

AGENCY FOR INTERNATIONAL DEVELOPMENT
 WASHINGTON, D. C. 20523
BIBLIOGRAPHIC INPUT SHEET

FOR AID USE ONLY

1. SUBJECT CLASSIFICATION	A. PRIMARY Agriculture
	B. SECONDARY Livestock

2. TITLE AND SUBTITLE
 Diagnosis and treatment of equine colic

3. AUTHOR(S)
 Padmore, C.L.

4. DOCUMENT DATE 1975	5. NUMBER OF PAGES 12 p.	6. ARC NUMBER ARC
--------------------------	-----------------------------	----------------------

7. REFERENCE ORGANIZATION NAME AND ADDRESS
 Department of Agricultural Science, Tuskegee Institute.
 Tuskegee Institute, Alabama 36088

8. SUPPLEMENTARY NOTES (*Sponsoring Organization, Publishers, Availability*)
 (In Tuskegee Institute, Dept. of Agr. Sciences, Annual report, 1974/1975:
 211(d) Livestock Project. Appendix 7, p. 137-148)

9. ABSTRACT

This paper begins with a short review of the anatomy and pathology of the equine's stomach and large intestine, common sites of most digestive problems. This and the remainder of the paper are accompanied by illustrations. To diagnose equine colic, the author recommends a thorough physical examination including the following points which are detailed in the report: evaluation of the degree of pain; abdominal distension; temperature, pulse, and respiration; mucous membranes; auscultation of the abdomen; rectal examination; pass the stomach tube; paracentesis; and laboratory tests. Treatments outlined are: control pain, sedatives, relief of obstruction, decrease production of toxins, prevention or treatment of vasoconstriction, and correction of volume deficit. If surgery is necessary, the following approaches are offered: 1) paralumbar fossa; 2) vertical or transverse flank; 3) oblique low flank, cranioventral or paracostal approach; 4) oblique low flank, caudoventral or Marcenac approach; 5) ventral abdominal approach; and inguinal approach.

10. CONTROL NUMBER PN-AAC-109	11. PRICE OF DOCUMENT
----------------------------------	-----------------------

12. DESCRIPTORS Equines Gastritis Gastrointestinal system Horses	13. PROJECT NUMBER
	14. CONTRACT NUMBER
	15. TYPE OF DOCUMENT COD 3676-211(d)

CSD-3676 211(d)
PN-AAC-159

APPENDIX VII

DIAGNOSIS AND TREATMENT
OF
EQUINE CHOLIC

Paper Presented by

Dr. C. L. Padmore

August 11-17, 1975

at the

Carribean Veterinary Conference

Port of Spain, Trinidad

DIAGNOSIS AND TREATMENT OF EQUINE COLIC

Disturbances of the digestive tract is a common finding in the equine species. Poor physical condition, improper management, abnormal exercise, bacterial and viral infections and parasitism are more likely to precipitate abdominal distress in the horse than in any other species of domestic animal.

The stomach and large intestine of the equine are the two areas where most of the digestive problems tend to occur and because of this I will like to take a few minutes to review the anatomy, as well as, the pathology of these areas which may produce symptoms of colic.

(Fig. 1) The stomach is relatively small, having a capacity of 2 to 4 gallons. It is shaped like the letter "J" and is situated in the dorsal part of the abdominal cavity behind the diaphragm and liver, mainly to the left of the median. The most common pathology of the equine stomach is dilatation which may be either primary or secondary.

Large Intestine: The large intestine of the equine is very large in proportion to that of other species and consists of the cecum, large colon, small colon and the rectum.

(Fig. 2) The cecum is about 4 feet long, comma shaped and has a capacity of 7 to 8 gallons. It is located to the right of the median plane, the base is in the right sublumbar space and the apex is on the abdominal floor near the xyphoid.

The most common pathology of the cecum is impaction due to obstruction of the ceco-colic orifice.

(Fig. 4) The large colon is about 10 to 12 feet long and about 8 to 10 inches in diameter. The large colon is folded so that it consists of four parts and three flexures.

