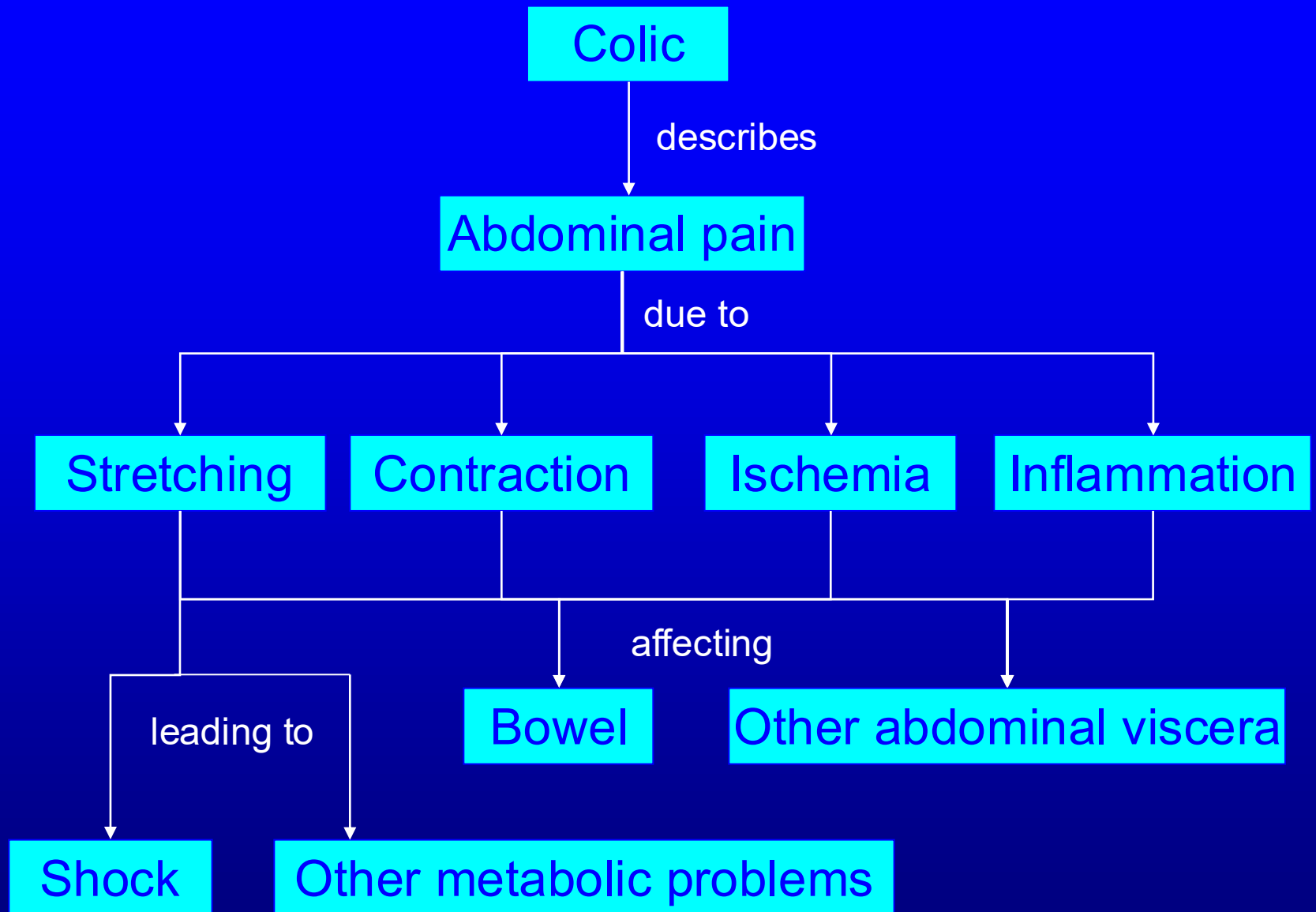


Management of Acute Abdominal Disease in Horses

RP Hackett, DVM, MS





Signs of mild to moderate abdominal pain

- lying down,
- restlessness
- pacing the stall
- playing in the water bucket
- stretching
- flank watching



Signs of moderate to severe abdominal pain

- pawing
- kicking at the belly
- profuse sweating
- getting up and down
- violent rolling
- mania



General causes of colic in horses

- Parasitism
 - strongyles
 - ascarids
 - tapeworms
 - Gasterophilus sp.
- Management-induced
- Anatomic predisposition

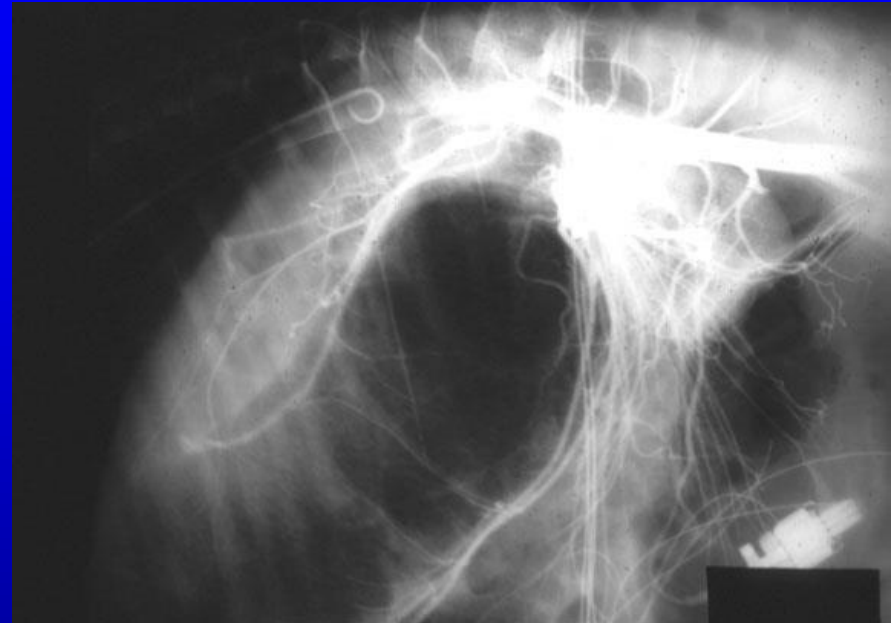
Strongyles as a cause of colic

- Strongyle infestation was once considered to be the most important cause of colic in horses.
- Now a problem only in horses under poor parasite control programs
- Strongyle damage, cranial mesenteric arteritis, results in reduced blood flow either by thromboembolism or by release of vasoactive compounds.
- Signs range from very mild colic to rapid death of the horse (non-strangulated infarction).

Thromboembolic bowel disease



Cranial mesenteric arteritis



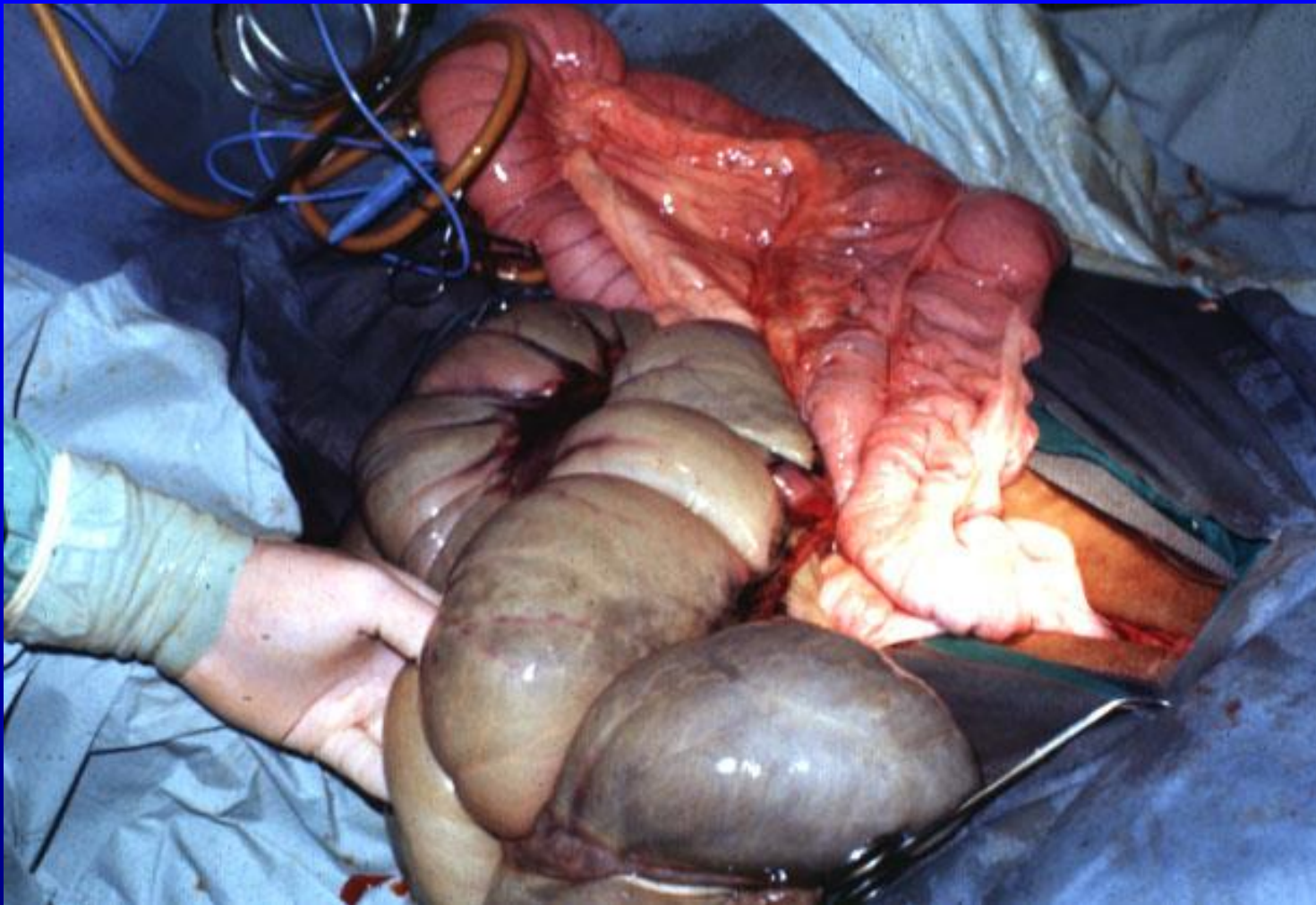
Arteriogram of the cranial mesenteric artery

Thromboembolic bowel disease



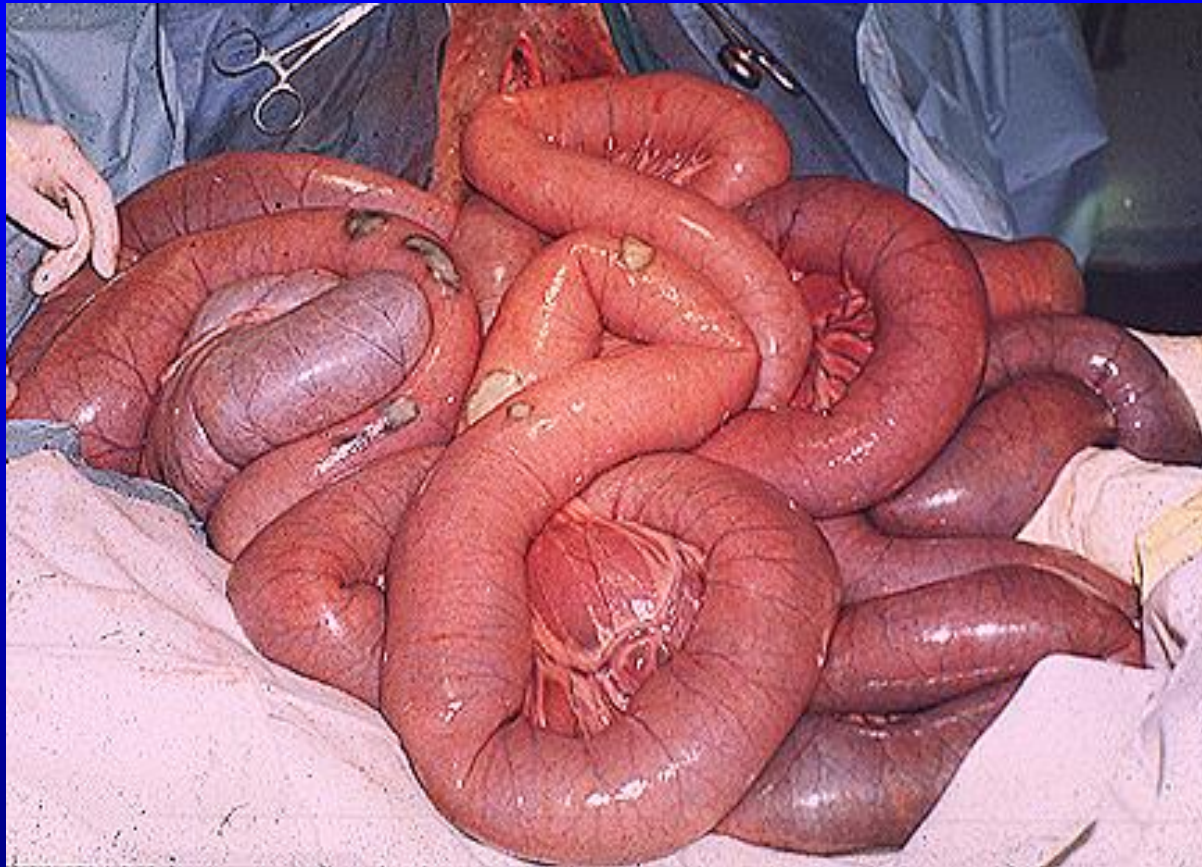
A small infarct in the small intestine due to TEC.

