MEDICAL WORKUP OF A COLIC

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Introduction

Clinicians are frequently called to examine a horse with colic in the field where supplies and equipment can be limited, or in a hospital based facility. When referral to a surgical center is not an option, treatment by the primary veterinarian becomes the only therapeutic option. Fortunately, many cases can be medically managed successfully.

Examination

Facility Evaluation

Facilities vary widely on farms, and difficulties with patient restraint, lack of water or electricity, and occasionally access to the patient are some of the many challenges an ambulatory veterinarian is presented with when asked to examine a horse with colic. Upon arrival at a farm, the veterinarian should begin to look critically at the facilities and determine what is available to safely examine the horse, administer intravenous fluids, and perform a rectal exam. Is there sufficient shelter? Is running water available? Is there enough electricity to power an ultrasound? These are all questions that must be considered in developing a plan for evaluating and treating the horse with colic.

Patient Evaluation

The veterinarian's first impression of the patient should enable categorization of the horse into one of three categories: 1.) mildly painful, 2.) moderately painful, and 3.) severely painful. A mildly painful horse can be treated successfully primarily and should have a complete and detailed physical exam. A moderately painful horse should receive a complete exam, and the option of referral should be discussed. Although the horse may be stable initially, if referral is an option the horse should be shipped to a facility for further management prior to decompensation. A severely painful horse should receive an abbreviated physical exam that focuses on resuscitative and analgesic therapies. The horse should be stabilized for transport to a surgical facility.

Every thorough physical examination should begin with a detailed history. Has there been any recent diet change or new shipment of hay? Has there been a change in exercise level or access to pasture? Changes in diet and exercise are known to increase the risk for colic in horses. Questions about the medication history will occasionally turn up information about supplements the horse is receiving that may be causing a problem or may help identify an ongoing problem. Asking open-ended questions such as "Can you tell me what problems you are having?" or "What do you think is the problem?" frequently provides more useful information than direct questions.

Early in the examination of any painful horse, referral should be discussed. If it becomes necessary, the client should be prepared with regard to where the horse should be transported and what the expected costs and experience of the referral will be. In many instances, transportation has to be arranged for the horse, and clients should be counseled to start preparing transportation in the event that referral is warranted. Clients should be advised of the expected costs early in the diagnostic workup, and the insurance status of the horse should be discussed.

When a patient is stable enough for thorough examination, the clinician's initial impression is formed by the horse's general appearance. Is there evidence of discomfort, such as nostril flare or high respiratory rate? Is there evidence of self trauma around the eyes that is indicative of prior pain and rolling? Is the horse covered in mud or bedding? Is the horse trembling or sweating?

Any good examination follows a system. The author's system begins with evaluation of the mucous membranes. Mucous membranes are described in many different colors, and the term toxic line is often mentioned. The author prefers a simpler system. Injected mucous membranes are red and have prominent vasculature. The red color is a result of hyperperfusion of the vasculature bed secondary to increased cardiac output in the early stages of the systemic inflammatory response syndrome (SIRS). As disease progresses, the mucous membranes become pale secondary to vasoconstriction as the body attempts to maintain perfusion in response to falling cardiac output. Finally, the vessels vasodilate, leading to the cyanotic color seen with serious hypotension and low cardiac output; this change is consistent with the later stages of SIRS. The color of the mucous membranes can help the veterinarian understand the volume status of the patient and whether there is a need for intravenous fluids. Both pale and cyanotic membranes indicate the need for intravenous resuscitative fluids. Icteric membranes are frequently encountered if the horse has been anorexic or has hepatic disease or hemolysis. Like the oral mucous membranes, the sclera should be examined for evidence of inflammation or icterus.

The capillary refill time (CRT) is related to perfusion of the oral mucosal capillary bed. A prolonged CRT is an indication of the need for oral or IV fluids. Prolonged CRT with poor mucous membrane color warrants aggressive resuscitative fluid therapy. The feeling of the mucous membranes is also useful, as changes in the tactile quality of the membranes is related to interstitial fluid hydration. Tacky mucous membranes indicate interstitial fluid dehydration and the need for oral or IV fluids.

While examining the face, the veterinarian should look for nasal discharge and assess the horse's breath odor, as many "colic" cases turn out to be horses with other types of illness. Ignoring signs of respiratory disease may cause the examiner to miss the entire problem that is causing the signs of colic.

The elasticity of the skin is affected by interstitial fluid volume, and prolonged skin tenting indicates dehydration. As horses age, the skin loses elasticity and the skin tent may be prolonged to some extent, even with normal hydration. Additionally, some hereditary dermal diseases can also affect skin tenting.

