

Pathology of Alimentary system

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- The digestive system is one of the **largest organ systems** in the body; it includes the **alimentary tract, salivary glands, tonsils, liver, pancreas, and peritoneum.**
- This system is involved, either directly or indirectly, in most of the diseases that affect animals.
- In fact, any well **transcribed clinical record** will include a large component of information relative to its status; i.e., **feed consumption, water intake, appearance of the oral mucous membranes, bowel movements, consistency of the feces, even Body temperature etc..**

- Alimentary disorders are **very frequent** in animals.
- **Normal gross appearance:** Both the **mucosal & viscera** (serosal/ abdominal cavity) surfaces are **Smooth** and **shiny**.
- **Diagnostic procedures include:** **Clinical exam** (endoscopy, U/S, laparoscopy), **Biopsy**, **Fecal exam**, **Necropsy & histopathology** and **Other lab tests**.
- **Signs of GIT Disease:** **Dysphagia** (difficulty of swallowing), **Vomiting**, **Diarrhea**, **Weight loss**, **Abdominal pain**, **Melena** (the passage of dark tarry stools), and **Suboptimal performance**

Objective

- At the end of this session students will be able to determine **pathological conditions affecting the mouth, pharynx, salivary glands, oesophagus and crop.**

Pathology of Oral Cavity and Associated Structures

1. Inflammation of The Oral Cavity

- **Stomatitis** refers to **diffuse inflammation of the oral mucosa** and includes
 - **Glossitis**: inflammation of the **lingual mucosa**,
 - **Lampas**: inflammation of the **hard palate**,
 - **Gingivitis**: inflammation of the **gums**
 - **Chilitis**: inflammation of the **lips**.
 - **Pharyngitis**: inflammation of the **pharynx**, and
 - **Tonsillitis**: Inflammation of the **tonsils**.

- Stomatitis may be **caused** by **physical agents** (foreign bodies, maloccluded teeth, hot water, etc.), **Chemical Agents** (acid, alkali, etc.), **Bacterial Agents** (Fusobacterium necrophorum, etc.), **Viral Agents** (vesicular exanthema, bovine virus diarrhea, malignant catarrhal fever, etc.), and **Fungi** (usually *Monilia* spp.).
- **Clinically**, characterized by **partial or complete loss of appetite, chewing movements and smacking of the lips, profuse salivation and slow and painful mastication.**

- **Morphological changes of stomatitis are** Macules (redness), Papules, Vesicles (blisters), Erosions, Ulcers, Necrosis with pseudomembranes, Granulomas.

- ❖ **Macule:** Circumscribed lesion, 1 cm or smaller in diameter, characterized by flatness and distinguished by coloration (white, black, red, etc.)

- ❖ **Vesicle:** Fluid-filled raised lesion 1 cm or less across (**Bulla** is greater than 1 cm. **Blister** is the common term for either)

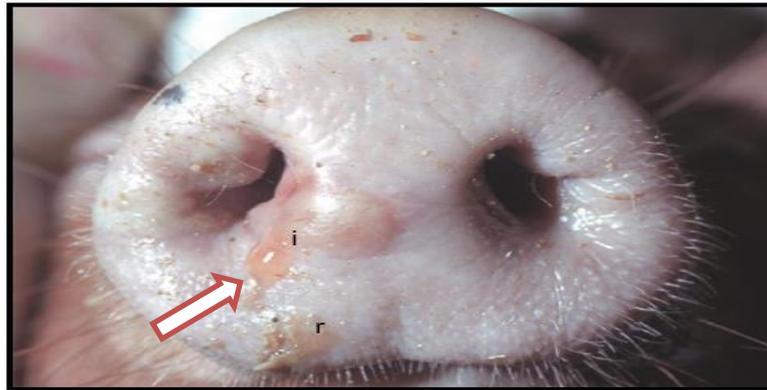
• Types of Stomatitis

A. Vesicular stomatitides

- Seen in **Foot and mouth disease**, **infectious vesicular exanthema** and **infectious vesicular stomatitis**.
- **Vesicles, blebs or blisters containing clear fluid** are formed on the mucosa.
- **Rupture of the blisters** results in the **formation of erosions**, which subsequently heal.
- Catarrhal and vesicular stomatitis may develop into ulcerative variety.

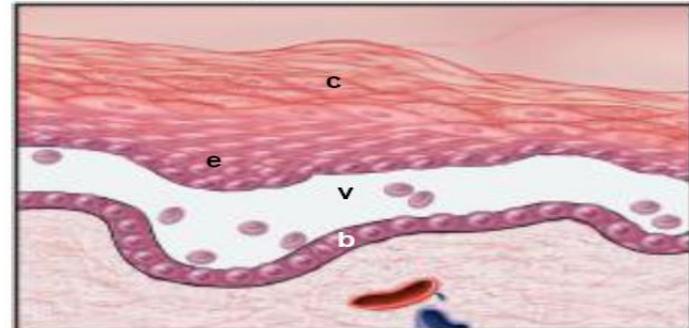
Pathogenesis of vesicular stomatitides

- Epithelial damage (viral) → intracellular edema (ballooning degeneration) → vesicles → bullae → erosions → ulcers → cellular infiltration
- Lesions present in any stratified epithelium



Intact (i) & ruptured (r) vesicles, pig, Vesicular exanthema.

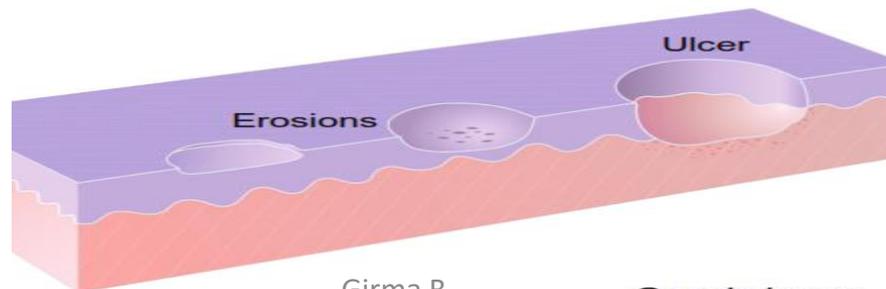
Schematic representation of a suprabasal vesicle, there is a fluid filled space above the basal stratum (b). The rest of the epidermis (e), including the stratum corneum (c) forms the roof



Microscopic appearance of a vesicle (v), human. There is a large space dissecting the epidermis (e). C: stratum corneum, d: dermis.

B. Erosive & Ulcerative Stomatitides

- **Erosion:** Discontinuity of a body surface due to partial loss of surface epithelium
- **Ulcer:** Full-thickness epithelial loss revealing the underlying submucosa
- **Pathogenesis:** Epithelial necrosis & inflammation without vesiculation
 - Lesions in stratified squamous epithelium of mouth (may extend to esophagus and forestomach)



Erosive & Ulcerative Stomatitides

Sharp, discrete erosions & ulcers, BVD

Some specific diseases/conditions:

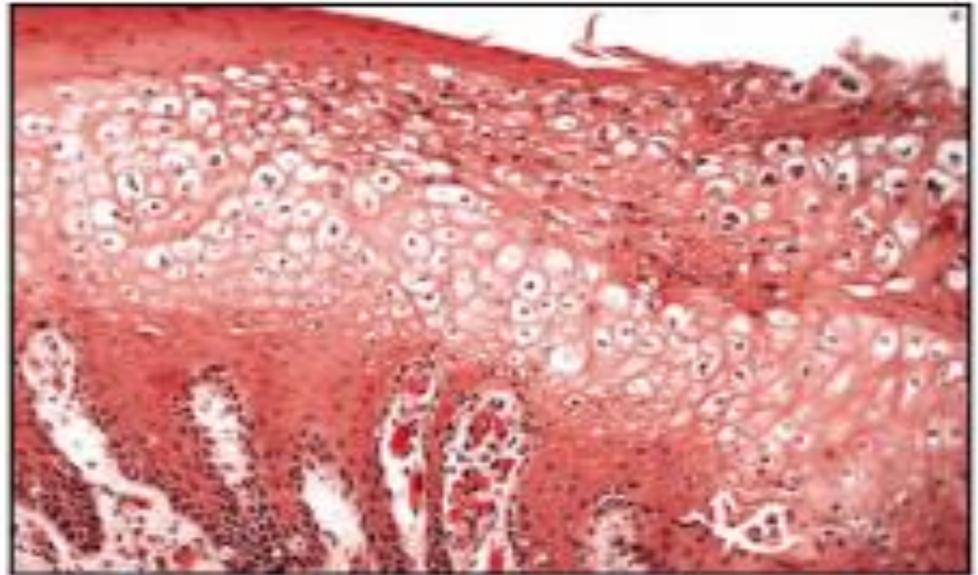
- BVD/MD
- MCF
- Rinderpest
- Peste des petits ruminants
- Bluetongue
- Herpesvirus in cats, horses, primates
- Feline calicivirus
- Uremia



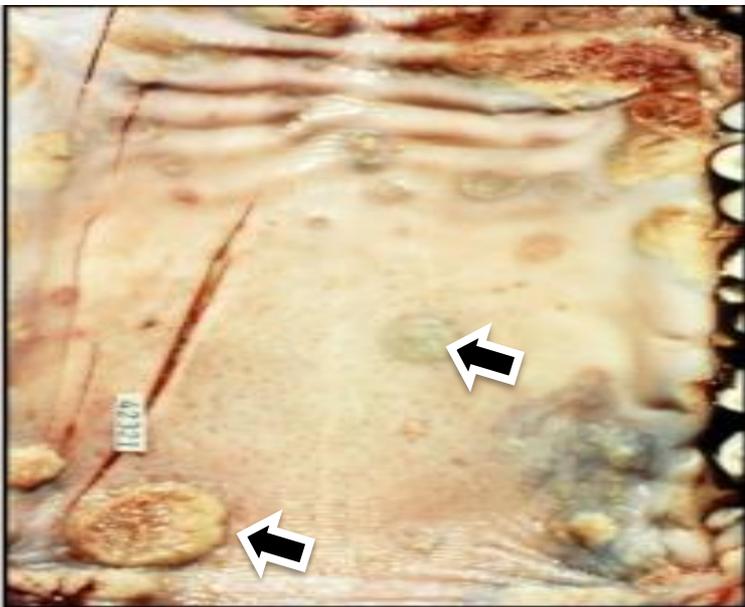
C. Papular Stomatitides

- Caused by **parapoxviruses** (Contagious ecthyma & Bovine papularstomatitis)
- Seen Mainly in **young animals**
- **Papule**: Elevated **dome-shaped or flat-topped** lesion 1 cm or less across
- **Pathogenesis**: Epithelial degeneration, hyperplasia and inflammation → papule formation → ulceration & slow healing

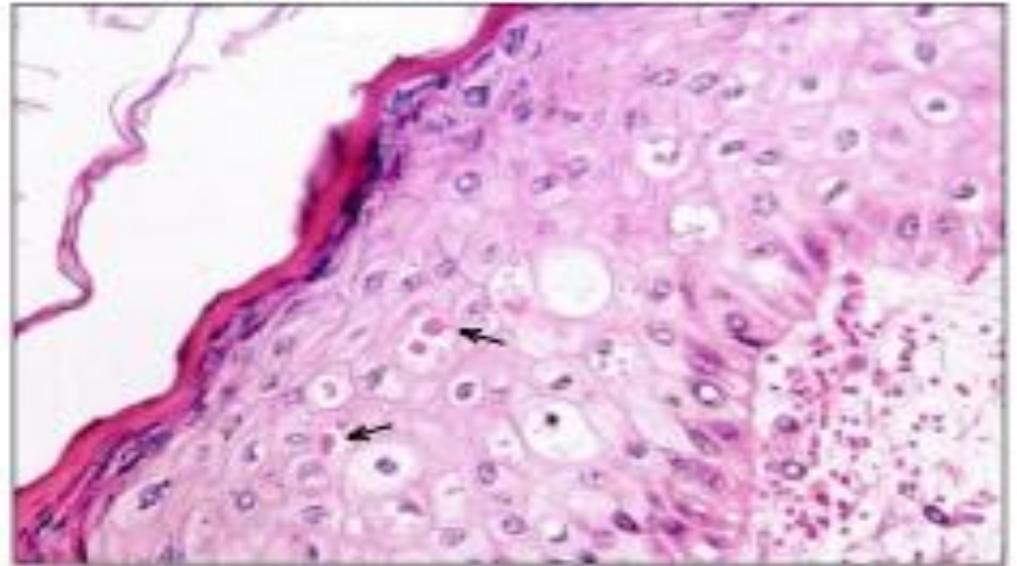
Contagious ecthyma (scabby mouth)



