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Vomiting in Dogs - A Review

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Abstract

Emesis or vomiting is most common clinical condition reported in dogs. It is an acid-related gastric disorder due to structural or functional defect in mucosa of stomach pertaining to innumerable grounds. Vomiting is a cardinal sign of inflammation of gastric mucosa. Many etiological factors are responsible for gastric disorders such as dietary carelessness, infectious diseases, stress, toxicity, routine management, excessive medications and other systemic diseases. In pathological terms, gastric disorders usually involves the gastric mucosal lining. They are instigated due to an imbalance between aggressive factors such as hydrochloric acid (HCl), pepsin, refluxed hue, reactive oxygen species (ROS) and defensive factors, which include the function of mucus-bicarbonate barrier, prostaglandins (PGs), mucosal blood flow, cell renewal and migration, non-enzymatic and enzymatic antioxidants and some growth factors. The acid-related disorders can be prevented by dietary discretion, routine exercise, regular deworming and vaccination as per standard regimen. The major strategies of therapy used against acid disorders are fluid therapy, proton pump inhibitors (PPIs), H_2 blocker, cytoprotective and antiemetics along with antioxidants.

Keywords: Gastritis; hydrochloric acid; inflammation; vomiting

Introduction

Dog vomiting is cardinal sign of gastritis that is common in acid-related diseases in stomach (Patel *et al.,* 2020) and also frequently displayed by the praying posture in dogs lying on the floor and seeking cold. Excessive increased acid production and loss of gastro protective barriers lead to inflammation of gastric mucosa. Vomiting may be caused by poor management dietary indiscretions which lead to structural and functional defects in gastric mucosa. It is important to note the difference between vomiting (using effort to bring food/liquid up) and regurgitation (no effort demonstrated when bringing food/liquid up) as they have different etiology and their management. Frequent or chronic vomiting in dogs can also be a sign of a more serious condition such as colitis, intestinal obstruction or parvovirus as well as even life-threatening medical emergencies, such as toxicity. Sometimes it can also be used as a curative measure in order to facilitate the flushing of system in case of poisoning. Suokko *et al.* (2020) have reported that rope in irole can act as a potential emesis inducer in dogs affected by toxic chemicals without causing any neurological and physical alteration. Vomiting can also be associated with gastrointestinal and systemic disorders. Other predisposing causes of vomiting in dogs are stress-induced, infectious (bacterial, viral and fungal), parasitic, antipyretic and anti-inflammatory drugs (Webb and Twedt, 2003). The changes in different blood chemicals are important for diagnosis as well as management of naturally occurring gastritis (Amorim *et al.,* 2016). Frequent nausea is associated with prodromal signs of vomiting such as licking, sweating, pallor and dizziness which is produced as a reflex *via* complex mechanism of respiratory and retrograde behavior of small intestine (Grélot and Millor, 2019). The sensation of nausea stems from complex mechanisms involving cortical structures in forebrain responsible for conscious perception, these mechanisms are thus far poorly characterized (Holmes *et al.,* 2009; Horn, 2008 and Sanger and Andrew, 2006). Vomiting if primary can resolve itself in 1-2 days but if it is intermittent and chronic it needs special attention and thorough diagnosis. The plain and contrast radiographs are useful for determining the possible origin of abdominal disturbances (gastric foreign bodies) but may be unsatisfactory in smart verification of gastric ulceration. Ultrasonography of gastrointestinal tract (GIT) is a valuable diagnostic imaging technique in animals. Ultrasonography is used for recognizing foreign bodies and masses, identification of GI perforation and used to detect drug-induced gastric mucosal changes and sometimes provides a helpful tool in

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surgery (Patel *et al.,* 2018a). Endoscopic examination is important for diagnosis and provides perfect diagnosis by direct gastric mucosal visualization, biopsy collection, aid as a deciding factor in prognosis and therapeutic benefits (Day *et al.,* 2008). The basic treatment of stomach hyperacidity related disorders can be achieved by removal of primary cause, appropriate fluid therapy, proton pump inhibitors, H_2 blockers, gastroprotective agents, antioxidants and correcting secondary circumstances (dehydration, anemia, weight loss). In this article we are studying some possible causes, diagnosis and possible major strategies of therapy, such as fluid therapy, proton pump inhibitors, H_2-blocker, cytoprotective, antiemetics and antioxidant therapy against acid disorders.

Types of Vomiting

Acute/ Sudden episode of Vomiting

Acute vomiting is a sign of acute gastritis which is characterized by sudden or severe onset of vomiting which can be a serious symptom of quite a few diseases, secondary disorders and complications.

