Management of the Colicky Cow

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Abdominal pain in cattle can be subtle despite serious disease. Often the only presenting complaint we are provided is a drop in milk production, or the animal has simply been noted to be "ADR" (ain't doin' right). The source of pain can originate from visceral stretch receptors within the mesentery, organ capsules, or ligaments; from muscular spasms or inflammation and ischemia. Pain can also arise from parietal sources including the parietal peritoneum, abdominal muscles, or rib cage. Additionally, extra-abdominal conditions can mimic intraabdominal pain. Our goal as practitioners is to localize the source of the pain, and initiate a therapeutic plan based on the problem, prognosis and intended use of the animal.

The first steps in managing an acute abdomen is the same as any other case; obtain a history and perform a physical exam. Depending on how stable the animals is, these steps may take place simultaneously. The signalment is an important piece of the history. Knowing the age and stage of production of the animal can provide useful clues to common conditions that are known to occur during specified time points. Management and feeding are also important pieces of the puzzle as some management or feeding practices are known to be associated with certain conditions. Additionally, specific history on a given farm can provide clues to farm specific repeating problems. The specific health history of the patient including recent clinical signs and medications administered prior to veterinary exam can also raise your level of awareness to specific conditions. The time course of the clinical signs is also helpful, as a rapid acute onset suggests different disease processes than a longer history of gradual decline. **Table 1** below summarize some examples of causes of colic that often come with specific signalment or historical findings.

Table 1: Examples of some diseases that may have specific signalment or historical findings

Disease	Signalment	History
Uterine torsion	Late gestation	Acute onset
Urolithiasis	Steer, (bull)	High grain ration
Torsion, intussusception	Not specific	Acute onset, rapid progression/ clinical decline
Mesenteric fat necrosis	Old cattle	Fescue feeding, gradual progression
Hemorrhagic Bowel Syndrome	Brown swiss cows, high producing dairy cows	Acute onset of disease

A thorough physical exam can be your most important diagnostic tool. Carrying out the complete physical exam in a systematic order will help the examiner become more efficient and confident during the physical examination. The author prefers to progress through the exam in the following order: distance observations, rear of the animal (excluding rectal exam), left side (abdomen, thorax, neck, ventrum, lymph nodes), right side (abdomen, thorax, neck, ventrum

lymph nodes), mammary, rectal exam, head. Specific areas to which to pay particular attention during the exam of a colicky cow are discussed as follows. During the visual assessment pay particular attention to the abdominal contour from both sides and the rear. **Figure 1** illustrates the changes in abdominal contour indicating different disease processes occurring within the abdomen. Also during your visual exam, note the animal's gait, posture, attitude, and respiratory rate and effort. Animals with abdominal pain may show a hunched posture and may have elbows abducted; this posture could also be due to thoracic pain, or sore feet. Abnormalities noted on the visual exam can be further investigated during the close-up exam. Evaluation of the vital parameters (temperature, pulse, respiration) and assessment of perfusion and volemic status are important as many intraabdominal conditions may be associated with hypovolemic or septic shock. Evaluation of the abdomen is obviously of paramount importance when investigating cases of colic. Both sides of the abdomen are assessed for pings using simultaneous auscultation and percussion. When a ping is detected, the area surrounding the ping is more closely evaluated to determine the borders of the ping and thus the most likely anatomic causes. The site is further examined with ballottement and succussion to assess for a splash which may help confirm findings after locating a ping, or reveal tense abdominal muscles due to parietal abdominal pain. A useful review of ping locations relative to causes of colic is provided in Chapter 5 of the text "Rebuhn's Diseases of Dairy Cattle" second edition. The abdomen can be further evaluated for pain using a withers pinch test, or xyphoid compression. Upon pinching the withers, a normal animal should ventro-flex to avoid the noxious stimulus of the pinch. A failure to ventroflex, or grunt (may require stethoscope over larynx to appreciate) indicates cranial abdominal pain or thoracic pain is likely. Compression of the xyphoid using a knee or a bar may also elicit a grunt if pain is present. Important differentials for cranial abdominal pain include hardware disease and abomasal ulcers. Rectal palpation should be completed to further aid the investigation into abdominal pain. **Table 2** summarizes some examples of common rectal exam findings with associated causes of colic. Evaluation of the respiratory tract and cardiovascular system can help rule in or out thoracic disease mimicking abdominal pain as well as assess degree of systemic compromise. Examination of the musculoskeletal system, especially the distal extremities can help rule in or out musculoskeletal problems such as painful foot lesions that may be mimicking colic. **Table 3** summarizes the localization of different causes of colic.