Ballooning degeneration & intracytoplasmic inclusion bodies (arrows) in papular stomatitis, cow



Coin-shaped papules & ulcers in papular stomatitis, cow



D. Necrotizing (deep) Stomatitides

- Often **secondary to erosions/ulcers and trauma**
- **Opportunistic bacteria** penetrate mucosa and invade deeper tissues
- Ulcers/erosions are often covered by **yellow-grey pseudomembranes**
- Results in **chronic inflammation** (abscess, granuloma or cellulitis)

Eg. Calves (Calf diphteria) & pigs (*Fusobacterium necrophorum*)

2. Oral cavity Neoplasm

- A wide variety of neoplasms may arise from tissues of the mouth and **related structures**.
 - In dogs, **viral oral papilloma** occur **most frequently**. They tend to disappear spontaneously in 1-3 months if not removed.
 - **Squamous cell carcinomas** frequently occur in cats, dogs, cattle, and horses.
 - **Fibrosarcomas** are the most common sarcoma of the oral cavity. **Osteogenic sarcomas** may arise in the alveolar processes of the mandible and maxilla.

3. Developmental Abnormalities

a) Palatoschisis (cleft palate): direct communication between nasal and oral cavity.

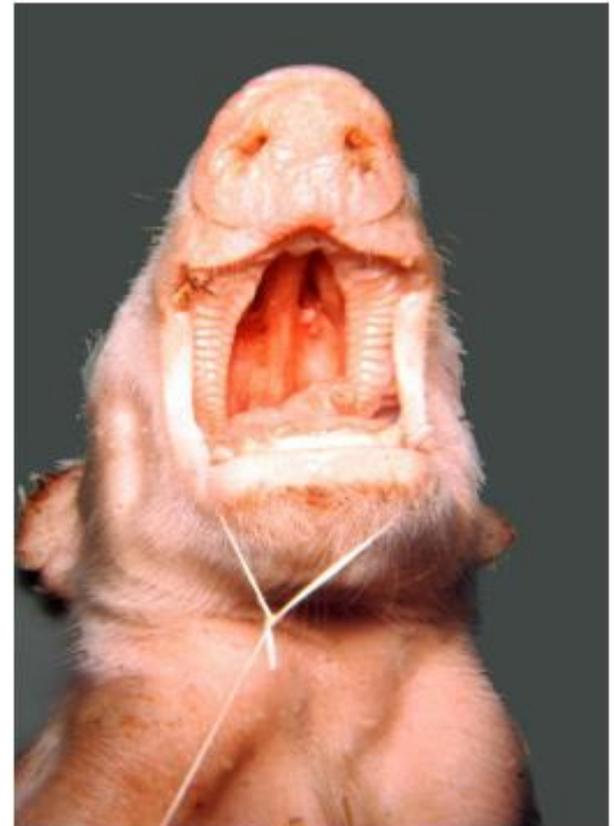
Causes:

- Genetic (Charolais, along with arthrogryposis)
 - Toxic plants in cattle, sheep & pigs
 - Steroid administration (primates)
- Results in **starvation or aspiration pneumonia & death**

Palatoschisis (cleft palate), a direct communication between the oral and nasal cavities, bovine



Palatoschisis (cleft palate), pig



Arthrogryposis, piglet

b) Cheiloschisis (cleft lip or hare lip)

- Failure of fusion of the upper lip along the midline or philtrum
- May be uni-or bilateral, superficial or extend into the nostril
- Usually of no clinical significance

c) Epitheliogenesis imperfecta

- Incomplete development of the stratified squamous epithelium of skin, adnexa, and/or oral mucosa.
- May lead to bacterial infection or dehydration



Dental Caries:

- **Caries** refer **destructive decalcification** of the dental **enamel** which is followed by **destruction of underlying tissues**.
- **Caries usually develop** when the normal **alkaline condition** of the mouth **changes to acid**.
- After the **pH change**, **anaerobic streptococci** which are found in the mouth of all animals, **attack sugars and CHO**, resulting in **lactic acid production**.
- The **lactic acid** accumulates around teeth **resulting in decalcification**.

- A developing carie usually presents the appearance of a "**black cavity**" in the tooth. Eventually, the entire tooth turns black or a dark color.



Pathology of Salivary Glands

- **Ptyalism (sialosis):** refers to excessive secretion of saliva resulting in an abnormal accumulation in the mouth.
 - it is associated with stomatitis, encephalitis, heavy metal poisoning.
- **Ranula:** refers to cystic dilatation and an accumulation of saliva in the salivary duct of the sublingual region.
- **Mucocele:** refers to an accumulation of salivary secretion adjacent to salivary ducts.
- **Sialolithus:** refers to calculi or concretions that form in salivary glands.
- **Sialoadenitis:** refers to inflammation of the salivary glands.

Pathology of Esophagus

Clinical consequences of diseases of esophagus:

- Manifested by **regurgitation, dysphagia, multiple swallowing attempts & excessive salivation**
- May lead to **respiratory disease** (aspiration pneumonia)



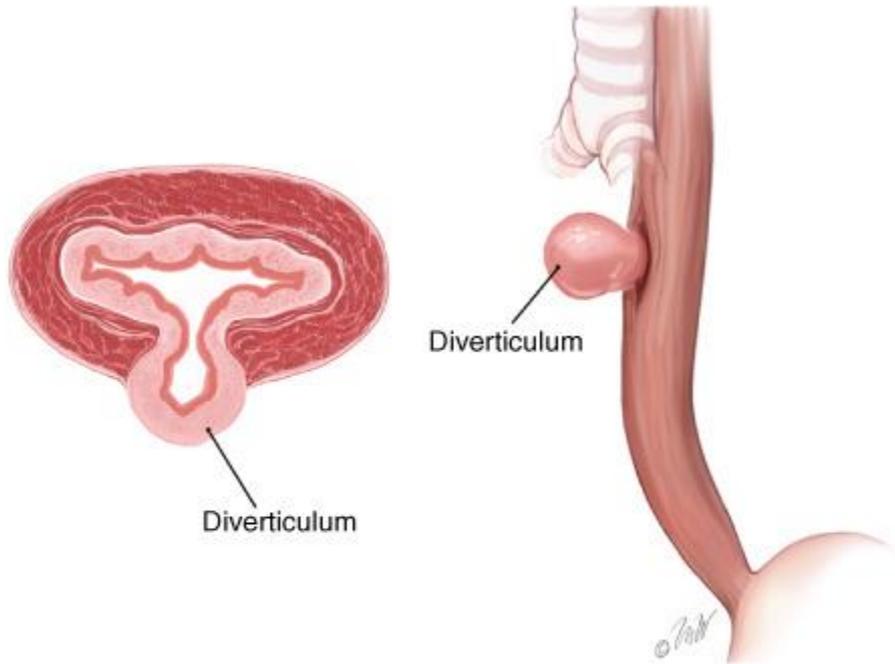
Girma B.
Normal esophageal-gastric junction

1. Inflammation of The Esophagus:

- Inflammation of the esophagus is referred to as **esophagitis**.
- Caused by **Trauma** (foreign bodies, etc.), ingestion of **caustic chemicals** (lye, etc.) and **infectious** diseases (papular stomatitis, malignant catarrhal fever, etc).

2. Dilation of the Esophagus:

- Esophageal dilatation (Esophagectasia) refers to an **increased caliber of the lumen**.
- The condition may be either **localized, generalized, congenital or acquired**.
- Remember, dilatations should be differentiated from diverticula of the esophagus.
 - **Dilatations** involve the **entire circumference** of the affected portion; whereas,
 - **Diverticula** involve only a **portion of the circumference**.



B

Source: Sugarbaker DJ, Bueno R, Krasna MJ, Mentzer SJ, Zellos L: *Adult Chest Surgery*: <http://www.accesssurgery.com>

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- **Acquired dilatations** may be seen in any animal species.
 - The **dilated segments are located proximal to the point of obstruction (stenosis, foreign bodies, etc.)**.
- **Megaesophagus** refers to a **diffuse (non-localized) dilatation of the esophagus**.
 - This condition **frequently occurs in puppies**.

1. Megaesophagus

- Dilation due to insufficient/uncoordinated peristalsis
- Often no microscopic lesions
- Congenital form
 - Vascular ring
 - Idiopathic



Congenital megaesophagus, dogs.
The dilated portion is cranial to the heart and is due to persistent right 4th aortic arch.

3. Esophageal Rupture and Chock:

- Esophageal rupture may be a consequence of impaction, foreign bodies, external penetrating wounds, neoplasms or improper instrumentation.
- Ruptures at any location within the esophagus usually prove fatal because material contaminated with bacteria can gain entry into the fascial planes of the neck resulting in phlegmon or gangrene.

2 & 3. Esophageal rupture and obstruction (choke)

▪ Obstruction sites:

- Larynx
- Thoracic inlet
- Base of the heart
- Diaphragmatic hiatus

▪ Sequelae:

- Cellulitis
- Perforation
- Stenosis*
- Pleuritis/
pyothorax
- Pneumonia
- Bloat

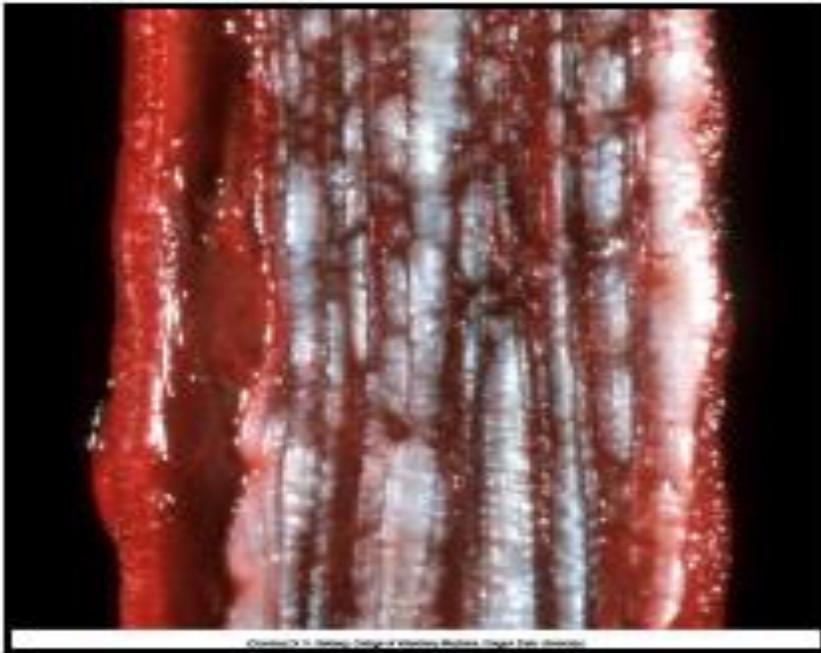
* Narrowing of the esophageal lumen



Examples of foreign bodies causing choke, ulceration (left), and perforation (right top), dogs. If the animal survives, healing is by fibrosis, which may lead to stenosis, horse (bottom right)

4. Reflux esophagitis

- Chemical damage of the squamous epithelium due to repeated gastric acid reflux.

