body condition, severity of changes in serum biochemistry variables, presence of visceral perforation or peritonitis, and ability to perform surgical removal of the foreign body without contaminating the abdomen. Cattle that are less than 10% dehydrated, have mild to moderate hypochloremic (e.g., Cl O80 mEq/L), and ketabolic alkalosis (e.g., bicarbonate O32 mEq/L) have a fair to good prognosis for recovery. Cattle that are more than 10% dehydrated, have severe hypochloremia (e.g., Cl 80 mEq/L), and metabolic acidosis (e.g., bicarbonate 20 mEq/L), or have visceral perforation have a poor prognosis for survival. Immediate surgical intervention is required for alleviation of clinical signs caused by intraluminal foreign bodies.

Prevention

Intraluminal obstruction of the intestine occurs infrequently in cattle. The sporadic nature of the problem limits recommendations for prevention. Adequate dietary roughage should be made available to cattle at all times. Lice control strategies, particularly during the winter months, prevents pruritus-associated ingestion of hair.

INTUSSESCEPTION

Intussusception refers to the invagination of one segment of intestine into an adjacent segment of intestine. The invaginated portion of intestine is termed the ‘‘intussusceptum,’’ and the outer, or receiving, segment of intestine is termed the ‘‘intussuscipiens.’’ Intussusception occurs sporadically in cattle of all ages, breeds, and gender and may be seen at anytime during the year.

Clinical signs

Cattle affected with intussusception demonstrate clinical signs of abdominal pain (restlessness, kicking at the abdomen, lying down and getting up frequently, assuming abnormal posture) for up to 24 hours after the onset of disease. Cattle are frequently anorectic, lethargic, and reluctant to walk. After the initial signs of abdominal pain subside, affected cattle become progressively lethargic, recumbent, and show apparent depression. Abdominal distention becomes apparent after 24 to 48 hours duration. This is caused by gas and fluid distention of the forestomach and intestines, and sequestration of ingesta within the gastrointestinal tract results in progressive dehydration and electrolyte depletion. Heart rate increases proportionally to abdominal pain, intestinal necrosis, and dehydration. Fecal production may be normal for up to 12 hours after the occurrence of the intussusception, but minimal faecal production is noted after 24 hours duration. Passage of blood and mucous from the rectum is common at this time.

Clinical pathology

Hemoconcentration is usually present (increased packed cell volume and total protein), and an inflammatory leukogram may be seen if ischemic necrosis of the intussusceptum has occurred. Often, changes in the white blood cell count and differential are minimal and changes in peritoneal fluid constituents are not seen because the intussusceptum is isolated by the intussuscipiens. Hypochloremic, metabolic alkalosis is found with serum biochemistry analysis. Hyponatremia, hypokalemia, hypocalcemia, azotemia, and hyperglycemia also may be found. The magnitude of these changes is dependent on the location and duration of the lesion. Proximal jejunal intussusception causes rapid and severe dehydration, electrolyte sequestration, and metabolic alkalosis. Most lesions occur in the distal jejunum and may require more than 48 hours to develop these changes. Elevation of rumen chloride concentration (O30 mEq/L) may be found if fluid distention of the rumen is present.

Diagnosis

Diagnosis of intussusception is usually made during exploratory laparotomy. Occasionally, the intussusception can be felt during rectal palpation, but distention of multiple loops of small intestine is most commonly identified. In calves and small ruminants, percutaneous palpation and ultrasonographic examination of the abdomen may be used to identify intestinal distention and, possibly, the intussusception. It should be suspected in cattle with a history of abdominal pain and abdominal distention, scant feces consisting of blood and mucous, and palpable distention of the intestine. Differential diagnoses include primary indigestion, functional ileus, trichobezoar, foreign bodies, intestinal incarceration or strangulation, vagal syndrome, intestinal neoplasia, fat necrosis, and jejunoileal flange volvulus.

Treatment

Affected cattle must be stabilized before surgical intervention is performed. Fluid therapy should be aimed to replace fluid and electrolyte deficits. Surgical correction may proceed after the patient has been assessed as a suitable candidate. Right paralumbar fossa exploratory laparotomy is the surgical approach of choice for treatment of intussusception. Most of the small intestine of cattle has a short mesentery, preventing adequate exteriorization of the intussusception through a ventral midline incision.

