

DISPLACEMENTS OF THE INTESTINES

1. EVENTRATION

Displacement of a portion of the gut, usually the small intestine, outside the abdominal cavity.

- Congenital
 - Schistosomus reflexus
 - Patent umbilicus
 - Congenital diaphragmatic hernia
- Acquired (trauma)



2. CECAL AND COLONIC DILATION, TYMPANY AND TORSION

- In ruminants, cecal dilation and torsion
 - ✓ Occurs in animals fed High-concentrate rations
 - ✓ Has been associated Late gestation and ileus from other causes



➤ In horses, cecal and colonic tympany

✓ Readily fermentable carbohydrate

CLINICALLY

- Severe abdominal distension
- Compression of intra-abdominal organs
- Reduced cardiac return due to postcaval compression
- Reduced respiratory capacity due to compression of the diaphragm
- Severe pain
- Hypovolemia, acidosis, large bowel ruptures
- **Laminitis (in recovered horses)**

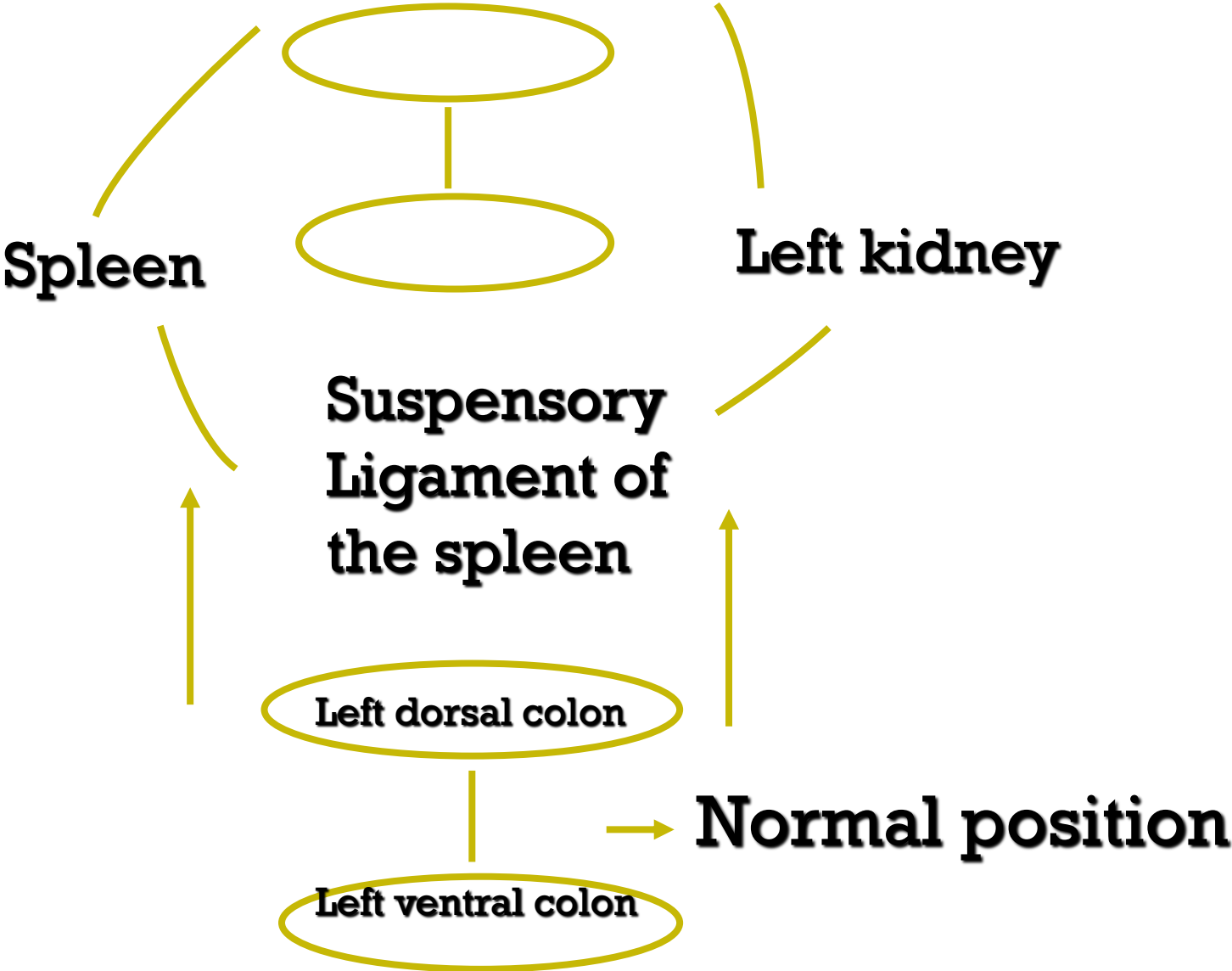


3. DISPLACEMENTS OF THE EQUINE COLON

- Right dorsal displacement of the colon
- Left dorsal displacement of the colon
- Colonic torsion and volvulus



Abdominal wall



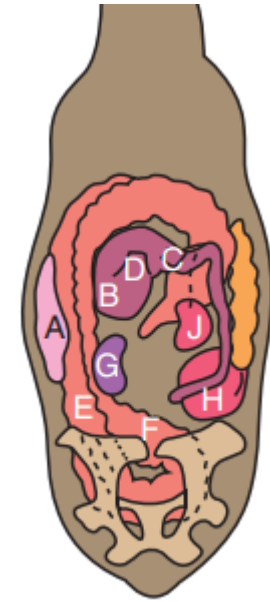
❖ **Right dorsal displacement of the colon,**

- involves displacement of the *left segments of the large colon* **to the right of the cecum**