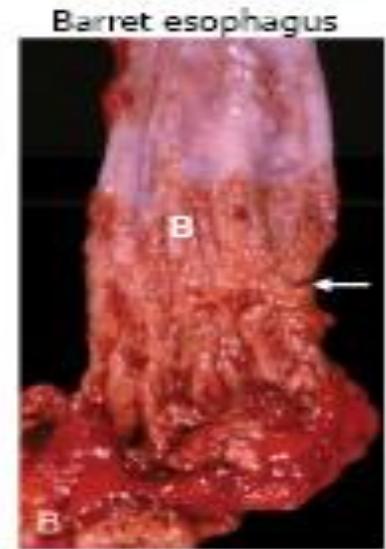


Acid reflux esophagitis, horse. The dark red streaks are areas of epithelial loss secondary to gastric acid reflux. The white streaks are areas of unaffected mucosal epithelium.

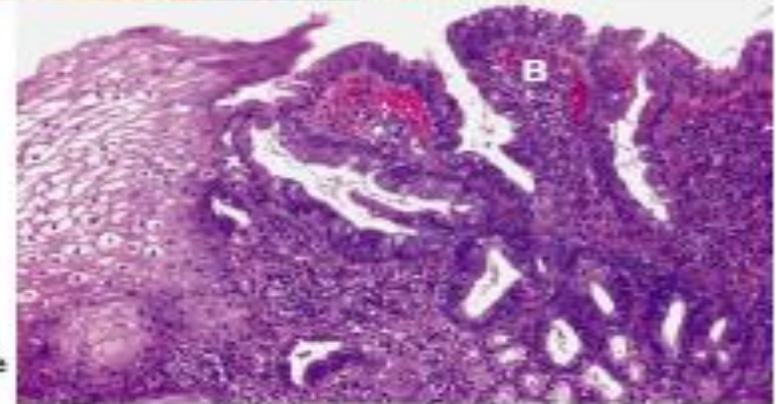
Barret esophagus (B= intestinal metaplasia human), right. Lesions are most severe on the esophageal mucosa adjacent to the cardia (arrows) It is a complication of long-standing gastroesophageal reflux in humans



Normal



Barret esophagus



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- Barrett Esophagus:**

- Replacement of squamous epithelium by columnar epithelium with goblet cells

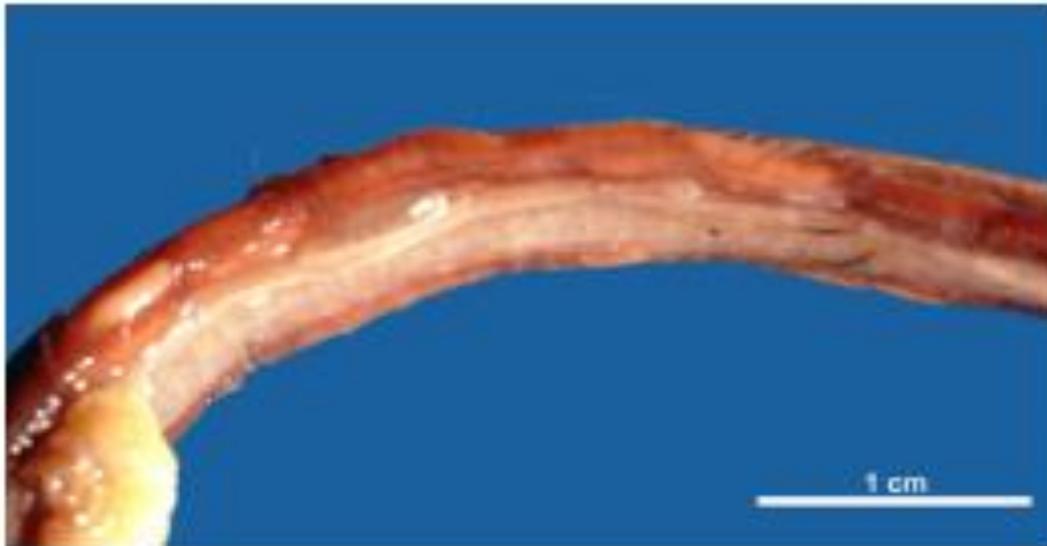
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Girma B.

- Complication of long-standing reflux esophagitis

5. Parasitic lesions

- **Sarcocystosis** (*Sarcocystis* sp)
- *Spirocerca lupi*
- *Gongylonema* spp
- *Gasterophilus* & *Hypoderma* spp – Fly larvae



Sarcocystosis , esophagus, duck. Note the pale elongated nodules within the esophageal muscle.



Gongylonemiasis, esophagus, cow. Note The serpentine nematodes underneath the mucosa

6. Neoplasms of The Esophagus:

- Neoplasms of the esophagus are **uncommon**.
- However, neoplasms of **epithelial and connective tissue** origins have been reported.
 - **Sarcoma associated with *S. lupi***
 - **Papilloma (common in esophagus)**
 - Papilloma virus
 - **Squamous cell carcinoma**
 - Pteridium aquilinum (Bracken fern)
 - **Lymphoma**

Pathology of the Crop of Birds

1. Inflammation of crop

– Inflammation of crop is called **ingluvitis**.

a. Acute catarrhal ingluvitis

- Caused by **Trauma by foreign bodies, Chemical agents (phosphorus, fertilizers), Toxins from decomposed food, Infectious diseases.**

– Parasites – *Acuaria sp* ; *Capillaria sp*

- Grossly the Lesions include **cogestion, edema and tympanites.**

b. Diphtheritic ingluvitis: This is found in **fowl pox.**

2. Obstruction of Crop In Birds

- **Aetiology**
 - Ingestion of large quantities of dry grain which swell in the crop and form a hard mass.
 - Atony or paralysis of wall leading to stasis of food.
 - Foreign bodies like wire etc.
- **Grossly**
 - The stagnated food gets decomposed, gas accumulates and inflammation sets in.

Sequelae

- **Rupture** due to **distention by food and gas** or due to **penetration by the foreign body**.
- Death because of
 - **Heart failure** due to pressure on heart.
 - **Asphyxia** due to compression of trachea.
 - **Intoxication** due to absorption of toxins from decomposed foods.
 - **Starvation**, since, food does not enter the proventriculus.

Pathology of the Fore stomachs of Ruminants

- The forestomachs of ruminants are closely associated anatomically and functionally and **disease of one usually affects the others.**
- The **two major functions** of the forestomach are:
 - **Bacterial digestion** and fermentation and
 - Physical maceration **by contraction** of the stomach walls.
- Diseases of forestomach: Most are **related to management practices**

1. Simple Indigestion:

- Simple indigestion is characterized by anorexia, lack of ruminal movement and constipation.
- It develops subsequent to atony of the forestomachs.
- It is common in dairy cattle and stall-fed beef cattle because of the variability in quality and the large amounts of food consumed.
- Atony of the forestomachs is commonly related to abnormalities in the dietary intake, such as indigestible roughage, mold and overheated or frosted feeds.
- Simple indigestion is not usually a fatal disease.

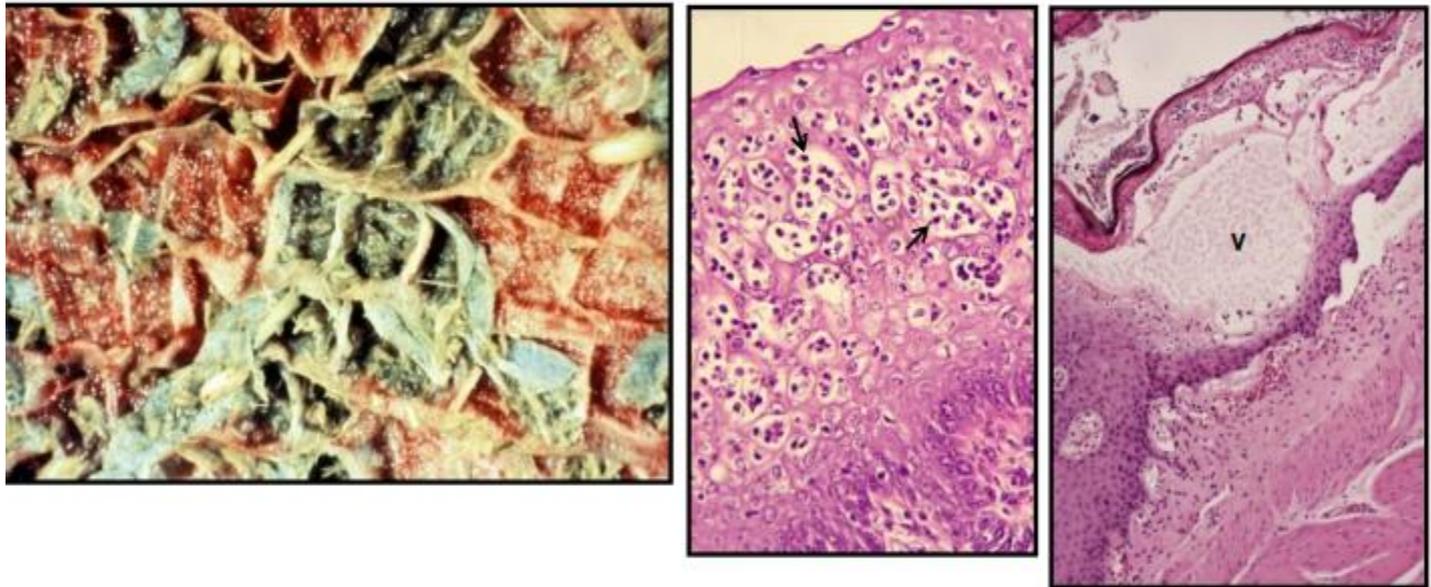
2. Carbohydrate Engorgement:

- **Carbohydrate engorgement** in ruminants develops following the **ingestion of large amounts of highly fermentable carbohydrate rich feed.**
- **Clinically**, the disease is characterized by **severe toxemia, ruminal stasis, dehydration, weakness, recumbency** and a high mortality rate.
- Acute carbohydrate engorgement is also referred to as **grain overload, rumen overload and acidosis.**

Pathogenesis of grain overload

- Sudden change to high CHO diet → overgrowth of gram + bacteria → ↑ lactic & dissociated fatty acids → **pH < 5** & ruminal atony:
 - Acidic pH → eliminates normal gram-negative bacteria
 - Acidic pH → damages mucosa → microvesicles
 - Organic acids → osmotic effect → fluids into rumen
- Sudden death from dehydration, acidosis & endotoxemia
- Survivors often have grave sequelae

- At **necropsy**: the rumen is filled with **foul-smelling**, fermenting feed and **acute passive congestion** of the ruminal wall is prominent. A few **petechial and ecchymotic hemorrhages** may be found over the heart and serosal surfaces.
Lesions of grain overload



Grain overload, bovine: Marked hyperemia of reticular mucosa (top left); moderate cellular infiltration (arrows) and vesiculation (v) of the mucosa (histo).

Sequelae of grain overload

- **Bacterial rumenitis**
 - *Arcanobacterium pyogenes*
 - *Fusobacterium necrophorum*
 - Healed ulcers (“stellate scars”)
- **Liver abscesses**
 - Often subclinical
 - May rupture into vena cava
 - fatal septic embolism
- **Mycotic rumenitis**
- Well demarcated, circular hemorrhagic infarcts
 - Can become systemic
 - placentitis & abortion

3. Ruminal tympany (Bloat)

- **Over-distension** of the rumen and reticulum with gases of fermentation.
- These gases may be present in the **form** of a persistent **foam mixed with the rumen ingesta (frothy bloat)** or in the form of free gas separated from the ingesta (**free gas bloat**).

