Carol's (215) Contorted Conundrum

Bethany R. Granger

Mississippi State University

College of Veterinary Medicine

Class of 2021

Clinicopathologic Conference

April 30, 2021

Advisor:

Dr. Gretchen Grissett, DVM, MS, DACVIM

Introduction

Displaced abomasum in cattle is a gastrointestinal disorder that can cause significant economic loss through costs of treatment, premature culling, and production losses. The exact pathogenesis is not known; however, it is generally a disease process of multiple contributing factors with abomasal hypomotility and excessive gas buildup in the abomasum being consistent predisposing factors.[4] This condition is commonly seen in dairy cattle, although it can occur in any animal with an abomasum. The highest incidence of this disease is seen in dairy cattle approximately three to four weeks postpartum.[9] The occurrence of this disease process is very rare in small ruminants.

Abomasal displacement can occur to the left or right side of the abdomen. It is generally more common to see a left displaced abomasum (LDA) at an occurrence of 85-95% that of a right displaced abomasum.[10] Left displaced abomasum is generally seen within the first four weeks post-partum. Only 50-70% of right displaced abomasums are seen in the early lactation period, while the rest are seen without correlation to stage of gestation or lactation.[2]

Right abomasal displacement (RDA) can be followed by a torsion or volvulus on its mesenteric or long axis.[1, 8] This leads to complete disruption of blood flow within the organ as well as ingesta movement out of the organ.[10] The ultimate sequala to an RDA with a volvulus is ischemic necrosis of the abomasum and it rapidly becomes fatal.[11] This requires immediate diagnosis and emergency surgical correction.[10, 11]

History and Presentation

215 was an approximately 4-year-old Holstein cow that presented to White Oak Veterinary Services on August 26th, 2020 for lethargy, decreased milk production, and being off

feed for approximately 12 hours. She was approximately 6 weeks post-partum. She had been slow to feed the night before presentation and went off feed that morning, 215 began rapidly declining within 3-5 hours prior to examination.

Upon physical examination, 215 was weak, dull, and slow to respond. She had a body condition score of 2.5 out of 5. Her heart rate was elevated above normal limits at 115 beats per minute. She was approximately 10% dehydrated; the eyes were sunken and skin tent was persistent for longer than 3 seconds. The abdomen was distended bilaterally, most noticeably in the right flank area. On rectal examination, there was decreased rumen fill and absent motility. No ruminations or gut sounds were heard on auscultation. There was a fluid wave upon ballottement of the right flank. The caudal portion of a large fluid/air filled structure was palpable on the right side of the abdomen, as well as dark, tarry, scant feces with traces of frank blood, consistent with melena. There was a ping heard on auscultation and percussion of the right abdomen from the cranial portion of the right paralumbar fossa to approximately the 9th rib.

Diagnostic Approach and Differential Diagnosis

A displaced abomasum is generally diagnosed presumably based on history and clinical findings. The most suggestive finding in diagnosis is the presence of a ping on percussion and auscultation between the 10th through 13th rib of the affected side.[11] In severely affected cases, such as, an RDA with volvulus the ping may extend as far forward as the 8th rib and caudally into the paralumbar fossa.[10] Cattle with an RDA with volvulus are presumably diagnosed based on a rapid decline and severity of the clinical signs (depression, dehydration, shock, recumbency, comatose and/or death).[11] If bloodwork is performed, abnormalities may include metabolic alkalosis with paradoxical aciduria, hyponatremia, hypochloremia, hypokalemia, markers of

dehydration (increased BUN, creatinine, and hemoconcentration), increased lactate, as well as an increased anion gap.[6, 8]

There are multiple causes for a right sided ping in cattle, including abomasal volvulus, right displaced abomasum, cecal distention (may also develop a volvulus), gas within the spiral colon, pneumorectum, pneumoperitoneum, and physometra.[10] Other differentials include intestinal obstruction or volvulus and can usually be differentiated on rectal palpation.[10] Due to the location of the ping on the right side and the severity of the dehydration and systemic illness of 215, abomasal volvulus was presumptively diagnosed.