- This occurs when the large colon pelvic flexure moves under or around the cecum, ending up located between the cecum and the right abdominal wall.
- Consequently, when the carcass is opened from the right side of the body, the left colons are visible first.
- because of tympany



Nephrosplenic Entrapment

- ❖ **Left dorsal displacement of the colon**, variously known as entrapment of the colon by the nephrosplenic, renosplenic, or phrenicosplenic ligament, or by the suspensory ligament of the spleen.
- The left dorsal and ventral colon move **laterally and dorsally between the spleen and the left body wall**, and become entrapped. Finally, colon is entrapped among them:
- spleen (left), suspensory ligament of spleen (ventral), left kidney (medial), abdominal wall (dorsal)



A, spleen; B, stomach; C, liver; D, esophagus; E, left ventral colon; F, left dorsal colon; G, left kidney; H, base of cecum; J, right kidney; K, duodenum

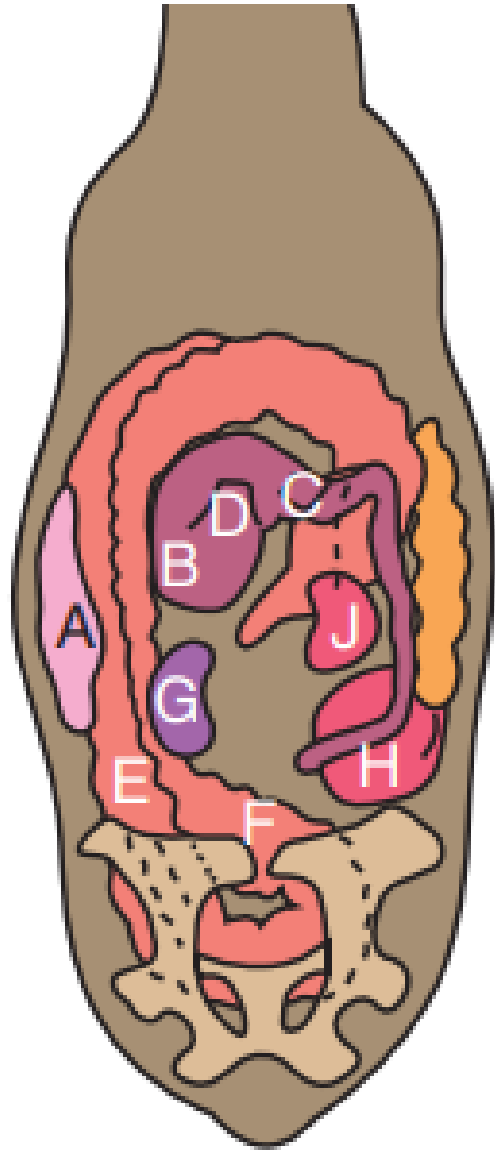
Jubb-kennedy-palmer pathology of domestic animals



The left dorsal and ventral colon move laterally and dorsally between the spleen and the left body wall, and become entrapped.