3.1. Primary Ruminal Tympany (Frothy Bloat):

- It is **dietary in origin** and occurs in cattle on **legume pasture** and in feedlot cattle which are **fed diets containing high levels of grain**.
- Frothy bloat is due to the **production of a stable foam** which **traps the normal gases** of fermentation in the rumen.
- The **small gas bubbles** which have mixed with the rumen contents **do not coalesce, eructation cannot occur**, and pressure within the rumen increases.
- **Leguminous bloat** is due to the **foaming qualities** of the **soluble leaf proteins** in legumes and other forages frequently associated with bloat.

- Evidence suggests that primary ruminal tympany or frothy bloat develops when:
 - The ingesta contains foaming substances (especially soluble leaf proteins, feeding finely ground grain and large amounts of grain),
 - The pH of the rumen is suitable for the growth of encapsulated bacteria which produce extracellular polysaccharides (slime), and
 - Insufficient saliva to exert a buffering effect on the pH of rumen may promote the tendency for foam to develop.
 - salivation is insufficient either because of the failure of the diet to stimulate it or because of the individual salivary paucity of the animal.

Pathogenesis of primary bloat

- Ruminal fermentation & acid production → low pH (5-6)
- Legumes & CHO's → ↓salivary secretion → ↑viscosity of rumen contents → foam → physical **blockage of the cardia**
- Accumulation of gases → ↑ intra-abdominal pressure → diaphragmatic & abdominal vein compression → respiratory & circulatory failure → death

Pathogenesis of primary bloat

▪ Pasture bloat

- Legumes → release of chloroplast particles (containing soluble proteins) → rumen microbes colonize particles & degrade proteins (insoluble proteins) → gas bubbles get trapped among the particles & do not coalesce → **stable foam**
- Organic acids (from legumes) + salivary bicarbonates → **CO₂**

▪ Feedlot bloat

- CHO's (fine particles) & microbes which produce slime → it entraps gasses → **stable foam**
- CHO's → growth of encapsulated bacteria (↑ polysaccharides) → ↑viscosity of rumen contents → **stable foam**

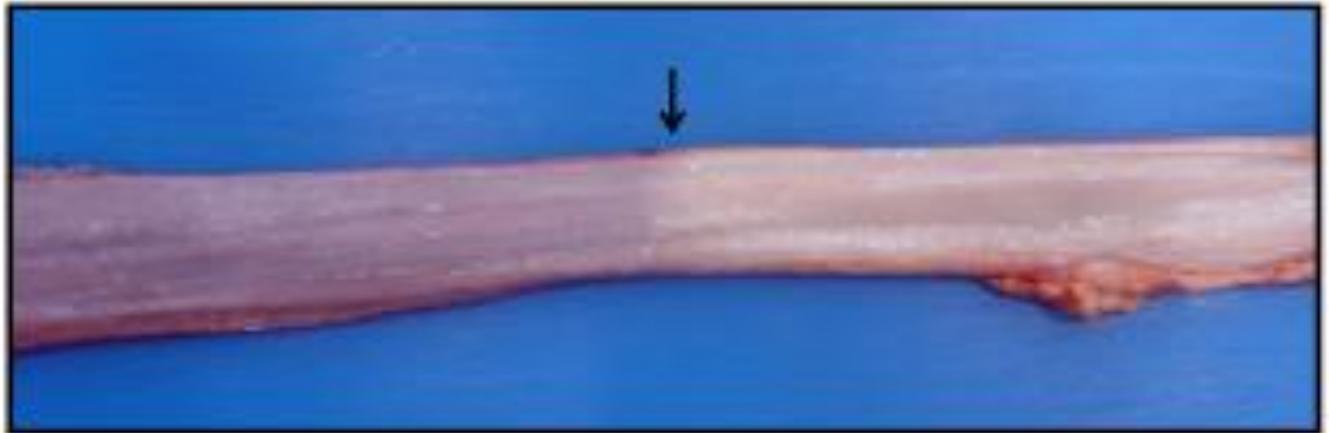
2. Secondary Ruminal Tympany (Free Gas Bloat):

- Usually due to some **physical obstruction** which **prevents the gases of normal fermentation from escaping via the esophagus (interference with eructation)**.
- **Physical obstruction to eructation** occurs in **esophageal obstruction** caused by foreign bodies, stenosis, pressure from enlargements outside the esophagus, etc.
- The **free gas** is usually **present on top** of the solid and fluid ruminal contents. Treatment in these cases consists of **passage of a stomach tube** or **trocarization** which results in the expulsion of large quantities of gas.

Signs & lesions in bloat

- Lesions of primary tympany are **difficult to detect** if there is **time interval between death & postmortem** (foams can collapse)
 - Abdominal distension
 - Animal found dead & rolled on back
 - Large volume of frothy rumen content
- Marked congestion of head, neck & hind limbs
- “**Bloat line**” is a sharp demarcation between pale bloodless caudal and congested cranial mucosa of the esophagus. This is diagnostic for bloat.

Bloat line (arrow),
esophagus, sheep



Bloat line, esophagus and trachea at the thoracic inlet, cow. There is a sharp demarcation between the caudal (white) and the cranial (congested) mucosa of the esophagus (arrow).

4. Foreign Bodies In the Rumen:

- It has been estimated that approximately **50%** of adult cattle have foreign bodies in the rumen and reticulum.

2. Foreign bodies

2.1 Trichobezoar (hair balls)

2.2 Phytobezoars (plant balls)

2.3 Lead substances → poisoning

2.4 Sharp metals → hardware disease
(traumatic reticuloperitonitis or
reticulopericarditis)



Trichobezoar, from stomach and duodenum, human.

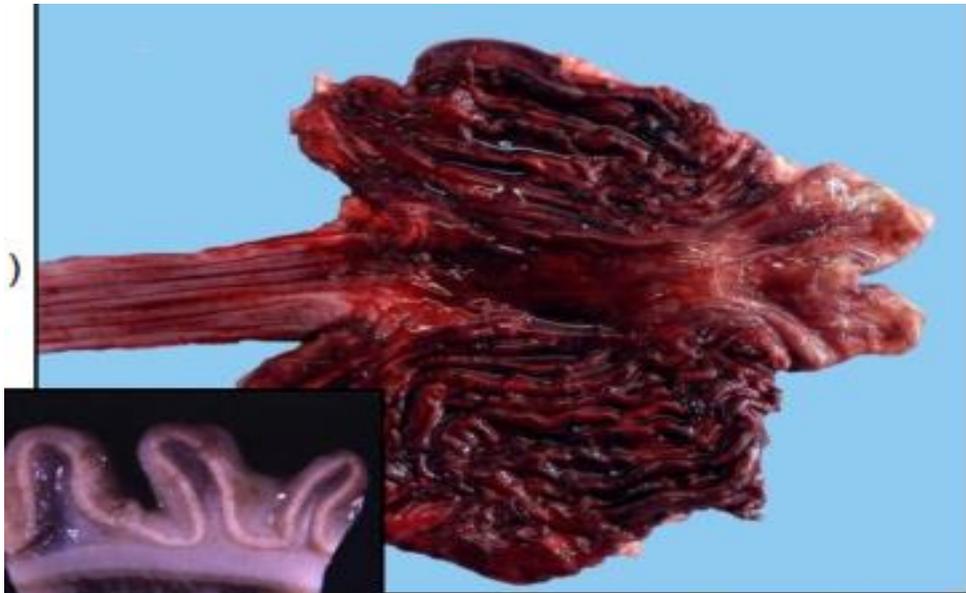


- **Impaction of The Rumen:**
 - Is a rumen which is **firm and almost completely filled with very dry ingesta.**
 - Atony is present and there is usually no fermentation or digestion occurring.
- **Postmortem Maceration of Ruminal Epithelium:**
 - Within a **few hours after death, large patches of ruminal epithelium detach when the ingesta is disturbed.**
 - This postmortem change is referred to as **maceration.**

Pathology of the True Stomach

1. Inflammation of the Stomach:

- Inflammation of the **monogastric stomach** is referred to as **Gastritis**, whereas inflammation of the **abomasum** is commonly referred to as **Abomasitis**.
- **Grossly**: the mucosa is **reddened** and **swollen** and there is **increased secretion of mucus**.
- **Microscopically**: there is **desquamation of the epithelium** together with **leukocytic infiltration**.



Uremic gastritis, dog. Note the mucosal mineralization (inset) and hemorrhage.

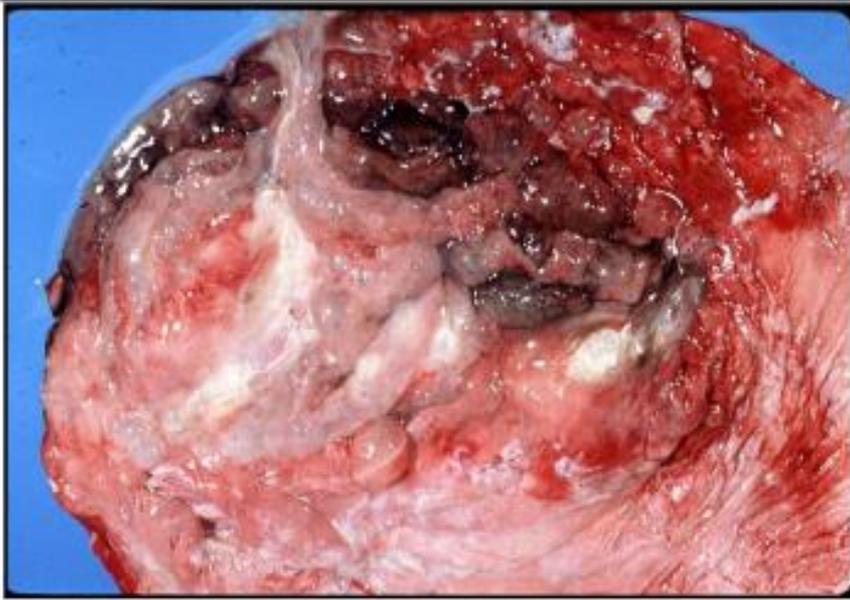


<http://w3.vet.cornell.edu/nst/nst.asp>



Noah's arkive

Hypertrophy of the gastric mucosa (Hypertrophic gastropathy), dog. Note the prominent folds and redundant "cerebriform" mucosa.

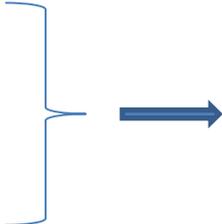


hemorrhagic abomasitis

2. Acute Gastric dilation and volvulus (GDV)

- Dilatation of the stomach **can be caused** by **Failure of eructation and pyloric outflow** by foreign bodies, gross overeating and drinking excessive amounts of water, etc.
- Mostly in **large dog breeds, rarely horses and pigs.**
- **Subsequent** to acute dilatation, **rupture** of the stomach may occur **in the equine**, but this is not common in other species.

