

## Bloat (GDV) Article

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“Bloat’ / gastric dilatation-torsion (GDV): what it is and how to help prevent it.

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I am a ‘physician’ and not a surgeon, so this talk is very much from the medical perspective, not the surgical one - it is usually surgeons or intensive care vets who give lectures on GDV. But once your dog sees them, it already has a torsion and a serious life-threatening disease with a high chance of dying. As a physician and someone very interested in diet and nutrition, I am more interested in preventing ‘bloat’ in the first place and this is the focus of this lecture. I hope you may take away from it a better understanding of what the condition is and why it occurs and some tips for prevention if possible. However, you should also remember that, in spite of a lot of clinical research on the subject, we still do not fully understand why this condition occurs or how to prevent it. This is because it is primarily a problem with gut ‘motility’ i.e. movement and not so much gut structure - and primary gut motility disorders are the hardest to study and treat - in people as well as animals.

### What is ‘Bloat’/GDV?

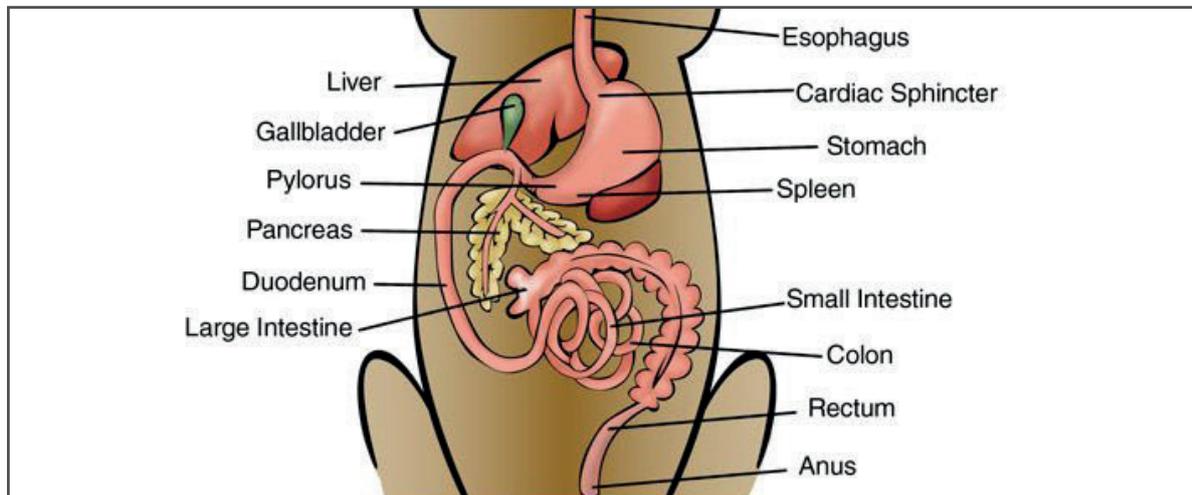
‘Bloat’ or gastric dilatation is when the stomach fills up with gas like a balloon. Bloat itself is very uncomfortable for the dog but not life-threatening until the stomach ‘twists’ which = ‘torsion’ (gastric dilatation and volvulus or GDV to use the technical term.) GDV IS life threatening because it prevents blood in the veins returning to the heart and causes the stomach wall to die - these result in shock and death if something is not done quickly. It has been calculated that high risk large and giant breeds had a 21-24% risk of getting GDV during their lifetime and a 7% risk of dying as a result.

Dogs which get recurrent bloat are at very high risk of developing a GDV, and dogs can die very quickly during their first episode of GDV. Therefore, if your dog is a high-risk breed (see below) and starts bloating it is essential that your vet operates as soon as possible to stitch the dog’s stomach to the body wall (Pexy) to stop it from twisting. This Pexy will not stop the bloating - which can carry on and still be uncomfortable, so we need to consider dietary and other means to stop the bloat (see later). However, it will stop the stomach from twisting and potentially killing the dog.

When a dog gets ‘bloat’ you notice its stomach behind the ribs swell and the dog becomes distressed and repeatedly tries but fails to be sick. It will often salivate a lot, too. If this starts to happen it is an emergency and you need to ring your vet immediately!