Thromboembolic bowel disease



Cecal infarction due to TEC

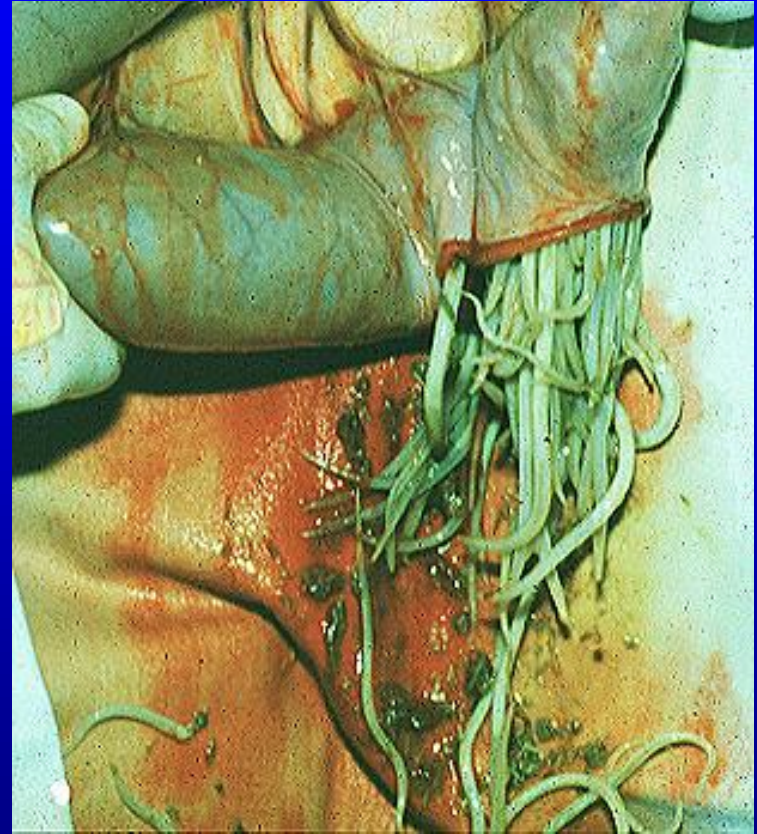
Thromboembolic bowel disease



Multiple small intestinal infarcts
from a thromboembolic “shower”

Other parasites as causes of colic

- *Parascaris equorum* may cause impaction of the small intestine
 - heavily parasitized young horses
 - May follow use of anthelmintics
- *Anoplocephala* sp. (tapeworms)
 - commonly found in the ileum and cecum of young horses
 - Incriminated in ileal obstruction, ileocecal intussusception, and cecocolic intussusception
- *Gasterophilus* sp (bots)
 - not an important cause of colic



Colic due to poor management

Diet:

- Feeding lush, highly fermentable feeds, especially without a period of acclimatization, may result in tympanitic (gas) colic.
- Impaction colic may be caused by the feeding of coarse, indigestible feed, infrequent feeding or by long periods without water
- Erratic feeding schedules may risk spasmodic colic

Colic due to poor management

Dental care:

Inadequate dental care causing improper mastication of feed may predispose to impaction colic.



Colic due to poor management

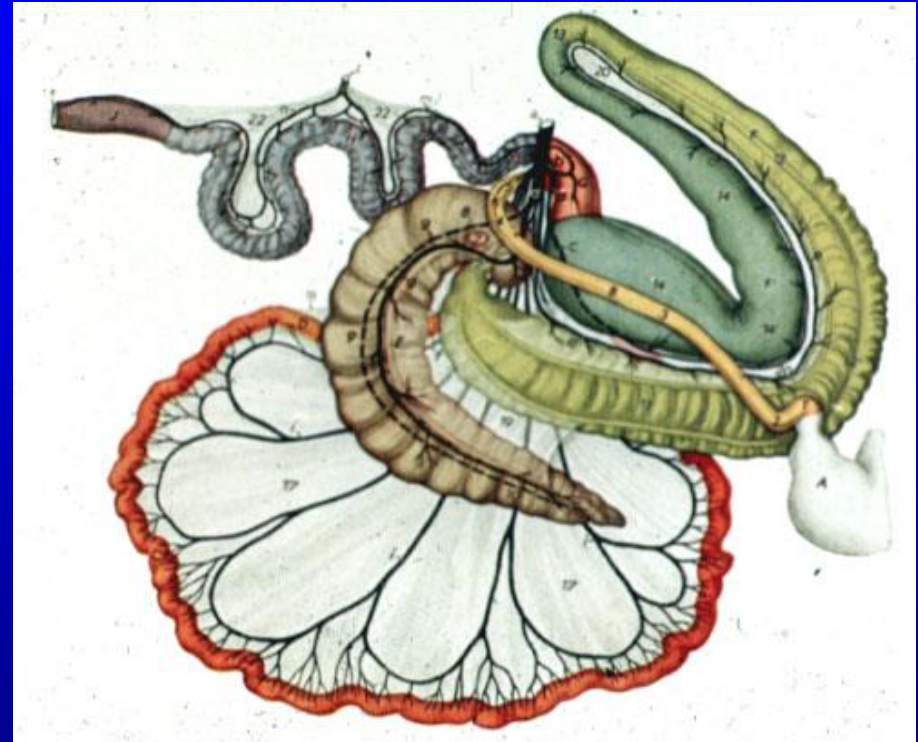
Foreign bodies:

- Feeding practices which lead to ingestion of sand or gravel (e.g. feeding grain on the ground) may lead to obstruction
- Access to nylon fibers or other foreign material may result in intestinal obstruction.
 - rubber fencing
 - tire feeders
 - burlap bags



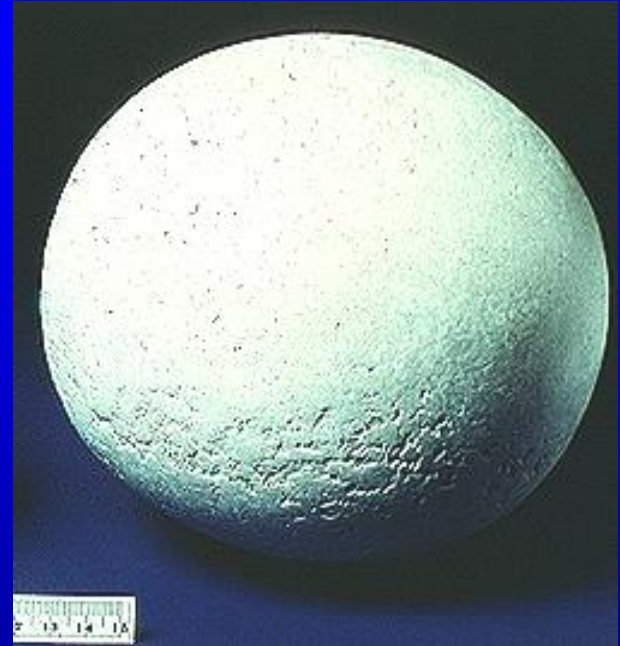
Anatomical predisposition to colic

- The horse has a long and complex intestinal tract that is confined to a relatively small abdominal cavity.
 - predisposes to impaction, displacement, and volvulus.
- Internal or external hernia
 - may cause entrapment of bowel and subsequent abdominal pain



Other causes of colic

- Infections
 - enteritis
 - peritonitis
 - abdominal abscess
- Neoplasia
- Stone formation
 - enteroliths, urinary or biliary calculi
- Urogenital problems
 - normal labor
 - uterine torsion
 - uroperitoneum



Classification of colics by functional or anatomical lesion

- Functional colic
- Simple obstruction
- Strangulation obstruction
- Non-strangulated infarction
- Gastric dilation/rupture
- Non-intestinal colic

Functional colic

- The function of the intestinal tract is impaired (especially motility) but the structure is intact (i.e., there is no mechanical obstruction of the bowel).
- The majority of colic cases seen in practice.
- Most respond satisfactorily to medical therapy so a definitive diagnosis is usually not obtained.

Types of functional colic

- Idiopathic disorders of intestinal motility
 - Spasmodic colic
 - “Impaction-like” colic
 - Tympanitic (flatulent, gas) colic
- Motility disturbances due to inflammation/infection
 - Peritonitis
 - Enteritis
 - Proximal enteritis

Spasmodic colic

- marked acute pain
- increased intestinal motility
- usually short lived (less than 2 hours).
- most common in nervous horses or horses undergoing changes in routine.



"Impaction-type" colic

- Signs of large colon impaction
 - low grade chronic abdominal pain
 - prolonged course (12-48hrs)
- No impaction can be palpated per rectum.

Flatulent (tympanitic) colic

- severe abdominal pain
- significant gaseous distension of the intestine
- often feed-induced
 - rapid change to highly digestible feed/forage
- usually responds to medical therapy but surgical decompression may be necessary in severe cases



Colic due to peritonitis

- Sources of peritoneal contamination
 - verminous arteritis
 - bacterial septicemia (especially *Streptococcus equi*, *Streptococcus zooepidemicus*, and *Corynebacterium pseudotuberculosis*).
 - rupture or perforation of GI or UG viscus
- Signs of mild to moderate abdominal pain
- Relatively prolonged course.
- Peritoneal fluid white blood cell count elevated (30,000 to 100,000⁺ cells/ml)

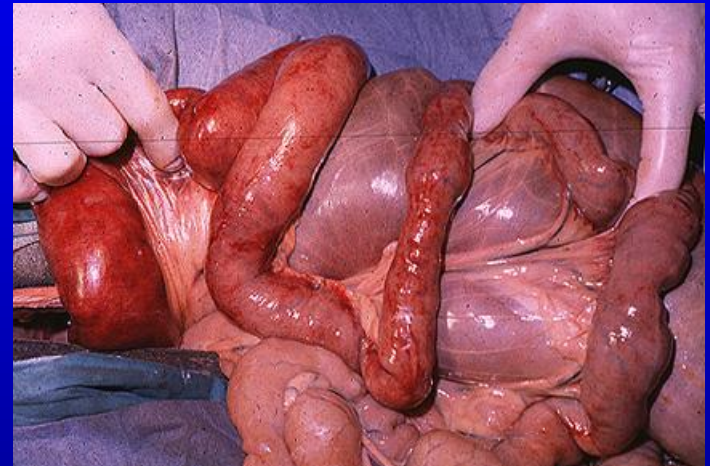


Colic due to enteritis

- Colic may be caused by acute enteritis (especially salmonellosis and clostridial enteritis)
- Signs of abdominal pain
 - usually precede onset of diarrhea
 - may be severe
- Many horses with enteritis
 - are mildly febrile (38.5-39°C)
 - are neutropenic (< 2,000/ul).

Colic due to anterior enteritis

- Severe inflammatory disease of the duodenum and proximal jejunum is termed anterior enteritis (duodenitis-proximal jejunitis, proximal enteritis)
- Clinical signs of this disease include mild to severe colic, gastric reflux, depression, moderate fever (38.5-39.5°C), and tachycardia.
- Etiology is unknown (*Clostridium* sp. or *Salmonella* sp.?)



Simple obstruction of intestine

- Obstruction to the passage of ingesta with no vascular compromise of affected intestine.
- Causes of obstruction:
 - obturation of the lumen
 - intrinsic lesions (e.g. stricture, intramural neoplasm)
 - extrinsic lesions (e.g. adhesions)
 - intestinal displacement

Obturation of the lumen leading to simple obstruction

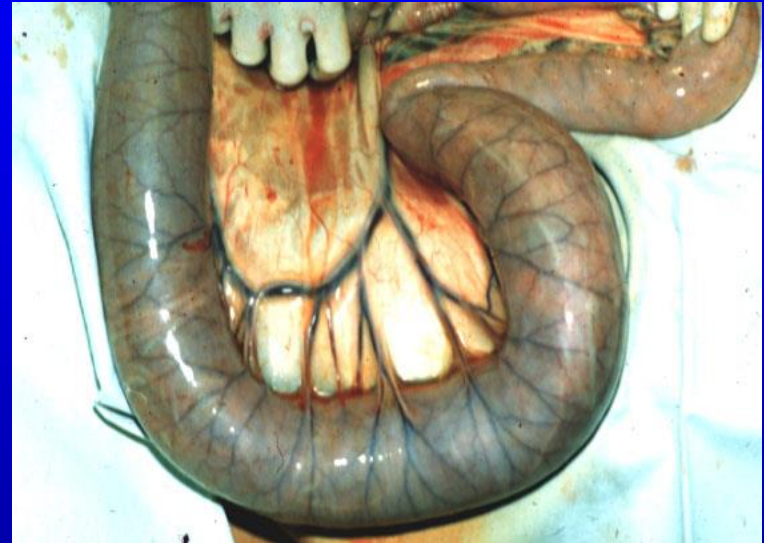
- = blockage of the intestine by an object in its lumen
- most common form of simple intestinal obstruction.
- most large intestinal obstructions are simple (feed impaction or mild displacement).



Obturation of the lumen leading to simple obstruction



Enteroliths



Ascarid impaction

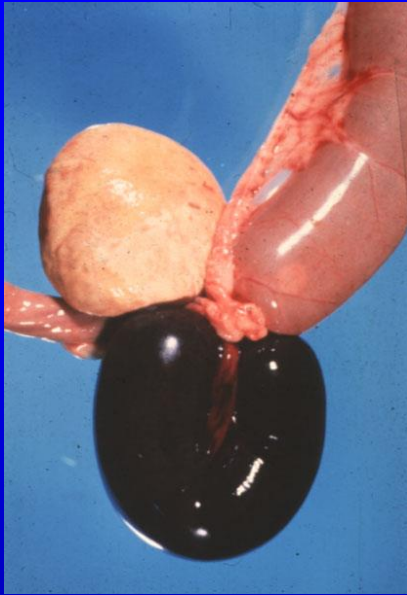
Signs of simple intestinal obstruction

- Intensity of signs depends on the level and duration of the obstruction
- Small intestine:
 - severe pain due to intestinal spasm and fluid-distention of intestine and stomach
 - rapidly develop dehydration, electrolyte loss and imbalance, acid-base imbalance and hypovolemic shock
- Large intestine:
 - mild to moderate pain due to intestinal spasm and gas-distention of cecum and colon
 - metabolic deterioration is very slow (days)

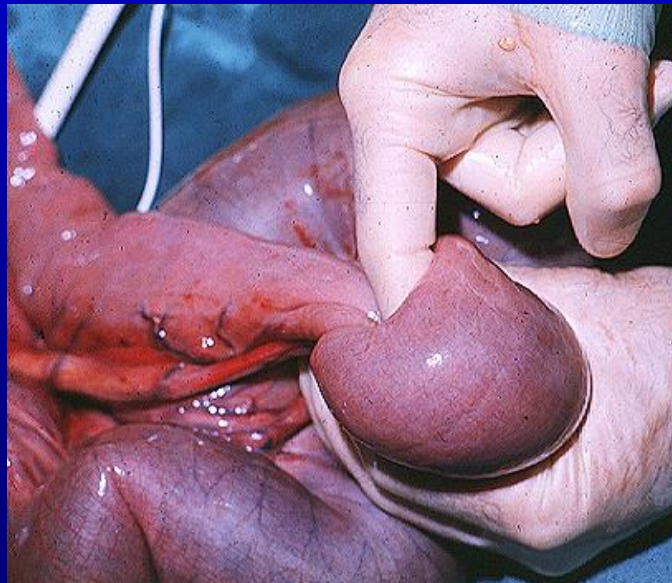
Strangulation obstruction of intestine

- Compromise of the blood supply to the affected intestine in addition to intestinal obstruction.
- Hemorrhagic strangulation vs. ischemic strangulation
- Rapidly lethal due to:
 - hypovolemia
 - endotoxemia
 - blood loss
- Most small intestinal obstructions are strangulating

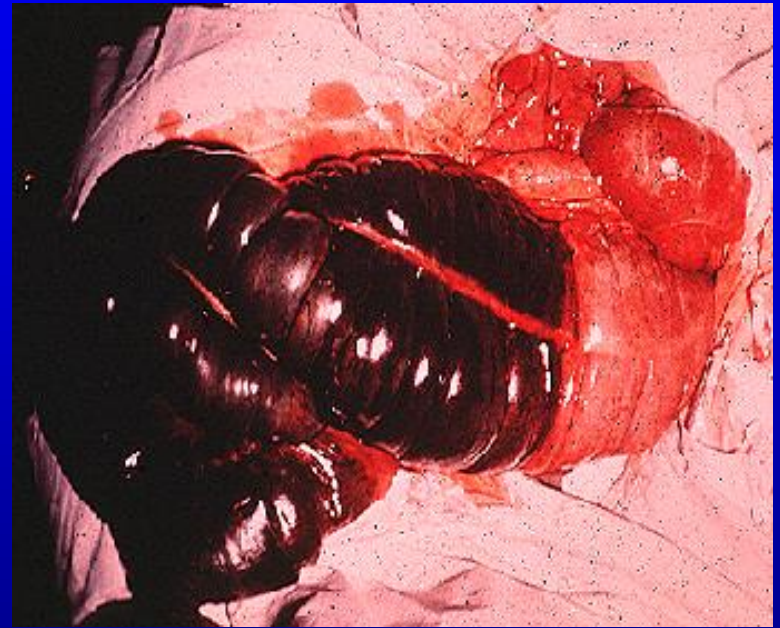
Examples of strangulation obstruction



Strangulating lipoma



Jejuno-jejunal
intussusception



Large colon volvulus

Non-strangulated infarction

- A term used to describe ischemic necrosis of intestine associated with thromboembolism due to verminous arteritis
- Clinically indistinguishable from strangulation obstruction

Gastric dilation/rupture

- Overdistension of the stomach with fluid and/or gas causes severe abdominal pain.
- Primary gastric dilation:
 - idiopathic (pylorospasm?), grain overload, obstructive pyloric lesions (bots, neoplasm, ulcers)
- Secondary gastric dilation:
 - results from a functional or mechanical small intestinal obstruction that results in reflux of intestinal contents into the stomach.