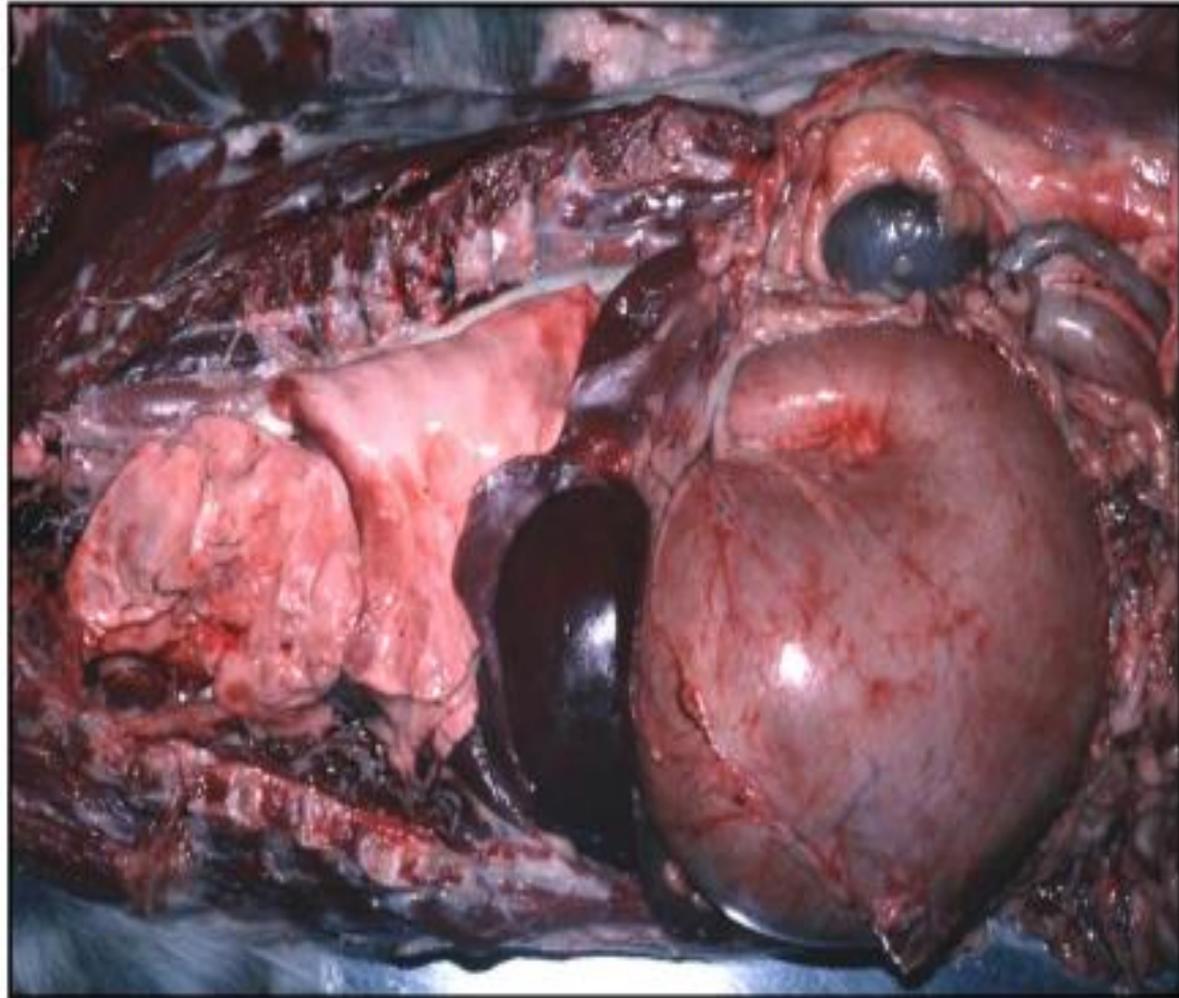
Pathogenesis

- Follows large meal (dry or highly fermentable)
 - Failure of normal eructation & pyloric outflow
- 

→ Excess gas production → gastric dilation → functional obstruction of cardia & pylorus → **torsion** (rotation on its mesenteric axis) → compression of lung & posterior vena cava → circulatory collapse (shock) → **death from respiratory & circulatory failure**

■ Gross changes:

- Severe abdominal distension
- Clock-wise rotation of stomach
- Hemorrhagic infarction
- Rupture of stomach
- V-shaped bending of enlarged spleen
- Congestion of intestines



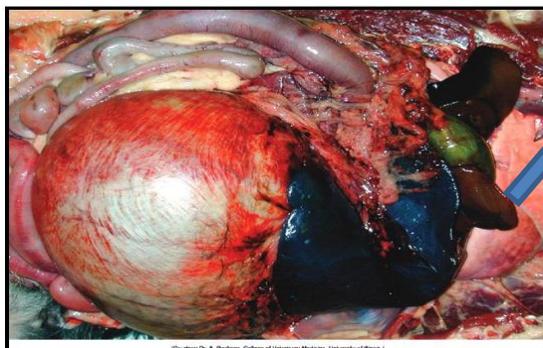
Gastric dilation and volvulus, dog. The stomach is filled with fluid and gas and the serosa is congested. The spleen is engorged, and displaced to the right and cranially.



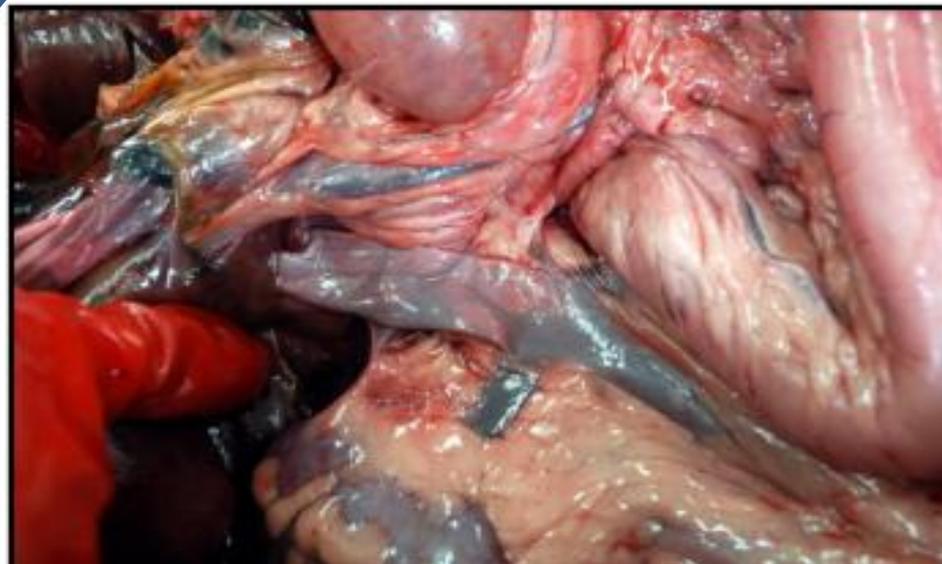
GDV, Stomach rotates on its mesenteric axis



GDV, V-shaped bending of enlarged spleen



GDV, compressed caudal vena cava (decreased venous return to the heart)



3. Displacement of The Abomasum

a) LDA mostly in **dairy** cows

- Common GIT disorder **requiring surgery**
- Caused by Feeding **high grain diet** (**volatile fatty acid decrease motility**)
- Occurs **most commonly** in large high producing adult **dairy cows during late pregnancy** or immediately after **parturition**.
- **Abomasal atony** is considered to be the **primary dysfunction** in this condition.
- **Pathogenesis:** The **gravid uterus displace the rumen & abomasum cranially & to the left** → **rupture of attachment of greater omentum** → **LDA**

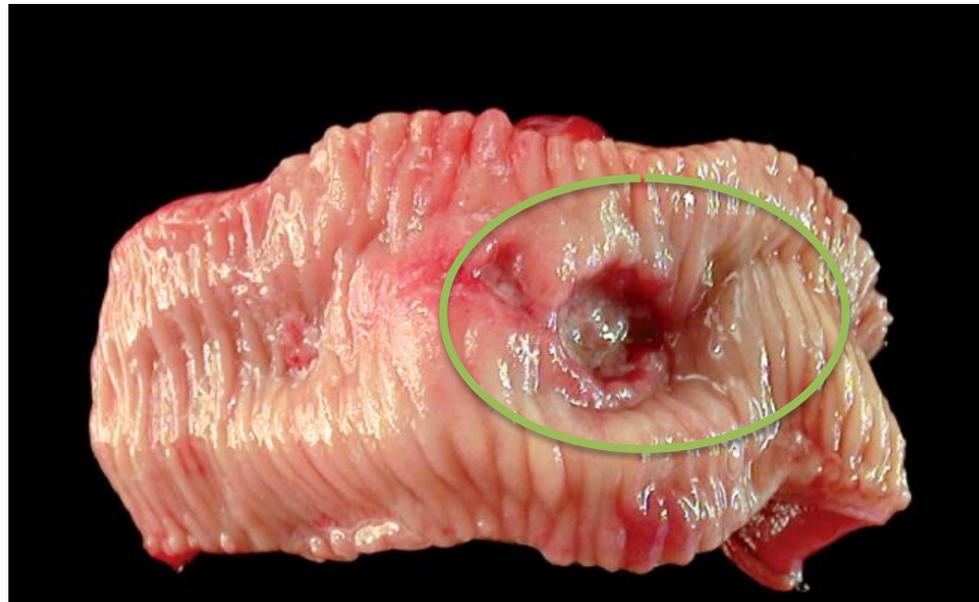
b) RDA mostly in **calves**

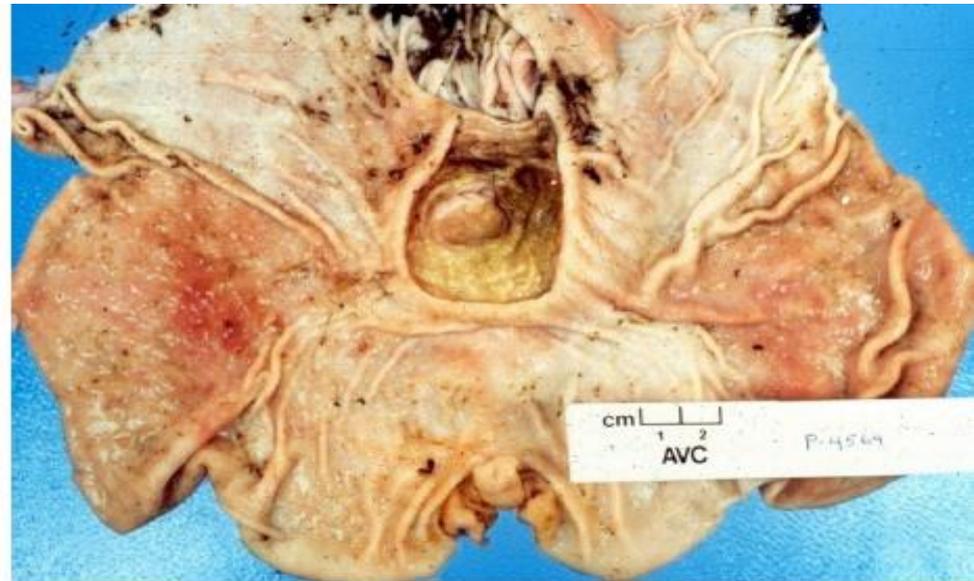
- Over **distended abomasum** → displaced **dorsally (and to the right)**, → rotated on its mesenteric axis (torsion) → RDA.
- LDA & RDA **results haemodynamic disturbance** mainly **congestion** of the displaced abomasum and serosal congestion
 - if prolonged → **Ischemic necrosis**

4. Ulceration of the Stomach:

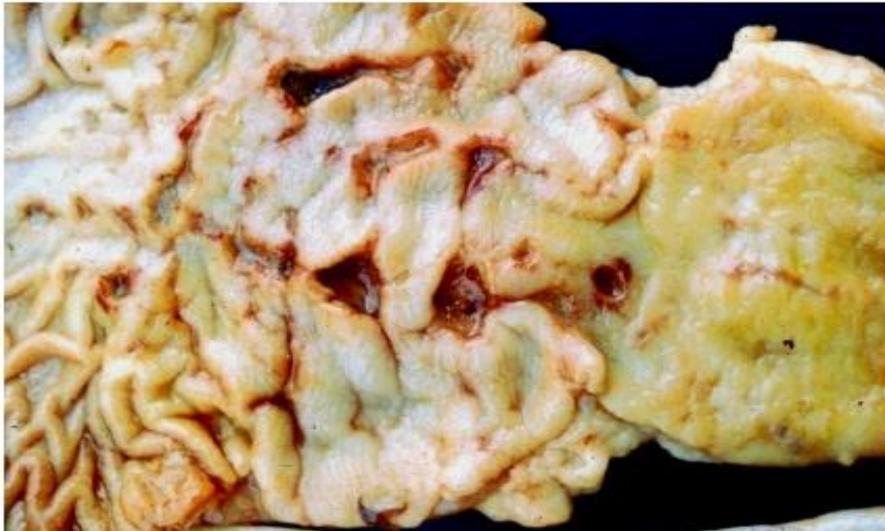
- Gastric ulcerations occur **in all animal species**, but they are **most frequent in farm animals (cattle, swine and horses)**
- less important than in humans
 - where they are **usually traumatic** or **associated with erosive or ulcerative diseases** (bovine virus diarrhoea, etc.)
- Main signs: **Hematemesis, Melena, Anemia, Abdominal pain.**

- **Ulcers** → central area of necrosis surrounded by active hyperemia & inflammation (red periphery).
- Epithelial necrosis → erosion → ulceration → bleeding → perforation → peritonitis





Gastric ulcers in animals. In calves, gastric ulcers may perforate (top left) and cause fatal peritonitis. In pigs, they occur as a oval or rectangular crater (top right), often as incidental finding, but could be fatal. In dogs, they may result from mast cell tumors (bottom left). In horses, lesions are often subclinical and affect the squamous mucosa (bottom right).



