

Abomasal Volvulus

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Definition

Abomasal volvulus is an acute disease with sudden onset, often progressing to severe illness and death with 2-4 days. It results from the rotation of a loop formed by the abomasum, omasum and the proximal part of the duodenum around an axis through the lesser omentum. Abomasal volvulus differs from simple right-side displacement of the abomasum (RDA) in that the organs not only are distended, but are twisted to form a closed loop obstruction. Proximally, the obstruction occurs at the reticulo-omasal junction, or less commonly at the omaso-abomasal junction. Distally, the site of obstruction is in the cranial part of the duodenum, midway between the pylorus and the sigmoid.

History and Clinical Signs

Cows in the early postparturient period are most commonly affected; however, abomasal volvulus is also observed in pregnant cows, bulls and in calves as young as 1 week of age. Affected cows become acutely anorectic and have a marked decline in milk production. In the early stages of the disorder, cows appear apprehensive and nervous. Signs of mild colic may be evident. Thereafter, the cow becomes progressively depressed, developing sunken eyes and fullness of the right side of the abdomen.

Cows may develop abomasal volvulus and deteriorate rapidly after having a simple RDA for days or weeks. In other cases, cows may persist for several days with a seemingly mild form of abomasal volvulus without developing severe illness. Perhaps these cows do not have a twist tight enough to cause complete outflow obstruction from the duodenum.

Affected cows become dehydrated and develop hypochloremic, hypokalemic metabolic alkalosis due to the accumulation of abomasal contents rich in HCl within the abomasum and omasum. Because the proximal (reticulo-omasal) obstruction occurs later than the duodenal obstruction in most cows, there is also reflux and sequestration of abomasal contents into the ruminoreticulum. As the disorder progresses, dehydration becomes more severe and abomasal necrosis develops due to vascular compromise. A mixed primary acid base disturbance than becomes apparent, consisting of metabolic alkalosis with superimposed metabolic acidosis. Depending upon the relative severity of these two metabolic disturbances, the cow will have a high, normal or low blood pH.

Physical Findings

The affected cow is depressed, anorectic and dehydrated. There is distention of the caudal rib area of the right side. In advanced stages of abomasal volvulus, an arched, dorsoventrally oriented area of distention is clearly visible and palpable in the cranial portion of the right paralumbar fossa, sometimes extending as far caudally as the transverse plane of the 3rd lumbar vertebrae. This corresponds to the caudal limit of the greater curvature of the abomasum. An area of tympanitic resonance is consistently elicited by auscultatory percussion over the right abdominal surface. This area of ping is centered over the 10th-12th ribs and can extend as far cranially as the 9th intercostal space in severely affected cows. The caudal limit of the ping region corresponds to the area of paralumbar fossa distention. The ventral border of the ping area is usually straight and is determined by the amount of fluid within the abomasum. An area of dullness can be identified along the ventral border of the ping area and corresponds to the position of the angle of the abomasum (*incisura angularis*). Cranial to the non-tympanitic area, the ping may be of higher pitch and extend farther ventrally, corresponding to the position of the pyloric part of the abomasum.

Succession of the right side of the abdomen yields prominent splashing sounds which indicate the presence of a large fluid- and gas-filled viscus. The rumen is usually hypomotile or atonic, with moderate fluid distention. Occasionally, cows will have great ruminal distention. Scant amounts of loose, slimy, dark feces are passed, or the rectum is empty. On rectal examination, the caudal border of the tightly distended abomasum can often be palpated at the level of the cranial portion of the paralumbar fossa. The temperature is usually normal, although the pulse rate is high. Respirations may be slow to compensate for the metabolic alkalosis.

Abomasal volvulus is probably caused by the same pathophysiologic mechanisms responsible for simple left or right side abomasal displacement; namely, decreased motility and increased gas production. The anatomic progression and final position of the stomach compartments and associated viscera have been variously described. Most authors agree on the final configuration of the organs but there is disagreement as to the mechanism and progression of rotation.