Gastric dilation/rupture

- Horse cannot easily vomit so marked gastric dilation may occur. Gastric rupture results from overdistention of the stomach
- Diagnosis of gastric dilation is confirmed by nasogastric intubation. A low gastric content pH (<4) suggests primary gastric dilation. A high (>7) pH suggests secondary dilation.

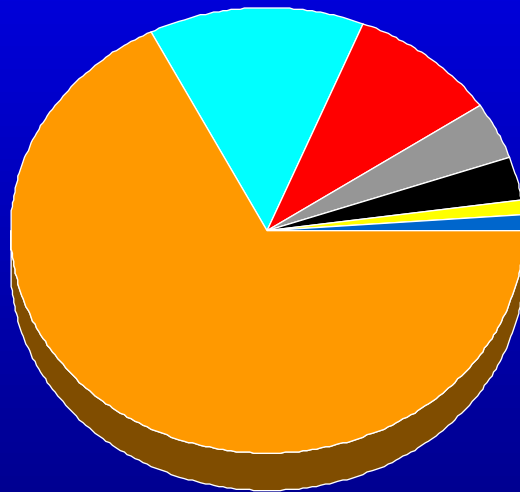


Non-intestinal colic

- Signs of abdominal pain originating at a site other than the digestive tract.
- Examples:
 - normal parturition, uterine torsion, invagination of an uterine horn, hematoma of the broad ligament
 - urolithiasis
 - ruptured urinary bladder in foals
 - pleuritis
 - myopathy or lameness

Types of colic identified during a 24 month study of 3175 horses on 132 horse farms in Michigan

77 cases of colic in 62 horses



No diagnosis	Obstruction	Spasmodic	Sand colic
Gas colic	Arteritis	Enteritis	

Risk factors:

Foaling

Deworming

Increased age

Show activities

*Kaneene JB et al: Prev Vet
Med April, 1997*

Frequency of Types of Colic

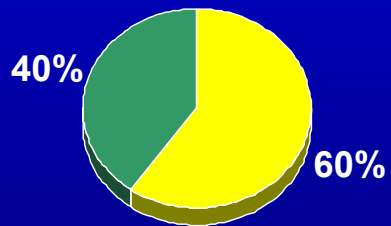
Based on 4644 cases of colic seen at US university hospitals between 1979 and 1984.

	% of Total	% Mortality
Simple obstruction	34.3	25.6
Strangulation obstruction	20.7	75.9
Nonstrangulating infarction	2.9	84.2
Peritonitis	4.4	81.9
Enteritis	5.3	60.0
Undiagnosed colic	26.5	11.0

Mortality of Colic

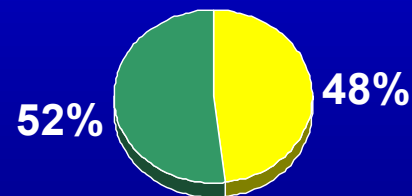
Based on 4644 cases of colic seen at US university hospitals between 1979 and 1984.

**Total cases of colic
(n=4644)**



■ Survived ■ Died

**Cases undergoing surgery
(n=2055)**



■ Survived ■ Died

EVALUATION OF THE HORSE WITH COLIC

Goals of evaluation:

- Rarely able to determine the exact cause of abdominal pain.
- The goal of evaluation is to determine the proper management option:
 - Manage medically
 - Manage surgically
 - Euthanatize

EVALUATION OF THE HORSE WITH COLIC

It is difficult to determine the exact cause of abdominal pain in most horses with colic. A systematic approach to diagnosis must be employed.

General Evaluation

Signalment and Medical history

Signs of abdominal pain

Physical Examination

General condition

Vital signs

Hydration

Peripheral perfusion

Temperature of extremities

MM appearance & CRT

Evaluation of the Abdomen

Abdominal auscultation &
percussion

Assessment for abdominal
distention

Abdominal guarding

Rectal palpation

Nasogastric intubation

Abdominal paracentesis

Ultrasonic examination

Abdominal radiography

Signalment

- Age, sex, and breed predispositions exist for abdominal lesions.
- Horses < 3 yrs
 - Small intestinal volvulus, jejunojejunal intussusception, and ileocecal intussusception
- Horses > 8 yrs
 - Epiploic foramen incarceration, incarceration by pedunculated lipoma, cecal impaction, and large intestinal volvulus
- Breed predispositions
 - epiploic foramen incarcerations in TB, scrotal hernias in SB, small colon impactions in Shetland ponies and miniature horses

Medical history

- duration and progression of the colic episode
- previous episodes of colic in this and other horses,
- parasite control (especially recent deworming),
- feeding routine (especially changes in routine or access to unfamiliar feeds),
- bowel movements and urination

Medical history

- Recurrent episodes of mild to moderate colic
 - verminous arteritis
 - chronic partial obstruction (e.g. chronic ileocecal intussusception in young horses).
- Recent deworming
 - ascarid impaction
 - thromboembolic (3-4 wks after deworming)

Interpretation - Colics with an acute onset and rapid course are more likely to require surgery than those with a slower onset and progression

Abdominal pain

- Pain is due to one or more of the following:
 - intestinal distention
 - intestinal spasm or hypermotility
 - intestinal ischemia
 - inflammation of peritoneum or bowel
- Consider effects of analgesic medications on signs of pain.
- Consider age/temperament of horse

Abdominal pain

Interpretation:

- Sudden decrease in pain in an animal with severe colic — rupture of stomach or other viscus
- Slow decline in signs of pain — necrosis of a strangulated segment
- Pain uncontrollable with analgesics —surgical indication
- Pain which is increasing in severity or chronic unrelenting pain —surgical intervention likely
- Low grade or intermittent pain — usually conservative management.

Physical examination

- general body condition
- vital signs -- rate and quality of pulse, rate and character of respiration, and rectal temperature
- examine for hernia.

Interpretation -

High pulse rate — pain or cardiovascular collapse or both. Deteriorating pulse quality may indicate the latter.

A consistent high pulse or a rapid climbing pulse frequently occurs in surgical colics but the pulse rate, in and of itself, is a poor indicator of the need for surgery.

Peripheral perfusion

- Mucous membrane color
- Capillary refill time
- Temperature of the extremities (ears and limbs).

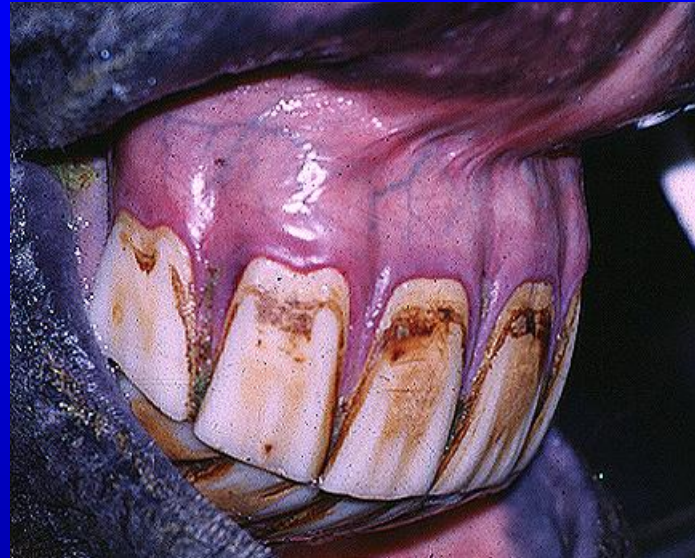


Interpretation

Normal capillary refill time is < 3 seconds. An ↑ in CRT indicates ↓ peripheral perfusion.

Cool extremities indicate ↓ peripheral perfusion

Peripheral perfusion



Interpretation

Cyanosis of the mucous membranes indicates progressive toxemia, cardiovascular collapse, and failure of peripheral perfusion.

Hydration

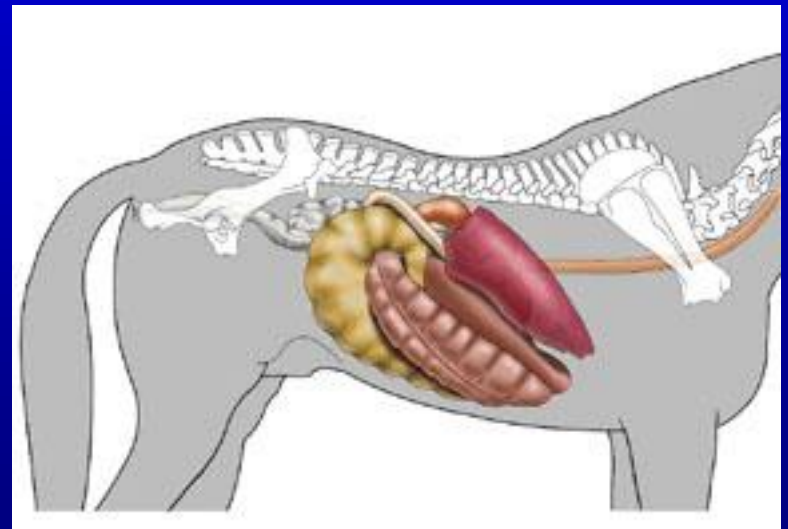
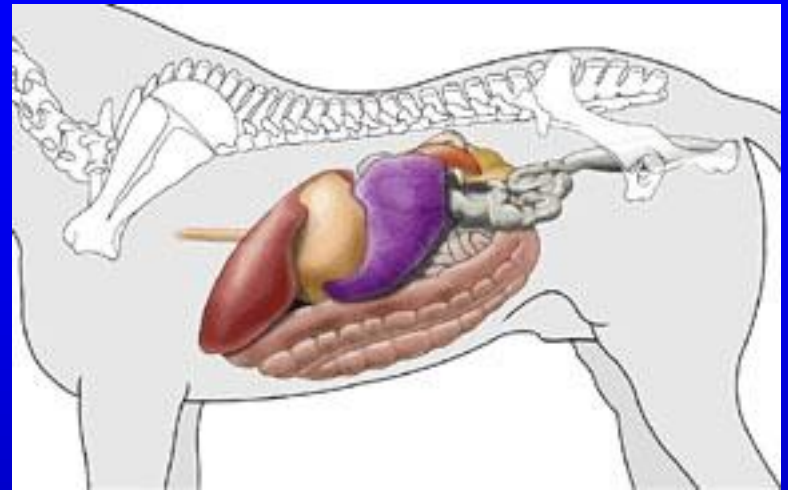
- Skin pinch
- Moistness of mucous membranes.

Interpretation

Marked dehydration early in the course of a colic episode may indicate sequestration of fluid proximal to an obstructed small intestine $\pm$ endotoxemia.

Abdominal Auscultation

- Assess intestinal motility at several sites on each side of the abdomen
- Borborygmi may be increased, normal, decreased, or absent.



Abdominal auscultation

Interpretation

- ↑ intestinal sounds
 - "spasmodic" colic, early cases of intestinal obstruction.
- ↓ or absent intestinal sounds
 - ischemia, overdistension of bowel with gas or fluid, chronic obstruction of bowel, peritonitis. drugs
- Normal or increased borborygmi indicate that the bowel is not undergoing major pathologic change such as strangulation. Peristalsis is decreased or absent in most conditions requiring surgical intervention.

Abdominal Percussion

- Simultaneous auscultation and percussion (pinging) allows delineation of tympanitic segments of bowel.
- Used to determine if abdominal distension is due to gaseous (large intestine) distention or fluid (small intestinal) distension.
- Used to outline gas-distended segments of bowel if percutaneous decompression is indicated.

Assess for Abdominal Distention

- Marked abdominal distension is ordinarily associated with tympany of the large colon.
- Obstruction of the small intestine infrequently causes conspicuous abdominal distension except in foals.



Interpretation -

Marked distension of the large colon with gas is a clear indicator for surgery. Distension of the abdomen due to fluid distension of the small intestine indicates either functional or mechanical obstruction.