5. Neoplasms of The Stomach:

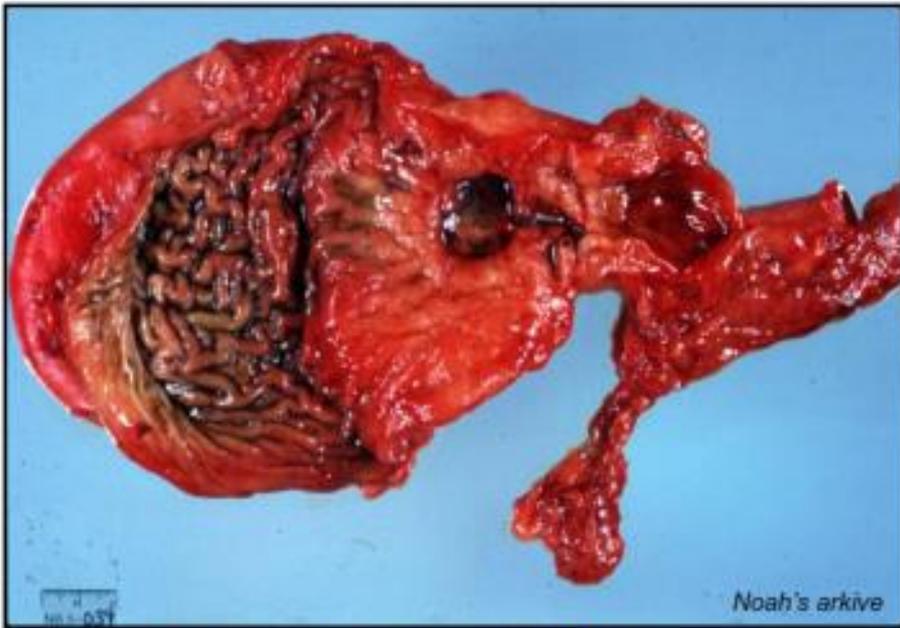
- **Primary neoplasia** is relatively **uncommon** in domestic animals.
- However, **neoplasms with multicentric origin;** e.g., **lymphosarcoma, Squamous cell carcinoma (horses), Adenocarcinoma (dogs)** have been noted to **occur with more frequency.**

Gastric leiomyoma, dog



Pathologic Basis of Veterinary Disease , 4thed., Mosby-Elsevier

Squamous cell carcinoma, stomach, equine



Gastric adenocarcinoma, ulcerated, dog

6. Parasitic diseases of stomach

1. Parasitic diseases

- **Ruminants**
 - Haemonchosis
 - Ostertagiosis
 - Trichostrongylosis

- **Equine**
 - Gastric bots
 - *Draschia megastoma*
 - Trichostrongylosis

- **Swine**
 - Hyostrongylosis

Pathology of Small and Large Intestines

Structure of intestine

- Long coiled tube, large surface area
- Folded mucosa
- Villi (7-14 fold increase)
- Microvilli (15-40 fold increase)

Function of intestine

- Digestion, absorption, excretion
- Fermentation vat (cecum)
- Good defense mechanisms

Diseases of Small and Large Intestines

- Congenital anomalies
- Obstruction and functional disorders
- Inflammation
- Specific enteric diseases (mostly infectious)
- Neoplastic diseases

1. Congenital anomalies of intestine

- **Segmental defects**

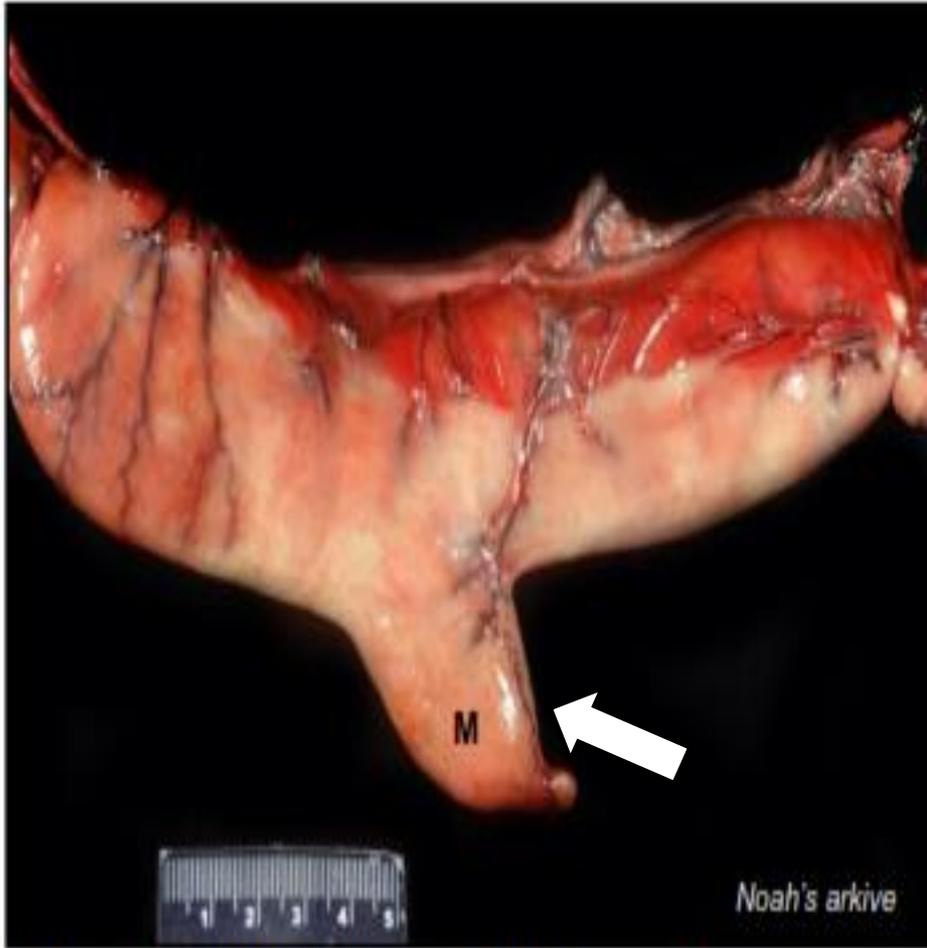
- Stenosis (partial occlusion)
- Atresia (complete occlusion)
 - Atresia ani, atresia coli, atresia ilei

- **Persistent Meckel's diverticulum (Out pouching of a hollow)**

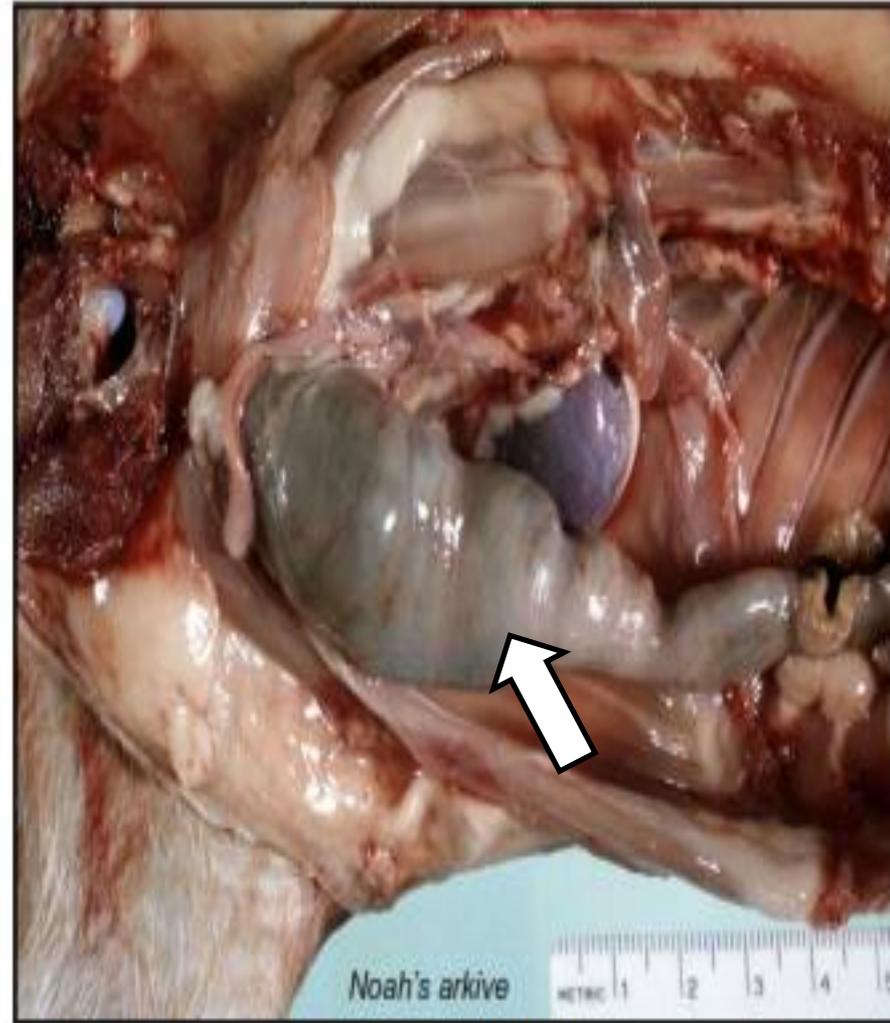
- Derived from omphalomesenteric duct (stalk of the yolk sac)

- **Megacolon**

- Reduction/absence of ganglion cells of myenteric plexus (aganglionosis)
 - 2ary to atresia ani
 - Damage to the colonic innervation



Meckel diverticulum. The blind pouch (M) is located on the antimesenteric side of the small bowel.