GDV happens in certain breeds and types of dog as a result of severe things going wrong with the normal stomach motility. Prevention involves dietary and other measures to normalize stomach motility. So, to understand bloat, we have to understand what normally happens in a dog's stomach:

## Normal Stomach Anatomy



- The gullet (oesophagus) opens into the stomach just beyond the diaphragm at the gastroesophageal sphincter. The stomach itself consists of a body and fundus. The outflow of the stomach to the small intestine is through the pylorus.
- Glands in stomach wall secrete mucus; hydrochloric acid; an enzyme to digest protein (pepsinogen) and a hormone to control acid secretion and growth of the folds of the stomach wall (gastrin). Acid secretion in the stomach is controlled both locally and more distantly by nerves and hormones which respond to the type of food eaten, stretch of the stomach wall and even the thought of food! The pH of a dog's stomach goes as low as 1-1.5 during a meal (= very acid indeed) but secretion of gastric acid is intermittent in dogs - pH as high as 3-7.9 in dogs).
- Why doesn't the acid dissolve the stomach wall? It is protected from autodigestion by tight junctions between the lining (epithelial) cells and rapid epithelial repair, mucus on the surface with trapped bicarbonate and very good mucosal blood supply. Prostaglandins especially PGE2 are particularly important in controlling acid secretion, blood flow, mucus and bicarbonate secretion and epithelial cell turnover - they protect the stomach wall. This is why prostaglandin-inhibiting drugs (like aspirin) can cause stomach ulcers both in dogs and people.

## Normal Stomach Movements

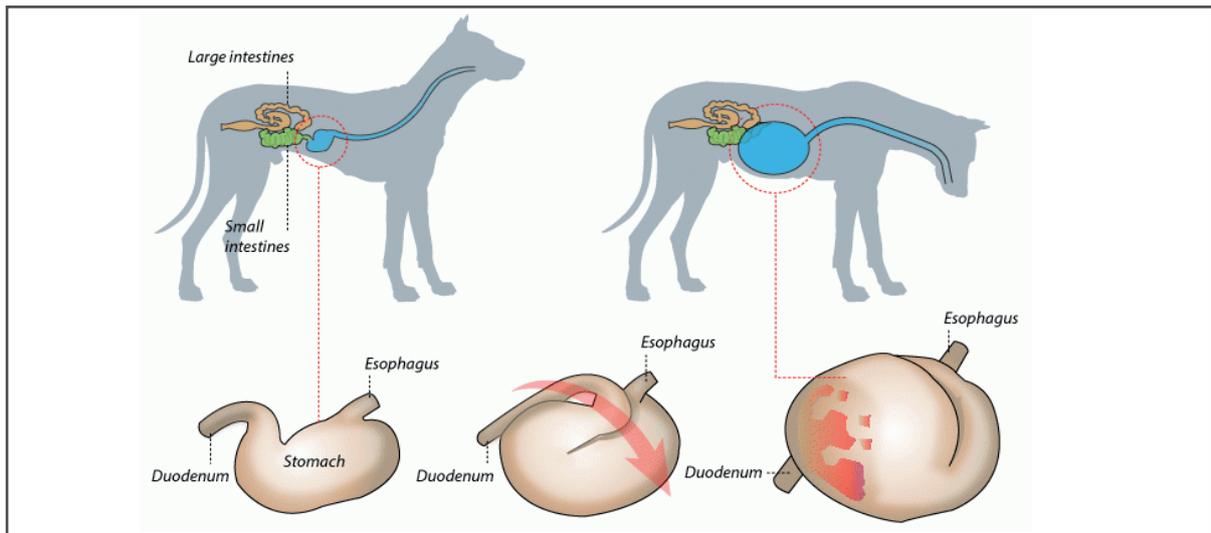
The stomach is not just a flaccid sac but has very complex, co-ordinated movements to make sure that food is broken down into small particles and mixed and released slowly into the small intestine to allow adequate digestion - if too much is released suddenly, or the particles are too big, it cannot be digested and the dog will get diarrhoea. It is amazing how little it all goes wrong considering how complicated it is. The stomach has its own pacemaker and movements and is also affected by a nerve from the brain (the vagus). It also responds to messages coming back to it from lower down the gut to slow down emptying if necessary. Key points are:

- As the stomach stretches during a meal, an active reflex mediated by a nerve (the vagus) allows the muscle to relax so stomach size increases without an increase in pressure - if you are not a physicist, think of a balloon and how it tries to deflate more the more you fill it with air - the stomach does NOT behave like this but as it fills, the wall actively relaxes so the balloon gets no harder to fill with food as it gets bigger. This 'active relaxation' is disrupted in gastritis, which is why it is better to feed your dog little and often when it has a stomach upset.
- Gastric contractions mix and break up food against a closed pylorus then let out particles 1-2mm in size, except between meals when giant contractions (migrating motility complexes) push out larger items (e.g. foreign bodies like corn cobs!). The normal pylorus contracts 2-3 times per minute and the stomach normally empties by 10-12 hours after a meal (varies with type and size of food see appendix).
- \* An amazing variety of chemicals in the gut wall are involved in co-ordinating motility - in fact, there are more neurotransmitters in the gut wall than in the entire nervous system - no wonder we still do not understand it properly! For those who like to be blinded with science, they include: Acetylcholine; Substance P; Vasoactive intestinal polypeptide; Nitric oxide; GABA; Serotonin; Noradrenaline; Opioids + secretin, gastrin, somatostatin, and cholecystokinin.
- \* One important reflex co-ordinating stomach emptying is the 'ileal brake' - if undigested food reaches the end of the small intestine (= ileum), then messages are sent back to the stomach to slow stomach emptying - this is because all the diet should be digested by the time it reaches the end of the small intestine. If it is not, it suggests the stomach is emptying too quickly (or the intestine is diseased - which is more common!) so the body tries to slow down its emptying. This may play a role in the development of GDV in dogs with concurrent inflammatory bowel disease - see later.
- Now for the important bit for dogs with GDV: what happens if the stomach is over-distended (e.g. the dog eats far too big a meal)? There are reflexes present to protect the animal: first, the gastro-oesophageal sphincter relaxes (allows reflux of gas and food up the oesophagus). The body of the stomach also relaxes, and the pylorus initially contracts to stop food getting out (because too much food flooding into the intestine will cause diarrhoea). However, as the stomach fills yet further, to stop it bursting, the pylorus opens and allows food to flood into the intestine (because diarrhoea is better than a ruptured stomach).