<u>Part.</u>	<u>Flexures</u>
Right Ventral Colon	Sternal Flexure
Left Ventral Colon	Pelvic Flexure
Left Dorsal Colon	Diaphragmatic Flexure
Right Dorsal Colon	

Pathology:

A. Impaction

1. The pelvic flexure due to the acute bend, and considerable decrease in size is the most common site of impaction in the equine.
2. The terminal right dorsal colon due to a sudden narrowing at the junction with the small colon is another site of impaction.

B. Torsion

The left dorsal and left ventral parts of the large colon, and the diaphragmatic and sternal flexures are movable; while the right ventral and right dorsal colon, because of the short mesentery, are relatively fixed. In torsion the left dorsal part may turn laterally or medially around the left ventral part and this will also involve the sternal and diaphragmatic flexures. As a result of this ingesta will collect in the lumen in front of the sternal flexure while gas and bloody transudate will collect between the sternal and diaphragmatic flexures.

Torsion is thought to be due to mechanical influence such as rolling - in these cases death usually occurs in 6 to 10 hours if the condition is not corrected.

C. Circulatory Disturbances (Fig. 5)

The main supply to the small and large intestine of the equine is the anterior or cranial mesenteric artery which arises from the aorta under the lumbar vertebra. Aneurysms and thrombosis of the anterior mesenteric artery due to the larvae of *Strongylus vulgaris* are very common (Figs. 6 & &).

The Effects are:

1. Ischemia which may lead to infarction and/or gangrene
2. Diminished peristalsis resulting in impaction
3. Embolus formation which may cause severe damage depending on the location and the degree of involvement.

When one speaks of colic in the quine one is referring to abdominal pain which may be due to acute gastric dilatation, intestinal indigestion with stasis or intestinal hypermotility.

Because of the various causes of colic and the numerous areas which may be involved an accurate diagnosis is essential if adequate therapy is to be instituted.

The history should give some idea as to the feeding program, work habits, signs and onset of symptoms, type of pain, treatment if the animal was treated and the response to treatment. One should also include in the history when the horse was last wormed, or if the owner uses a regular worming program.

A thorough physical examination should be performed and should include:

- A. An evaluation of the degree of pain. All intestinal obstructions cause pain but the lower the segment of intestine, the lesser the pain. Impaction causes horses to lie down more than usual, but it seldom causes the intense pain manifested by involvement of the small intestine.

Degree of Pain

- (a) Sudden, intense, intermittent pain - associated with spasmodic type colic.
 - (b) Sudden, mild, transient pain - manifested by animals with small ischemic areas.
 - (c) Sudden, intense, continuous pain - observed in cases of gastric distension, as well as, animals with irreversible morphologic changes.
 - (d) Sudden, variable, continuous pain - associated with torsion, gut tie and herniation
 - (e) Gradual, dull, intermittent - chronic impaction (cecum)
 - (f) Sudden, moderate, intermittent pain - cases of acute impaction with gas formation.
- B. Abdominal Distension: Involvement of the stomach and/or small intestine does not produce visible distension of the abdomen, whereas involvement of the cecum and/or colon produces tympany and visible abdominal distension.
- C. The temperature, pulse and respiration should be examined immediately after the patient is presented and frequently thereafter.

- (a) An increase in temperature above 101°F is significant and a continuous rise in temperature should warrant a poor prognosis.
 - (b) A rising pulse is unfavorable - pulse rates between 40 to 50/min are not bad, whereas rates 60 and above are not favorable and suggests compartmental fluid shift, decreased circulating blood volume or an increase in blood viscosity.
 - (c) Shallow, rapid respiration of increasing intensity suggests a state of acidosis, the inadequate removal of CO₂ is responsible for the increased respiratory rate. However, the increased rate is not enough to maintain acid base balance resulting in metabolic acidosis, as well as, respiratory acidosis.
- D. Mucous Membranes - the mucous membranes mirrors the status of the peritoneum. The color and rate of capillary refill are good indicators of the quality of tissue perfusion. The more shocky and toxic the horse the more cyanotic the mucous membranes become. Although the heart rate is increased in shock, the cardiac output has decreased which results in a slower capillary refill. One can measure the refill time by blanching the gum with thumb pressure and then noting how rapidly the color returns (2-3 secs in the normal animal).
- E. Auscultation of the abdomen - The stethoscope offers the best means of assessing peristalsis. The examiner should listen long enough for peristaltic rushes to occur. By auscultating the left flank and left mid abdomen he can determine the peristalsis of the left dorsal and central large colon. One can determine if the viscus is distended with gas by snapping the finger against the belly wall while auscultating the area, if there is an accumulation of gas in the large colon this will produce a high pitch sound. The cecum can be ausculted high along the right flank. A gas cap in the cecum can be outlined in a manner similar to that described for the large colon. One should bear in mind, however, that a small gas cap is normal in this structure. The activity of the small intestine is best determined by listening along the lower right flank. Although borborygmus can be heard when auscultating the chest it does not indicate diaphragmatic hernia. On auscultation areas that are quiescent warrant a poor prognosis, whereas hypermotility though serious is not as alarming.