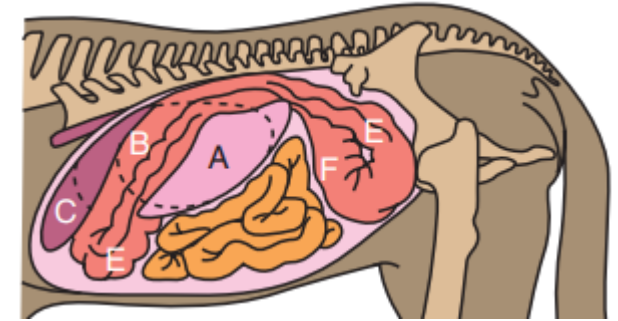
Left dorsal displacement (nephrosplenic entrapment) of the equine colon. Entrapment with the sternal and diaphragmatic flexures of the colon below the stomach.

A, spleen; B, stomach; C, liver; D, esophagus; E, left ventral colon; F, left dorsal colon; G, left kidney; H, base of cecum; J, right kidney; K, duodenum



Entrapment with the sternal and diaphragmatic flexures

- **As the colon becomes entrapped it rotates along its axis** with the result that **the ventral colon lies dorsally** and **the dorsal colon lies ventrally**.
- The colon caudal to the entrapment **may become curved cranially**, with the pelvic flexure rotated through 180° .
- If the weight of the displaced colon **is supported by the nephrosplenic ligament**, the spleen may move away from the left body wall.

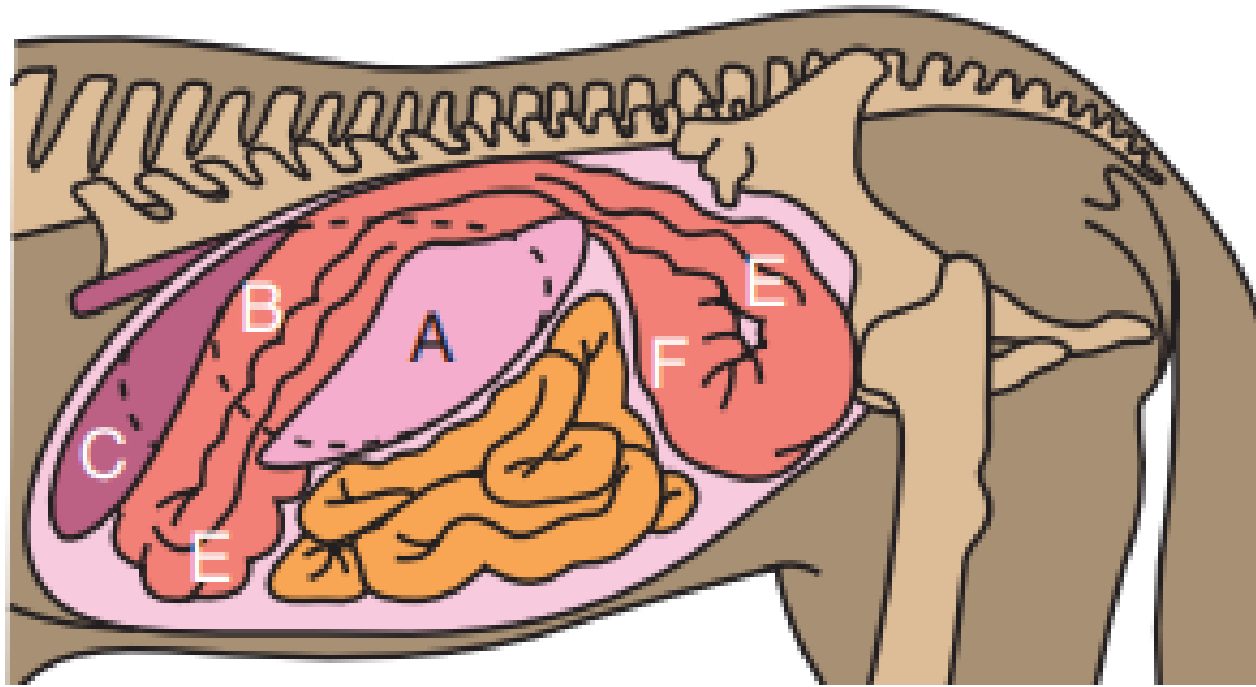


A, spleen; B, stomach; C, liver; D, esophagus; E, left ventral colon; F, left dorsal colon; G, left kidney; H, base of cecum; J, right kidney; K, duodenum

The cause of left dorsal displacement is **unknown**, but may be related to an **anatomic predisposition** resulting from a large cleft between the spleen and the left kidney.