Chronic Vomiting

Chronic vomiting is a sign of chronic gastritis and is clinically defined as intermittent, frequent or long-term vomiting with duration of more than 1-2 weeks, especially if it is accompanied by vomitus with blood, anorexia, abdominal pain, depression, dehydration, weakness, fever and severe weight loss.

Causes of Vomiting

Vomiting is the cardinal sign of gastritis which is pertaining to inflammation of stomach. The cause of vomiting is multifactorial alterations in mucosal, vascular, endocrine and neurologic variables.

Following are the protective barriers in stomach any breach or alteration in which can lead to gastric disorders:

Pre-epithelial: Mucous, bicarbonate and surface-active phospholipids

Epithelial: Cellular resistance, restitution, growth factors, Prostaglandins E_2 (PGE2) and cell proliferation.

Subepithelial: Blood flow and leukocytes. There are so many different reasons why your dog may be vomiting. Some of the most common reasons are:

Dietary Indiscretion:

It is also known as scavenging or eating something inedible substances may be out of curiosity or due to deficiency of vitamins and minerals. This is most common cause of vomiting in dogs. Most common sources found inside and outside home are categorized as followings:

Indoors

- Human medications - Many human medications, including antipyretics, analgesic and steroidal anti-inflammatory drugs.
- Small toys, String, yarn, Holiday decorations and other similar objects - Dogs likes to play with them, but many of them lead to blockage of gastrointestinal tract and can also cause choking which induces emesis.
- House cleaning and decorating products - Phenols, lead paints, aerosol sprays and fumes are toxic for dogs.

Kitchen

- Alcoholic beverages, apple seeds, bones, caffeinated beverages, cherry seeds, chocolates, coffee and coffee beans, garlic, grapes, edible parts of marijuana, onions and shallots, potatoes with growth or sprouts, raisins and yeast dough.

Outdoors

- Cocoa mulch - Dogs are attracted to chocolaty flavor, but ingredients in cocoa mulch can be lethal if ingested.
- De-icing salts used for snow and ice - Irritate the paws and are toxic to dogs.

Garage

- Fertilizers, antifreeze or other ethylene glycol products, garbage cans, pest control poisons, insect repellents and rodent poisons are highly dangerous for pets.

Gardens

Fertilizers: Many people are using fertilizers to maintain their lawns and gardens. Mostly young ones are wondering, playing and grooming dogs on the lawn and they get exposed to toxic fertilizers. When a dog consumes a high amount of fertilizer, it can become a life-threatening situation with signs of drooling, nausea, vomiting, diarrhea, difficult breathing, tremors, asphyxia, seizures and respiratory derailments. Organic or 'natural' fertilizers, such as bone meal, blood meal, feather meal and fish meal, are attractive to dogs, but they are harmful to their GI systems.

Plants and Flowers: Some well-known and loved flowers and plants, such as Daffodils, Tulips, Azaleas, Oleander and Sago Palm are gastrointestinal toxic for dogs if ingested. These plants are grown outdoors or indoors, can cause vomiting and diarrhea with blood, acute kidney and liver failure resulting in death.

Mushroom: The most common family of harmful mushrooms is Amanita, Lepiota and Galerina families. Amanita family includes the 'death cap' that has a fishy odor that is attractive to dogs.

Dietary-related gastritis: A sudden change in diet, food intolerance and dietary allergy can lead to harmful effects.

Heatstroke: Most often caused by leaving a dog in hot car.

Parasitic infestation: Gatric parasites (such as larvae of *Spirocerca lupi*, *Gnathostoma spinigerum, Ollulanus tricuspis,* etc.). Intestinal parasites (such as *Ancylostomum caninum, Toxocara canis,* etc).

Viral infection: Parvovirus, Infectious canine hepatitis, Canine Distemper and Rota viral infection.

Bacterial infection: Leptospirosis, Colibacillosis, Salmonellosis and *Helicobacter* infection.

Fungal infection: *Histoplasma capsulatum, Cryptococcus neoformans* & *Pythiuminsidiosum etc.*

Systemic diseases: Kidney failure, liver failure, thyroid and pancreatic disorders.

Toxicity: Metal toxicity, non metal toxicity, organochemical, toxicity via plant and animal toxins.

Bloat: Most commonly caused by eating too fast or due to overeating.

Gastrointestinal disease: Inflammatory Bowel Disease, GI obstructions.

Metabolic disease: Diabetes, Cushing disease, Addison's disease, etc.

Uterine infections: Pyometra, endometrial hyperplasia, cystic ovarian degeneration.

Neoplasm: Cancerous growth on stomach.