- F. Rectal Examination - this should be performed in an orderly manner to determine areas of impaction, areas distended with gas, painful areas and the presence of new growths. At the same time the presence or absence of feces, as well as, the consistency and content of the feces may be significant. One should always be aware of the fact that feces may be present in the intestine posterior to an obstruction for up to 12 hours after the obstruction has occurred. Also in cases of impaction of the cecum, the passage of small amounts of feces is a common finding. Continuing with the rectal examination, the root of the mesentery, the anterior mesenteric artery, the iliac arteries, the urogenital tract and the inguinal ring in colts and stallions should be examined. Negative findings are not always significant as the pathology may be so far cranial that it may not be palpable and this may be an indication for an exploratory laparotomy.
- G. Pass the Stomach Tube - This is a very useful therapeutic instrument which is often overlooked in the diagnosis of equine colic. There are only three major valves in the approximately one hundred feet of the digestive tract of the horse. These are the cardiac sphincter of the stomach, the ileo - cecal valve and ceco-colic valve. If the obstruction is within the small intestine one can expect to get a reflux of fluid and gas when a tube is passed into the stomach. On the other hand if the obstruction is in the large intestine or from the cecum to the small colon fluid should not accumulate in the upper digestive tract - stomach and duodenum because of the ileo-cecal. However, there will be more fluid and gas distension in the cecum or large colon.
- H. Paracentesis - this procedure is not proposed as a routine measure in every case of colic. It is, however, useful in determining the condition of the peritoneal cavity.

Procedure (Fig. 6-9) - The equipment necessary are a small scalpel and blade, a 1½" - 2" teat cannula, an 18 or 20 gauge 1 inch hypodermic needle and a 5 ml syringe.

The site is on the midline about 5 to 6 inches caudad to the xiphoid. The area is clipped and surgically prepared. A wheal of anesthetic is deposited in this area following which a small nick is made in the skin and linea alba; the cannula is then passed into the peritoneal cavity and a sample of the fluid obtained for examination.

Peritoneal Fluid Chart - Nelson⁶

<u>Color</u>	<u>Contents</u>	<u>Indications</u>
Straw-amber Turbid	WBC	Normal Infections Lymphosarcoma
Pink to red	RBC	Traumatic Paracentesis
Brownish-Yellow	Bacteria WBC Pigment from damaged intestinal wall	Early gut necrosis
Muddy-brick	Bacteria WBC RBC Increased pigment	Necrotic intestine
Brown	Fecal WBC Debris	Ruptured intestine or accidental gut penetration

Fig. 10

I. Laboratory Tests - there are a number of laboratory tests which may be used as guidelines in the diagnosis, treatment and prognosis of equine colic. Those which I find to be extremely valuable are:

1. Packed cell volume (PCV) - this to me is the most informative of all the blood studies. This simple procedure helps one to determine if the animal needs I.V. fluids. If the PCV is over 50%, one knows that the horse is losing fluid into the lumen of the intestine and from there into the peritoneal cavity.
2. Other tests which I use less frequently are the HB (Normal 11-19 Gms%), and the Total Protein (Normal 5.3-7.6 Gms%). The value of these two tests also mount rapidly in severe intestinal obstruction particularly in cases of necrosis and incarceration.

In recent years I have also begun to measure the blood glucose levels as an aid in the diagnosis of colic. In these cases the blood glucose level increases from a normal of 54-111 Mg% to as high as 200 Mg% and there have been reports of this value being as high as 360 Mg%.

Death in cases of abdominal crises in the equine is ultimately the result of shock brought about by the vaso-active properties of bacterial toxins, as well as, by pain, fear and anxiety.