Also, the attachments of the greater omentum limit exposure with this approach. The presence of the rumen in the left hemiabdomen prevents adequate exteriorization of the intussusception through a left paralumbar incision. Most often, diagnostic exploratory laparotomy is performed with the cow standing after regional anaesthesia. Tension on the mesentery of the small intestine results in pain and cattle may attempt to lie down during the procedure. Preoperative planning should include anticipation of this possibility. When intussusception is suspected and the animal is of high perceived economic value, right paralumbar fossa celiotomy may be performed with the patient under general anaesthesia and in left lateral recumbency. The intussusception may be more difficult to elevate through the incision in recumbent cattle because the fluidfilled bowel gravitates away from the surgical site, but isolation and resection of the intussusception can be done without risk of the animal lying down during the procedure and with minimal risk of contamination of the abdomen.

Surgical removal by resection and anastomosis is the treatment of choice for intussusception. The intussusception is exteriorized from the abdomen and isolated using a barrier drape and moistened towels. Manual reduction of the intussusception is not recommended because of the risk for rupture of the intestine during manipulation, probable ischemic necrosis of the intestine after surgery, possible reoccurrence of the intussusception, and prolonged ileus caused by motility disturbance and swelling in the affected segment of bowel. The margins for excision are selected in healthy-appearing intestine.

In general, the distal margin may be 10 cm aborad to the lesion, but the proximal margin should be a minimum of 30 cm orad to the lesion. The larger proximal segment is chosen because chronic distention, inflammation, microvascular thrombosis, relative ischemia, and noxious ingesta accumulated in this segment may cause severe and prolonged postoperative ileus. Cattle have a short mesentery; traction on it is painful and the animal may go down at this moment. This short mesentery precludes adequate exteriorization of some segment of the small bowel. Only the portion to be resected should be exteriorized to avoid excessive traction and contamination during the resection-anastomosis. Infiltration of lidocaine 2% into the mesentery where it is planned to be resected may decrease the pain of traction.

The mesenteric vessels (arteries and veins) are ligated using ‘‘mass ligation’’ with absorbable suture material (#3 chromic gut, #1 polyglactin 910) being sure not to compromise the blood supply to the intestine to be preserved. Mass ligation is required because cattle do not have an arcuate vascular anatomy as do horses and the fatty mesentery render vessels identification impossible. The sutures are placed in an overlapping pattern such that double ligation of the vessels is accomplished. This technique may be performed rapidly and efficiently. In my experience,

stapling instrumentation is highly unreliable for occlusion of mesenteric vessels because of the large amount of fat normally found in the intestinal mesentery of cattle.
After completion of mesentery ligation and transection, Doyen intestinal forceps are used to occlude the lumen of the normal and abnormal bowel. Then, the intussusception and associated bowel is resected and discarded. The proximal segment of bowel is carefully exteriorized to its maximum length and the Doyen forceps is removed. Ingesta within the intestine orad to the lesion is ‘‘milked’’ out through the enterectomy site being careful not to contaminate the incision or abdomen with ingesta. This procedure lessens the severity of postoperative ileus and shortens convalescence. The two segments of intestine are reunited by end-to-end or side-to-side anastomosis with an absorbable suture material (#2-0 polydioxanone or polyglactin 910) using a simple continuous suture pattern. The anastomosis is performed in three overlapping suture lines, each placed in one third of the circumference, or in four overlapping suture lines, each placed in one quarter of the circumference so that a ‘‘purse-string’’ effect is not created.
The initial suture line should be placed at the mesenteric attachment because this is the most likely site for leakage to occur. A second row of sutures is placed to prevent leakage using interrupted segments of inverting suture patterns (e.g., Cushing or Lembert). The affected intestine is thoroughly washed with sterile isotonic fluids, checked for the presence of leakage, and replaced into the abdomen. I prefer to place a solution of antibiotic (5 million units potassium penicillin G, or 1 g of sodium ceftiofur), heparin (20 units/kg body weight), and saline (1000 mL) into the abdomen before closing the abdominal wall in routine fashion.
Postoperative management should be directed to prevent dehydration, maintain optimal blood electrolyte concentration, control for infection and inflammation, and stimulate appetite. Intravenous fluids are beneficial during the first 24 hours after surgery. Withholding food after surgery should not be done. Administration of butorphenol tartrate (0.02–0.04 mg/kg intravenously) may help with pain-induced ileus by providing mild visceral analgesia without direct adverse effects on intestinal motility.