Pathophysiology

The exact pathogenesis of a displaced abomasum is not entirely known. However, it is known that this is a multifactorial disease process and abomasal hypomotility or atony and excessive gas build up are the prerequisites to developing a displaced abomasum in the cow.[2] Other contributing factors include breed predispositions (Holstein-Fresian, Guernsey, etc those with tall stature and deep body depth), genetic components, metabolic disorders (ketosis, hypocalcemia, etc), twinning, feeds high in concentrate and low in fiber, comorbidities (mastitis, endometritis, lameness).[10,2] In more recent studies, it has been suggested that there may be a functional issue in the enteric nervous system of the abomasal wall playing a role.[2] The presence of increased activity of neuronal nitric oxide synthase and decreased acetylcholine sensitivity in cattle with abomasal displacement is suggestive of a functional disorder, however it is not certain whether this is a cause or a result of impaired circulation in the inflated organ.[2] Breed may also play a role in this as some have varying levels of neurotransmitters substance P and vasoactive intestinal peptide in the wall of the abomasum.[2] For instances, German Holstein cattle were found to have significantly less substance P, a stimulatory neurotransmitter, and higher amounts

of vasoactive intestinal peptide, an inhibitory neurotransmitter, when compared to German Fleckvieh.[2] This aligns with the breed predisposition that Holsteins have a higher incidence of displaced abomasum, while Fleckvieh's incidence rates remain lower.

It is not known whether a simple right displacement always proceeds an abomasal volvulus, but it is suspected.[10, 8] The torsion can happen at several locations and involve multiple structures including the reticulum and the omasum. According to one paper, the torsion has most commonly been seen at the reticuloomasal junction and the duodenum is always wrapped around the omasum.[10] In an experiment done on calves, the abomasal volvulus was most easily recreated when the gas-filled fundus of the abomasum with decreased motility rose around the cranial surface of the omasum and as a result pulled the reticulum with it.[10] This displacement then led to a counterclockwise (viewed from the right or rear) rotation of the abomasum and potentially the omasum, which would result in a abomasal omasal volvulus.[10,8] The duodenum is pulled medially to the body of the omasum and wrapped around the neck of the organ.[10] The continued release of hydrochloric acid and gas that continues to accumulate exacerbates the tension on the duodenum and creates blockage of the outflow tract of the abomasum.[10] The abomasal blood flow and ventral vagal trunk become compromised as well, leading to ischemic necrosis and ultimately deterioration of the abomasal wall which may lead to leakage of abomasal contents into the abdomen.[10] Inflammatory mediators and bacterial toxins will be released and absorbed into the bloodstream resulting in certain death.[10]

Treatment and Prognosis

There are numerous approaches available for treatment of a left or right displaced abomasum. The value of the cow should be evaluated and humane euthanasia should be considered in the case of an abomasal volvulus especially in evolved cases. The recommended

treatment for abomasal volvulus if treatment is to be pursued is immediate surgical corrections, it is imperative to perform emergency surgery anytime an RDA is diagnosed as it is very difficult to definitively differentiate an RDA from an abomasal volvulus pre-operatively.[8] In addition, an RDA could later develop a volvulus and the condition could escalate quickly.