Three mechanisms for the anatomic progression of the

stomach and associated organs in adult cattle with simple RDA and abomasal volvulus are postulated:

- Gas accumulates first in the fundus, thereby causing the cranial part of the abomasum (and omasum) to move dorsally adjacent to the right abdominal wall (RDA stage). The organs continue to move dorsally, then caudally, resulting in a 180° - 270° rotation of the abomasum and omasum in a counter-clockwise direction as viewed from the right side of the cow.
- Gas accumulates first in the pyloric part of the abomasum and causes an initial 180° rotation of the abomasum in a clockwise direction as viewed from the right side (RDA stage). The abomasum, omasum and proximal part of the duodenum then rotate 360° in a counter-clockwise direction as viewed from the back of the cow.
- Gas accumulates first in the body of the abomasum and causes dorsal migration of the greater curvature of the abomasum along with the right surface of the abdominal wall. This results in a counter-clockwise rotation of the abomasum as viewed from behind the cow (RDA stage). The abomasum and duodenum then rotate in a counter-clockwise direction as viewed from the right side of the cow.

The results of experimental manipulations of the stomach compartments support the first description (above) as being the most mechanically feasible method of rotation to the volvulus stage. However, this does not preclude the likelihood of either of the other methods of rotation as causing the RDA stage. Dynamic studies of the movement of the involved organs in adult cattle have not been done. Regardless of the mechanism of twist, the resulting configuration is usually consistent.

Diagnosis

Diagnosis of abomasal volvulus can sometimes be made with confidence based solely on the presence of the characteristic pattern of distention within the cranial part of the right paralumbar fossa. However, the diagnosis is usually based on the identification of a large area of tympanic resonance with succussible fluid centered over the caudal 3-4 rib spaces, and the identification of the caudal border of a large viscus at the level of the cranial portion of the right paralumbar fossa on rectal examination. Preoperative differentiation from simple abomasal displacement is not always possible; however, cows with volvulus are generally very ill and have severe fluid and electrolyte disturbances. Nevertheless, the clinical differentiation of these two disorders is not necessarily imperative, as surgical repair using the same abdominal approach is generally indicated. The stage of illness is important because the prognosis decreases as the duration and severity of illness progresses. Vital signs and clinicopathologic parameters for three adult cows, representing the early, mid and late stages of abomasal volvulus are summarized in the table on page 5.

TABLE 1. Vital signs and clinicopathologic parameters for 3 adult Holstein-Friesian cows with abomasal volvulus in various stages of severity.

	Stage of Illness		
	Early	Mid	Advanced
Degree of Abomasal Distention	mild	moderate	severe
Pulse Rate (no./min.)	68	86	108
Volume Abomasal Fluid			
Removed (L)	none	35	55
Packed Cell Volume (%)	33	44	37
Blood pH (venous)	7.46	7.49	7.35
Plasma HCO ₃ ⁻ (mEq/L)	32	42	17
Base Excess (mEq/L)	+9	+18	-6
Plasma Na ⁺ (mEq/L)	135	137	126
Plasma Cl ⁻ (mEq/L)	87	76	81
Plasma K ⁺ (mEq/L)	2.9	3.0	4.9
Anion Gap (mEq/L)			
Na ⁺ + K ⁺ - (Cl ⁻ + HCO ₃ ⁻)	19	22	33

The rumen Cl⁻ concentration is moderately increased in the early stages of the disease and reflects reflux (internal vomition) of abomasal contents into the forestomach compartments. After the reticulo-omasal orifice becomes occluded by the external pressure exerted by the encircling duodenum, this reflux stops. Aciduria (urine pH 6-7) is a characteristic, although not consistent, response to the secretion of aldosterone in attempt to conserve body water and sodium in the face of volume contraction and chloride and potassium depletion.

Apart from simple right side abomasal displacement, the principal ruleout is dilation or volvulus of the cecum and/or proximal colon. The ping area in cows with dilation of the first and second segments of the proximal loop of the ascending colon can extend as far cranially as the 10th rib; however, the area of ping is usually oriented in a craniocaudal direction rather than the circular or dorsoventral orientation present in cattle with abomasal volvulus. Differentiation based upon rectal findings is usually definitive. In cows with abomasal volvulus, the caudal and left surfaces of the abomasum can be felt as a tightly distended, rigidly positioned organ. The caudal surface and a small portion of the left side may be felt but palpation between the right surface of the abomasum and the abdominal wall is difficult. In cows with cecal dilatation and/or volvulus, the cecum or ascending colon are farther caudal and can be more readily palpated.

Therapy

Cows with abomasal volvulus will not survive without surgery and operative repair should not be delayed. However, severely affected cows should receive preoperative intravenous fluid therapy to optimize their chance for recovery. In general, intravenous fluid therapy provided during the intra-operative period will suffice.