Abdominal Guarding

- Evaluated by pressing the fist deeply into the flank
- Voluntary guarding
 - The horse tenses the abdominal wall in response to stimulation.
- Involuntary guarding
 - abdomen is rigid at all times, even when breathing.
 - reflexive response to peritoneal irritation and suggests peritonitis



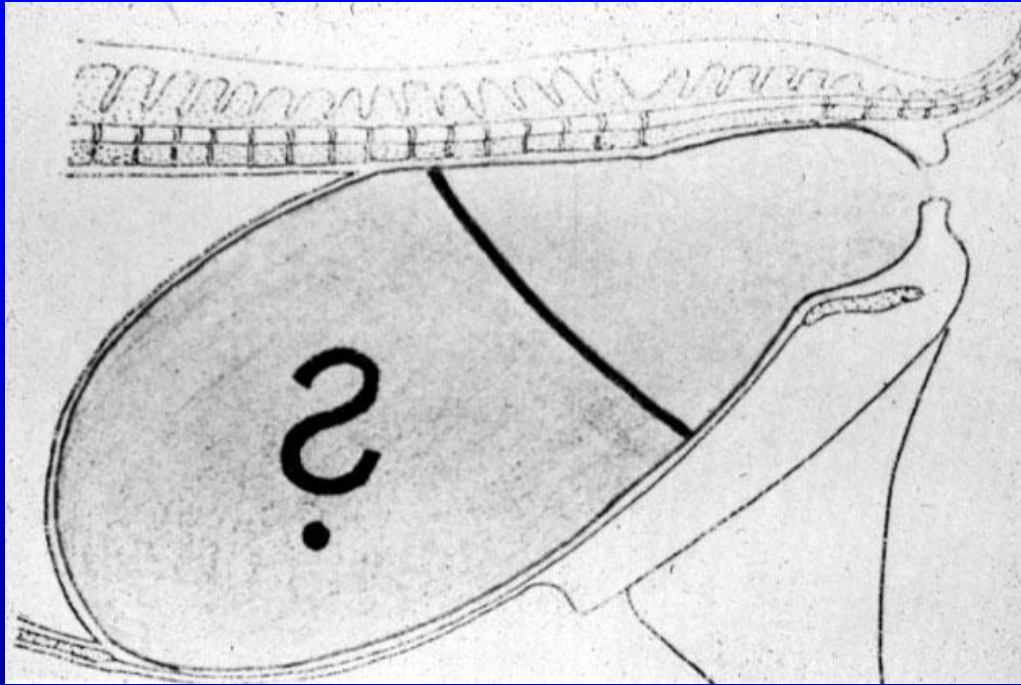
Rectal Palpation

- Determine if there is fecal material in the rectum. Stringy mucus on the feces indicates intestinal stasis.
- All palpable structures should be evaluated
- Evaluate bowel for location, gas-or fluid-distended loops, masses (impaction, abscess, neoplasm) and tight mesenteric bands.

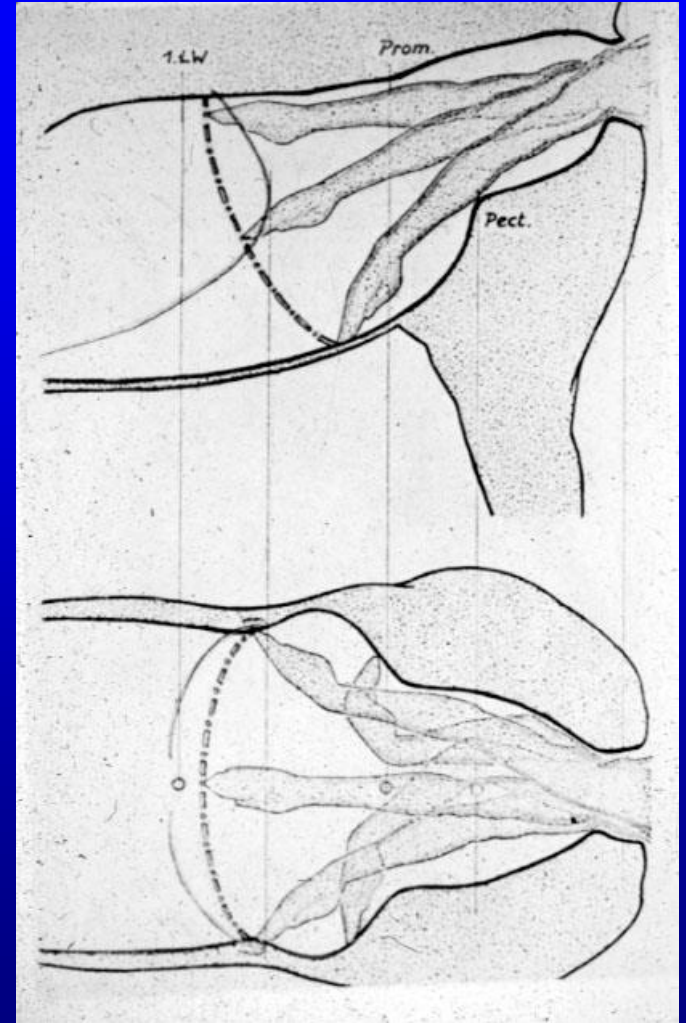
Interpretation

Rectal palpation may reveal a finding (e.g., impaction or distended loops of small intestine) requiring surgical intervention. The examiner can evaluate only 1/3 to 1/2 of the abdomen by rectal examination; therefore, a negative rectal does not necessarily indicate a non-surgical patient.

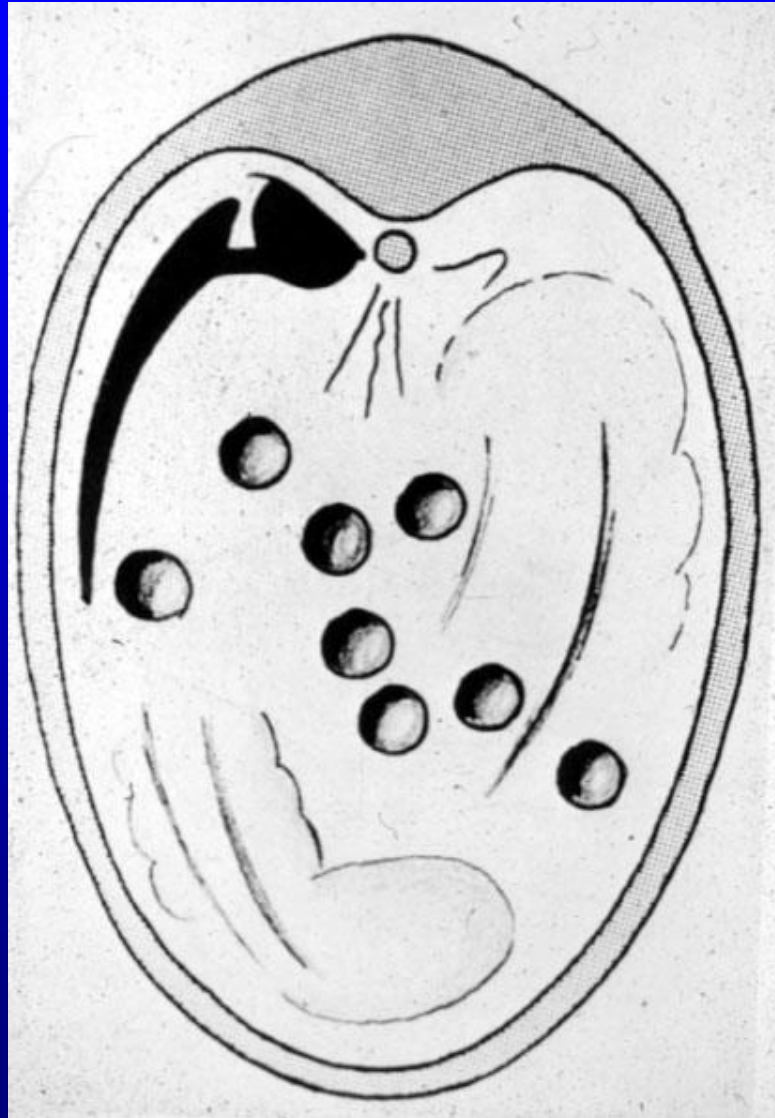
Rectal Palpation



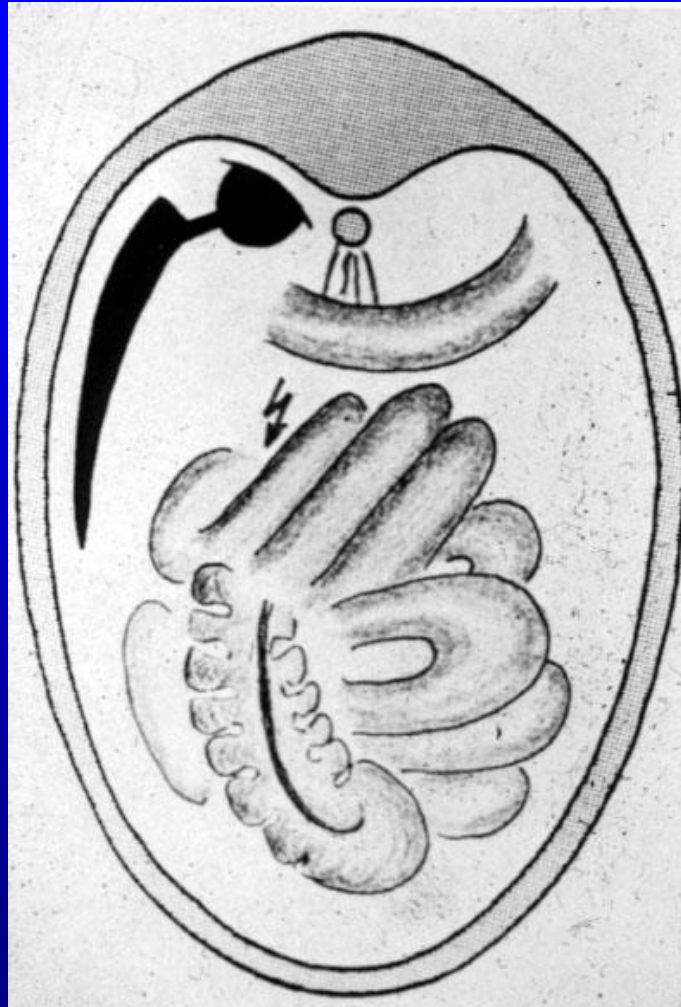
Drawings from Huskamp et.al1.