Medical treatment is generally used in conjunction with surgical therapy to treat abomasal displacements and the aim is to correct the cause of the abomasal atony, promote GI motility and correct fluid and electrolyte abnormalities.[8] Calcium supplementation orally or systemically may be administered to correct hypomotility issues where hypocalcemia is a contributing factor.[8] Intravenous fluid supplementation, as well as oral fluid therapy (postoperatively), are indicated to correct dehydration as well as electrolyte abnormalities.[8] In the early stages of the disease, generally there is a hypochloremic, hypokalemic metabolic alkalosis and in the later stages there is the potential for an extreme metabolic acidosis to develop.[10] In the case of metabolic alkalosis, 0.9% NaCl fluids with supplementation of potassium would be appropriate.[10] The potassium should be administered at a rate of no more than 0.5 mEq/kg/hr the avoid cardiac effects. A Ringer's solution may be more appropriate if the transition to metabolic acidosis has occurred.[10] It is also noted that hypertonic saline can improve hemodynamic function in cattle suffering from an abomasal volvulus. [8] Antibiotics of broad spectrum should be considered if integrity of the abomasal wall was compromised and non-steroidal anti-inflammatories should be administered to combat inflammation, pain, and shock symptoms.[10] In a study, it was shown that pre-operative erythromycin can act to increase abomasal emptying rates and improve abomasal hypomotility postoperatively.[8]

There are various techniques for correcting a displaced abomasum and the preferred technique varies depending on surgeon's preference, facilities and equipment available,

economic factors, type of displacement, etc.[8] Right flank techniques are the surgical approach of choice for abomasal volvulus.[7] The right flank omentopexy is performed by incorporating the greater omentum (close to the pylorus) into the body wall closure, after the abomasum has been deflated and drained of excess fluid and moved back into the correct location.[8] The omentum is incorporated via a simple continuous pattern with the first layer of the closure including the peritoneum and transverse muscle.[7] This suspends the organ close to its correct anatomical location.[8] The internal and external oblique muscles are then closed with a simple continuous. Finally, the skin is closed via a Ford interlocking pattern.[7] This technique decreases the likelihood of leakage of abomasal contents in the abdomen as no sutures are placed into the abomasum itself, therefore decreasing the risk of peritonitis and/or fistula formation.[8] Due to the ability of the omentum to stretch and that it is often friable and will break down (especially in cows of increased body condition), some surgeons prefer to perform a pyloropexy and incorporate the pyloric antrum into the incision instead of or in addition to the omentum.[8] This technique is performed the same as the omentopexy, however the pyloric antrum is instead incorporated into the first layer of closure.[7] Care should be taken not the suture through the muscular pylorus as it can lead to stricture and secondary abomasal outflow issues.[8] As previously mentioned, there is a risk of abomasal content leakage and fistula formation with this technique, especially if the lumen of the pylorus is penetrated with the suture.

Cattle with abomasal volvulus have poorer prognosis rates than those suffering from a left or right displacement due to the hemodynamic compromise.[8] It was shown in a study that cattle had an approximately 67% chance of return to a productive status with an abomasal volvulus as compared to an RDA at an approximate 81% return to production.[8] A abomasal volvulus will typically end the concurrent lactation cycle, but the cow can remain productive in

other ways (i.e. carry a calf and have a normal lactation next cycle). Pre-operative tachycardia, significant dehydration, and longer lengths of inappetence are associated with a poor prognosis in cases of abomasal volvulus. Intraoperative findings associated with poorer prognosis include omasal involvement, a large amount of abomasal fluid, thrombosis of the vasculature, and darkening of the wall of the abomasum before decompression.[8] A study showed that anion gap was a more accurate prognostic factor than serum chloride or base excess and anion gaps of 30mEq/L or greater was associated with a poorer prognosis.[8] Blood lactate levels of 2mmol/L or less were associated with a better prognosis, and those of 6mmol/L or greater were associated with a worse prognosis.[8] Melena, persistent tachycardia, anorexia, and dehydration are associated with poorer prognosis when seen post-operatively.[10]

Case Outcome

After discussing treatment options and the poor prognosis with the dairyman, he initially decided to proceed with correction of the torsion and displacement followed by a right pyloropexy; as well as oral fluid therapy, antibiotics and NSAIDs. 215 was being prepped for surgery and the distal paravertebral lidocaine block had been administered when the dairyman decided to humanly euthanize instead. 215 was euthanized via the gunshot method and an abbreviated field necropsy was performed for educational purposes. A counterclockwise volvulus of the abomasum at the omasal-abomasal junction was confirmed. The abomasum was distended more the 2.5 to 3 times a normal size and filled with approximately 4 gallons of foul smelling, dark red fluid. A portion (approximately 25%) of the abomasal wall was dark red and had multiple areas of hemorrhages evident upon dissection. There was a focal area of thickening within the wall of the abomasum at the body and was suspected to be an incidental finding. The omasum and reticulum were enlarged, and fluid filled as well. The rumen was smaller then

normal. The contents of the GI had very little fiber content in what little feed material was present, suggestive that lack of effective fiber may have been a major contributing factor. No other significant abnormalities were found on necropsy.