One indicator of volume status is jugular filling time. Occluding the vein should lead to a visibly distended jugular vein in approximately 2 seconds. Prolonged jugular fill time is an indication of hypovolemia and indicates the need for IV fluids. Similarly, heart rate is impacted by volume status. Cardiac output is the product of heart rate and stroke volume: CO = HR X SV. Reduced stroke volume necessitates an increase in heart rate to maintain cardiac output. Heart rate will also increase secondary to stress, pain, and systemic inflammation.

Auscultation of the heart and lungs should be done deliberately and slowly. The rhythm, character, and rate of the heart beat should be evaluated. Lung and tracheal auscultation in all fields should be evaluated for fluid, crackles, wheezes, or pleural rubs. The lung fields can be percussed for evidence of consolidation or pleural effusion. Horses with cardiac and pulmonary disease often are presented for evaluation of colic.

Auscultation of the abdomen should not be rushed. An appropriate length of time should be dedicated to listening for borborygmus. Identification of different sound quality can help identify horses that are painful from ileus versus those that have intestinal cramping from hypermotile activity. Percussion of the abdomen may identify a "ping," indicating that there is a gas-fluid interface in a viscus, a finding consistent with colonic gas distension and large-intestinal ileus.

Obtaining the rectal temperature is important because many inflammatory conditions cause fever. Rectal temperature is not always equal to core body temperature. Low rectal temperatures are seen with hypovolemia, which leads to poor perfusion and can also be the result of a pneumorectum. External palpation of the abdomen may identify ventral edema, which develops when fluid flowing into the interstitial space exceeds that draining via the lymphatics. Pleural effusion, low oncotic pressures, or local inflammation are common causes of ventral and pectoral edema.

Diagnostic Tests

Gastric decompression is both a diagnostic and therapeutic procedure. Volume of reflux fluid, color, odor, consistency and presence of feed material are worth noting. Reflux occurs when there is obstruction of the gastric outflow tract or small intestine. If the intensity of pain does not improve with appropriate decompression of the stomach, a strangulating lesion should be considered. Not all small intestinal obstructions manifest with reflux. Many distal small intestinal obstructions (eg, ileal impactions, distal strangulations) become painful before enough fluid has accumulated in the small intestine to back up into the stomach. Care should be taken in administering anything orally until a small intestinal obstruction has been excluded.

Rectal palpation provides much information about the origin of abdominal pain. However, rectal examination should not be attempted if there is any risk to the patient, handler, or clinician. Adequate restraint of the horse for rectal palpation can be problematic at farms. If a horse is to be referred, there is likely little to be gained from rectal examination on the farm; palpation is most valuable in determining whether referral is needed. Sedation, epidural anesthesia, and administration of anticholinergic agents such as n-butylscopolamine can provide some assistance in relaxing the horse and allowing for adequate rectal examination. The rectal examination should follow a standard pattern and the same structures should be identified every time.

Abdominocentesis can be a very useful adjunct procedure when help is needed to make decision on treatment, referral for additional diagnostic evaluation, or referral for surgery. Although the initial fluid analysis may not make that decision clear, having a baseline reference for cell counts, protein concentration, and lactate concentration can be critical for decision making as the case progresses. The most dependent site of the ventral abdomen, just to the right of midline, is the best site for centesis in most cases. Fluid can frequently be seen on abdominal ultrasound, but failure to detect free peritoneal fluid on ultrasound is not correlated to failure to collect fluid upon peritoneal puncture. The value of ultrasound imaging with regard to abdominocentesis lies in its ability to determine the thickness of the body wall and intra-abdominal fat layer prior to selection of needle length or teat cannula length. In most horses, an 18-gauge X 1.5-inch needle is sufficient to penetrate the peritoneum and collect

fluid. Most horses tolerate this procedure with application of a lip twitch, but the clinician should be very cognizant of where they are standing. In some very large or obese horses, use of a spinal needle or teat cannula may be necessary to collect a sample. Occasionally, injection of 10 mL of air into the needle will assist with needle placement. If the needle tip lies in the retroperitoneal fat layer, air will be heard escaping back out of the needle. If the needle has penetrated through the peritoneum, the air will travel dorsally, occasionally dislodging omentum or serosa that may be obstructing the needle. Fluid should be collected into appropriate tubes for cell counts, total protein concentration, AST activity, lactate concentration, and culture. It is not possible to determine cell counts on fluid in the field, but significant gross abnormalities may be seen that indicate the need for referral, including abnormal color or abnormal volume. Total protein and lactate concentration can be determined with point-of-care monitors in the field. Lactate values > 9.4 mmol/L carry a guarded prognosis. High values for total protein or lactate concentration indicate the need for further diagnostic testing and referral.