**So you can see that, to get a GDV, a dog not only has to have a dilated stomach, but also the normal protective reflexes have to fail - the dog cannot 'burp' or release gas and food in to the small intestine like it usually should.**

## **Why does Bloat occur?**

We still do not fully understand why this happens, but I will outline our current understanding of the causes of this disease. The odd thing is that usually even if you try to twist a dog's stomach at surgery, you cannot because it is held tight by the ligaments inside. Therefore, chronic stretching of these ligaments (e.g. by previous episodes of dilatation) can predispose to torsions. Risk factors include:



- Certain breeds e.g. deep-chested breeds such as Irish Setters and Great Danes are pre-disposed.
- Within high risk breeds, the most deep-chested individuals have the highest risk, and other risk factors within high risk breeds include:
  - \* Eating rapidly
  - \* Being nervous/stressed
  - \* Being underweight
  - \* Being male
  - \* Advancing age
  - \* Previous episodes of dilatation
  - \* A history of major health problems in the first year of life.
- There may well be an underlying general motility disorder in some dogs e.g. in some cases, it is also associated with dilatation and reduced motility in the oesophagus and intestines (and this may be what underlies the increased risk in certain breeds rather than literally the size of the dog - I favour this hypothesis from what I have seen in the clinic). Also, there is some evidence that dogs with GDV may often have other gut problems as well (e.g. inflammatory bowel disease).
- A lot is said about food and the risk of GDV. Diet should certainly NOT be ignored because food has a profound effect on stomach motility (see appendix). However, it is important to realize the difference between **dietary factors which cause GDV** and **dietary changes used to treat GDV** in a dog which is already affected. The following dietary factors have been shown in clinical studies to be related to an increased risk of GDV:
  - \* Being fed a big meal once a day instead of several small meals.

Also, dogs fed more than once a day but given a large volume of food at each meal were at increased risk.

- \* Eating rapidly
- \* There may also be an increased risk in susceptible dogs if they are fed very high fat foods (there is a logical reason for this related to stomach emptying - see appendix)
- \* One study also suggested feeding large particle sizes increased the risk (again there is a logical reason for this - see appendix)
- On the other hand, a large and very well designed study in pet dogs (Akitas, bloodhounds, Collies, Great Danes, Irish Setters, Irish Wolfhounds, Newfoundlands, Rotties, St Bernards, Standard Poodles and Weimeraners - Raghaven 2004) in the USA found that the following diet factors did NOT predispose to GDV: Type of diet fed (dried vs canned vs home-cooked) and proportion of energy in the diet which is carbohydrate as opposed to protein.
- Another large study in the US tested the suggestion that having either high amounts of soy or cereal ingredients or high amounts of animal protein in the diet increased this risk of GDV but it found that neither of these affected the risk of GDV.

## How can we prevent it?

Prevention is better than cure - but remember, if your dog is already suffering from recurrent bloat, take it to the vet and discuss surgery to stitch the stomach to the body wall as soon as you can! We will consider the list of risk factors outlined above to see what can be done to help prevent 'bloat':

### Risk factor no.1:

Certain breeds e.g. deep-chested breeds such as Irish Setters and Great Danes are predisposed. The reason is not known but this may also be related to a tendency to have inflammation of the gut and/or motility problems in certain breeds. Also involved:

- \* Having a first degree relative with GDV (i.e. sire, dam, sibling or offspring)

To deal with this we need to think about further work on the genetics of the condition in the future to try to identify the genes involved and selectively breed them out of high risk breeds - note as breeders that this does NOT mean not breeding from a particular line but rather allows the removal of the 'bad' genes from that line selectively over a few generations. This is the ideal and the aim for the future but will be some years yet!