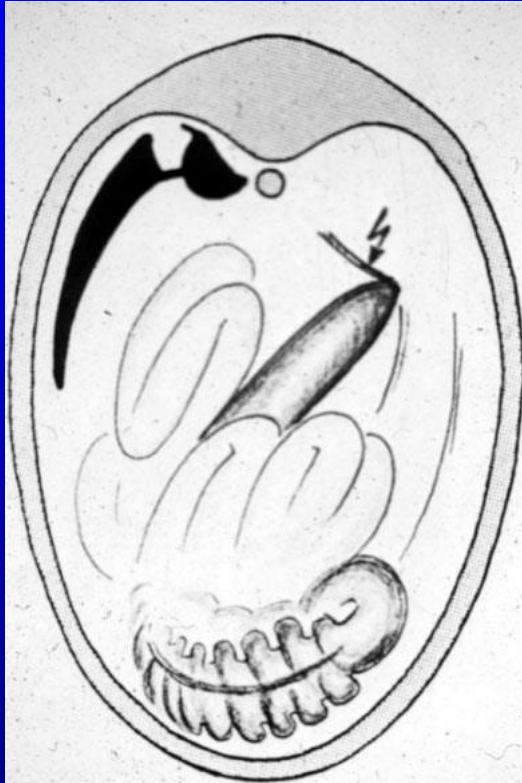
Rectal Palpation—Normal findings



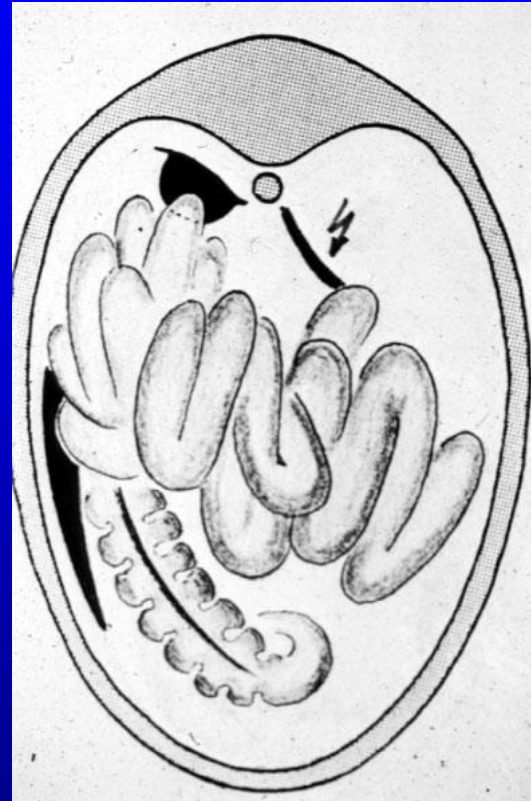
Rectal Palpation—SI obstruction



Rectal Palpation—Ileal impaction

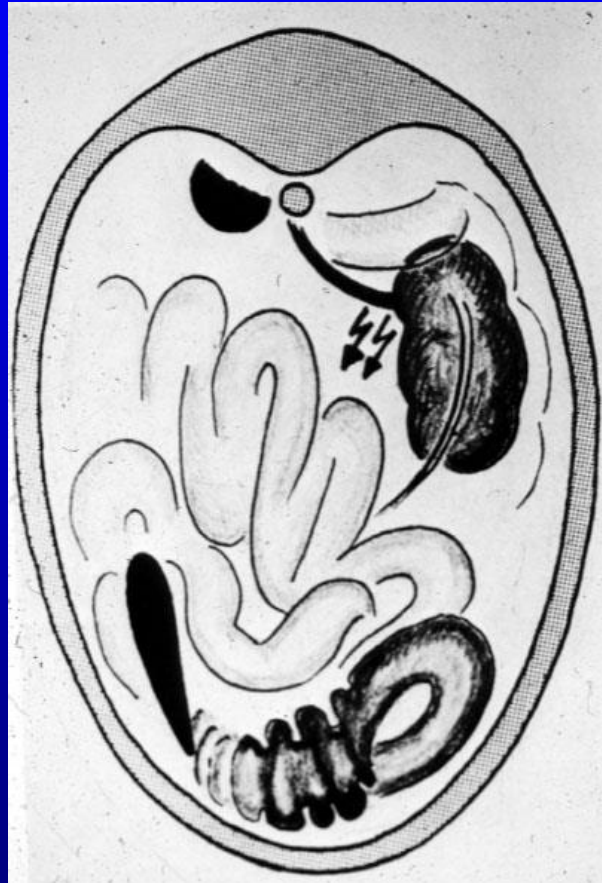


Early

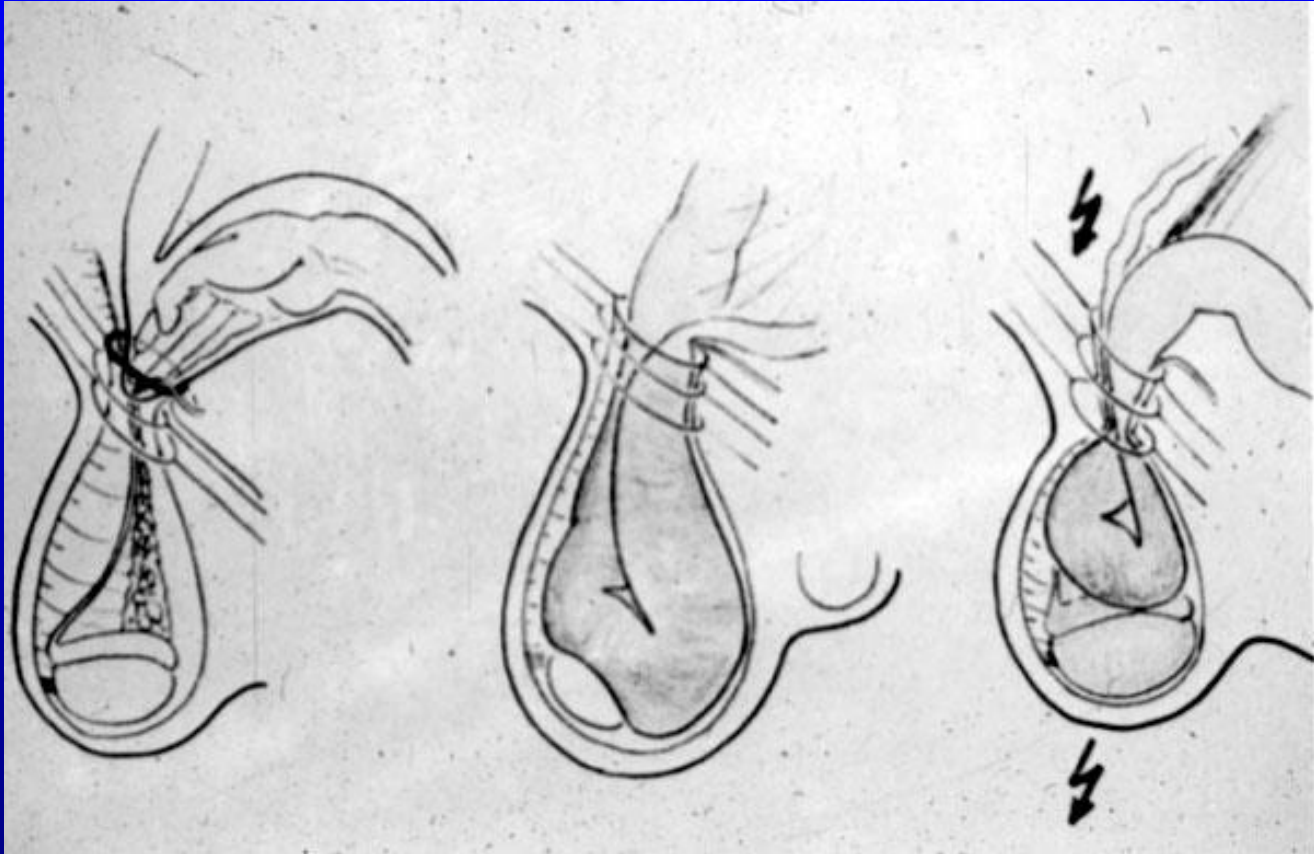


Later

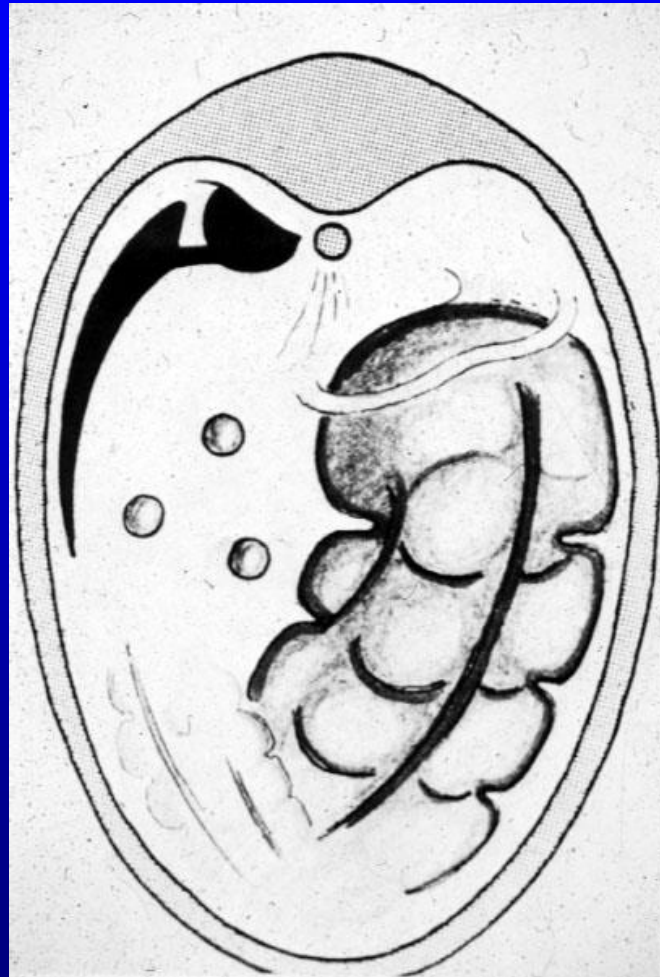
Rectal Palpation—Ileocecal Intussusception



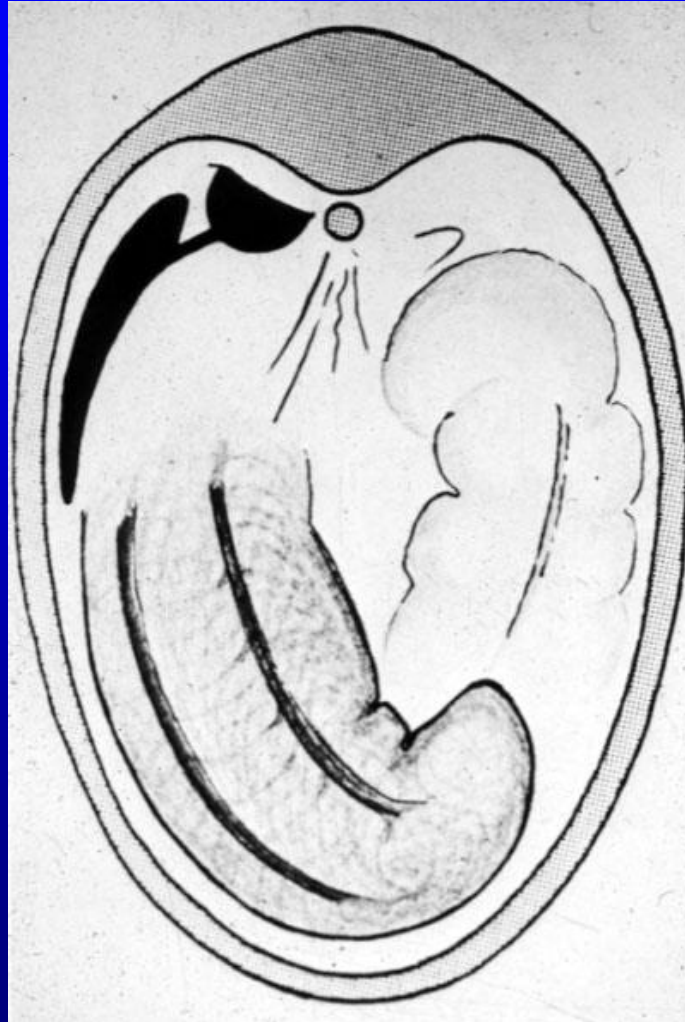
Rectal Palpation—Inguinal hernia



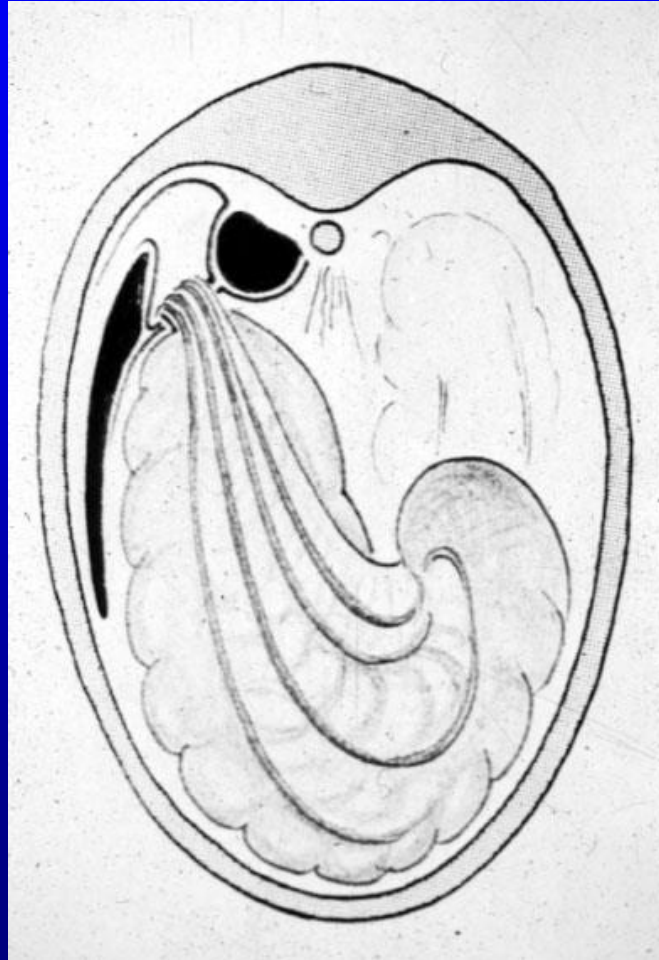
Rectal Palpation—Cecal impaction



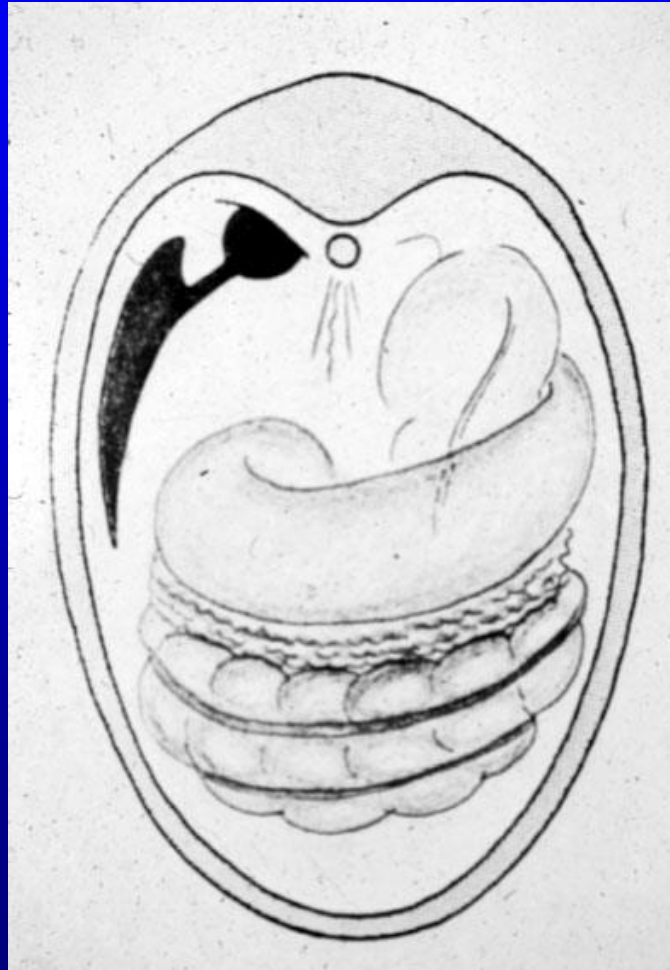
Rectal Palpation—Pelvic flexure impaction



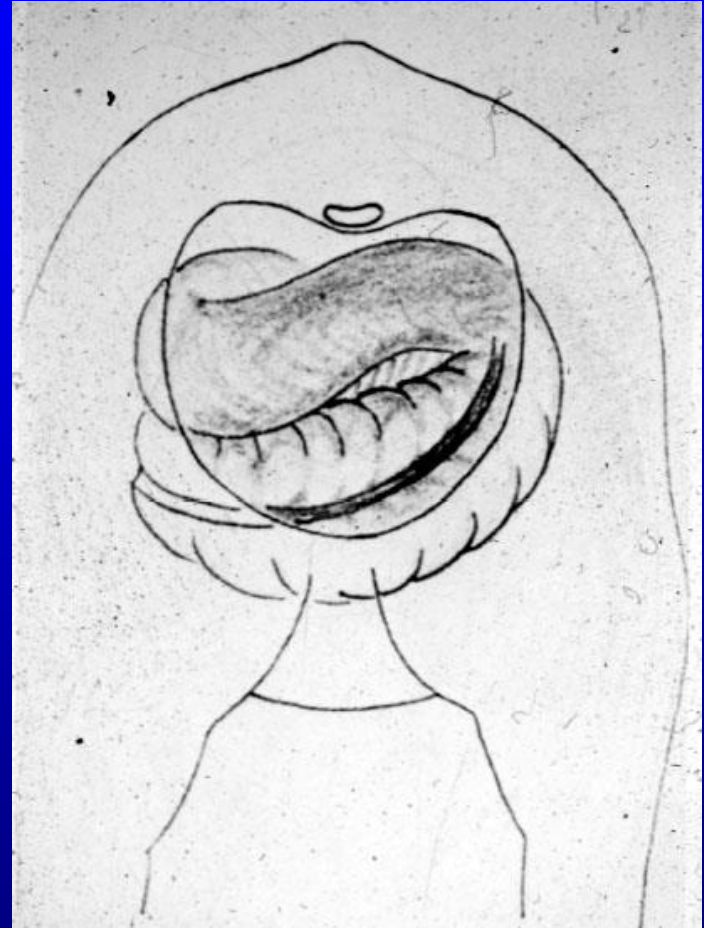
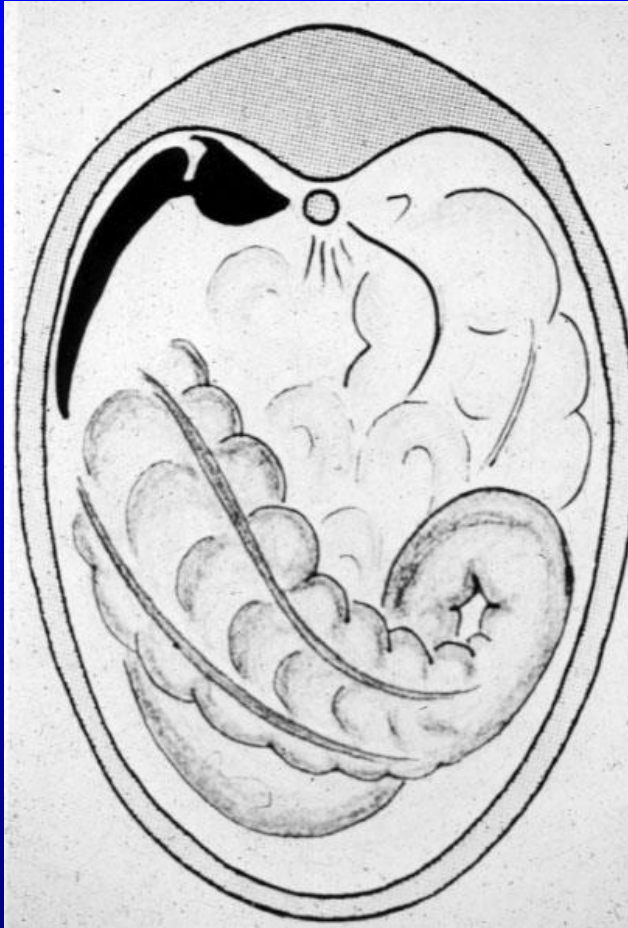
Rectal Palpation—Renosplenic entrapment of the left colon