Jubb-kennedy-palmer pathology of domestic animals





**the ventral colon
lies dorsally and
the dorsal colon
lies ventrally.**

Jubb-kennedy-
palmer pathology of
domestic animals

Entrapment with the sternal and diaphragmatic flexures displaced dorsal to the stomach

A, spleen; B, stomach; C, liver; D, esophagus; E, left ventral colon; F, left dorsal colon; G, left kidney; H, base of cecum; J, right kidney; K, duodenum



❖ **Colonic volvulus**

- One of the most common and grave colic causes in horses.
- The loop of large colon, with or without the cecum, may rotate around itself at some point along its length, or around the root of the mesentery.
- The condition is lifethreatening because of:

Intestinal ischemia and infarction.



4. INTERNAL HERNIA

- **INTERNAL HERNIA** is a displacement of intestine through normal or pathological foramina within the abdominal cavity without the formation of a hernial sac.
- Herniation through a natural foramen
(foramen of Winslow)(in horses)
- Omental hernia
- Mesenteric hernia
- Pelvic hernia (in young ruminants)
- Hernia spatii renolienalis

without the formation of a hernial sac



4. EXTERNAL HERNIA

- Ventral hernia of the abdominal wall
- Umbilical hernia
- Parietal hernia
- Inguinal hernia
- Scrotal hernia
- Femoral hernias
- Perineal hernias
- Diaphragmatic hernias



consist of abdominal contents contained within the tunica vaginalis

abdominal contents pass through the internal inguinal ring and come to rest in a subcutaneous position