Point-of-care monitors have improved veterinarians' ability to run more detailed serum profiles in the field. Handheld monitors run cartridges that assay for creatinine, BUN, glucose, Na, K, Cl, calcium, and lactate, among others. Access to this equipment is becoming more common. However, detailed hematology is not routinely run in the field. Results of many prognostic studies indicate that packed cell volume is an important factor. While polycythemia is not likely the problem, a high PCV value can indicate a cardiovascular problem and the need for referral for more intense therapy. Most practitioners do not carry a centrifuge in their practice vehicle, but simply pulling up whole blood into a 10-mL syringe and letting it settle vertically can give the practitioner a reasonable estimate of PCV. Each 1-mL mark represents 10% of the 10-mL volume, so a red cell column that sediments to the 4-mL mark would have an estimated PCV of 40%. When PCV is 50% or greater, the clinician should consider beginning resuscitative fluid therapy and referring the patient for additional fluid therapy.

Abdominal ultrasound offers a noninvasive method of evaluating internal organs. The value of abdominal ultrasound is not limited to large hospitals or referral centers, as much information can be obtained with most ultrasound units used for reproductive exams that are on the market at present. Any machine used for abdominal ultrasound should be set to the lowest frequency and at a sufficient imaging depth to penetrate into the abdomen. Clipping hair and applying coupling gel help improve the quality of the image, but important clinical information can frequently be determined by simply applying copious volumes of rubbing alcohol.

Practitioners are often frustrated by their ability to diagnose the cause of abdominal pain during a colic exam, and despite the comfort of many practitioners using ultrasound for musculoskeletal and reproductive examination, it continues to be underutilized for abdominal examination. Ultrasound is non-invasive and allows the user to evaluate the horse for pleural inflammation, gastric distension, small intestinal distension, impending diarrhea, and in most cases will provide a detailed view of the intestinal mucosal surface, interstitium and serosal surface. The limitations of transabdominal ultrasound include availability of equipment, and difficulty penetrating deep into the abdomen. Fortunately most clinicians have a machine equipped with a linear probe for musculoskeletal or reproductive examinations. Additionally most diseased intestine tends to be heavier than normal and will "sink" in the abdomen and be visible ventrally.

Like any good exam, the user should develop a protocol to follow to insure that every area is imaged at each examination. The following is the protocol developed and used at BVEH as a colic screen. It is not a protocol for a detailed abdominal ultrasound, but rather a quick screen to examine several key areas important in determine when a surgical lesion may exist and possibly identifying the specific intestinal problem causing the abdominal pain.

Ultrasound Screening

Settings

Initially the machine should be set to the lowest frequency the probe will allow. A depth setting of 8 cm generally allows for 4-6 cm of visceral exam in all but the most obese patients. The patient should be clipped or have the hair cleaned of debris and soaked in alcohol. Most cases at BVEH are soaked in alcohol using spray bottles. Rarely a horse will begin to shiver when coated aggressively in alcohol. Once the viscera are imaged, the machine should be adjusted to the highest frequency that will provide a quality image.

Left

A colic screen is started on the left side of the horse just caudal to the elbow (intercostals space 4-6). This area allows the operator to evaluate for pleural disease, pericardial disease, small intestine distension, intestinal wall edema, and free peritoneal fluid. The operator should be able to identify the diaphragm, ventral lung tip, pleura, heart, colon, and liver in this area. Pleural disease is commonly confused with colic early in the course of the condition and every horse should have the thorax imaged as part of the exam. Additionally the author has identified multiple diaphragmatic hernias during examination.

A second window on the left should be examined between intercostals space 6 and 12. This area allows the operator to evaluate for gastric size, gastric tone, gastric paresis, increase in peritoneal fluid, small intestinal distension, and increase in intestinal wall edema. The operator should be able to identify the liver, stomach, spleen, and diaphragm. Horses needing to have their stomach decompressed will show gastric ileus and a gas/fluid/solid line in the lumen of the stomach. Occasionally with intestinal displacement the stomach is moved from its normal anatomic location and can be imaged over several rib spaces. In these cases the wall of the stomach is not distended and the tone is relaxed.