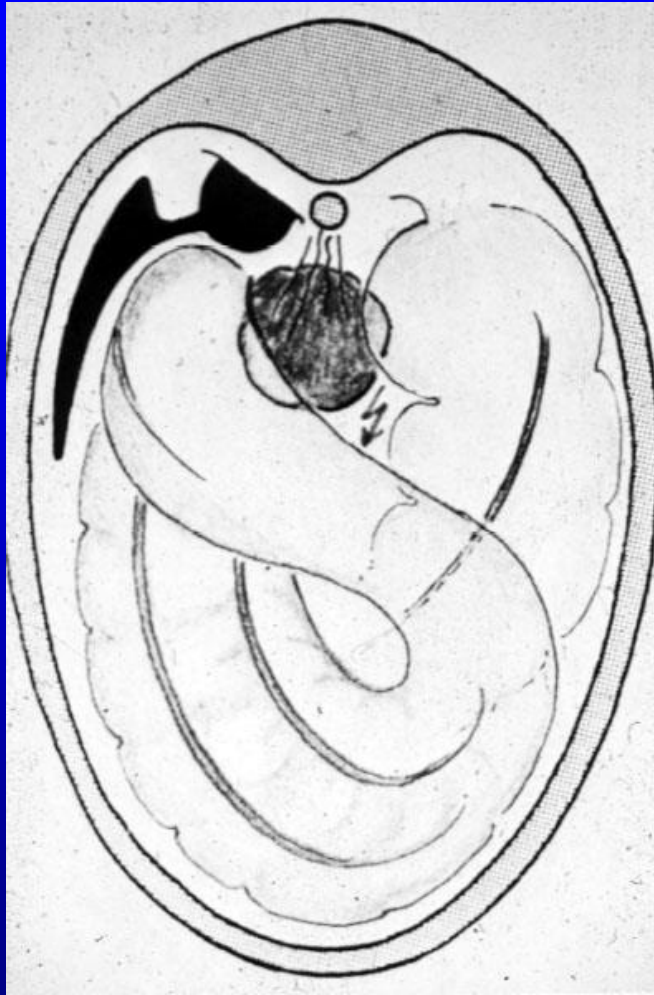
Rectal Palpation—Colonic displacement



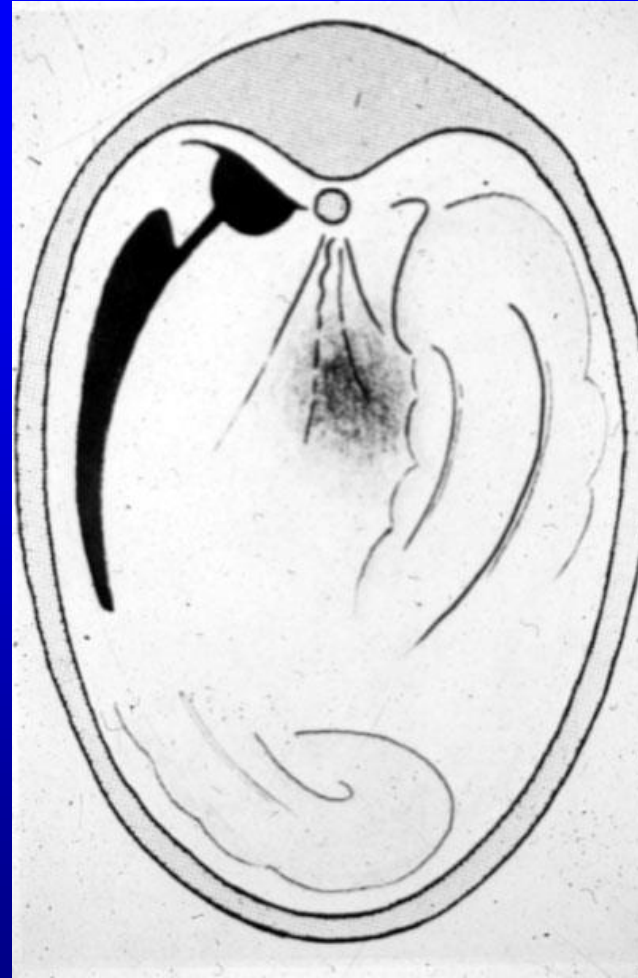
Rectal Palpation—Colonic volvulus



Rectal Palpation—RDC obstruction

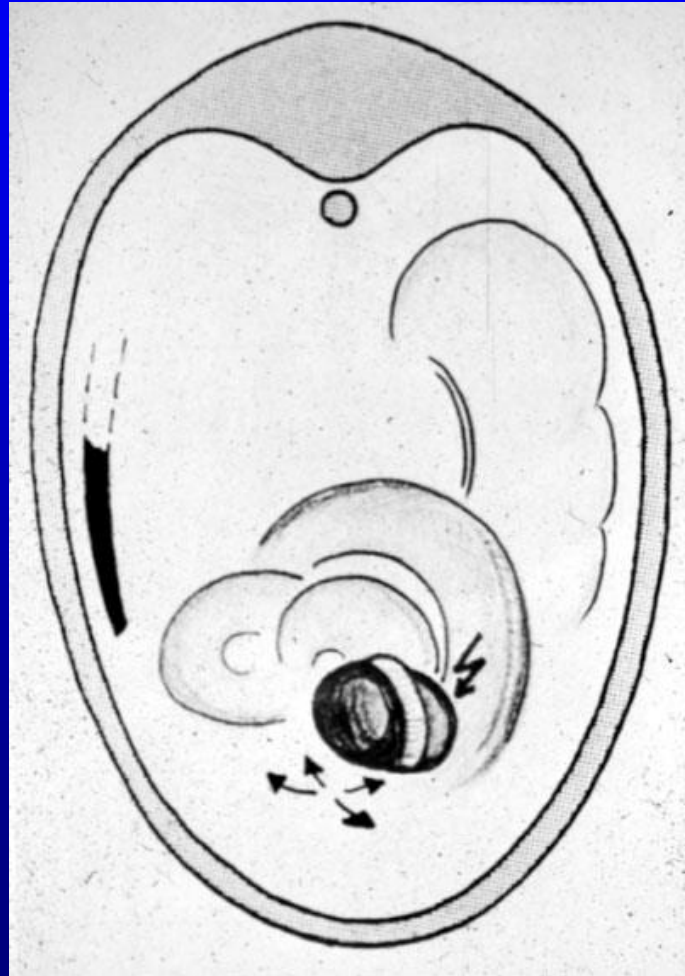


Enterolith



Impaction

Rectal Palpation—Small colon obstruction



Nasogastric Intubation

- A nasogastric tube should be passed in every horse with colic
 - Determine amount and nature of gas and fluid in the stomach
 - Measure pH of refluxed fluid

Interpretation

Reflux of large volumes of fluid and gas indicates either primary or secondary gastric dilation.

A neutral or alkaline pH indicates small intestinal obstruction with reflux of alkaline small intestinal secretions into the stomach.



Abdominal Paracentesis

- Mandatory in a severe colic or a colic that does not respond rapidly to conservative therapy.
- Tap on the ventral midline at low point of the abdomen between the xiphoid cartilage and the umbilicus. Uterus or spleen may be encountered.
- Ultrasonic examination may be used to determine the location of collections of peritoneal fluid.
- In obese horses, a 4-6 inch needle will be required to penetrate the subperitoneal fat.
- Excellent restraint in foals is necessary to ↓ risk of bowel laceration.

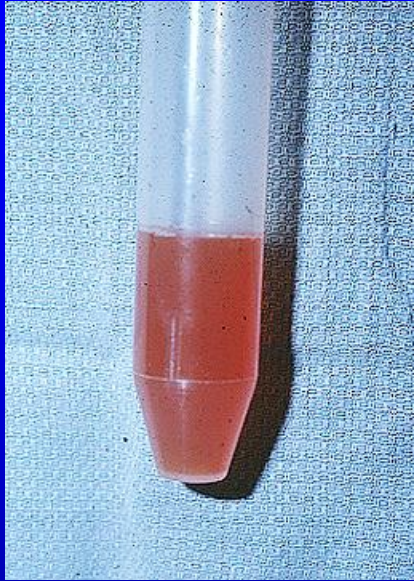
Abdominal Paracentesis



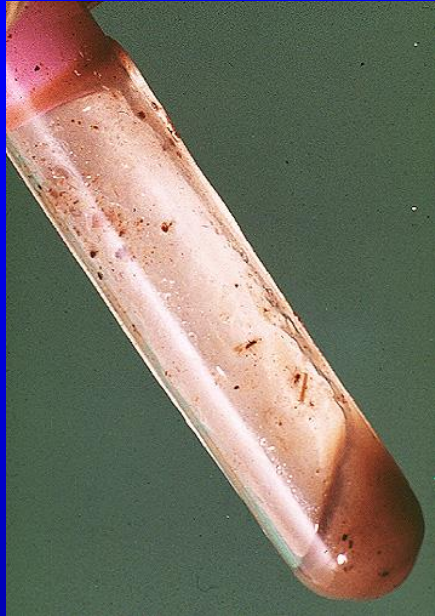
Abdominal Paracentesis

Normal	Clear, variable color
Peritonitis	↑ turbidity due to ↑ cells or protein
Intestinal strangulation	Amber to dark red fluid, odor of necrosis
Ruptured viscus	Reddish-brown fluid containing feed particles
Hemoperitoneum or splenic tap	Free blood
Tap contaminated with blood	Pink or light red fluid

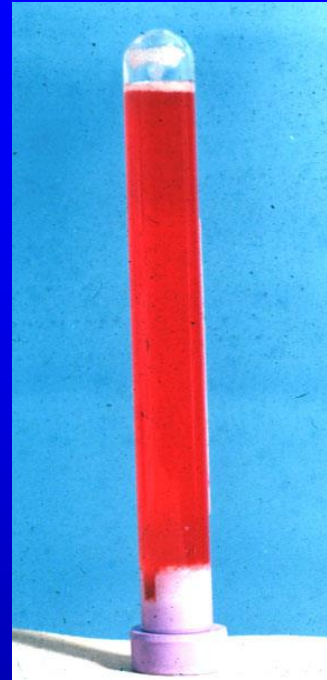
Abdominal paracentesis



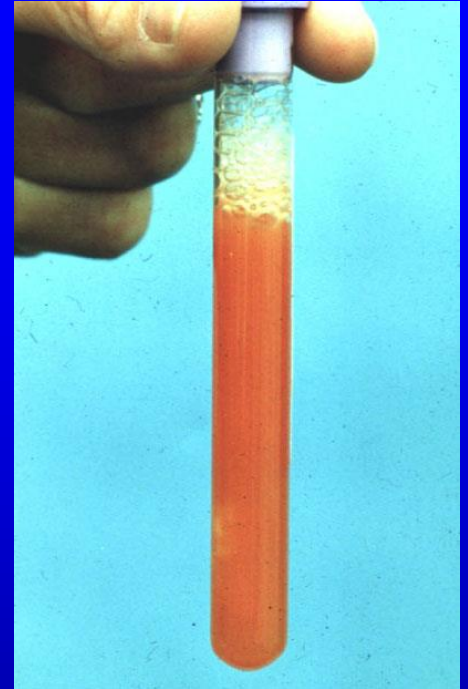
Bowel
strangulation



Bowel
rupture



Blood
contamination



Peritonitis

Abdominal Ultrasound

- 5 megahertz head
- useful in all cases but particularly valuable in horses too small for rectal examination
- assess the size and thickness of intestinal segments, intestinal motility, peritoneal surfaces (adhesions or fluid accumulations). Renosplenic entrapment of the left colon can be diagnosed by ultrasonic exam.

Interpretation

Dilated, static, thickened small intestinal loops strongly suggests intestinal strangulation. Distended but motile loops suggest a less serious disorder.