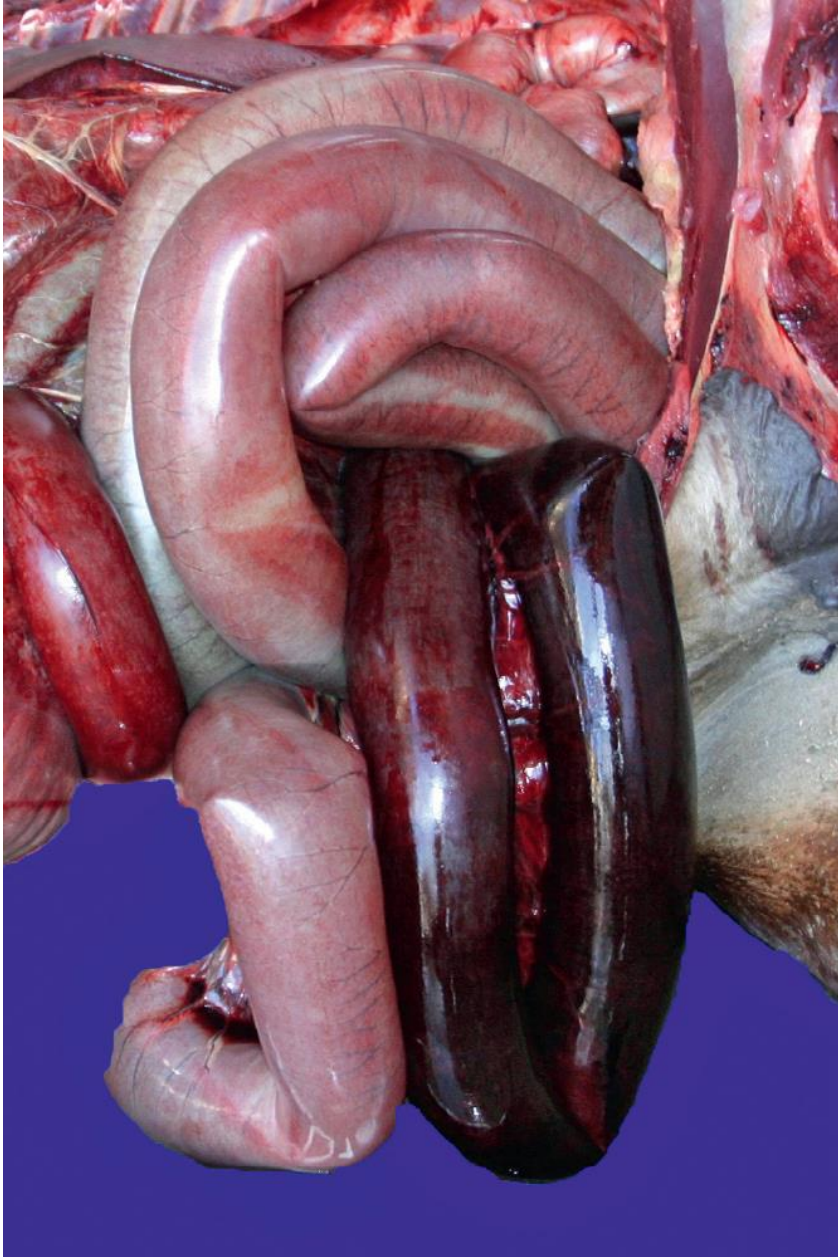


INTESTINAL ISCHEMIA AND INFARCTION

1. VENOUS INFARCTION

- Displacements of intestine
- Torsion of the long axis of the mesentery
- Volvulus
- **Invagination (Intussusception)**
- Cecal inversion and cecocolic intussusception in the horse
- Segmental ischemic necrosis of the small colon





Venous infarction of a segment of equine small intestine that has undergone volvulus.

Jubb-kennedy-palmer pathology of domestic animals



INVAGINATION (INTUSSUSCEPTION)

- Telescoping of intestine one portion into another.
- Linear foreign bodies, heavy parasitism, previous intestinal surgery, enteritis, and intramural lesions such as abscesses and tumors may be associated.
- Common in dogs, most frequently ileocolic.
- Venous infarction of the intussusceptum. Edema, congestion, necrosis and gangrene may develop.



- The progressive invagination of the leading edge of the intussusceptum into the distal segment results in the wall of the intussusception being comprised of 3 layers:
 - (1) the inner entering,
 - (2) middle returning, segment of invaginated bowel,
 - (3) the outer wall of the receiving segment of gut.



2. ARTERIAL THROMBOEMBOLISM

- *Mannhemia* spp (*Pasteurella* spp) septicemia in lambs
- *Histophilus somni* bacteremia in cattle
- Endoarteritis, mainly at the root of the cranial mesenteric circulation, caused by migrating larvae of *Strongylus vulgaris*



3. REDUCED PERFUSION

- Hypovolemic states (hemorrhagic shock in the dog, cat and possibly other species)
- Disseminated intravascular coagulation (DIC-dogs)
- Hepatic disease and portal hypertension (dogs)
- Hypotensive shock due to heart failure
- Verminous endoarteritis (horses)
- Acute acorn poisoning in the horse
- Mercury poisoning (horse)
- Nonsteroidal anti-inflammatory drugs (horses and dogs)
 - Phenylbutazone (horse)
 - Flunixin meglumine (horse/dog)



THE CONSEQUENCES OF ISCHEMIC LESIONS

- **Strangulation, volvulus and similar lesions** → **Physical obstruction + Ileus**
- **Reduced arterial perfusion or thromboembolism** → **Functional obstruction + Ileus**
- **Effusion of tissue fluid and blood into the lumen, proliferation of anaerobes occurs in the lumen of the ischemic area with accumulation of gas** → **gangrene+ Rupture of ischemic gut**
- **Toxin production by anaerobes (*Clostridia*)** → **Circulatory failure**
- **Absorption of endotoxin** → **Septic peritonitis**
- **Transmural invasion by enteric bacteria**



MALASSIMILATION and PROTEIN-LOSING SYNDROMES

▪ LYMPHANGIECTASIA

- ✓ Common in dogs.
- ✓ Most common cause of malassimilation and protein-losing enteropathy.
- ✓ Associated with a syndrome characterized by:
 - ✓ Chronic diarrhea
 - ✓ Hypoproteinemia (Peripheral edema, ascites, hydrothorax)
 - ✓ Lymphopenia
 - ✓ Hypocalcemia
 - ✓ Hypocholesterolemia
- Dilation of the lacteals, and often lymphatics of the submucosa, muscularis, serosa, and mesentery