Megacolon, cat. Fecal-filled, enlarged colon

2. Obstruction and functional disorders

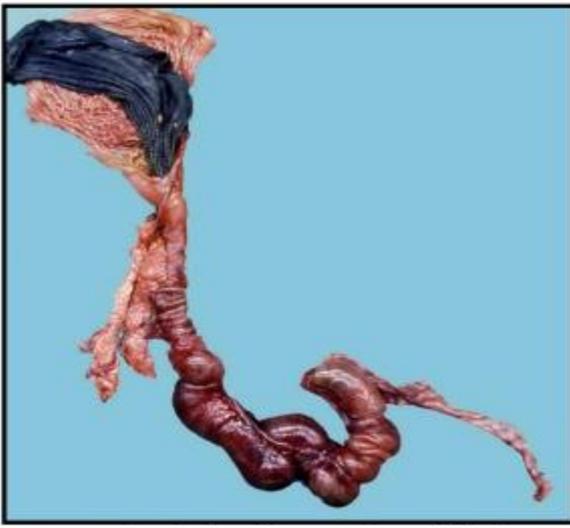
- Can be caused by **Obturation** (intraluminal), **Compression** (external), **Stenosis** (strictures or narrowing), **Intestinal displacement**, **Functional** (absence of peristalsis).
- Consequences of obstruction is **Death** from
 - **Toxemia** (bacterial overgrowth),
 - **Shock** (dehydration, etc),
 - Starvation

• Gross lesions

- Distended abdomen
- Dilated bowel proximal to obstruction
- Collapsed and empty distal part
- Congested/infarcted area of obstruction
- Perforation



Foreign body (sock), accordion-folded intestine, dog



Foreign body (sock), accordion-folded intestine, dog



Congenital stenosis, lamb

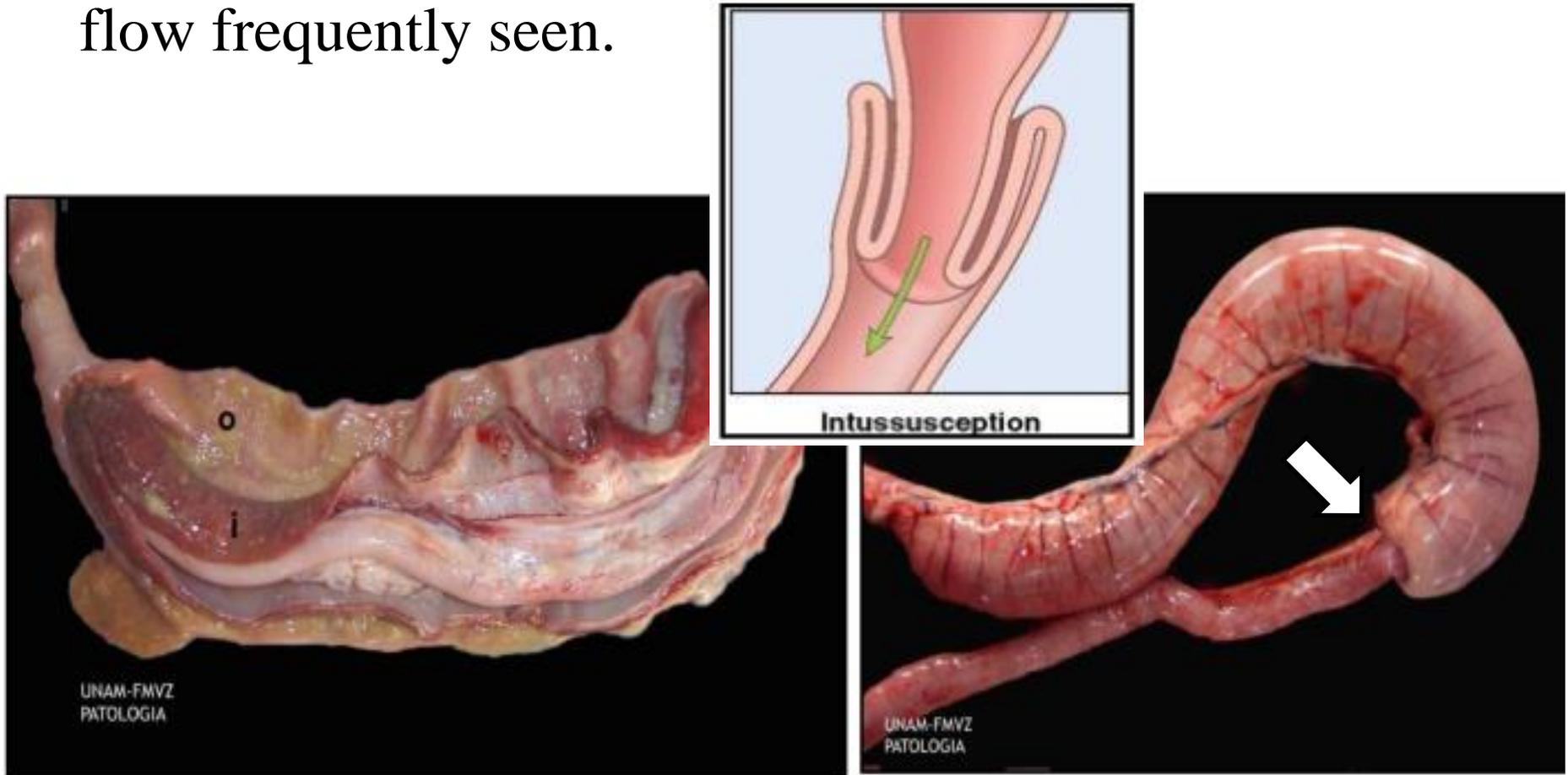


Enterolith, horse

3. Intussusception

- is **Telescoping** (entrapped or enveloping) segment
 - this means a portion of intestine **enters in caudal segment** due to **violent peristaltic movement**.
- Caused by **Irritability/hypermotility**
- It results **obstruction, passive congestion and oedema**.
- **Pathogenesis:**
 - Vascular strangulation → congestion/edema → ischemia → infarction → gangrene (necrosis or rotting)

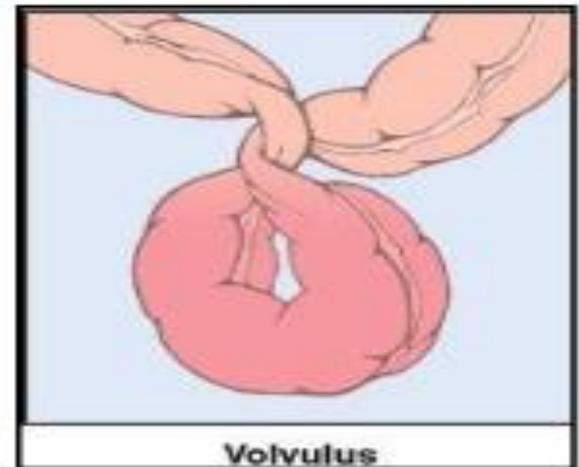
- **Sharp line of demarcation** between **viable colon** and **nonviable colon** caused by obstruction of venous blood flow frequently seen.

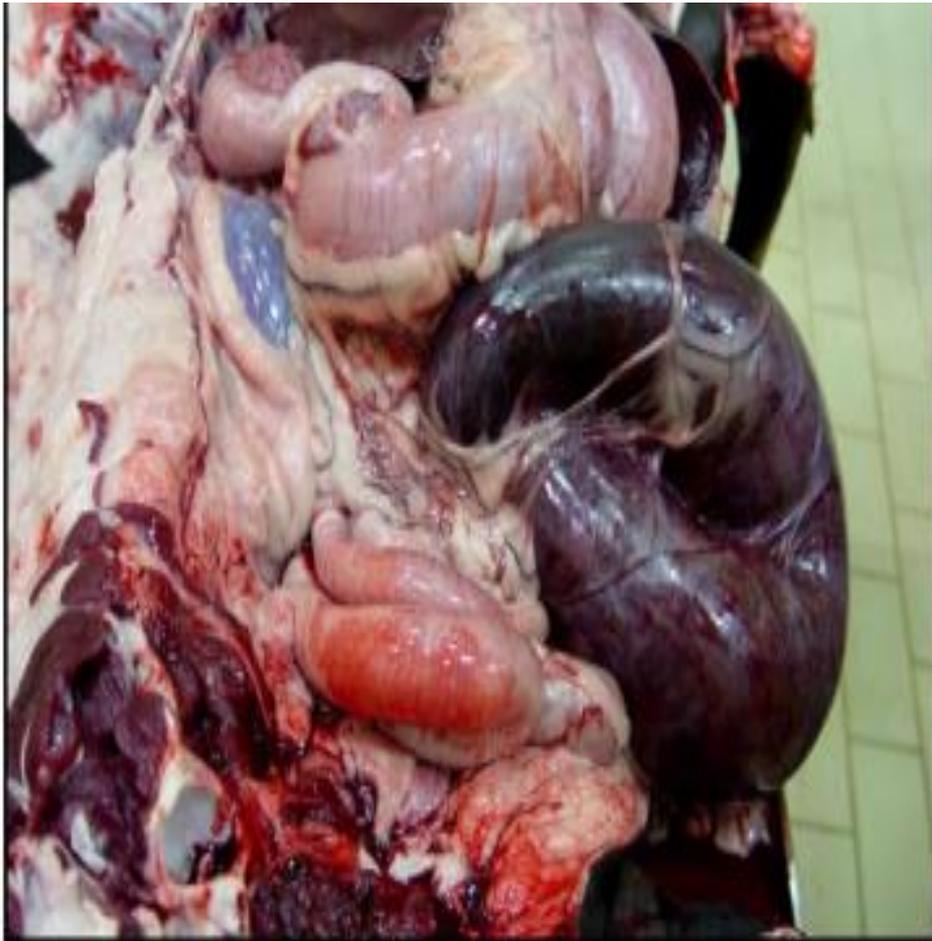


Intussusception, dogs. Intussusceptum (i), intussusciens (o)

4. Volvulus

- The loop of intestine passes through **a tear in mesentery**
- It causes **obstruction** at both ends of loop.
- Common **Left colon** in horses

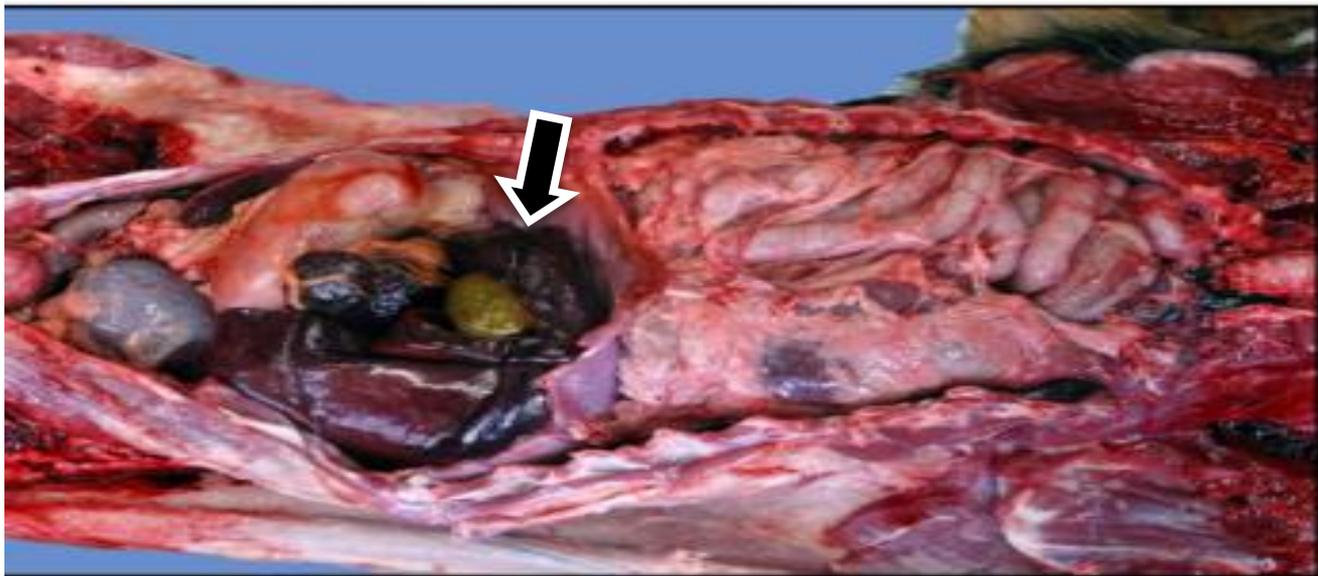




Volvulus of small intestine (dog, left) and spiral colon (pig, right) resulting in marked dilation and venous infarction.

5. Herniation

- is the **protrusion of the abdominal viscera** through a **natural or artificial opening**.
 - Displacement through a foramen
- It could be **Internal** (Foramen of Winsloe, Omental or mesenteric tears, Renosplenic ligament) and **External** (Diaphragmatic , Umbilical, Scrotal or femoral, ventral)
 - External hernia **consists** of a **hernial sac, hernial ring** and **The hernial contents**.
- which causes **passive congestion, Strangulation** (interference with blood flow), **edema, obstruction in intestines** and **Perforation**.