Figure 1: Abdominal contour and associated intra-abdominal conditions. *Image courtesy of Dr. Andrew Niehaus.*

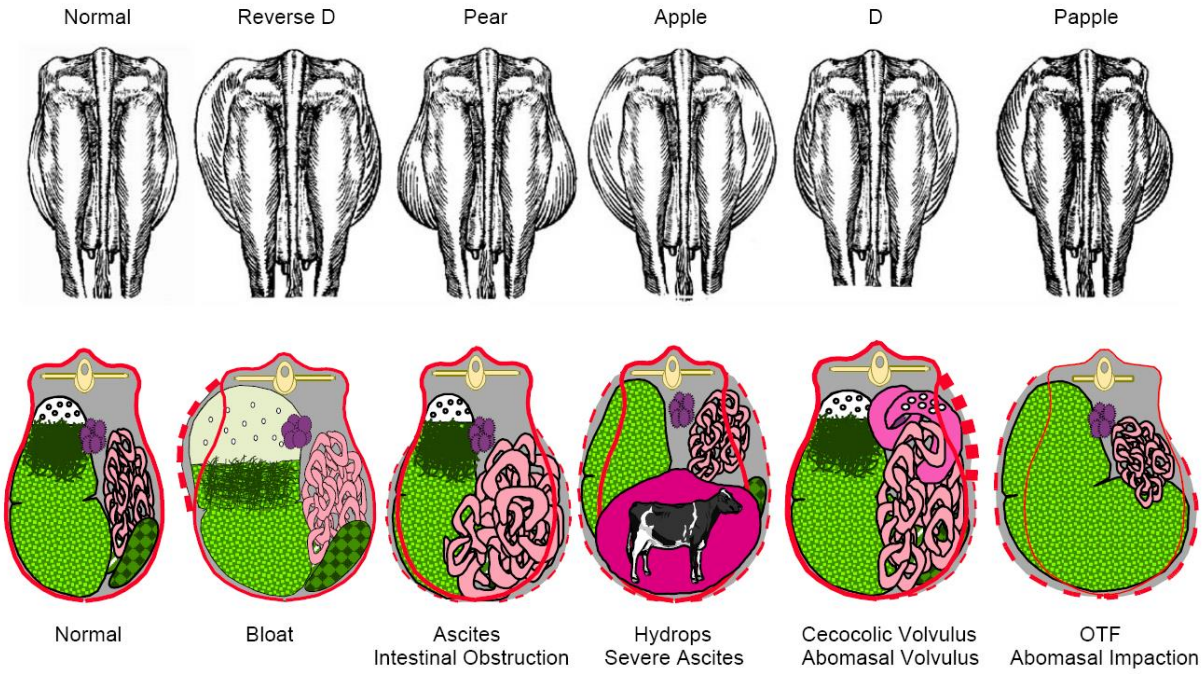

Table 2: Examples of causes of colic with suggestive rectal exam findings

Condition	Rectal Exam Findings
Cecal dilation	Gas filled blind ended viscous; apex mobile
Intussusception or Hemorrhagic Bowel Syndrome	Dilated loops with a firm mass
Peritonitis	Poorly mobile rectum, often tight rectum, adhesions.
Urolithiasis	Pulsing pelvic urethra, large urinary bladder
Pyelonephritis	Enlarged kidney and/or ureter. Decreased feeling of renal lobulation
Obstruction or Ileus	Lack of manure (*manure may still be present for first days of obstruction*)
Mesenteric fat necrosis	Firm mesenteric mass(es) +/- dilated loops of bowel.