Abdominal radiography

- Foals
 - assess for intestinal obstruction (small intestine vs. colon)
- Adult horses
 - sand colic
 - enterolithiasis

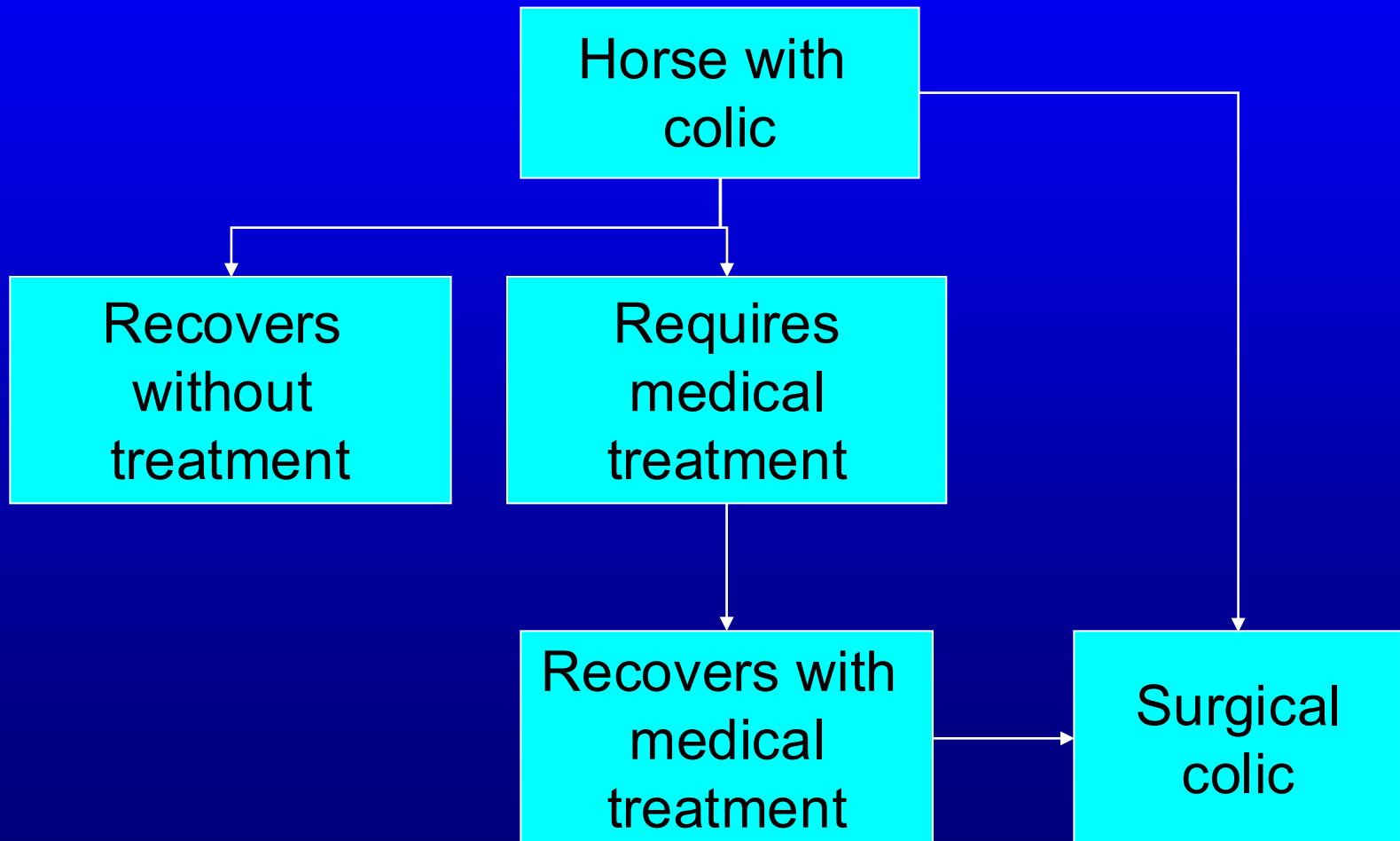


Laboratory tests

- Aids to diagnosis of colic
 - White cell count (enteritis)
 - Peritoneal fluid analysis (total protein, cell count, cytology)
- Tests to aid treatment/prognosis
 - PCV/TP (hydration)
 - Acid:base/electrolytes (fluid therapy)
 - Anion gap (prognosis)
 - Serum lactate (prognosis)



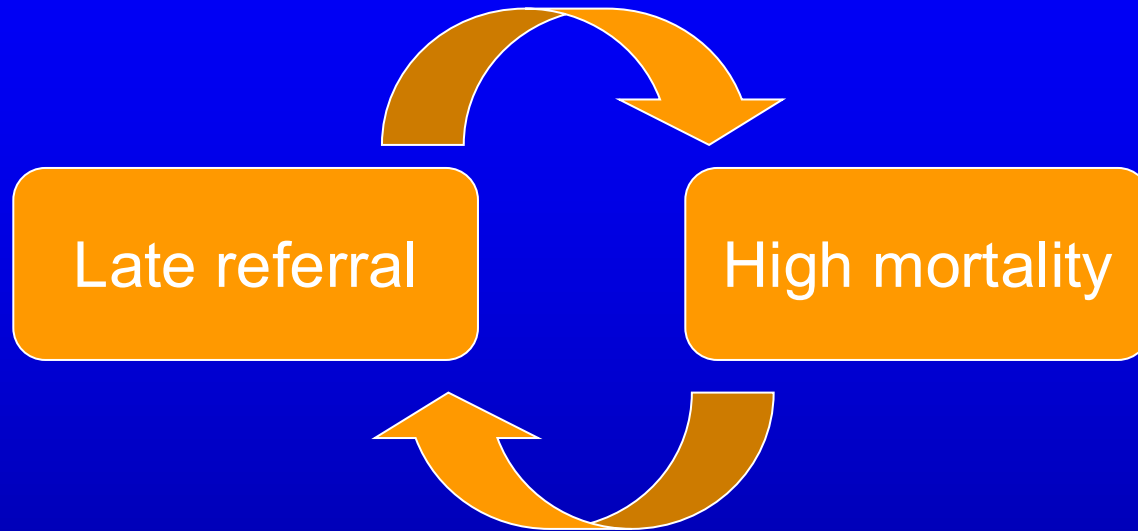
MANAGEMENT OF THE EQUINE COLIC PATIENT



Surgical diseases

- Strangulation obstruction—SI or LI
- Simple obstruction of SI
- Certain simple obstructions of LI
 - enteroliths/fecoliths/phytobezoars
 - obstructions with severe tympany
 - nonstrangulated displacements
- Thromboembolic bowel disease
- Certain functional colics
 - tympanitic colic

Your Role as the Referring Veterinarian



- Colics should be referred as "potentially surgical" or "probably surgical." Referral should not be delayed until the horse obviously requires abdominal surgery, especially if a long trip to a surgical facility is necessary.

Indicators for referral

- ① uncontrollable pain
- ② marked large intestinal tympany
- ③ marked fluid distension of the small intestine (determined by rectal or ultrasonic exam) especially when coupled with reflux of large volumes of fluid from the stomach
- ④ identification of a surgical disorder (e.g. cecal impaction) on rectal examination
- ⑤ serosanguinous or amber abdominal tap characteristic of intestinal infarction
- ⑥ colic signs of longer than 48 hrs without a distinct diagnosis

Monitoring the horse with colic

	FAVORABLE	UNFAVORABLE
Onset and progression of pain	Slow onset and progression	Acute onset and rapid progression
Degree of pain	Mild to moderate	Moderate to severe
Heart rate	< 40-60	> 60-80
Mucous membrane color	Normal pink	Dark pink to purple
Hydration	Normal	Delayed skin tent
Temperature of extremities	Normal	Cool ears & limbs
Intestinal sounds	Normal or increased	Reduced or absent
Abdominal distention	None	Present

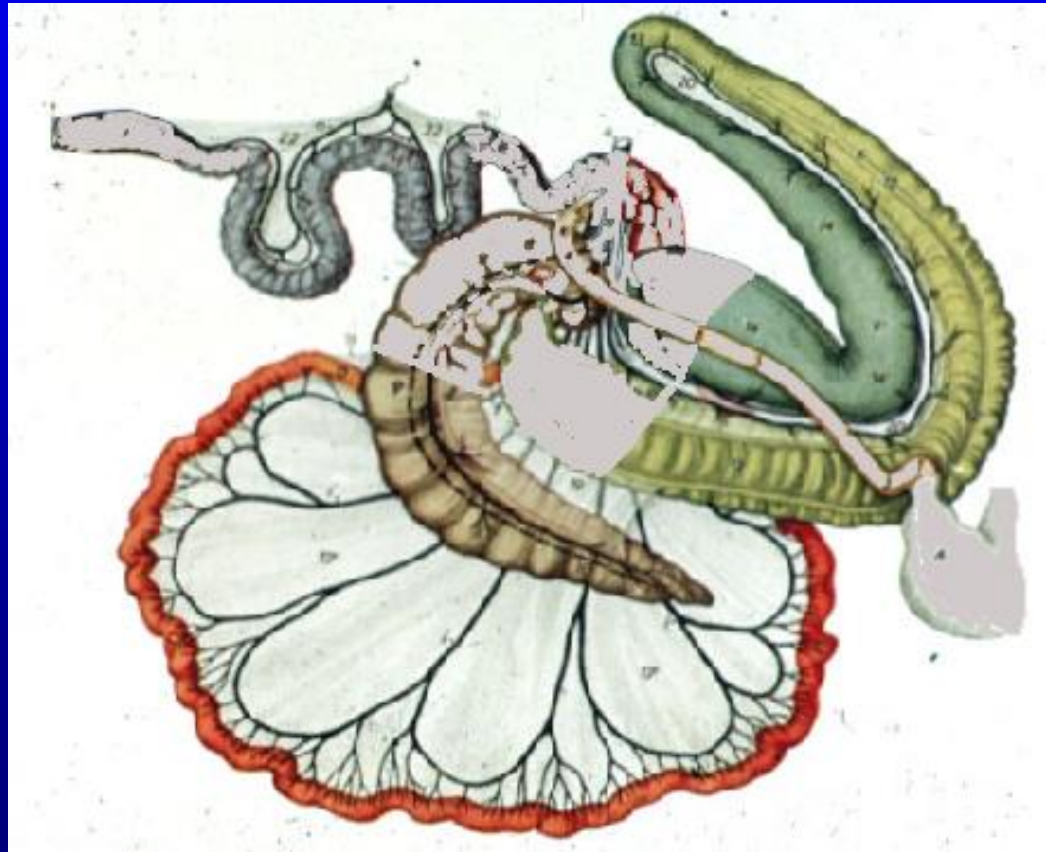
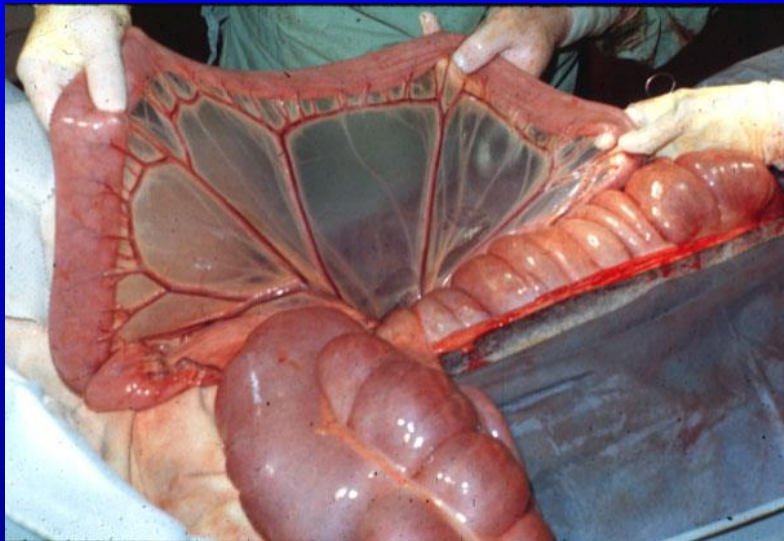
Preparation for shipment to referral hospital

- Antibiotic therapy (penicillin + aminoglycoside).
- Nasogastric tube should be left in place during transit.
- Banamine® for pain relief and to diminish the effects of endotoxemia.
- Xylazine or detomidine may be dispensed to the owner to manage severe pain during transport.

Surgical treatment of colic

Ventral midline surgical approach:

- Good for palpation of all abdominal viscera
- Variable exposure



Pedunculated lipoma

- A benign fatty tumor arising from the mesentery with a pedicle that wraps around intestine causing strangulation
- Frequent in older horses (12-15+ yrs)
- Most common cause of small intestinal strangulation in horses
- Clinical signs are typical of SI strangulation but progression may vary with amount of strangulated bowel
- Occasional cause of small colon strangulation

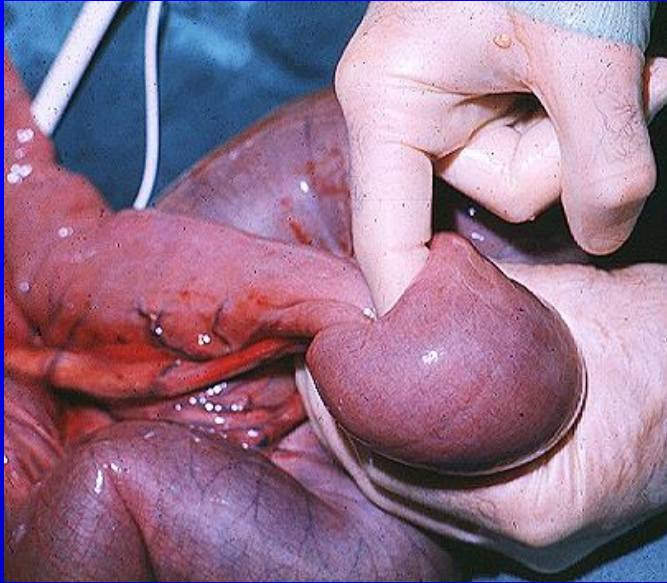
Pedunculated lipoma



Intussusception

- A telescoping of one segment of bowel (the intussusceptum) into another segment (the intussuscepiens)
- Several types
 - jejunojejunal
 - acute SI obstruction in young horses
 - ileocecal
 - acute SI obstruction in young horses
 - chronic ileocecal
 - low grade colic and unthriftiness in yearlings
 - cecocecal, cecocolic or colocolic
 - signs of simple colonic obstruction

