

## **Enteritis (including malabsorption, enteropathy, and diarrhea)**

The term enteritis is used to describe inflammation of the intestinal mucosa resulting in diarrhea and sometimes dysentery, abdominal pain occasionally, and varying degrees of dehydration and acid-base imbalance, depending on the cause of the lesion, its severity, and location. In many cases, gastritis also occurs together with enteritis.

### **Etiology and epidemiology**

- There are many causes of enteritis or malabsorption in farm animals and the disease varies considerably in its severity depending on the causative agent.
- Enteropathogens include bacteria, viruses, fungi, protozoa, and helminths. Many chemicals and toxins can also cause enteritis .
- In addition to the primary etiologic agents of enteritis, there are many epidemiologic characteristics of the animal and the environment that are important in facilitating or suppressing the ability of the causative agent to cause enteritis.
- Thus newborn calves and piglets deficient in colostral immunoglobulins are much more susceptible to diarrhea,
- Enteric salmonellosis is commonly precipitated by the stressors of transportation or deprivation of feed and water.
- The prolonged use of antimicrobials orally in all species may alter the intestinal microflora and allow the development of a superinfection by organisms that would not normally cause disease.

### **Pathogenesis**

- **Normal Intestinal Absorption Under normal conditions,**
- a large quantity of fluid enters the small intestine from the saliva, stomach, pancreas, liver, and intestinal mucosa.
- This fluid and its electrolytes and other nutrients must be absorbed, mainly by the small intestines, although large quantities move into the large intestine for digestion and absorption, especially in the horse.

- The brush border membrane of the villous epithelial cells is of paramount importance for the absorption of water, electrolytes, and nutrients.

-The enteric nervous system is a critical component of the mechanism regulating fluid secretion in the normal intestine and a key element in the pathophysiology of diarrhea.

**-Neural reflex pathways increase epithelial fluid secretion in response to several enteric pathogens of veterinary importance such as Salmonella spp., Cryptosporidium parvum, rotavirus, and C. difficile.**

**-The enteric nervous system also has an important role in epithelial secretion triggered by products of activated leukocytes during inflammation.**

Mechanisms of Diarrhea Any dysfunction of the intestines will result in failure of adequate absorption and diarrhea. Depending on the causative agent, intestinal malabsorption may be the result of at least four different mechanisms:

- Osmotic diarrhea
- Exudative diarrhea
- Secretory diarrhea
- Abnormal intestinal motility

### **1-Osmotic Diarrhea**

There may be an osmotic effect when substances within the lumen of the intestine increase the osmotic pressure over a greater than normal length of intestine, resulting in an osmotic movement of an excessive amount of fluid into the lumen of the intestine.

The fluid is not reabsorbed and accumulates in the lumen.

### **2-Exudative Diarrhea**

**Acute or chronic inflammation or necrosis of the intestinal mucosa results in a net increase in fluid production; inflammatory products, including loss of serum proteins; and a reduction in absorption of fluids and electrolytes.**

### **3-Secretory Diarrhea**

**A secretory–absorptive imbalance results in a large net increase in fluid secretion with little if any structural change in the mucosal cells.**

The enterotoxin elaborated by ETEC results in intestinal hypersecretion. The villi, along with their digestive and absorptive capabilities, remain intact.

**-The crypts also remain intact; however, their secretion is increased beyond the absorptive capacity of the intestines, resulting in diarrhea.**

**-The fluid that is lost consists primarily of water; the electrolytes sodium, chloride, potassium, and bicarbonate; and varying quantities of protein.**

**-Protein is lost (protein-losing enteropathy) in both acute and chronic inflammation, leading to hypoproteinemia in some cases.**

- **-Almost any noxious influence can increase the rate of extrusion of these cells, which are then replaced by cells that are immature and not fully functional. The villi become shortened (villous atrophy) and chronic malabsorption. The destruction of villous epithelial cells explains the long recovery period of several days in some animals with acute enteritis and the chronic diarrhea in others with chronic villous atrophy.**

### **Concurrent Gastritis**

**Gastritis (or abomasitis) may also be the primary lesion, resulting in a profuse diarrhea without lesions of the intestines. Examples are ostertagiasis and abomasal ulceration in cattle.**

### **CLINICAL FINDINGS**

The major clinical finding in enteritis or malabsorption is diarrhea. Dehydration, abdominal pain, septicemia, and toxemia with fever occur commonly and their degree of severity depends on the causative agent, the age, the species of the animal, and the stage of the disease.

#### **In acute enteritis**

, the feces are soft or fluid in consistency and may have an unpleasant odor. They may contain blood (dysentery), fibrinous casts, and mucus or obvious foreign material such as sand.

