Bloat in young calves

Summary

- Abomasal bloat can affect calves four to 21 days old that have previously appeared healthy.
- Affected calves suffer from the sudden onset of bloat or abdominal distention and die, generally within 6 to 48 hours
- Some calves will respond to therapy if they receive immediate and aggressive intervention.
- Little is known about this frustrating disease.
- The cause of abomasal bloat has not been fully defined but is almost certainly related to milk-feeding nutrition.
- Several risk factors include feeding large volumes of milk in a single daily feeding, fortified milk-feeding programmes, bacterial infections, lack of water, irregular feeding times and inadequate colostrum intake.

What is abomasal bloat?

The pre-weaned calf relies primarily on digestion of milk in the abomasum (the fourth stomach) and small intestines. In the very young calf the first three stomachs (reticulum, rumen and omasum) are not sufficiently developed and the calf is considered to be a 'simple stomached' (monogastric) animal at this early age. The abomasum has an acidic environment which helps in the formation of the milk clot before its passage to the small intestines for absorption of nutrients.

Figure 1. Rumen Development From Birth To Weaning

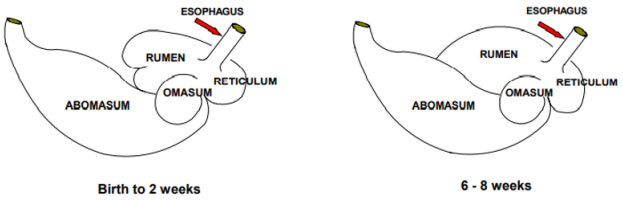


Figure 2. Rumen Development From 3 Months To Maturity

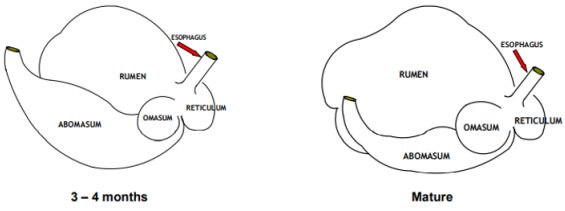
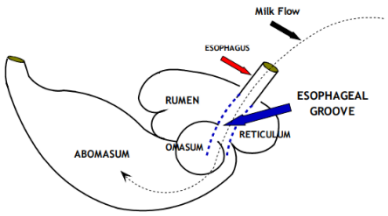


Figure 3. The Esophageal Groove



Esophageal Groove. After feed is swallowed, it moves down the esophagus toward the stomach. Since the esophagus joins the stomach in the area of the rumen and reticulum, ingested feed first enters this section of the stomach. However, prior to weaning, milk and milk replacer take a different route. A combination of factors such as suckling, the presence of milk proteins and anticipation result in neural responses that cause muscular folds in the reticulorumen to form a groove that extends from the esophagus to the abomasum. The esophageal groove allows milk and milk replacer to bypass the rumen, reticulum and omasum and to flow directly into the abomasum for digestion. Allow at least 10 minutes after milk feeding before water is fed to give the groove a chance to relax. Water needs to enter the rumen, not the abomasum to facilitate grain digestion and rumen development.

Abomasal bloat syndrome, ABS, is often rapidly progressive and life threatening. The processes involved are not completely understood but what is known in ABS cases is that a rapid growth or proliferation of organisms results in the production of an excessive quantity of gas that cannot escape the abomasum. This causes severe distention that compresses the abdominal and thoracic organs (heart, lungs) and blood vessels that lead to them. The result is asphyxiation and heart failure.

ABS, is characterised by sudden distension of the abomasum similar to bloat in adult cattle to give the calf a bloated abdomen appearance on one or both sides. It typically affects calves less than three weeks of age that have previously appeared healthy

In mild cases, calves may show only slight abdominal distension with a fluid or gas splashing sound, have inconsistent mild diarrhoea and mild depression. In severe cases, calves are usually off their milk, are dehydrated, show signs of discomfort such as kicking their abdomen or lying flat-out and have a severely distended abdomen. They may or may not have diarrhoea. Death can occur within 6 to 48 hours if the bloat progresses and is not relieved. This condition tends to occur sporadically in dairy calves and some herds have multiple cases at once.