Prognosis

The prognosis for return to productivity after surgical correction of intussusception is variable and somewhat dependent on the duration of the lesion. Cattle presenting with severe dehydration (O12%), tachycardia (heart rate O120 bpm), severe decrease in serum chloride concentration (Cl 80 mEq/L), and severe abdominal distention are considered to have a poor prognosis for survival. In my experience, calves respond more favorably to surgery than adult cattle. If viscera rupture is present at the time of surgery, the prognosis is grave.

Prevention

Recommendations for prevention of intussusception are difficult because the cause is seldom identified and a seasonal predilection has not been demonstrated. Changes in dietary management should be made gradually, and good hygiene and control strategies should be practiced to minimize transmission of enteric diseases or internal parasites.

- **INTESTINAL VOLVULUS**

Volvulus refers to the rotation of viscera about its mesenteric attachment. Torsion refers to the rotation of viscera about its own (or long) axis. Although torsion of the abomasum and uterus are found in cattle, torsion of the small intestine is rare. Small intestinal volvulus may occur in different forms. The most severe form of intestinal volvulus originates from the root of the mesentery and involves the entirety of the small intestine and mesenteries. Volvulus of the root of the mesentery causes obstruction of venous outflow and arterial blood supply to the intestines. Ischemic necrosis of the intestine occurs rapidly, which causes metabolic acidosis, shock, and death. Volvulus of the jejunoileal flange refers to volvulus of the mid- to distal jejunum and proximal ileum where the mesentery is long. This long mesentery and associated bowel has been termed the ''flange'' and may rotate about its mesentery without involving the remaining small intestine. Often, arterial occlusion is not found with volvulus of the jejunoileal flange, possibly because extensive fat deposits within the mesentery may prevent compression of the muscular wall of the arteries until the volvulus becomes severe. Obstruction of outflow of venous blood may be equally detrimental because of mural edema, shunting of blood away from the mucosa, and progressive ischemia. Cattle of any breed, age, or gender may be affected by intestinal volvulus at any time during the year.

Clinical signs

Cattle having volvulus of the root of the mesentery may be found dead with severe abdominal distention. Early in the course of the disease, affected cattle demonstrate acute, severe abdominal pain (kicking at the abdomen, rolling, lying down and getting up frequently, grunting) and have marked elevation in heart rate (O120 bpm) and respiratory rate (O80 bpm). The rapid progression of the disease precludes development of significant dehydration, but cardiovascular shock is usually present. Cattle having volvulus of the jejunoileal flange may present similarly to cattle having volvulus at the root of the mesentery. Cattle may be dehydrated at the time of examination.

Clinical pathology

Because of the rapid onset and progress, cattle having intestinal volvulus may not demonstrate changes in serum biochemistry or hematology data. The changes expected with intestinal volvulus are consistent with intestinal obstruction, stress, and dehydration: azotemia, hypocalcemia, hyperglycemia,and a leukocytosis with a mild left shift. In the early stages of the disease, cattle develop alkalemia with normal serum potassium concentration. As cardiovascular compromise and intestinal ischemia proceed, cattle develop metabolic acidosis and hyperkalaemia. Cattle having the shift to acidosis and hyperkalaemia have a poor prognosis for survival.

Diagnosis

Diagnosis of intestinal volvulus is by exploratory laparotomy. Rectal palpation reveals multiple loops of distended intestine filling the caudal abdomen and excessive tension on the intestinal mesentery. Simultaneous auscultation and percussion of the abdomen yields multifocal pings of variable pitch and location. Findings of scant feces, abdominal pain, sudden onset of abdominal distention, and multiple loops of distended intestine on rectal palpation in cattle are highly suggestive of intestinal volvulus. Differential diagnoses include intussusception, cecal volvulus, abomasal volvulus, intraluminal obstruction, and severe indigestion.