Immunocompromised puppies: Puppy vomiting is always more serious than dog vomiting hence they should be treated as an emergency case. Puppies lose their maternal immunity after six weeks and they do not have a fully mature immune system which makes them vulnerable to the risk of contracting serious diseases like parvoviral infection, canine distemper, or parasites.

Stress: Severe exercise, mental trauma, environmental and oxidative stress.

Vomiting with associated clinical signs in gastritis: If frequent episodes of vomiting occur then several clinical signs are also associated with acid related disorders.

- Loss of appetite
- Blood in vomit or feces
- Dull, depress and lethargy
- Change in frequency of urination
- Change in thirst
- Diarrhea
- Comatose condition
- Pale or white conjunctiva and gums
- Abdominal pain
- Weight loss
- Dehydration

Difference between Vomiting and Regurgitating

Vomiting: When dogs vomit, they forcefully eject stomach and duodenal contents. Prior to this objectionable exhibit, they usually exhibit signs of nausea, such as retching sound, excessive drooling, contractions of the abdomen and licking of lips. Vomitus is often coated with yellow bile or digested food material.

Regurgitation: Regurgitation is a passive process in which undigested food and fluids come up from the esophagus or pharynx, usually without any warning and without abdominal contractions. Unlike vomiting, the signs of regurgitation are difficult breathing and coughing. Regurgitated material is undigested and may be coated with heavy amounts of saliva and mucus and may keep the cylindrical shape of esophagus if solid.

Diagnosis

History

- History of ingestion of foreign materials, chemicals, poisons, coarse food materials and non-steroidal anti-inflammatory drugs (NSAIDs).
- History of frequency of vomiting and contents of vomitus like bile, food, froth, blood (frank or

digested) or evidence of an ingested substance (e.g. grass, bones, foreign material, etc) forms an important part of diagnosis.

- History of any intense exercise, motion sickness, traveling history or any stressful environment.
- History of pregnancy, spaying and any other uterine infections.
- History of previous diseases and any other systemic disease like hepatic disease or renal disease and deworming and vaccination should be taken into account.

Other Clinical Signs Associated with Vomiting

Common clinical signs associated with vomiting due to gastric disorders are loss of appetite, blood in vomitus or faeces, body temperature depends on primary cause of vomiting like tachycardia, tachypnoea and increased pulse rate, abdominal pain, dull, depress and lethargy, diarrhoea, pale or white conjunctiva and gums, weight loss, dehydration and comatose conditions. The normal vital parameters are tabulated under Table1.

Table 1: The normal vital parameters of dogs

Parameters	Reference range*
Resting heart rate (beats/minute)	70-120
Temperature (°F)	100.2-103.8
Resting Respiratory Rates (breaths/min)	18-34
Urine volume (Ml/kg body wt/day)	20-100
Urine specific gravity	1.016-1.060

**Source:* Merck Veterinary Manual, 11th Edition

Complete Blood Tests

Diagnosis of the root cause of the vomiting is very essential to find out its origin. The haemato-biochemical tests perform for the diagnosis of the changes in vital parameters. The most common gastric hormones associated with vomiting are gastrin, histamine, cortisol, pepsinogen A, C & A: C. More production of reactive oxygen species (ROS) due to disbalance between oxidants such as malondialdehyde (MDA), acid reactive substances (TBARS) etc. and antioxidants such as, Glutathione peroxidase (GPx), total antioxidant capacity (TAC) etc. leads to damaging effect on cells of stomach (Patel *et al.,*2018a). The common alterations in normal haemato-biochemical parameters used in diagnosis of gastritis and its associates are tabulated as under Table 2.

Other Sample Examinations

- Faecal examinations: Diagnosis of GI parasites (Bhatt *et al.,* 2019; Yadav *et al.,* 2019).
- Blood smear examinations : Diagnosis of haemoprotozoa (Patel *et al.,* 2019)
- Serum examinations: LAT (Latex Agglutination Test) and MAT (Mucous Agglutination Test) for leptospirosis (Patel *et al.,* 2018b).

Imaging Technique

- Contrast radiographs: Useful for determining possible origin of abdominal disturbances.
- Ultrasonographic examinations: For studying Thickness, motility and perforations on the stomach.
- Endoscopic examinations: For gastric mucosal visualization, biopsy collection, aid in prognosis and designing therapeutic regimen.

Treatment

According to Patel *et al.,* 2018a the principles of treatment of vomiting due to gastric disorders are following:

(a) Withdrawal of food prevents stimulation of gastric glands.

(b) Removal of root cause of disease

(c) Gastritis and peptic ulcer healing supported by fluid therapy

Fluid therapy: Stabilization of the cardiovascular system and preserve mucosal perfusion by appropriate fluid therapy.