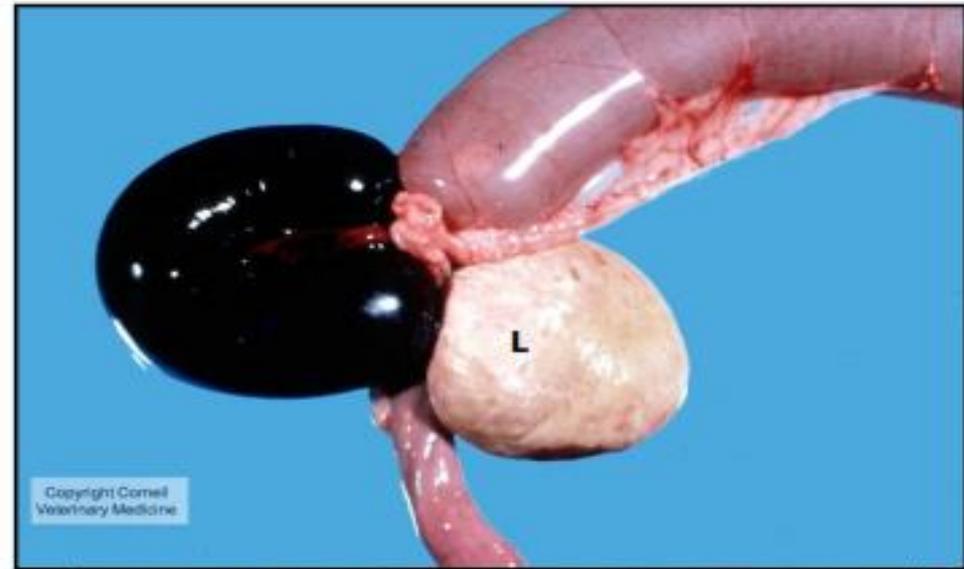
Herniation through the diaphragm, dog

6. Torsion

- Torsion is twisting of intestine **upon itself or axis causing obstruction.**
- common in **Cecum**
- Results → **Obstruction and infarction** → strangulation



Torsion, large colon, horse. Note the sharp line of demarcation between viable colon (to the right) and nonviable colon (to the left) caused by obstruction of venous blood flow.



Pedunculated lipoma, horse (L).
The tumor wrapped around the mesentery and strangled the bowel.

7. Inflammation of intestines

- It leads to
 - **Diarrhea**
 - An increase in feces mass, frequency, and/or fluidity
 - Consequences of diarrhea are Dehydration, Acidosis, Hypoproteinemia & ascites , Electrolyte imbalance → Death
 - **Dysentery**
 - Painful, bloody diarrhea
- **Causes of enteritis are viruses, bacterias, Parasites, Dietary factors, Ingested intoxicants, Allergies and Idiopathic**

- **Types of enteritis: gross lesions**

- Catarrhal (dark bloody)
- Hemorrhagic (bloody)
- Fibrinous/fibrinonecrotic
- Ulcerative (sore of mucous membrane)
- Proliferative/hyperplastic
- Granulomatous (mass of granular tissue)



Noah's arkive

Necrohemorrhagic enteritis, small intestine, horse. Necrosis and sloughing of the mucosa caused by the ingestion of cantharidin, a toxin in ingested blister beetles (*Epicauta* spp).

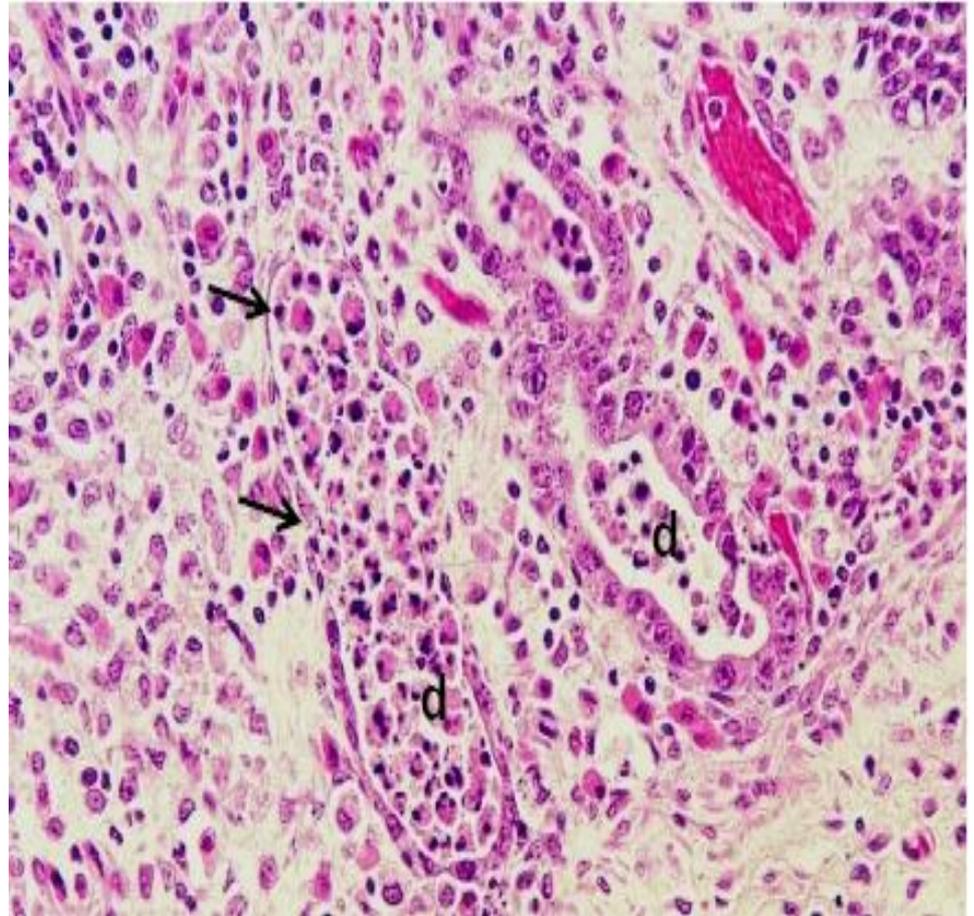


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Ulcerative colitis

Microscopic features in enteritis

- Infiltration of lamina propria
- Crypt necrosis & inflammation (cryptitis, crypt abscess)
- Crypt dilation
- Crypt hyperplasia
- Necrosis of enterocytes
- Villous atrophy



8. Concretions/ Enteroliths

- Calculi found in the intestine are called **enteroliths**.
- Sometimes they are found in the **large intestines of horses**.
- When animals are **fed on wheat or bran** which are **rich in magnesium phosphate**, intestinal calculi can occur.
- **Normally magnesium phosphate** is dissolved by the gastric juice and then absorbed in the intestines.
- If an animal suffering from **chronic catarrhal gastritis** in which **gastric juice is not secreted**, much of the magnesium phosphate reaches the intestines in an **undissolved state**.

- This combines with ammonia that is formed from the decomposition of protein (which is also abundant in wheat and bran) to form triple phosphate.
- This **triple phosphate crystallises** around foreign bodies like a grain of sand, a piece of metal or undigested plant fibre.
- Enteroliths do not form in the small intestines because the movement of the food is too rapid there to allow the deposition of salts and formation of calculi and Bacterial decomposition of proteins to form ammonia does not take place there.

- Grossly: Enteroliths may sometimes attain a large size, some may weigh as much as 20 lbs and are usually round and smooth.



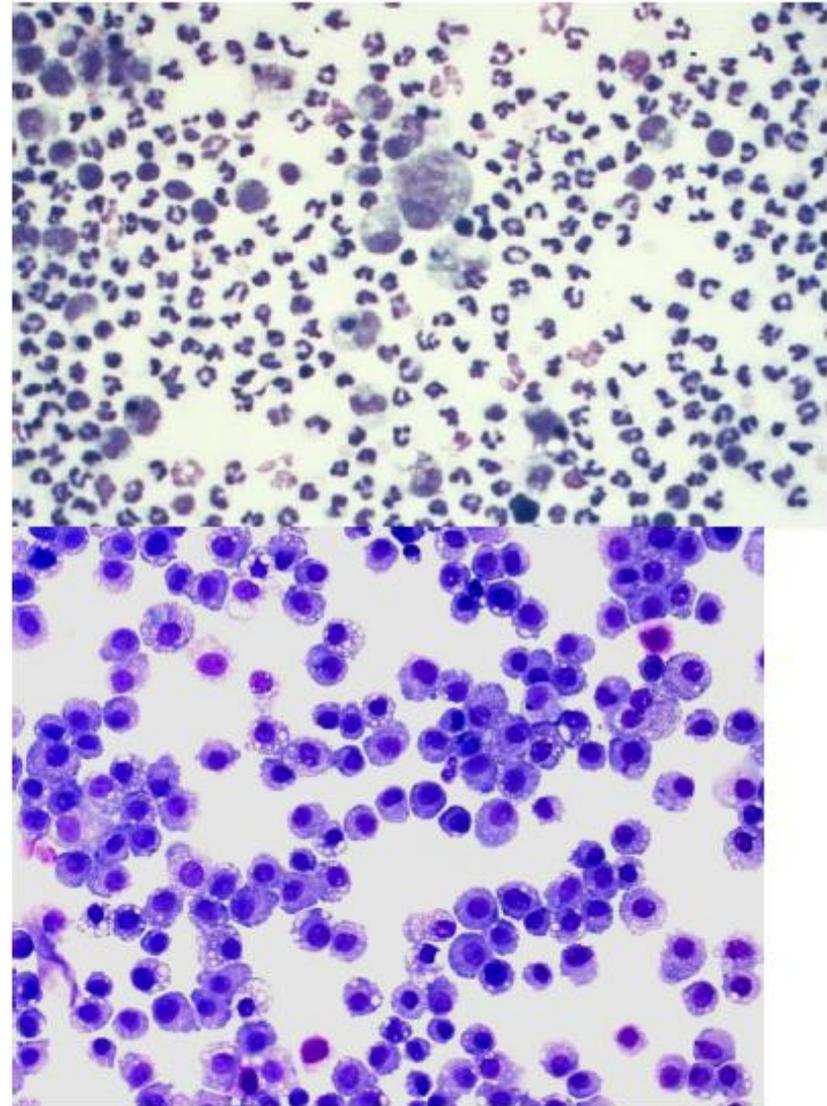
Enterolith, horse

Adhesion

- Intra-abdominal adhesions generally affect the small intestine and usually cause **obstruction of the intestinal lumen, although they may cause strangulating obstruction.**
- These adhesions develop in response to **peritoneal injury** and, most often, are the result of previous small-intestinal surgery, chronic small-intestinal distention, peritonitis, or larval parasite migration.
- The tissue response to ischemia, traumatic tissue handling, foreign material, hemorrhage, or dehydration results in the formation of **fibrinous** (and subsequently fibrous) adhesions.

2. Peritonitis

- Very common in large animals
- Usually bacterial, less often viral, parasitic & chemical (e.g. bile, pancreatic enzymes)
- **Bacteremia/septicemia** in young animals
 - Omphalitis or mucous membranes → infected monocytes with limited bactericidal power → serosal, synovial & meningeal surfaces
- **Classified as:**
 - Primary or secondary
 - Acute or chronic
 - Localized or diffuse
 - Septic or nonseptic
 - Type of predominant exudate
- **Sequellae:**
 - Fibrous adhesions → intestinal obstruction



Microscopic images from cytological smears. Large numbers of **neutrophils** (top), **macrophages** and reactive **mesothelial cells** (the latter two look very similar, bottom) are usually present in pleural or peritoneal fluids associated with inflammatory processes.

QUESTIONS