Table 3: Localization of different causes of colic. *Information contained in Table 4 is summarized from the text "Large Animal Internal Medicine" 5th ed, by Smith, page 801.*

Colic			
Abdominal			**Extra abdominal**
Visceral		***Parietal***	
Intestinal	***Extra-intestinal***		
Torsion of the mesenteric root	Urolithiasis	Peritonitis	Pleuropneumonia
Cecal dilation/ volvulus	Pyelonephritis	Traumatic reticuloperitonitis/ pericarditis	Diaphragmatic hernia
Intussusception	Ruptured bladder	Abomasal ulcer	Laminitis
Abomasal volvulus	Urinary tract infection		Myopathy
Intestinal foreign body or obstruction	Uterine torsion		Spinal lesions
Intestinal incarceration/ adhesions	Liver disease		
Atresia coli (calves)	Chlolelithiasis		
Abomasal bloat (calves)	Fat necrosis		
HBS	Hernia		
Enteritis			
Ileus			

In a field setting, ancillary diagnostic test may be limited and commonly include: passing an orogastric tube +/- gross assessment and pH of ruminal contents, fecal gross exam and sedimentation in a rectal sleeve to look for sand, ketone strips or electronic readers, rectal ultrasound (*can be used outside the rectum to scan reticulum, or under the flank to look for dilated loops of bowel or locate fluid pockets for sampling, or scan the lungs chest to aid in ruling out thoracic disease, for example),* abdominocentesis and gross examination. Some practitioners choose to carry more portable diagnostic equipment such as electrolyte and lactate analyzers and small centrifuges. Examples of additional ancillary diagnostics that can be quite useful in cases of bovine colic that can usually be carried out at in-house facilities include: PCV/TP, blood gas and electrolyte analysis, blood or peritoneal fluid lactate, complete CBC/Chemistry panels, fibrinogen, urinalysis, microscopic and chemical analysis of abdominocentesis samples, and diagnostic imaging such as abdominal ultrasound and radiographs (*the radiograph machines necessary to image the adult bovine abdomen are typically only available at large animal referral facilities).* For the field practitioner, some cases necessitate an initial work up, followed by medical management while samples are submitted through local laboratories, before a final treatment plan is established.

A decision must be rapidly reached as to whether or not the condition requires surgery. Many conditions necessitate surgical correction, however during the initial colic investigation the

exact cause of the abdominal pain may not be known. For cases where the exact cause has not yet been elucidated, the following findings suggest a surgical condition is likely, and laparotomy should be considered: severe active signs of colic, rapid deterioration of vital parameters, pings consistent with torsion or volvulus (cecal, abomasal, intestinal, mesenteric root) or other distended bowel on rectal exam, peritoneal fluid consistent with devitalized bowel, or lack of feces.[1] **Table 4** provides a list of conditions that necessitate surgical vs medical or combination management.

Table 4: Medical vs surgical management in cases of bovine colic. *Information summarized from the text, "Large Animal Internal Medicine" 5th ed, by Smith, page 803.*

Acute Abdomen			
Surgical Emergency	**Medical Treatment Suitable before surgery**	**Surgical Treatment May or May Not be necessary after Medical Management**	**Medical treatment (surgery unnecessary)**
Abomasal volvulus	Intestinal foreign body	Traumatic reticulitis	Paralytic ileus
Abomasal bloat (calves)	Intussusception	Cecal dilation	Enteritis/ enterotoxemia
Torsion of the mesenteric root	Atresia coli (calves)	Abomasal ulcer	Pyelonephritis
Intestinal volvulus or incarceration	Hernia	Hemorrhagic bowel syndrome	Urinary tract infection
Cecal volvulus/ torsion	Urolithiasis	Peritonitis	Liver disease
	Ruptured bladder	Fat necrosis	Cholelithiasis
	Uterine torsion	Reticulopericarditis	Pleuropnemonia

The thorough physical exam often provides sufficient information to make an initial problem list. In the case of an acute abdomen, initial therapy is often started based on the current problem list, and further diagnostics may be carried out thereafter.