A third window on the left should be examined in the paralumbar fossa. In machines with sufficient depth the operator can evaluate for nephrosplenic entrapment, increase in peritoneal fluid, small intestinal distension, and increase in intestinal wall edema. The operator should be able to identify the spleen, kidney, and colon. A displacement of the spleen off the body wall and/or displacement ventrally are indications of a nephrosplenic entrapment in machines without sufficient power or depth to image the left kidney. The ability to see the left kidney with ultrasound does not completely rule out a nephrosplenic entrapment, but makes it unlikely.

A fourth window on the left should be examined in the left inguinal/caudal abdomen. This area allows the operator to evaluate for right colon displacement, increase in peritoneal fluid, small intestinal distension, and increase in intestinal wall edema. The operator should be able to identify the colon and occasionally small intestine in this area. A lack of colon and multiple loops of small intestine found in this area is characteristic for a right displaced colon.

Right

The colic screen is continued on the right side of the horse just caudal to the elbow (intercostals space 4-6). This area allows the operator to evaluate for pleural disease, pericardial disease, small intestine distension, intestinal wall edema, and free peritoneal fluid. The operator should be able to identify the diaphragm, ventral lung tip, pleura, heart, colon, and liver in this area

A second window on the right is examined in the right intercostal space 12 to the paralumbar fossa. This area allows the operator to evaluate for duodenal motility and edema, right dorsal colon wall edema, consistency of the colon contents in the right dorsal colon, hepatomegaly, increase in peritoneal fluid, small intestinal distension, and increase in intestinal wall edema. The operator should be able to identify liver (in most horses), right dorsal colon, lung, diaphragm, duodenum, and right kidney. In older horses it is not infrequent to find the right lobe of the liver has atrophied and is not visible deep to the lung. Any liver that is visible extending beyond the costochondral arch is enlarged. With enteritis cases, the duodenum will be distended and the wall will often be thickened.

A third window on the right is examined in the mid thorax area of intercostal space 10-15. This area allows the operator to evaluate for a right colon displacement, right dorsal colon wall edema, consistency of the colon contents in the right dorsal colon, hepatomegaly, increase in peritoneal fluid, small intestinal distension, and increase in intestinal wall edema. The operator should be able to identify large intestine in this area. With a right displaced colon the mesenteric vessels of the left colon may be visible along the body wall.

A fourth window on the right is examined in the inguinal/caudal abdomen. This area allows the operator to evaluate for cecal distension, cecal luminal contents, small intestinal distension, increase in intestinal wall edema, small intestinal peristalsis, and increase in peritoneal fluid. The operator should be able to identify the cecum and cecal mesenteric vessels in this area. This area is the most frequent area to identify a small intestinal luminal obstruction.

Ventral

The ventral abdomen is the third and final area examined. The ventral abdomen can be examined in one long scan, or more frequently examined as cranial, mid, and caudal sections. This area allows the operator to evaluate for splenomegaly, small intestinal distension, increase in intestinal wall edema, small intestinal peristalsis, increase in peritoneal fluid, colon luminal contents, colon sacculation, and colon peristalsis. Most diseased intestines are edematous and heavy. They typically fall ventrally and can be found in this area. Edema of the colon wall is consistent with colon torsions. Edema of the small intestine is consistent with compromised small intestine. Small intestinal distension without edema is consistent with an ileal luminal obstruction.

All of the above can be completed in less than 5 minutes. If an abnormality is identified, that area should be more closely examined. Use of existing equipment to ultrasound the abdomen of a colic is an easy and non-invasive tool to assist with diagnosis.

Therapeutics

A cornerstone of all critical care is managing body fluid and blood pressure. These are not mutually exclusive criteria, as manipulation of one impacts the other. Although the technology for doing so exists, blood pressure is infrequently measured in large animal medicine at present. However, in most instances, criteria are measured that are directly impacted by fluid volumes. Body fluid volumes can be separated into three compartments; intravascular, interstitial, and intracellular.