The right paralumbar fossa is the most commonly used approach for celiotomy. An oblique dorsoventral incision is

made parallel and just caudal to the 13th rib. Care is taken not to incise the distended abomasum upon entry into the abdominal cavity. The parietal surface of the abomasum, uncovered by omentum, is greatly distended and is positioned next to the right abdominal wall from the region of the 9th or 10th ribs to the cranial portion of the paralumbar fossa. The pylorus is at the level of ribs 8-10 midway between the level of the vertebrae and sternum. The greater curvature faces dorsally and caudally; the lesser curvature faces cranially and ventrally. The omasum, also distended with fluid, lies on the abdominal floor ventral to the pyloric part of the abomasum and covered by lesser omentum unless the latter has been torn. The reticulum lies between the abomasum and the right side of the rumen, with its long axis oriented craniocaudally and the apex at the transverse plane of rib 12-13. The proximal part of the duodenum extends ventrally from the pylorus, then medially in a cleft formed between the rumen and the omasum, and finally moves dorsally along the left side of the reticulum, at which point it is attached to the liver and bile duct. The segment of duodenum proximal to the point where it passes from right to left around the neck of the omasum is greatly distended with fluid. Distal to this point, the duodenum is empty. The liver is bent along its long axis with the abomasum becoming interposed between the parietal surface of the right lobe and the right body wall in what has been described as the "ship's screw distortion." The liver is large and has rounded edges due to passive vascular congestion. The site of twist can be palpated on the left side of the abomasum. Differentiation from simple RDA can be made by identifying the pylorus and following the course of the cranial duodenum.

The need for gaseous and fluid decompression is dependent upon the organ size and the experience of the surgeon. If indicated, the abomasum is deflated by evacuation of gas, or of gas and fluid. If there is a large volume of fluid within the abomasum, removal of the fluid before evacuation of gas is advocated. Fluid is siphoned from the abomasum by inserting a stomach tube through the hole created by a stab incision in the greater curvature. A purse string suture is preplaced to prevent leakage. Following decompression, the left hand and forearm are placed along the left surface of the abomasum. The abomasum is pushed cranioventrally and cranioventrally to release the duodenum from the cleft between the rumen and omasum. If this is unsuccessful, the omasum should be elevated to free the "trapped" duodenum. Once freed, the pyloric part of the abomasum is drawn caudally, then dorsally, until the pylorus is exteriorized at the incision.

To insure that the volvulus is completely reduced, the pylorus is held stationary with one hand while the other hand is used to palpate ventrally along the greater curvature of the abomasum until the reticulum is felt. The omasum is then palpated to ensure that it is correctly positioned against the right abdominal surface, dorsolateral to the body of the abomasum. Finally, the cranial part of the duodenum is traced from the pylorus to the liver attachment and caudally to the descending part.

The abomasum is anchored to the right body wall by omentopexy or abomasopexy. Pyloromyotomy and abomasoduodenostomy (abomasojejunostomy) have been suggested as methods for reducing the possibility of post-operative vagal indigestion; however, the usefulness of these techniques has not been satisfactorily documented.

Complications

Type III or IV vagal indigestion is the most common complication of cows with advanced abomasal volvulus. This is caused by direct damage to the ventral branch of the vagus nerve at the site of the twist or at the level of the diaphragm. Affected cows pass scant amounts of feces, do not regain full appetite, and develop progressive bilateral abdominal distention. Surgical attempts to relieve the vagal indigestion are usually unsuccessful, although some cows gradually improve. The most consistently successful treatment is aimed at rumen decompression by large bore nasogastric tube, maintenance of electrolyte normalcy (especially potassium and calcium), and provision for adequate exercise.

Cows with very severe abomasal volvulus in which there is necrosis of the abomasum, omasum and proximal part of the duodenum die during surgery or shortly thereafter due to irreversible shock.

Prognosis

Cows in the early stages of abomasal volvulus have a very good prognosis, similar to that seen in cows with LDA or simple RDA. However, as the disorder becomes more advanced, the prognosis worsens due to damage to the vagal nerve. In very severely affected cows, in which abomasal (and commonly omasal) necrosis is evident, the prognosis is grave. The results of retrospective studies evaluating the prognosis of cows with abomasal volvulus indicate that cows with preoperative serum chloride concentrations less than 80 mEq/L or base excess concentrations less than 0 mEq/L have a poor prognosis.