In unclear cases that do not appear to necessitate immediate surgical intervention, general medical management can be attempted and the case re-evaluated. Such management typically involves therapy directed at known problems, but not necessarily a known underlying cause. Common medical interventions include fluid therapy, pain management, antimicrobial therapy if translocation of GI bacteria is suspected, and possibly laxatives or motility modifiers. These treatments are discussed further below.

Fluid therapy with crystalloid fluids is often indicated to hydrate the GI tract, replace fluid losses and improve circulation. In a field setting, prolonged or high volume IV fluid administration is not always feasible. Volume deficits are often treated with hypertonic saline (0.9% NaCl) followed by oral fluid administration. The typical dose for hypertonic saline is

approximately 4mL/kg administered over approximately 10 minutes. A 500kg cow would thus be dosed with 2L hypertonic saline. Drinking water should be made immediately available after administration of hypertonic saline. When the animal does not drink, oral fluids (approx. 10gal per large adult bovine if rumen fill permits) should be administered via orogastric intubation or crystalloids can be administered IV at a rate of up to 40-80mL per hour (although of approximately 20mL/kg/hr is likely the maximum achievable rate through an IV catheter). Estimation of fluid deficits in adult cattle are complicated by changes in weight and rumen fill, and most research into correlation of clinical signs of dehydration with volume deficits has been done in neonatal calves. A very rough estimate of fluid deficit in cattle is often estimated in liters by applying the estimated percent dehydration to the animal weight in kg. For example, a 500kg cow that appears 10% dehydrated would have an estimated fluid deficit of 50L. If fluid therapy is to be ongoing, daily maintenance and ongoing losses should also be considered in the daily fluid therapy plan. It is likely more important to provide initial fluid therapy based on a rough estimate of requirements followed by reassessing clinical signs and provision of changes in fluid therapy relative to these clinical signs than it is to attempt to precisely calculate fluid deficits.

Sodium replete fluids provide volume resuscitation. Additional electrolytes are often needed during fluid therapy. When possible, electrolyte therapy should be based on blood values. Such results are not always immediately available to the field practitioner. Adult cattle with GI disease commonly have a hypochloremic, hypokalemic metabolic alkalosis. However, when disease progresses and perfusion is compromised, cattle may become acidotic from lactate production. Severe hypochloremia may result from an abomasal outflow obstruction (functional or mechanical); hypochloremia (<79mEq/L), regardless of the cause, was associated with poor short term outcome in one study.[2] Clinical signs, signalment and treatment history may provide additional clues about potential electrolyte abnormalities. Recent treatment with dextrose or steroids with mineralocorticoid action (ex: isoflupredone), or anorexia all may result in hypokalemia. When large volumes of potassium are deemed necessary, the oral route is likely be better suited for administration, especially in a field setting. Ideal oral dosages of potassium are note well described for adult cattle; some clinicians use approximately 200-250g per adult cow. Intravenous potassium administration rates should be kept below 0.5mEq/kg/hour to avoid potentially fatal cardiac arrhythmias. Lactating animals, especially those in early lactation, may be hypocalcemic. Calcium is important for GI motility; even without other signs of milk fever hypocalcemia can contribute to poor GI motility because smooth muscle contraction depends on calcium. Calcium can be administered slowly in IV solutions, subcutaneously if perfusion is deemed to be adequate, or orally for slower release. For these reasons, initial electrolyte therapy for cases of bovine colic due to GI disease, should include Na, Cl, K and Ca. More details about electrolyte administration in cattle are summarized in the 2014 Vet Clinics of North America review, “Fluid and Electrolyte Therapy”.