Determinants of the need for IV or oral fluid therapy are revealed on the farm by the physical examination. Evidence of intravascular hypovolemia includes slow jugular fill, slow capillary refill time, high heart rate, and poor pulse quality. Evidence of interstitial dehydration includes prolonged skin tenting and dry mucous membranes. Evidence of intracellular dehydration includes alterations in mentation and slow-to-absent borborygmus. As long as there is not an obstruction or ileus, all forms of dehydration can be treated with oral fluids. Depending on the quality of perfusion and the disease status, some forms of hypovolemia may need to be treated with IV fluid therapy. Administering IV fluids necessitates placement of a catheter. In situations where there is poor jugular fill, placing a catheter becomes more challenging, as the flashback of blood in the stylet is much slower. Aspiration of air can occasionally be heard through the IV catheter, indicating a negative jugular pressure and more severe hypovolemia. These horses benefit from initial aggressive IV fluid therapy. Once a catheter has been placed, administering fluids can be challenging on the farm. Setting up a CRI and teaching owners or caretakers how to change fluid bags and monitor the catheter is done on a case-by-case basis. In situations where the horse needs IV fluids and this cannot be adequately managed on the farm, the case should be referred to a facility where fluid therapy can be monitored. In many cases where IV fluids are necessary for resuscitation, the 40- to 60-L volume required is not carried on the ambulatory vehicle. In that situation, a low-volume resuscitation strategy can be employed. Use of a hypertonic electrolyte solution and a colloid together has been explored. Addition of a colloid has not been shown to improve any of the measured parameters. Administering 7.2% hypertonic saline solution (HSS) improves intravascular volume deficits faster than administration of 0.9% isotonic saline. Use of HSS at a 4 mL/kg bolus dose can rapidly increase circulating volume by shifting interstitial and intracellular fluids to the intravascular space. Use of HSS should be followed with additional fluid therapy.

Alterations in many electrolytes arise in the face of endotoxemia and colic. Adding calcium, magnesium, or potassium to intravenous fluids should be done with caution and with use of serum electrolyte analysis. There is no current data to show a beneficial or detrimental benefit of any electrolyte supplementation in resuscitation or initial fluid therapy in the horse.

The volumes of fluid required to adequately resuscitate a horse may limit the usefulness of IV fluids on the farm. In many cases, oral fluid therapy can provide the appropriate volume of fluid. Additionally, administration of oral fluids is superior in treatment of large intestinal impactions. Similar to continuous IV fluids, a nasogastric tube can be affixed to the horse, and the owner can be shown how to administer fluids through the tube.

Along with oral fluids, laxatives are frequently administered via nasogastric tube. There are no data indicating that administration of any laxative, other than (sodium sulfate and magnesium sulfate) will increase fecal water content or reduce an intestinal impaction. Enteral administration of electrolytes is easily accomplished on the farm and may be the best therapy for rehydrating a horse with minimal systemic electrolyte disturbances.

The use of nonsteroidal anti-inflammatory drugs has been and continues to be cornerstone of the initial management of horses with abdominal pain. The NSAIDs are used for both their pain-relieving effect and as a diagnostic tool. A horse that does not respond completely to a single dose of pain medication should be considered to have a more complicated lesion and the owner offered referral. The use of NSAIDs should be judicious, as repeated doses without additional monitoring can lead to complications with GI tract and kidney function. Despite their broad acceptance as a first-line drug in the treatment of colic, recent studies have questioned these drugs' real impact. Commonly used NSAIDs used for pain control in colic include – flunixin meglumin (1.1 mg/kg IV or PO), firocoxib (0.09 mg/kg IV or PO), phenylbutazone (4.4 mg/kg IV or PO), meloxicam (0.6 mg/kg IV or PO) and ketoprofen (2.2 mg/kg IV).

Use of sedatives can be helpful in improving safety for both the clinician and the horse during examination. Some sedatives also have analgesic properties, and this should be considered when monitoring a patient for referral. The effects of sedatives should also be taken into consideration when a horse is being evaluated sonographically, because both alpha-2 receptor agonists and opioid drugs induce temporary ileus. It is possible to mistake the absence of borborygmus after sedation with detomidine or butorphanol for a more serious small intestinal obstructive lesion.

N-butyl scopolammmonium bromide is an anticholinergic drug used to treat intestinal spasm and facilitate anal sphincter relaxation for rectal palpation. Its use as an initial-treatment drug is increasing for simple impactions and spasmodic colic. Contraindications for the use of this medication include: ileus, high blood pressure, and glaucoma. N-butyl scopolamine is sold as Buscopan by Boehringer Ingelheimin the US and is labeled for the control

of abdominal pain associated with spasmodic colic, flatulent colic, and simple impactions in horses at 0.3 mg/kg slow IV. Additional research has shown a longer duration of effect with less impact on heart rate when given IM.

Conclusion

Correcting fluid deficits and maintaining comfort are the two most important components of medically managing a colic. Identifying the source of the pain or gastrointestinal abnormality are important in developing a long term medical management plan and determining when a horse needs to be referred.