■ CHRONIC INFLAMMATORY DISEASES

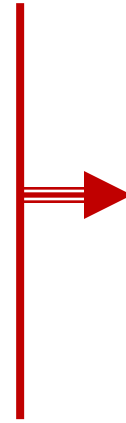
- ❖ Lymphocytic-Plasmacytic enteritis
- ❖ Eosinophilic gastroenteritis in dogs
- ❖ Eosinophilic granuloma
- ❖ Eosinophilic enteritis in cats
- ❖ Chronic eosinophilic enteritis in horses
- ❖ Granulomatous enteritis
 - ❖ Paratuberculosis (Johne's disease)
 - ❖ *Histoplasma* enteritis
 - ❖ Transmural granulomatous enteritis in dogs and cats
 - ❖ Idiopathic granulomatous enteritis in horses

❖ AMYLOIDOSIS



TYPHLOCOLITIS IN DOGS

- Glucocorticoid administration
- Functional adrenal cortical tumors
- Trauma
- Surgery involving the spinal cord



Ulceration, perforation,
Peritonitis, necrotizing
colitis, typhlocolitis

- Indomethacin (analgesic/experimentally → Ulcerative colitis)
- Uremia (necrotizing colitis/ulceration/perforation)
- Canine intestinal hemorrhage syndrome (*Clostridial*, *C. difficile*)
- *Clostridium difficile* → Ulcerative colitis
- *Trichuris vulpis* → mild colitis, hemorrhagic typhlitis, typhlocolitis



COLITIS IN CATS

- Idiopathic mucosal colitis
- Feline panleukopenia virus
- Mycotic colitis (*Candida*, *Zygomycetes*, *Aspergillus* hemorrhagic ulcerative colitis)
- Necrotic colitis
- Feline leukemia virus
- *Bacillus piliformis* (mild colitis)
- *Salmonella typhimurium* (Transmural acute ulcerative colitis)
- Ulcerative colitis
- Granulomatous or pyogranulomatous foci (Regional enterocolitis-feline infectious peritonitis virus)



TYPHLOCOLITIS IN HORSES

- Acute colitis
- Salmonellosis
- Equine monocytic ehrlichiosis
- *Rhodococcus equi*
- Histoplasmosis
- *Larval cyathostomes*
- *Larval strongyles*
- *Anoplocephalid tapeworms*
- Ischemic mucosal lesions
- Phenylbutazone
- Right dorsal colitis
- Granulomatous and eosinophilic typhlocolitis
- *Tritrichomonas*



TYPHLOCOLITIS IN RUMINANTS

✓ CATTLE

✓ Salmonellosis

✓ Bovine viral diarrhea

✓ Rinderpest

✓ Coccidiosis

✓ CGB

✓ Adenoviral infection

✓ Winter dysentery

✓ Arsenic

✓ Heavy metals

✓ Oak or acorn poisoning

✓ Trichuriasis (rarely/calves/hemorrhagic mucosal typhlitis)

✓ Johne's disease (Granulomatous typhlocolitis)

Acute to subacute
fibrinohemorrhagic typhlocolitis
(over 2-3 months of age)

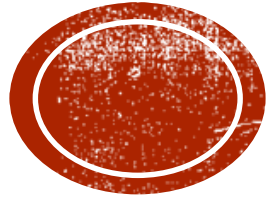
Acute fibrinohemorrhagic
typhlocolitis



SHEEP

- Bluetongue
 - Peste des petits ruminants
- Hemorrhagic
- Heavy metals intoxication → Hemorrhagic typhlocolitis
 - Salmonellosis → Fibrinohemorrhagic enteritis
 - Trichuriasis → Mucohemorrhagic typhlitis/typhlocolitis
 - Coccidiosis → Hemorrhagic ileotyphlocolitis
 - *Cl. perfringens* type D enterotoxemia (goats) → Fibrinohemorrhagic typhlocolitis





VIRAL DISEASES OF INTESTINE

VIRAL DISEASES OF INTESTINE

- **ADENOVIRAL ENTERITIS**
- **ENTERIC CORONAVIRUS INFECTION**
- **ROTAVIRUS INFECTION**
- **DISTEMPER**
- **PARVOVIRAL ENTERITIS**
 - ☞ **Feline panleukopenia**
 - ☞ **Canine parvovirus 2 infection**
 - ☞ **Canine minute virus**
 - ☞ **Bovine parvovirus infection**
- **HERPESVIRUS INFECTION**
 - ☞ **Canine herpesvirus infection**
 - ☞ **Equine herpesvirus infection**
 - ☞ **Aujeszky disease**



