

# Biochemistry of digestive disorders

- **Vomiting**
- **Gastric Dilatation-Volvulus**
- **Ischemia-Reperfusion Injury**
- **Acute Diarrheas**
- **Intestinal Malabsorption**

# Vomiting

- ❖ Vomiting is a coordinated reflex act which results in rapid, forceful expulsion of gastric contents through the mouth
- ❖ The reflex may be initiated by local gastric irritation caused by a variety of toxic irritants, infectious agents, foreign bodies, gastric tumors, or obstructions of the pyloric canal or the small intestine
- ❖ drugs such as apomorphine or other toxic substances that act centrally on the "vomiting center" of the medulla
- ❖ Severe vomiting produces loss of large quantities of water and of  $H^+$  and  $Ca^+$  ions

- ❖ These losses cause dehydration, metabolic alkalosis with increased plasma  $\text{HCO}_3^-$ , and hypochloremia
- ❖ Chronic vomiting may also be associated with the loss of significant tissue K ions and with hypokalemia
- ❖ The K ions deficit is caused primarily by increased urinary excretion resulting from alkalosis
- ❖ Vomiting occurs frequently in the dog, cat, and pig, but is an unusual sign in the horse, which has anatomical restrictions of the esophagus that interfere with expulsion of gastric contents
- ❖ In cattle, sheep, and goats, the physiological process of rumination utilizes neuromuscular mechanisms similar to those involved in vomiting

# Gastric Dilatation-Volvulus

- ❖ Acute gastrointestinal Disorder
- ❖ Occurs in large deep chested dogs but has been reported in smaller dogs, the cat, and other species
- ❖ Gastric dilatation precedes development of volvulus
- ❖ Gastric dilatation result of
  - ❖ - The accumulation of gas
  - ❖ - Mechanical or functional disturbances in pyloric outflow
- ❖ Distension and displacement of the stomach causes obstruction of the caudal vena cava and portal vein

# Ischemia-Reperfusion Injury

- ❖ Ischemia-reperfusion injury due to intestinal obstruction in horse *and* Gastric Dilatation-Volvulus *in dogs*
- ❖ Depending on the duration and severity of ischemia, oxygenation of tissue is compromised and there is a subsequent attenuation of oxidative phosphorylation and a decrease in ATP
- ❖ Anaerobic glycolysis ensues, leading to intracellular acidosis and increased intracellular concentrations of Ca ions

# Acute Diarrheas

❖ Passage of abnormally fluid feces with increased frequency, increased volume, or both

## Factors causing diarrhea

❖ An increase in the rate of intestinal transit (hyper motility)

❖ decreased intestinal assimilation of nutrients

-decreased intra-luminal hydrolysis of nutrients

-*maldigestion due to pancreatic* exocrine insufficiency or bile-salt deficiency

-defective mucosal transport of nutrients (malabsorption)

❖ increased intestinal secretion of water and electrolytes

# Intestinal Malabsorption

- ❖ Decreased absorption of nutrients may occur either as a result of defective intraluminal digestion (maldigestion) associated with pancreatic insufficiency (juvenile pancreatic atrophy, chronic pancreatitis) or because of defects in mucosal transport (malabsorption).
- ❖ Intestinal malabsorption is associated with several types of intestinal disease including chronic inflammatory diseases  
**Eg.** lymphocytic-plasmacytic enteropathy, eosinophilic enteritis, granulomatous diseases (Johne's disease, intestinal parasitism), and lymphoma
- ❖ The cardinal clinical signs of malabsorption include persistent or recurrent diarrhea, steatorrhea, and weight loss

# DISTURBANCES OF RUMEN FUNCTION

- ❖ Digestive process of ruminants differs from that of other animals because rumen microbial digestion occurs prior to other normal digestive processes
- ❖ Short-chain fatty acids (acetic, propionic, and butyric acids) are the primary end products of rumen fermentation and are the chief sources of energy available to ruminants from the diet
- ❖ Significant quantities of nonprotein nitrogen (NPN) can also be used by ruminal bacteria for protein synthesis, and this bacterial protein subsequently can be utilized to meet the protein requirements of the animal

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# Acute Rumen Indigestion (Rumen Overload, Lactic Acidosis)

- ❖ Acute rumen indigestion occurs in sheep or cattle consuming high-roughage diets when they inadvertently are allowed access to large amounts of readily fermentable carbohydrate, such as grain or apples
- ❖ *Streptococcus bovis* is the rumen microorganism believed to be chiefly responsible for rapid fermentation and for production of large quantities of lactic acid
- ❖ When lactic acid accumulates more rapidly than it is absorbed, rumen pH falls and rumen atony develops
- ❖ The excessive lactic acid production results in metabolic acidosis, characterized by reduced blood pH and  $\text{HCO}_3^-$  concentration and by a fall in urine pH from a normal alkaline value to as low as pH 5.0

❖ Fluid accumulates in the rumen because of the increased osmolality of the rumen fluid

❖ This accumulation of fluid into the rumen causes hemoconcentration, which in turn may lead to hypovolemic shock and death

# Acute Rumen Tympany (Bloat)

Rumen of mature cattle can produce 1.2-2.0 liters of gas per minute

Gas is the product of rumen fermentation and is composed primarily of carbon dioxide (CO<sub>2</sub>) and methane

Under normal conditions, these large amounts of gas are continually removed by eructation

Any factor that interferes with eructation can produce acute tympany of the rumen (bloat), leading to rapid death

Interruption of the normal eructation reflex or mechanical obstruction of the esophagus typically results in free-gas bloat

The most important form of bloat, however, is seen in cattle consuming large quantities of legumes or in feedlot cattle on highconcentrate diets