- The color of the feces will vary considerably: they are usually pale yellow because of the dilution of the brown bile pigments, but almost any color other than the normal is possible and,

- with the exception of frank blood (hematochezia) or melena (black tarry feces), the color of the feces is usually not representative of a particular disease.

- Some indication of the nature of the enteritis may be obtained from the distribution of the feces on the animal's perineum.

-Straining may occur, especially in calves, and be followed by rectal prolapse, particularly when the lesions are present in the colon and rectum.

- Intussusception may occur when the enteritis involves the small intestine.

-There are a number of diseases in which dysentery with or without toxemia occurs and death may occur rapidly. These include lamb dysentery, hemorrhagic enterotoxemia of calves, acute swine dysentery,.

### - **Systemic Effects**

-The systemic effects in enteritis vary considerably. Septicemia, toxemia, and fever are common in the infectious enteritides.

-An increased body temperature may return to normal following the onset of diarrhea or if circulatory collapse and shock are imminent.

- Dehydration will vary from being just barely detectable at 4% to 6% of BW up to 10% to 12% of BW, when it is clinically very evident.

- The degree of dehydration can be best assessed by tenting the skin of the upper eyelid or neck and determining the time taken for the skin fold to return to normal. The degree of recession of the eyeball is also a useful aid.

-Dehydration is usually evident by 10 to 12 hours following the onset of acute enteritis and clinically obvious by 18 to 24 hours.

-Peripheral circulatory collapse (shock) occurs commonly in acute and peracute cases.

-There may be tachycardia or bradycardia and arrhythmia depending on the degree of acidosis and electrolyte imbalance.

- In acute enteritis, there may be severe abdominal pain, which is most severe in the horse and is often sufficient in this species to cause rolling and kicking at the abdomen.

- The passage of intestinal gas also occurs commonly in horses with acute and chronic diarrhea.

-Abdominal pain in enteritis is unusual in the other species although it does occur in heavy inorganic metal poisonings, such as arsenic and lead, and in acute salmonellosis in cattle.

**Some severe cases of enteric colibacillosis in calves are characterized by abdominal pain evidenced by intermittent bouts of stretching and kicking at the abdomen.**

### **Intestinal Sounds in Enteritis**

Auscultation of the abdomen usually reveals sounds of increased peristalsis and fluid rushing sounds in the early stages of acute enteritis.

- Later there may be paralytic ileus and an absence of peristaltic sounds with only fluid and gas tinkling sounds.

-The abdomen may be distended in the early stages because of distension of intestines and gaunt in the later stages when the fluid has been passed out in the feces.

-Pain may be evidenced on palpation of the abdomen in young animals.

### **Chronic Enteritis**

**\_ In chronic enteritis, the feces are usually soft and homogeneous in consistency, contain considerable mucus, and usually do not have a grossly abnormal odor.**

**- Progressive weight loss and emaciation or “runting” are common and there are usually no systemic abnormalities.**

**- Animals with chronic enteritis will often drink and absorb sufficient water to maintain clinical hydration, but there may be laboratory evidence of dehydration and electrolyte loss.**

**-granulomatous enteritis of horses,**

**-and lymphosarcoma of the intestine of horses are examples of enteric disease causing chronic anorexia and progressive weight loss, usually without clinical evidence of diarrhea. These are commonly referred to as malabsorption syndromes.**

### **Clinical pathology**

**-Laboratory testing of animals to obtain an etiologic diagnosis of enteritis can be a complex, which requires careful consideration of the **history, the clinical findings, and the number of animals affected.****

- **In outbreaks of enteric syndromes, it may be important to submit samples from both affected and normal animals.**

## **Fecal Examination**

Examination of the feces to determine the presence of causative bacteria, helminths, protozoa, viruses, and chemical agents is described under specific diseases . It is important that fecal specimens are taken as the differentiation of the etiologic groups depends on laboratory examinations.

- In outbreaks of diarrhea, fecal samples should also be taken from a representative number of normal animals in the same group as the affected animals.

## **Intestinal Tissue Samples**

In outbreaks of diarrhea, especially in neonates, it may be useful to do necropsies on selected early untreated cases of acute diarrhea.