DIARRHEA IN NEONATAL ANIMALS

Etken/Enfeksiyon/ GÜN	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21		
E. coli																							
Rota ve Corona virus Cryptosporidium																							
Adeno virus																							
Salmonella VD/MD																							



ROTAVIRUS

- Reoviridae family
- 5 serotypes- A, B, C, D, E
- **Causes neonatal diarrhea**
- **Absorptive enterocytes, goblet cells susceptible**
- Pathogenesis is similar to Corona virus infection
- Group A – villi in the jejunum-ileum of cattle
- Causes damage to cells in the apical half
- Epithelial shedding and villi atrophy occur.
- **Cattle:** **Newborn, 2-3 weeks old or more than 4-5 days** old more common in animals. Similar to lesions that occur in Corona virus infection lesions develop. **BUT, unlike Corona virus infections, it does not cause lesions in the colon.**
- **Lambs:** Infects alone or in combination with E. coli and Cryptosporidium.
- **In foals:** It causes diarrhea in **three to four months old.**
- **Puppies:** It causes diarrhea and **death in 1-2 weeks old.**



ADENOVIRAL ENTERITIS

Adenoviruses are highly host-specific.

Infection can be seen animals as you see in the list and be subclinical, and disease seems to occur more commonly in immunologically compromised individuals.

Most infections are systemic; certain strains have **a tropism for the respiratory tract, and others for the alimentary tract, vascular endothelial cells, or hepatocytes.**



ADENOVIRAL ENTERITIS

CATTLE (10 serotypes)

- ✓ 1-8 → pneumoenteritis complex

SHEEP (6 serotypes)

- ✓ S. 1,2,3 → isolated from feces of normal sheep and lambs with enteritis and pneumoenteritis
- ✓ S. 4,5,6 → respiratoric diseases

PORCINE (4 serotypes)

- ✓ Asymptomatic infections
- ✓ Isolated from feces of normal pigs

EQUINE (2 serotypes)

- ✓ S.1 → subclinical/upper respiratory infection+ duodenal villus atrophy
- ✓ S.2 → Foals with diarrhea

DOGS

- S.1 → Infectious hepatitis+diarrhea
- S.2 → Upper respiratory tract infections



BOVINE ADENOVIRUSES

- Occur sporadically in **1-8 week-old calves** and **in feedlot animals**.
- Affected animals have **Fever, diarrhea, dehydration, congested mucous membranes**.
- Necrotic areas and ulcers in the **forestomaches and abomasum**.
- **The intestinal lesions** vary from slight distention with excessive fluid to severe multifocal or diffuse necrosis, which may be covered by a **pseudodiphtheritic membrane**.
- Congested and hemorrhagic colon especially in feedlot cattle



BOVINE ADENOVIRUS INFECTION

- **Fibrinocellular exudate** often covers the mucosal surface.
- Intestinal crypts **are dilated**, lined by flat epithelial cells, and usually contain necrotic debris.
- There is usually marked submucosal edema, congestion, and fibrinous exudation.
- Foci of necrosis are evident in the lymphoid follicles of the Peyer's patches, which are also **depleted of lymphocytes**.
- **Large basophilic to amphophilic inclusions** completely or partially fill the nuclei of endothelium in the vessels of the lamina propria and submucosa of affected areas of the rumen, abomasum, and intestine
- The endothelial cells are swollen and necrotic



ENTERIC CORONOVIRAL INFECTIONS

➤ CATTLE

- *Bovine coronavirus* infection is common cause of **diarrhea**, **alone or in combination with *Rotavirus* and *Cryptosporidium*** in **neonatal calves**.
- At *necropsy*, affected animals have the nonspecific lesions of undifferentiated neonatal calf diarrhea.
- Rarely, mild **fibrinonecrotic typhlocolitis** is recognized.
- Mesenteric lymph nodes may be enlarged and wet.
- Microscopically **villus atrophy in combination with mild colitis is typical.**
- ✓ Respiratory tract infection in calves
- **Winter dysentery is a syndrome in adult cattle that has been associated** with bovine coronavirus. The characteristics of winter dysentery are mostly attributed to **lesions of the colonic mucosa**. *Grossly*, in the colon congestion and hemorrhages are seen.