Conclusion

Right displaced abomasums with volvulus (RAV) in cattle occur much less commonly than a left displaced abomasum. Both conditions can cause significant economic loss through costs of treatment, premature culling, and production losses; RAV can decompensate rapidly and if left untreated quickly lead to shock and death. The exact pathogenesis is not known, although abomasal hypomotility and excessive gas buildup are two known predisposing factors. RAV is presumably diagnosed based on history, severity of clinical signs, and a right sided ping on percussion and auscultation of the right side, which may extend from the cranial paralumbar fossa to the 8^{th} rib in extreme cases. Treatment of choice is an emergency right flank pyloropexy (or omentopexy) combined with medical therapies to correct fluid and electrolyte abnormalities. Humanely euthanasia should be considered in the case of a RAV. RAV has a very poor prognosis due to hemodynamic compromise that occurs in result of the restricted blood flow to the abomasum resulting from the volvulus.

References

1. Abomasal displacement. (n.d.). Retrieved February 17, 2021, from http://www.veterinaryhandbook.com.au/Diseases.aspx?diseasenameid=3
2. Doll, K., Sickinger, M., & Seeger, T. (2009). New aspects in the pathogenesis of abomasal displacement. *The Veterinary Journal, 181*(2), 90-96. doi:10.1016/j.tvjl.2008.01.013
3. González-Martín, J., Pérez-Villalobos, N., Baumgartner, W., & Astiz, S. (2019). An investigation into the development of right displaced ABOMASUM by ROLLING 268 dairy cows with left displaced abomasum. *Journal of Dairy Science, 102*(12), 11268-11279. doi:10.3168/jds.2019-16529
4. ITOH, M., AOKI, T., SAKURAI, Y., SASAKI, N., INOKUMA, H., KAWAMOTO, S., & YAMADA, K. (2017). Fluoroscopic observation of the development of displaced abomasum in dairy cows. *Journal of Veterinary Medical Science, 79*(12), 1952-1956. doi:10.1292/jvms.16-0611
5. Large animal topics: Abomasal Displacement and Abomasal Volvulus in Cows. (n.d.). Retrieved February 17, 2021, from https://www.acvs.org/large-animal/abomasal-displacement
6. Malone, E., & Ezzo, A. (n.d.). Abomasal displacement. Retrieved February 17, 2021, from https://open.lib.umn.edu/largeanimalsurgery/chapter/food-animal-gi-cases/
7. Nichols, S., & Fecteau, G. (2018). Surgical management of Abomasal and SMALL Intestinal disease. *Veterinary Clinics of North America: Food Animal Practice, 34*(1), 55-81. doi:10.1016/j.cvfa.2017.10.007

8. Niehaus, A. J. (2016). Surgical management of Abomasal Disease. *Veterinary Clinics of North America: Food Animal Practice, 32*(3), 629-644. doi:10.1016/j.cvfa.2016.05.006
9. Potter, T. (n.d.). NADIS animal Health skills - displaced abomasums. Retrieved February 17, 2021, from https://www.nadis.org.uk/disease-a-z/cattle/displaced-abomasums/
10. Smith, B. (2015). Large animal internal medicine. In *Large animal internal medicine* (Fourth ed., pp. 855-861). St. Louis, MO: Elsevier Mosby.
11. Smith, D. F. (n.d.). Abomasal Volvulus. *The Bovine Practitioner, 22*, 162-164.