Pain management is also an important part of empiric treatment of bovine colic. Pain itself can decrease GI motility; GI pain increases sympathetic tone which inhibit GI motility. Inflammation also decreases GI motility (peritonitis or GI inflammation). Inflammatory mediators released systemically impairs cardiovascular function and thus also contribute to decreased GI motility. The use of NSAIDs is thus very reasonable choice for the acute bovine

abdomen. There is some evidence to support the use of flunixin for treatment of visceral pain in cattle.[3] The use of alpha-2 agonist sedatives such as xylazine or detomidine may also provide short term pain management in cases of bovine colic. These drugs should be used with caution in the colicky bovine because animals may go down, which is potentially very problematic during standing surgery. Detomidine is anecdotally reported to result in standing sedation with less risk of recumbency than xylazine. The hemodynamic consequences of either drug should be considered, particularly in patients with signs of hypovolemic or endotoxic shock. Additionally, the use of alpha-2 agonists may mask surgical pain in cattle, and slow GI motility.[1] Opioid such as morphine or butorphanol use can be considered for cases that require additional pain management or for those where NSAID use may be contraindicated. Although these drugs are used clinically for the treatment of abdominal pain in cattle, there is little data describing their use for this purpose. Remember that of the drugs listed in this section, only flunixin is approved for use in cattle, so AMDUCA guidelines must be followed during extra label drug use and appropriate steps taken to avoid drug residues.

If bacterial translocation for the GI tract is suspected, such as in cases of mechanical or functional obstruction, inflammation, or other damage to the wall of the GI tract, treatment with antibiotics is warranted. Ideally, a culture and sensitivity should be obtained when a septic site is accessible for sample (ex: peritoneal fluid or blood cultures). Until such results are available, broad spectrum antibiotics are reasonable and ELDU rules should be followed as set by AMDUCA with appropriate steps taken to avoid a drug residues.

Laxatives, also rumen alkalinizers, such as magnesium hydroxide can be used in GI cases that require forestomach or abomasal alkalinization. The routine use of these products for all cases of bovine colic is discouraged because the use of these products is associated with rumen alkalosis, decreased potassium absorption, decreased ruminal microbial activity and possible sedation from hypermagnesemia.[4,5]

When cases of colic are associated with ileus, motility modifiers may be pursued. Treatment of the underlying cause, and all electrolyte abnormalities, as well as providing adequate pain management will help eliminate these factors as contributors to ileus. Reviews of specific modifiers of motility in cattle are available.[6,7] It should be noted that no prokinetic is reported to directly increase rumen motility.[1] Transfaunation of the rumen with rumen juice may help repopulate rumen microflora and hasten the return of normal rumen function when prolonged anorexia or indigestion has decreased normal rumen function.

The treatment plan, whether medical or surgical, is not always straight forward and specific implications of our intervention to production need to be considered. The time-frame associated with surgical healing and drug withdrawal must be considered for an animal's intended use. For example, large volumes of lidocaine may be necessary for a laparotomy on an adult bovine and large volumes (up to 100mL) of lidocaine given as local infiltration are associated with a 4d meat, and 72hr milk withdrawal interval recommendation according to FARAD. Typically, flunixin is administered IV at the time of surgery, and this is associated with a label 4d meat and 36hr milk withdrawal time (although a longer withdrawal recommendation may be prudent[8]). Additionally, sutures from a laparotomy site can typically be removed between 14-21 days post

operatively; prior to suture removal the animal may not be acceptable to send to slaughter. The prognosis for return to intended function is also an important modifier of our treatment plan in cattle. Lactating cattle may drop significantly in milk production due to a variety of abdominal conditions; even if the condition is corrected, the lag time or failure to return to high milk production may cause enough economic disadvantage that the producer elects not to pursue surgical or medical managements associated with withdrawal times and rather chooses to cull the animal immediately. The nature of the abdominal condition may also influence culling decisions. Septic peritonitis, or obvious neoplasia will likely cause a carcass to be condemned, and the producer will not likely profit from slaughter of such an animal. These cases typically warrant humane euthanasia although short term therapy may be elected for select cases, such as animals late in gestation where the goal is to keep the animal comfortable long enough to obtain a live calf or other genetic material. If the animal's function is sentimental, more involved medical and surgical management may be elected to keep the animal alive and comfortable despite potential impaired fertility, milk production or carcass quality.

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