ENTERIC CORONOVIRAL INFECTIONS

SWINE

- ✓ Hemagglutinating encephalomyelitis virus causes vomiting and wasting disease in suckling piglets
- ✓ Transmissible gastroenteritis virus
- ✓ Porcine epidemic diarrhea virus
(Coronavirus 777)

] Syndromes of acute diarrheal disease in all age groups and chronic diarrhea and runting in weaned pigs

DOGS

CATS

SHEEP

FOALS

] Diarrhea



PARVOVIRAL ENTERITIS

- **Genus parvovirus (Feline panleukopenia virus and Canine parvovirus 2)**
- *Parvovirus* infect many species of laboratory and domestic animals. Among syndromes associated with parvovirus infection are: **disease in cats, dogs, and mink dominated clinically by enteritis**; **diarrhea in neonatal calves**; and reproductive wastage in swine.
- ***The effects of parvoviral infection are greatest in tissues with a high mitotic rate.*** These may include a variety of tissues during organogenesis in the fetus and neonate.
- In older animals, the proliferative elements of the **enteric epithelium, hematopoietic and lymphoid tissue** are particularly susceptible.



- The *pathogenesis of FPV and of CPV-2 infection* is similar
- The virus enters the body **alimentarily or with oral ingestion.**
- The replication occurs in **oropharynx.**
- **Release of virus into lymph, and dissemination of infected lymphoblasts from these sites, may result in infection of other central and peripheral lymphoid tissues, including thymus, spleen, lymph nodes, and Peyer's patches.**
- **Lymphocytolysis in these tissues releases virus.** Viremia is terminated when neutralizing antibody appears in circulation.

CANINE PARVOVIRUS 2 INFECTION

- **Gross findings:**

- subserosal **intestinal hemorrhage**, which may extend into the muscularis and submucosa

- **fibrinous effusion**

- **The microscopic lesions:**

- in stomach, small intestine colon, lymphoid tissue, and bone marrow caused by CPV-2 infection do not differ significantly from those described earlier in cats with panleukopenia.

- **Gastric lesions** are perhaps more frequently encountered in dogs with parvoviral infection.



CPV myocarditis

- CPV myocarditis can develop from infection **in utero or in animals younger than 6 weeks of age.**
- These animals with CPV myocarditis often die.
- Signs of cardiac dysfunction can be preceded by the enteric form of the disease or may occur suddenly, without apparent previous illness.



FELINE PANLEUKOPENIA

- The disease panleukopenia (**infectious feline enteritis, feline distemper**) usually occurs in young animals exposed after decay of passively acquired maternal antibody, but it may occur in naive cats of any age.
- Clinical signs of several days' duration, including depression, inappetence, vomition, diarrhea, dehydration.



- **At necropsy,**
 - **The thymus is markedly involuted** and reduced in mass in young kittens.
 - The intestinal serosa may appear dry and nonreflective, **with an opaque ground-glass appearance.**
 - **Flecks of fibrin** and sometimes casts may be in the content in the lumen.
 - The small bowel may be **segmentally dilated** and can acquire a hose-like turgidity in places, perhaps because of submucosal edema



Infection of the fetus during late prenatal life by FPV causes anomalies of the central nervous system, mainly **hypoplasia of the cerebellum.**



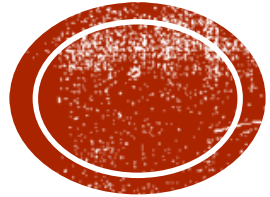
- **Microscopic lesions** are consistently found in the intestinal tract in fatal cases, and are usual in lymphoid organs and bone marrow.
- Necrosis and dilation of crypts of Lieberkuhn.
- Villous atrophy occurs secondary to crypt cell destruction.
- Basophilic intranuclear inclusion bodies in enterocytes and lymphocytes **early in infection.**
- Lymphocytolysis in follicles of lymph nodes, thymic cortex and splenic white pulp, and Peyer's patches



CANINE DISTEMPER

- Morbillivirus
- Alimentary system, respiratory system , nervous system and skin.
- Alimentary system:
 - ✓ Diarrhea
 - ✓ Catarrhal gastroenteritis
 - ✓ hyperaemia
 - ✓ Intracytoplasmic/intranuclear inclusion bodies.





BACTERIAL DISEASES OF THE INTESTINE