Intussusception



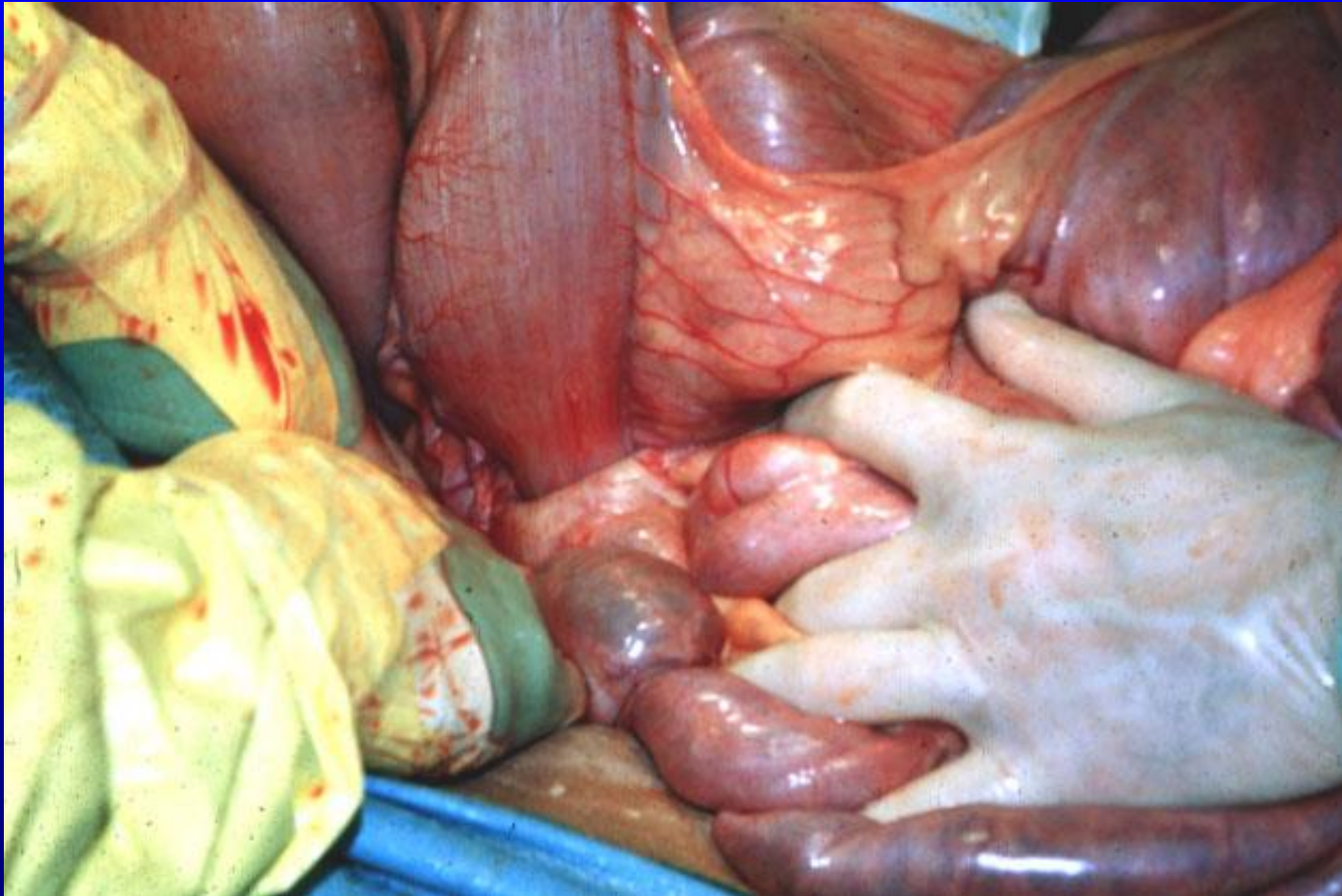
Jejuno-jejunal
intussusception



Ceco-colic
intussusception

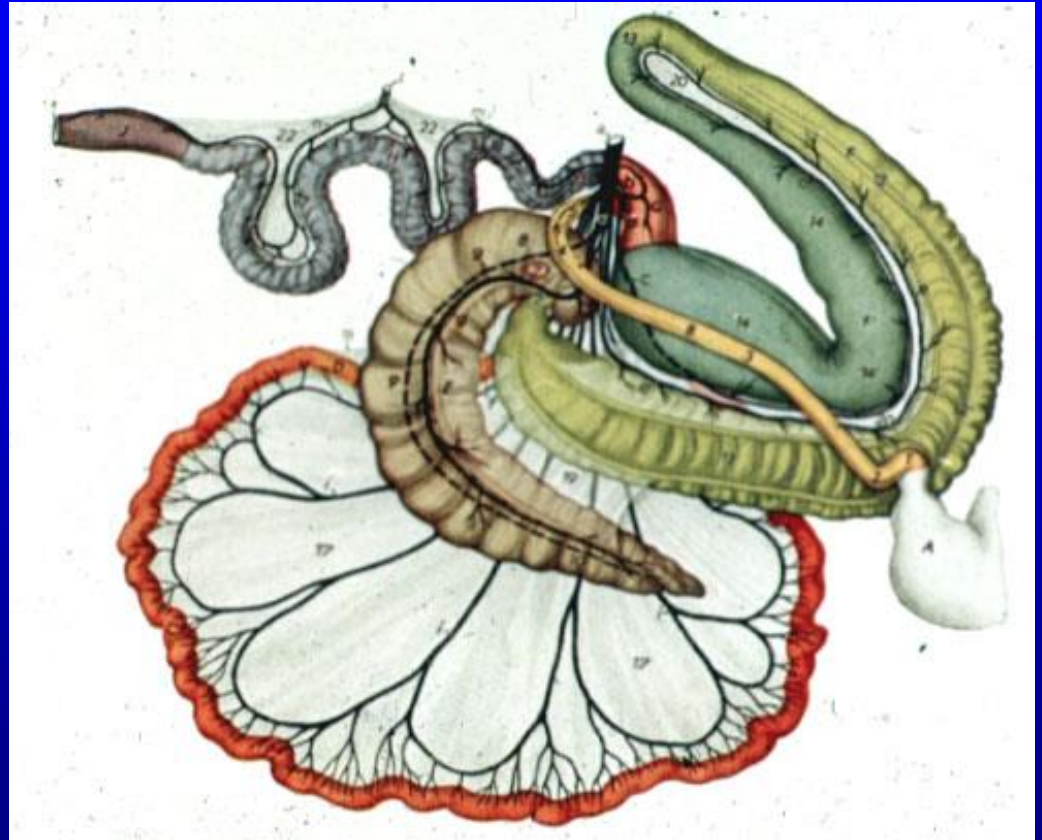
The outline of the
cecum can be seen in
RV colon

Chronic ileocecal intussusception



Impactions

- ileal
- cecal
- pelvic flexure
- transverse colon
- small colon

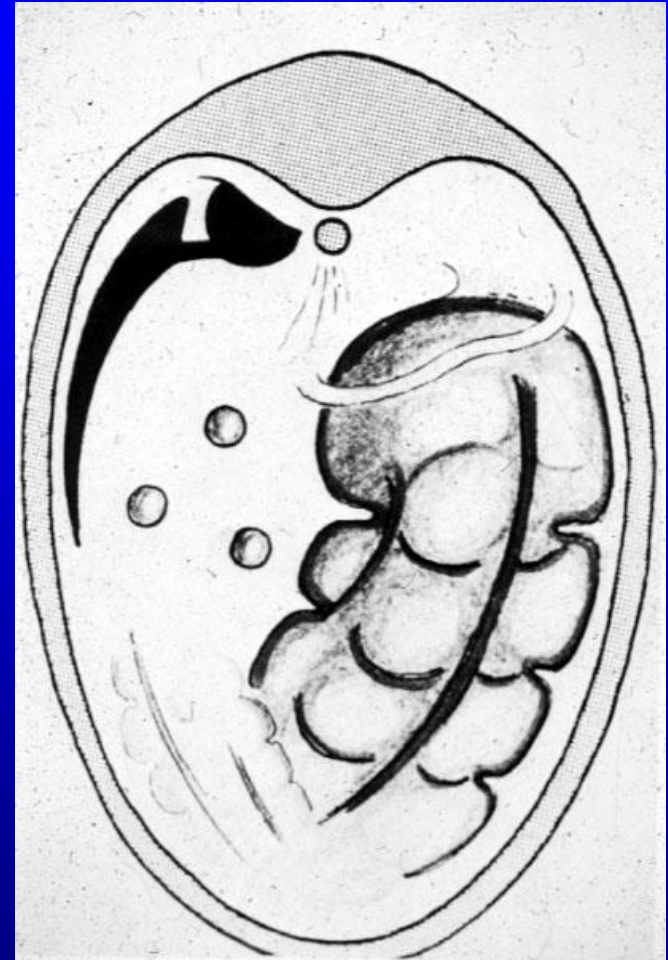


Ileal impaction

- signs typical of simple obstruction of the small intestine (intense pain, small intestinal distention, etc.).
- impacted ileum may be palpable early but generalized small intestinal distention later obscures the impaction.
- most cases in the southeastern U.S (Bermuda grass hays)
- Tx=surgery

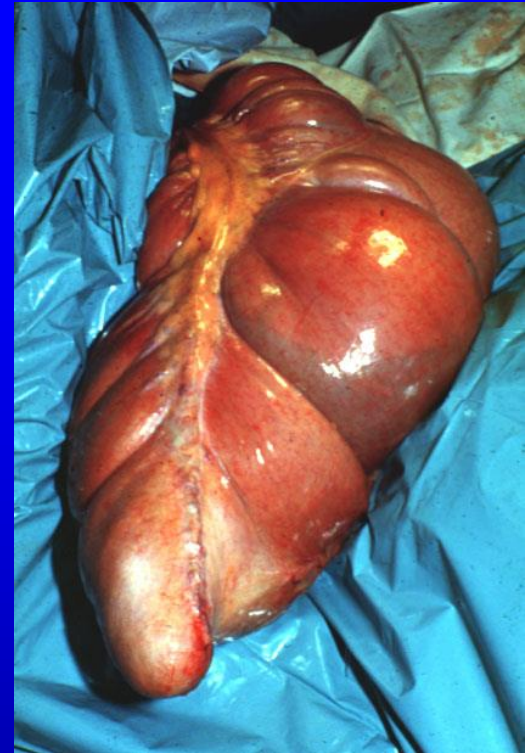
Cecal impaction

- Usually presents as intermittent chronic mild colic.
- Two forms
 - idiopathic
 - following a stressor, especially general anesthesia
- The impacted cecum is palpable per rectum.



Cecal impaction

- Treatment options
 - Conservative (risk of cecal rupture)
 - Surgical treatment
 - typhlotomy and evacuation of the cecum
 - cecal bypass (ileocolostomy)



Pelvic flexure impaction

- The most common impaction of horses
- Typically a gradual onset of mild to moderate pain
- Impaction is readily palpable per rectum
 - only the left ventral colon will be filled
- Usually respond well to conservative therapy (analgesics, IV fluids $\pm$ oral fluids)
- Surgical intervention is rarely necessary.



Transverse colon impaction

- Impaction due to feed, foreign material, -liths
- Typically moderate to severe pain
- Impaction is ordinarily not palpable per rectum.
- Poor response to conservative therapy (mural necrosis and perforation)
- Surgical treatment

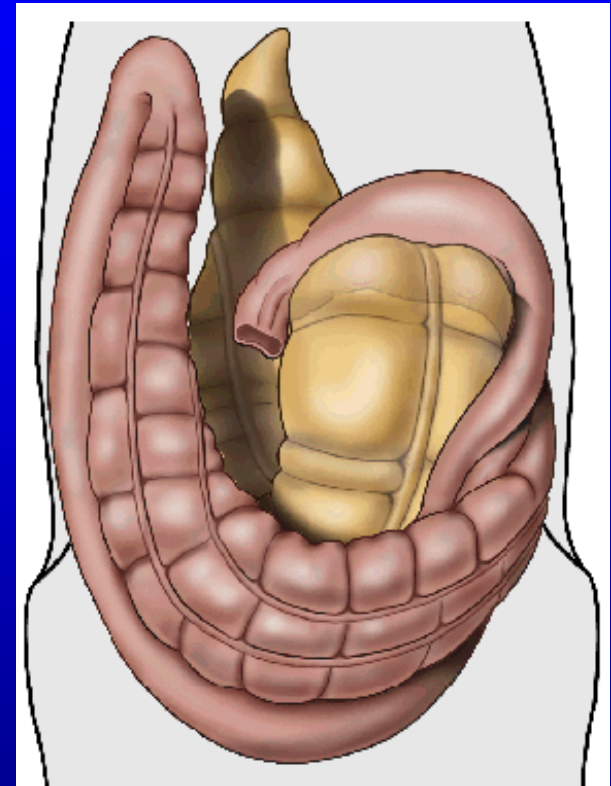
Small colon impaction

- Impaction due to feed (ponies, miniature horses), foreign material, -liths, meconium (neonates)
- Usually a gradual onset of pain and progressive abdominal distention. Severe colonic tympany may result.
- Impaction may or may not be palpable per rectum.
- Surgical intervention is indicated
- Meconium impactions rarely need surgery.



Nonstrangulated colonic displacements

- Several types:
 - volvulus of 180-270° involving the colon or cecum and colon
 - right dorsal displacement of the large colon
 - entrapment of the left colon by the nephrosplenic ligament
- Clinical signs typical of simple obstruction of the large colon
- Treated surgically except for nephrosplenic entrapment.



Right dorsal displacement
of the large colon

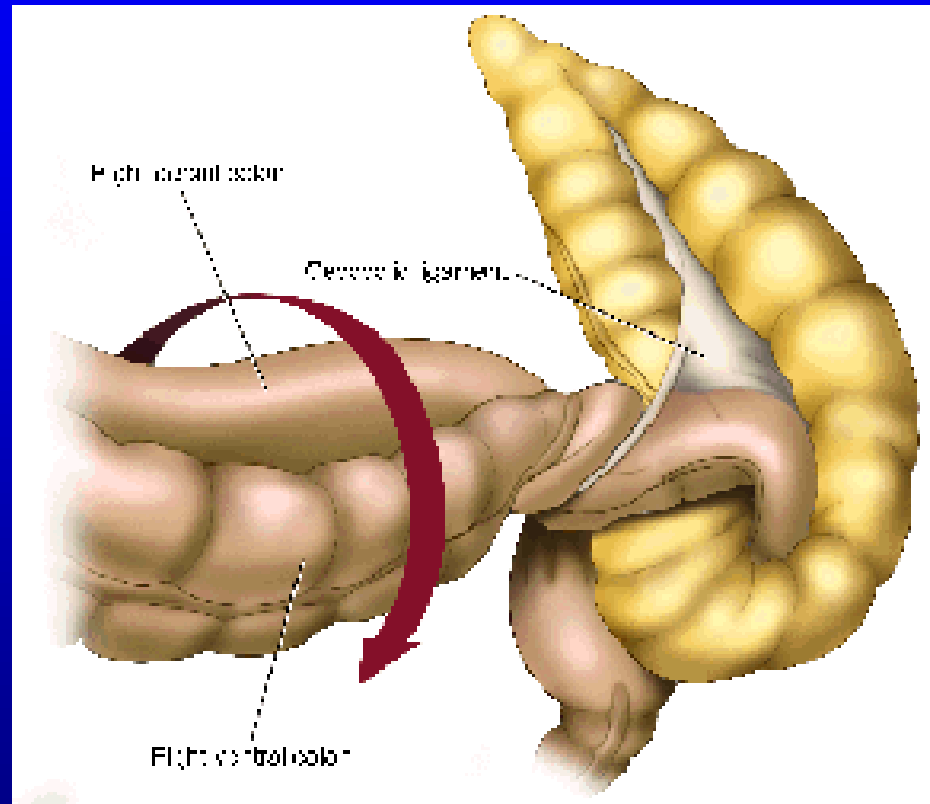
Nephrosplenic entrapment of the left colon

- Also termed “left dorsal displacement of the large colon”
- Diagnosed by rectal or ultrasonic exam
- Treatment options
 - phenylephrine + exercise
 - rolling
 - surgical



Colonic volvulus

- Volvulus of 360° or greater involving the colon or cecum and colon leading to strangulation
- Risk factor in postpartem mares
- Peracute clinical course
 - rapid shock
 - severe pain
 - marked abdominal tympany
- Surgical emergency



Rectal tears

- Usually a palpation injury (blood on rectal sleeve), occasionally a breeding injury
- Grading system
 - Grade 1. Mucosa & submucosa only
 - Grade 2. Muscular layers only
 - Grade 3. Mucosa, submucosa and muscular layers but serosa is intact (includes retroperitoneal tears and those into the mesorectum)
 - Grade 4. Full-thickness tear extending into the peritoneal cavity



Rectal tears

- Immediate treatment of Grade 3 & 4 tears
 - inform owner of problem and risks
 - epidural block
 - bare-handed rectal to confirm depth and location of tear
 - gently evacuate feces from near the tear
 - pack the rectum in front of tear
- Surgical treatment of Grade 3 & 4 tears
 - evacuate colon by pelvic flexure enterotomy
 - temporary diverting colostomy or rectal liner