### Risk factors within high risk breeds:

- \* Being nervous/stressed minimize stress - and pay particular attention to careful feeding of highly stressed individuals as they are at high risk.
- \* Being underweight and a history of major health problems in the first year of life these may reflect underlying inflammatory bowel disease or other gut problems and need careful veterinary attention: we can make a big difference with careful use of diet changes and drugs in these dogs.
- \* Being male cannot help that, but be aware it is a risk factor!
- \* Advancing age also cannot help that, but be aware it is a risk factor!
- \* Previous episodes of dilatation; these are the ones to get surgery done on . . .

### **Dietary risk factors:**

- \* Eating rapidly slow down eating! But note that putting the food bowl high up does NOT help and may even increase the risk!
- \* Being fed a big meal once a day instead of several small meals feed several small meals a day
- \* Also, dogs fed more than once a day but given a large volume of food at each meal were at increased risk. As above - feed little and often.
- \* There may also be an increased risk in susceptible dogs if they are fed very high fat foods. Do not feed very high fat foods, BUT note that you CAN feed high protein or high carbohydrate foods safely, if you consider the other points about feeding outlined above.
- \* One study also suggested feeding large particle sizes increased the risk - the wisest thing in high risk breeds would therefore be to feed soaked dried food - canned diets would not be ideal as they are often high in fat and also low in calorie density to in giant breeds you would have to feed a large volume - which is a primary risk factor in GDV dogs
- \* It has also been suggested by several authors that you should NOT allow your dog to drink a lot immediately after eating (i.e. avoid stomach over-fill again) and should also not exercise immediately after eating.

### **APPENDIX: how the diet affects stomach emptying**

Do not underestimate the effect of dietary composition and consistency on the stomach!

#### **FAT**

- Fat is an important source of calories (particularly in large breed dogs) and some dietary fat is necessary to supply essential fatty acids and fat-soluble vitamins.
- However, high fat foods delay stomach emptying and increase acid secretion. Low fat foods are therefore indicated in gastritis and in dogs which suffer from GDV and after GDV surgery.

#### **PROTEIN**

- Protein is essential for intestinal health: small intestinal lining cells use it as their main energy source, and it is vital for the health of the dog.

In stomach, high protein increases gastric acid secretion via inducing the release of gastrin (protein in stomach and amino acids in small intestine). However, it has little effect on stomach emptying time.

Proteins are important in being the major cause of GI “allergy” and novel protein diets are often used - see next talk.

#### **CARBOHYDRATE**

- No particular effect on stomach emptying, or risk of GDV

## **FIBRE**

- In the stomach, the actions of fibre are complicated: some types of fibre (soluble or fermentable fibre) delay stomach emptying which increases acid secretion whereas other types of fibre (Insoluble fibre) may be helpful as actually speed gastric emptying and has buffering action - but more work needed to assess its benefits before specific advice can be given in dogs with GDV. Generally, avoid high fibre diets in a dog prone to GDV mainly because it lowers the calorie density of the diet, so means you must feed a high volume, which increases the risk of GDV.

## **CONSISTENCY**

Changes in the consistency of the diet have a remarkably big effect on stomach emptying:

- Liquidising speeds gastric emptying and so reduces gastric acid secretion, so liquidised/mushy food best in gastritis and after a GDV.
- On the other hand, mushy food also has faster intestinal transit than dried food, so dogs with functional motility disorders causing rapid intestinal transit (e.g. nervous working breeds) may benefit from a dried diet to SLOW DOWN passage through the intestine.

## **REFERENCE LIST FOR THOSE INTERESTED**

Braun (1996): Gastric dilatation-volvulus in the dog with histological evidence of pre-existing inflammatory bowel disease: a retrospective study of 23 cases. *Journal of the American Animal Hospital Association* 32; 287-290

Broome C.J. and Walsh V.P. (2003) Gastric dilatation-volvulus in dogs. *New Zealand Veterinary Journal* 51: 275-283

Glickman et al 1997: Multiple risk factors for the Gastric dilatation-volvulus syndrome in dogs: a practitioner/owner case-control study. *Journal of the American Animal Hospital Association* 33: 197-204

Raghaven et al 2004: Diet-related risk factors for Gastric dilatation-volvulus in dogs of high-risk breeds. *Journal of the American Animal Hospital Association* 40: 192-203

Raghaven et al 2006: The effect of ingredients in dry dog foods on the risk of gastric dilatation-volvulus in dogs *Journal of the American Animal Hospital Association* 42: 28-36

Schaible et al 1997: Predisposition to gastric dilatation-volvulus in relation to genetics of thoracic conformation in Irish Setters. *Journal of the American Animal Hospital Association* 33: 379-383

Schellenberg et al (1998): influence of thoracic conformation and genetics on the risk of gastric dilatation-volvulus in Irish Setters. *Journal of the American Animal Hospital Association* 34: 64-73