(Fig. 11) Any gastrointestinal lesion that involves stasis or degenerative changes of the gut wall leads to increased absorption of bacterial toxins (primarily gram negative endotoxin). Increased levels of endotoxin are associated with an increase in the level of circulating catecholamines (epinephrine and norepinephrine derivatives), the net effect being vasoconstriction with capillary pooling - particularly in the splanchnic circulation. Due to the increased size of the intravascular compartment and loss of water into the interstitial space a circulating blood deficit occurs resulting in decreased venous return, decreased ventricular filling, decreased cardiac output, decreased capillary perfusions, diffuse intravascular clotting and irreversible cellular changes terminating in shock.

Treatment

Control Pain - Pain is a major factor in shock. In many instances, examination and further treatment cannot be accomplished until pain has been controlled. Numerous analgesics have been used to control pain -- Jenotone and Dipyrone are commonly used but these drugs decrease intestinal motility and are contraindicated in stasis, Rompun (xylazine) is a relatively new analgesic-tranquilizer that has been used with good results.

Sedatives - Promazine (400Mg) together with 30 Ml of a mixture of pentobarbital/magnesium sulfate and chloral hydrate give excellent results, but are contraindicated in cases where shock is already present.

Relief of Obstruction - Medical treatment for obstructive conditions primarily involves the treatment of impaction. This is best accomplished by the administration of mineral oil, which besides lubricating the intestinal surface and softening the mass, also impedes the absorption of toxins.

Smooth muscle stimulants may be indicated in impaction and depressed peristalsis. Antispasmodics are indicated when there is hyperistalsis or when intermittent sharp pain persists after analgesics have been administered. The injudicious use of antispasmodics should be avoided since intestinal stasis is a fundamental problem in colic.

Decrease the Production of Toxins - Since shock and death are due to large amounts of toxins. Steps should be taken to deplete the source. To accomplish this the addition of Neomycin Sulfate (1 to 2 fluid ounces Biosol) to the mineral oil is recommended. However, regardless of if Neomycin Sulfate or some other oral antibiotic is given it should be administered while the reticuloendothelial system is capable of catabolizing the resultant increase in endotoxin.

Prevention or Treatment of Vasconstriction - Vasodilation may be induced either with the administration of alpha blocking agents or by massive doses corticosteroids. Phenothiazine derivatives, phenoxybenzamine and phentolamine are effective alpha adrenergic blocking agents. These are indicated to prevent vasoconstriction in cases where the heart and peripheral pulse rates are equal and within normal limits. These drugs, as well as, adrenolytic compounds are contraindicated in the presence of hemoconcentration or a circulatory blood deficit.

In cases where shock already exists the administration of massive doses of corticosteroids (200 Mg Solu Delta Cortef^R or 250 Mg 9-Fluro-Prednisolone) intravenously have given good results. Steroids have been shown to stabilize lysosomes, counteract the effects of endotoxins and in pharmacological doses they have an alpha blocking effect thus promoting vasodilation. In addition they are anti-inflammatory, protect the elasticity of RBS, decrease platelet adhesiveness and have an inotropic effect on the myocardium, thus augmenting cardiac output and capillary perfusion.

Correction of Volume Deficit - In the field the need for fluid therapy is evidenced clinically by rapid heart rate, dry mucous membranes and delayed capillary filling time. A more direct assessment may be obtained by packed cell volume, hemoglobin or total protein determination. The primary requirement is replacement of volume with the right kinds of fluid. The question of how much fluid to give is one that often plagues individuals that are uneasy about their fluid therapy. A rule of thumb for initial volume replacement is 1 liter of Ringer's solution for each 1 per cent increase of packed cell volume above 40%.

Most horses with obstructive colic are also in a state of acidosis. The administration of 100 to 150 grams of sodium bicarbonate intravenously is usually effective in buffering the existing acidosis.

Surgical Cases

There are certain colic cases which can only be treated surgically (Figs. 13 & 14). The veterinarian, however, must be able to diagnose these cases and perform surgery while the animal is a good surgical risk. In general surgery is contra-indicated in cases of frank, diffuse peritonitis, perforation or rupture of the gut with contamination of the peritoneal cavity that has existed for sometime and in terminal shock.