Animals can bloat due to a variety of contributing factors. However, the common thread through all bloat cases is production of gas by organisms in the digestive tract. Feed equipment, feed temperature, feed ingredients, amount fed, feeding frequency, water availability, weather, stress etc., may be involved, but they do not cause bloat by themselves. Organisms, and not necessarily the pathogenic ones, produce the gas that causes bloat. Keeping these relationships in perspective can be a big help when it comes to figuring out how various components fit together to create a specific bloat situation.

What causes abomasal bloat?

The cause of abomasal bloat has not been fully defined but is almost certainly related to milk-feeding nutrition. It is known that abomasal bloat needs three elements to occur:

(1) a population of gas-producing micro-organisms,

(2) a source of dietary carbohydrates e.g. lactose (milk carbohydrate)

(3) a general abomasal environment, which results in the slowdown of the gas-emptying rate of the abomasum. (Abomasal emptying)

There are also a multitude of mitigating nutritional and management factors that seem to tie these three conditions together, which substantially increase the threat of abomasal bloat in dairy calves.

Several risk factors have been identified and these include feeding large volumes of milk in a single daily feeding, fortified milk-feeding programmes, bacterial infections, lack of water, irregular feeding times and inadequate colostrum intake.

It is thought that the excessive gas production is due to the fermentation of high-energy liquid feeds such as those used in accelerated growth programmes or electrolyte feeds with inadequate water. The fermentation process occurs as a result of bacterial over-growth and production of enzymes in the abomasum. Although researchers are not certain which exact species of bacteria cause ABS, *Clostridium perfringens*, *Sarcina* spp, *Streptococcal* spp, *Escherichia. coli*, and *Salmonella typhimurium* have been identified in the abomasum of affected calves. These are relatively common organisms found in many dairy barns, calf housing and even naturally in the gastrointestinal tract of exposed calves, but usually in small harmless populations.

Abomasal emptying refers to the time span the chymus, semi-fluid mass of partly digested food, remains in the abomasum before passing into the intestinal tract, which is a concept similar to gastric emptying in humans. Anything that slows down the rate of abomasal emptying increases the time that the bacteria have to ferment the feedstuff thus producing more gas in the abdomen. Feeding practices that significantly prolong abomasal emptying could increase rates of abomasal bloat.

In North America, high-osmolality electrolyte products and milk replacers have been identified as the primary risk factor of abomasal bloat on some farms. Osmolality is a measure of the concentration of particles in a solution, raw bovine milk typically has an osmolality of approximately 275 to 285 mOsm/L, whereas some newer milk replacers mixed according to label directions have osmolalities above 600 mOsm/L. Modification of protocols to prepare milk replacers such as adding more powder than the directions would indicate or not mixing with the correct amount of water would further increase osmolality and nutrient density. Consequently it is important to ensure the correct mixing rates are used for the specific brand of milk powder, whether used alone or in an accelerated growth programme.

Several feeding strategies can minimize the effect of more concentrated milk or milk replacer products on gastrointestinal health. For example, regularly estimating the nutrient density of milk by checking the percentage of total solids as it is being fed to calves helps prevent osmolality from getting extremely high and helps diagnose milk replacer mixing problems. Brix refractometers can be used and have been shown to provide a rapid and fairly accurate method for estimating milk total solids (Chigerwe and Hagey, 2014). Although exact recommendations for total solids are difficult to find in the published literature, in general abomasal bloat problems are often seen with total solid well above 15% (osmolality values over 650 mOsm/L).

Other factors include:

- Esophageal groove dysfunction when severe and recurrent bloat occurs in calves that consume only milk by suckling. This occurs when the esophageal groove does not form correctly and milk travels directly to the rumen where it ferments.

- ABS can also be seen in conjunction with abomasal ulceration causing a mechanical obstruction of the abomasum and facilitating the accumulation of gas.