Treatment

Immediate surgical correction is the treatment of choice. Intravenous fluids should be administered to treat cardiovascular shock, but preparation for surgery should not be delayed. The volvulus must be corrected before irreversible ischemic injury or thrombosis of the mesenteric arteries has occurred. A right paralumbar fossa laparotomy with the cow standing is the approach of choice. Restoration of normal anatomic position of the intestines is done more easily with the patient standing. Cattle that are believed to be at great risk of becoming recumbent during surgery should be placed under general anaesthesia, in left lateral recumbency, and the laparotomyperformed through the right paralumbar fossa. The presence of the volvulus and the direction of the twist are assessed by palpating the root of the mesentery and, in the case of jejunoileal flange volvulus, following this ventrally to the location of the twist. The intestinal mass is gently derotated being careful not to cause rupture of the viscera. This procedure may require exteriorization of various portions of the intestinal mass. After correction of the volvulus, the intestinal tract should be examined for evidence of nonviable bowel. If the intestine is compromised (arterial thrombosis, blackened serosa, friable wall of the affected segment, mural edema), intestinal resection and anastomosis are indicated (see the section on intussusception). Exploration of the abdomen should be done to rule out the presence of a second lesion (abomasal displacement, fecalith, intussusception, anomalous fibrovascular bands, peritonitis, and so forth).

TORSION OF THE MESENTERIC ROOT

This is a dramatic illness because so much of the bowel is involved in the twist. Only part of the duodenum and dorsal colon are spared. Affected animals experience profound pain. They may actually throw themselves on the ground, get up, and go down again. Bilateral abdominal distention becomes apparent, and cows are tachycardic and tachypneic. Tight bands can be palpated per rectum. Distended viscera can be palpated rectally or imaged by ultrasound.

Treatment

Prompt surgical intervention is essential. Perioperative fluids, antibiotics, and analgesics are indicated. This is a major insult, and affected adult cattle rapidly deteriorate and die. A liberal right paralumbar fossa celiotomy is made. Any gas in viscera is decompressed, and by following the mesenteric root, the twist is identified and corrected. Some surgeons do this procedure standing. The author's preference is lateral recumbency. Untwisting such a massive intestinal mass can predispose the intestine to absorb large amounts of endotoxin, and death may ensue. The rapid progression of signs makes the prognosis for adult cattle grave. A few calves have been saved in our hospital when astute owners recognized the early signs of abdominal discomfort.

MISCELLANEOUS CAUSES OF SMALL INTESTINAL OBSTRUCTION

Incarceration, Entrapment

Sporadic reports of the small intestine becoming entrapped in adhesions, embryonic remnants, or mesenteric rents have been made. Some specific examples include the following:

1. Persistent vitelloumbilical band that runs from the ileum to the umbilicus.
2. Persistent round ligament of the liver that runs from the liver to the umbilicus.
3. Urachal remnant traveling from the urinary bladder to the umbilicus.
4. Paraovarian bands run from the ovary or broad ligament to the omentum.

5. Remnants of the ductus deferens in steers.
The small intestine can either become wrapped around one of these bands or entrapped within a loop. The bowel becomes obstructed, and the band can compromise the blood supply at the site of the incarceration. Clinical signs are similar to those of cows with intussusception. It may be possible to palpate a taut band per rectum.
As with other small intestinal obstructions, a right paralumbar fossa celiotomy is performed. The abdomen is explored. The band is palpated and, if possible, exteriorized. If it cannot be visualized, the band may have to be transected blindly. The bowel that was entrapped should be examined to determine if an area of ischemia was created that might necessitate a resection and anastomosis. If it was a narrow band, inverting the affected segment is another surgical option. Fortunately, this is rarely necessary. The small bowel can become entrapped in a mesenteric rent, either spontaneously or secondary to intestinal surgery in which the mesentery was not closed properly. In some cases, the internal hernia has been corrected by enlarging the defect, replacing the bowel in normal position, and then closing the defect cows was saved.