Some attention should be given to the type of anesthesia to be used. In general the administration of barbituates intravenously is contraindicated in cases of colic. Gas anesthesia is undoubtedly the safest approach as the level of anesthesia can be adequately controlled thus allowing the anesthesiologist to keep the animal in as light a plane as possible. In cases of impending shock the administration of a tranquilizer and regional anesthesia may be sufficient to perform surgery.

The characteristics of the equine abdominal wall differs from that of other large animals. The fascia is thin and insecure thus making closure of the incision line difficult. This is especially true in those cases where the muscle has been incised. Because of this the abdominal muscles in the equine should be separated along their fibers rather than being cut. The perfect example of an abdominal incision is the McBurney incision for acute appendicitis in man. The incision is made in the direction of muscle pull at all layers, this results in the muscle fibers being separated rather than being cut, major nerve and blood vessels are not disturbed and the incision allows adequate access to the operative field. The counterpart to the McBurney incision in veterinary medicine is the "Grid Incision" which is used in paralumbar and low flank approaches to the abdominal cavity.

There are various surgical approaches to the equine abdomen, however, the site chosen should allow adequate exposure of the area involved. Some of the more common approaches to the abdomen of the equine included:

1. Paralumbar fossa
2. Vertical or transverse flank (Fig. 15)

If minimal exposure is all that is required the paralumbar and vertical flank incisions can be used. The principal

advantage of these approaches is that they can be employed on the recumbent or standing patient (Fig. 16 - Fig. 18).

3. Oblique low flank, cranioventral or paracostal approach (Fig. 19).

4. Oblique low flank, caudoventral or Marcenac approach - used by European workers for caesarean section, as well as, for cecotomy in cases of impaction (Fig. 20).

5. Ventral Abdominal Approach (Fig. 21-22). The horse is placed in dorsal recumbency. The midline approach is preferable to the paramedian because the linea alba is extremely strong and fibrous and is devoid of nerves and blood vessels. This approach also allows greater latitude of access and should be the site of choice if one is not sure of the exact location of the lesion. Many individuals are somewhat leary to use the ventral approach for fear of herniation. However, the problems associated with herniation can be avoided by using a strong overlapping Modified Mayo suture pattern in the closure of the abdomen (Fig. 23) with #2 to #4 medium chromic gut.

6. The Inguinal Approach - Fig. 24) - The inguinal laparotomy is classically used in cryptorchidectomy and inguinal herniorrhaphy. One real argument for the use of the inguinal canal approach in cryptorchidectomy over the alternative paramedian or flank approaches is that so many of the cases presented as cryptorchids are found to be either "high flankers" with the testicle located just outside the external inguinal ring or inguinal cryptorchids with the testicle located in the canal. In either case, these testicles cannot be retrieved from their positions of partial descent by either of the alternative routes. Also, in many cases where the testicle is abdominal, the processus vaginalis will have evaginated into the canal, usually with a loop of the epididymis therein. These structures are easily identified and, with very little dissection and retraction, lead directly to the retained testicle.

In equine colic, the correction of the existing condition will depend largely on what is found on opening the abdomen.

1. In paralytic ileus the intestine is usually distended with gas and will often balloon out of the incision when the abdomen is opened. Decompression is indicated in these cases and is best accomplished by placing a purse string suture in the intestinal wall and using a decompression set with a 12 or 14 gauge needle to remove the gas slowly from the lumen of the intestine.

2. Impactions may be broken down by massage alone or in some cases they may have to be injected to facilitate breakdown - glycerine and mineral oil are commonly used in these cases.

3. Removal of large hard masses such as enteroliths and fecaliths which cannot be broken down may be accomplished by enterostomy.

4. Some conditions such as volvulus, displaced or strangulated intestine may be corrected by manipulation.

5. In any case where there is necrosis of the intestine, resection of the necrotic portion and anastomosis of viable intestine is indicated.

Healing of abdominal incisions take longer in the equine than in other species. This may be due to the increased tension on the suture line - to eliminate dehiscence sutures should be left in for 12 to 14 days following surgery.

But, the surgeon's knife is not enough. All too frequently the condition is corrected with great surgical skill with little attention being paid to the animal's need. Simultaneous therapy to correct acidosis, hemoconcentration, and dehydration and to prevent infection should be started prior to surgery and continued throughout the operation and into the postoperative period.