Treatment:

Prompt veterinary attention is required in an attempt to relieve the abomasal distension by either trochar or passage of a stomach tube. Placing the calf in a 'dog-sitting' position with the front legs elevated, whilst passing a stomach tube, can aid in the relief of gas. Antibiotics are sometimes indicated especially where bacterial infections are suspected. The specific treatment is determined on a case-by-case basis and at the discretion of the veterinarian.

The syndrome is likely to be caused by multiple factors and although the definitive cause is unknown, dietary management is integral in the control of outbreaks. Prevention of abomasal bloat should be aimed at consistent milk-feeding nutrition and consultation with a veterinarian prior to feeding high volume or fortified milk feeding programs is advised.

Fortified milk feeding programs are not simply a matter of 'adding a bit of milk powder to whole milk'; the exact mix rate will depend on the individual farm's feeding system, frequency of feeding, brand of milk replacer used and the nature of the whole milk used to mix the powder with.

For these reasons, procedures and medications are usually not the best treatment options. Dietary management strategies are the preferred ways to prevent ABS. These include feeding the calves multiple, small meals on a consistent basis, mixing the milk replacer correctly according to the manufacturer’s instructions in order to lower osmolality, feeding warm milk, and providing adequate amounts of water (Smith, 2010).

ABS is a spontaneous and puzzling disease that affects many dairy farms. The calves at risk for ABS, associated symptoms of ABS, the potential causes of ABS, and the treatment and prevention of ABS

are important factors that must be studied and understood. Unfortunately, there are still many uncertainties and unknowns about this disorder, and further research is needed in order to learn more about the syndrome and the specific species of bacteria that cause it.

Management checklist for bloat prevention

- **Colostrum**. Ensuring a newborn calf receives an adequate amount of high quality colostrum at the right time is the single most important factor in preparing the animal to withstand disease challenges during the first few weeks of life. It may be appropriate to enhance colostrum quality by improving the antibody levels against certain disease organisms such as Clostridium through dry cow vaccinations.
- **Feeding frequency**. Feeding once-a-day is convenient, but it can put digestive stress on animals, especially if you are feeding a large volume of milk or milk replacer. More frequent feeding reduces hunger and provides smaller meals that are less likely to slow the rate of abomasal emptying which reduces the amount of time bacteria have to feed, grow and produce gas
- **Feeding Consistency.** Feed at the same time each day. Variable feeding times can cause calves to become very hungry. Hungry calves eat and drink quickly and often over-eat, leading to changes in digestion. Feed volume and feed types should be consistent with no sudden changes.
- **Solids.** Whole milk is about 12.5% solids. Mastitic milk often contains lower solids and non-saleable whole milk for calf feeding may contain water that has been added during the collection process. A refractometer should be used with every batch to check solids. Brix refractometers underestimate actual milk solids by two points, so be sure to add "2" to the refractometer reading. The amount of milk replacer or balancer powder needed to increase milk solids to the desired level can be calculated. Measuring solids of milk replacer is less accurate than measuring whole milk due to variability in how milk replacer ingredients refract light within the refractometer. You can develop a chart that compares actual refractometer results to calculated values. Since milk replace ingredients vary from company to company and from product to product, this needs to be done for each milk replacer.
- **Water Availability**. Water should be made available within the first couple days of life. Access to water can help the calf maintain normal osmolarity in the digestive tract and helps stimulate grain intake, digestion and rumen development.
- **Group Size.** Group feeding of calves is becoming more common and although there are many advantages, the size of the group is an important factor that causes stress on calves. Simply put, the larger the group, the more the stress with the potential for more disease challenges and reduced health and performance.
- **Feeding Equipment**. Clean feeding equipment is essential. Equipment used in feeding must be cleaned to remove dirt, manure, milk and other substances. Any biofilm, which is made up of fat, protein and carbohydrates must be removed to prevent pathogens from becoming embedded on the equipment. Equipment should be sanitized before use.

References: Bloat in Calves & Other Young Livestock. Rob Costello, Milk Specialties Global. milkspecialties.com
Abomasal emptying in calves and its potential influence on gastrointestinal disease. Johann Burgstaller, Thomas Wittek, and Geof W. Smith
Avoid abomasal bloat in calves. Gemma Chuck. The Vet Group in Victoria, Australia.