DUODENAL OUTFLOW OBSTRUCTION

Sporadic cases of duodenal outflow obstruction caused by inflammation of the duodenum that results from ulcers, penetrating foreign bodies, intraluminal or extraluminal masses, or adhesions in the vicinity of the sigmoid flexure have been reported. Common clinical signs include anorexia, decreased milk and faecal production, tachycardia, variable degrees of depression, and decreased ruminal contractions. Other signs present in some cattle include abdominal distention, colic, scant feces, and ruminal distention. In contrast to the occasional right ventral abdominal distention found with right-sided abomasal volvulus, cows with duodenal outflow obstructions tend to have bilateral ventral abdominal distention. Tympanic pings on the right side are also common findings in a position consistent with or dorsal to right abomasal displacement/volvulus.
A definitive diagnosis requires exploration from the right side, preferably a standing right flank exploratory. The characteristic sign of this condition is distention of the cranial portion of the duodenum with a flaccid descending duodenum. The abomasum may also be dilated and dorsally displaced. The initial cases of spontaneous duodenal obstruction were actually diagnosed as right abomasal displacement and treated by omentopexy without success. Careful palpation of the area of the sigmoid flexure may reveal a specific lesion that can account for the outflow obstruction. However, the normal ligamentous thickening in this area supports the fragile pancreatic and biliary ducts that should not be misinterpreted as an adhesion.

Treatment/Prognosis/Complications
Treatment involves removal of any identified obstructing lesions (adhesions, masses) or, if the lesion cannot be removed or identified, a duodenal bypass around the site of obstruction needs to be done. The cranial part of the duodenum is anastamosed to the descending duodenum usually in a sideside manner. Supportive fluid and/or antibiotic therapy are usually indicated based on the cause of obstruction and the status of the patient. Although this syndrome appears to be uncommon and bears many similarities to an RDA, definitive treatment for a functional or mechanical duodenal obstruction should be considered if, on initial exploration for an RDA, abomasal dilation/ displacement without volvulus and proximal duodenal distention to but not beyond the

sigmoid flexure is identified. Reexploration with definitive treatment is also a legitimate consideration if a cow with the above signs has been treated by omentopexy, and fluid and electrolyte disturbances have progressed during the first 2 days after surgery.

JEJUNAL HEMORRHAGE SYNDROME

Descriptions of this disease vary from acute death with no premonitory signs to animals that show visible signs of colic shortly before death. At necropsy, the major finding consistent within these animals has been severe hemorrhage of the jejunum. Most often, this is seen as an intraluminal blood clot, but some cases have been reported with subserosal hemorrhage. The only reliable finding seems to be the presence of *Clostridium perfringens* type A at the site of the jejunal lesion. It has been proposed that *C. perfringens* type A is the causative organism of this disease; however, this is quite controversial. If the animal lives long enough for observation, clinical signs include vocalization, diaphoresis, bruxism, enophthalmia, tachycardia, pale mucous membranes, and small bowel distention. Eventually, shock, recumbency, and death ensue. Occasionally, an animal is seen early enough with a localized lesion and has had a resection and anastomosis performed. In most instances, medical therapy with a blood transfusion, fluid therapy, and antimicrobials are essential. This can present as a herd problem.

FAT NECROSIS

It is rare—but possible—for fat necrosis or lipomatosis to encroach on the intestinal lumen, especially in older overconditioned animals. Affected cattle have a very insidious onset of disease with decreased amounts of loose manure, abdominal distention, and mild colic. It may be possible to palpate hard intraabdominal masses rectally or image them with ultrasound. In valuable animals, an exploratory celiotomy or ultrasound-guided biopsy may be indicated. The prognosis is grave, although resecting or bypassing the affected bowel may be possible in some instances.

NEOPLASIA

Another cause of extraluminal intestinal obstruction is neoplasia. The most common tumors found in cattle include adenocarcinoma and lymphosarcoma. In rare instances, it may be able to resect or bypass a localized neoplasm. Lymphosarcoma has a predilection for the pylorus, but can occur at other locations. Signs are vague as with fat necrosis. The prognosis is grave. Surgical resection in most cases is impractical.

SPONTANEOUS RUPTURE OF THE SMALL INTESTINE

Dr. John King (Professor Emeritus of Pathology at Cornell University) has observed spontaneous rupture of jejunal segments at post-mortem, which he postulated might be secondary to entrapment between the uterus and body wall during parturition.