Diminishing Gastric Acidity: Proton pump inhibitors (such as Omeprazole, Rabeprazole, Esomeprazole, Pantoprazole, etc.), H2 blockers, such as Ranitidine, Famotidine, Cimetidine etc. (Yadav *et al.,* 2018; Maheshwarappa *et al.,* 2020).

Antiemetics: Metaclopromide and Ondansetron are commonly used as antiemetics agents (Patel *et al.,* 2018a).

Shielding Gastric Epithelium: Shielding from ulcer by cytoprotective agents (such as Sucralfate, PG E2 analogs).

Correcting Secondary Circumstances: Dehydration, anemia and weight loss.

After stabilized, perfusion in patient, broad-spectrum antibiotics or combination of antibiotic therapy should be started.

Table 2: The normal hemato-biochemical parameters of dogs

Parameters	Reference range*
Hematological	
Hb (g/dl)	11.9-18.9
PCV (%)	24-46
TEC (10^6/cmm)	4.95-7.87
TLC (10^3/cmm)	5.0-14.1
Neutrophils (%)	58-85
Lymphocytes (%)	8-21
Monocytes (%)	2-10
Eosinophils (%)	0-9
Basophil (%)	0-1
Platelet count (10^6/cmm)	211-621
pH	7.31-7.42
Plasma fibrinogen (mg/dl)	1.5-3
Biochemical	
SGPT(U/L)	10-109
SGOT (U/L)	13-15
BUN (mg/dl)	8-28
Creatinine(mg/dl)	0.5-1.7
Total Protein (mg/dl)	5.4-7.5
Albumin (mg/dl)	2.3-3.1
Globulin (mg/dl)	2.7-4.4
Amylase (U/L)	226-1,063
ALP(U/L)	1-114
LDH (U/L)	0-236
Total T3 (ng/dL)	30-70
Total T4 (µg/dL)	1.2-3
Bicarbonate (mEq/L)	17-24
Bilirubin (mg/dl)	0-0.3
Glucose(mg/dl)	76-119
Calcium (mg/dl)	8.7-11.7
Chloride (mEq/L)	115-130
Cholesterol (mg/dl)	135-278
Magnesium (mg)	1.6-2.4
Phosphorus (mg)	2.9-5.3
Potassium (mg)	3.9-5.1
Sodium (mg)	142-152

**Source:* Merck Veterinary Manual, 11th Edition

More serious conditions often require more intensive therapy such as fluids, hospitalization with injectable medication and in some cases surgery.

Antioxidant Therapy

Ascorbic acid (Patel *et al.,* 2018a), N-acetyl cysteine (Huynh *et al.,* 2000) and vitamin E (Deepak *et al.,* 2018) are reactive oxygen species (ROS) scavengers that are used to prevent the generation of ROS as well as lipid peroxidation of the gastric epithelium (Patel *et al.,* 2018a). Coenzyme Q 10, N-Acetyl Cysteine, Silymarin, Vitamin B_1, Vitamin B_2, Vitamin B_6, Vitamin B_{12}, Vitamin C, Vitamin E and Selenium and Zinc helps to restore or maintain glutathione levels; prevents oxidative damage to gastric epithelium (Bhatt *et al.,* 2018). Vitamin C acts as antioxidant that prevents oxidative stress and helps in tissue repair as well as collagen production (Patel *et al.,* 2018c; Patel *et al.,* 2019; Patel *et al.,* 2019c).

Blood Transfusion: Indistinctly observed rate and volume of blood loss in patients who do not show sign of shock causes vascular hemodynamic abnormalities, disturbances in haematological parameters and parallel illness are noticed. It may be required if patient shows clinical signs of hypoxia (*e.g.* tachycardia, hyper-lactataemia, tachypnoea), or if series of hematological parameters showed failing haematocrit. value after the therapy started (Patel *et al.,* 2018a).

Conclusion

Vomiting is a commonly occurring phenomenon in dogs that are suffering from acid associated gastric disorders. Along with that several other causes are accountable for vomiting to occur. Consequently it is imperative to identify source of vomiting whether it is of primary origin or is a sign or symptom of some underlying secondary disease in order to cure it. Until and unless the root cause is identified no proper course of action will work. The acid related disorders can be thwarted by proper dietary management, routine exercise, pursuing regular deworming and vaccination protocol. The major strategies of therapy used against acid disorders (fluid therapy, proton pump inhibitors, H-2 blocker, cytoprotective) are implemented along with antioxidant therapy (ascorbic acid, N-acetyl cysteine, vitamin E) for early recovery and to replenish the lost vitamins and maintain normal physiological balance. Also, it is desirable to understand the causal mechanism and pathological relationship of emesis to lessen this unwanted discomfort.

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