## **Hematology and Serum Biochemistry**

**in diagnostic laboratories and in large-animal practice, it is becoming common to do considerable laboratory evaluation to determine the changes that are present for purposes of a more rational approach to therapy.**

**For each specific enteritis there are changes in the hemogram and serum biochemistry that aid in the diagnosis and differential diagnosis.**

**In bacterial enteritis, such as acute enteric salmonellosis in the horse, there may be marked changes in the total and differential leukocyte count, which is a useful diagnostic aid.**

**In most cases of acute enteritis there is hemoconcentration, metabolic acidosis, an increase in total serum solids concentration, a decrease in plasma bicarbonate, hyponatremia, hypochloremia, and hypokalemia.**

--The acid-base imbalances may vary considerably from case to case, and it is suggested that optimal fluid therapy should be based on laboratory evaluation of the animal's blood gas and electrolytes.

## **Digestion/Absorption Tests**

**- Digestion and absorption tests are available for the investigation of chronic malabsorptive conditions, particularly in the horse.**

- Intestinal biopsy may be necessary for a definitive diagnosis of chronic intestinal lesions that cannot be determined by the usual diagnostic tests.

## **TREATMENT**

**The principles of treatment of enteritis include the following:**

- Removal of the causative agent
- Alteration of the diet
- Fluids and electrolytes
- Intestinal protectants and adsorbents
- Antidiarrheal drugs

### **Removal of Causative**

Agent Specific treatment is usually directed at intestinal helminthiasis with anthelmintics, antiprotozoan agents against diseases such as coccidiosis, and

-antimicrobial agents against the bacterial enteritides.

- **-There are no specific treatments available for the viral enteritides in farm animals.**
- **-Many different antimicrobial preparations for both oral and parenteral administration are available.**
- **- In cases of subacute diarrhea with minimal systemic effects, the use of an oral preparation may be sufficient.** However, oral preparations should not be used for more than 3 days to avoid a superinfection.
- **Mass Medication of Feed and Water :**
- **Supplies Mass medication of the drinking water supply with antimicrobials for the treatment of outbreaks of specific infectious enteritides in animals is used.**
- **Severely affected animals in an outbreak need individual treatment.**
- **Alteration of the Diet** If the cause of the diarrhea is dietary in origin the feed should be removed until the animal has fully recovered .
- **Fluids and Electrolytes The initial goals of fluid and electrolyte therapy for the effects of enteritis are the:**
- **restoration of the body fluids to normal volume,**
- **effective osmolality, and**
- **composition and acid-base balance.**

- **The clinician must therefore assess the degree of clinical dehydration and, based on the history and clinical findings, estimate the degree of acidosis and electrolyte deficits that are likely to be present.**
- The three major abnormalities of dehydration, acidosis, and electrolyte deficit are usually corrected simultaneously with fluid therapy.
- **When severe acidosis is suspected, this should be corrected immediately with a hypertonic (5%) solution of bicarbonate given intravenously at the rate of 5 to 7 mL/ kg BW.**

<b>Table : Fluid deficits (L) in horses, foals and calves with 10% dehydration</b>		
<b>Animal</b>	<b>Dehydration (%)</b>	<b>Fluid deficit (L)</b>
<b>500-kg horse</b>	<b>10</b>	<b>50</b>
<b>75-kg foal</b>	<b>10</b>	<b>7.5</b>
<b>45-kg calf</b>	<b>10</b>	<b>4.5</b>

- **Intestinal Protectants and Adsorbents Kaolin and pectin mixtures are used widely to coat the intestinal mucosa, inhibit secretions, and increase the bulk of the feces in animals with enteritis.**
- {Kaolin is hydrated aluminum silicate, and acts as an adsorbent.
- Pectin is a carbohydrate extracted from citrus fruit that acts as an adsorbent and intestinal protectant. these products are likely to decrease absorption of other drugs}
- Bismuth subsalicylate, kaolin-pectin, activated charcoal and magnesium, and aluminum- and barium-containing products are often administered in acute vomiting or diarrhea to bind bacteria and their toxins and to coat the GI mucosa.
- **Antisecretory Drugs**
- **Antisecretory drugs are also available for the treatment of diarrhea caused by the hypersecretory activity of enterotoxin produced by bacteria such as ETEC.**
- **Antisecretory**
- **Omeprazole.**
- **Metronidazole.**
- **Berberine.**
- **Histamine.**
- **Flavonoid.**
- **Cytoprotective.**
- **Antiinflammatory.**
- **Proton Pump Inhibitor.**



## **Control**

**The principles of control include the following:**

- **Reduce infection pressure by controlling population density**
- **Ensure adequate nonspecific resistance by adequate colostrum intake of neonatal farm animals and maintaining adequate nutritional status**
- **Vaccinate for those diseases for which there is an effective vaccine**
- **Minimize managerial and environmental stressors**
- **Monitor morbidity and mortality and ensure that a diagnosis is obtained so that control measures for newly introduced diseases into a herd can be instituted**