

# Perioperative Evaluation of Cows With Right Abomasal Displacement and Abomasal Volvulus

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## Introduction

Cows with right abomasal displacement or abomasal volvulus typically have high packed cell volume (PCV) and plasma total solids (TS) concentrations due to dehydration. They have low plasma concentrations of  $\text{Cl}^-$  and  $\text{K}^+$  due to sequestration of gastric contents and anorexia, and metabolic alkalosis with hyperbicarbonatemia and increased base excess (BE) concentrations due to obstruction of abomasal outflow and the resultant accumulation of  $\text{HCO}_3^-$  in the extracellular fluid (ECF) space (4,6). However, we have observed that some cows presented to our referral hospital with severe abomasal volvulus have a PCV and TS concentration that is not as high as would be anticipated. Plasma concentrations of  $\text{Cl}^-$  and  $\text{K}^+$  have been higher in these cows than anticipated assuming a continued decrease of these electrolytes with increasing severity of volvulus. In addition, blood pH,  $\text{HCO}_3^-$  and BE were lower than anticipated, indicating the development of metabolic acidosis superimposed upon the existing metabolic alkalosis.

The purposes of this study were to use a large data base of cattle admitted to a referral hospital for treatment of right abomasal displacement or abomasal volvulus to evaluate the association between the outcome and the physical and laboratory parameters at admission, and the findings at surgery.

## Materials and Methods

Clinical, clinicopathologic and pathologic data were compiled from the medical records of adult cows admitted to the New York State College of Veterinary Medicine in the 8 year period (1980 to 1987) with a final diagnosis of right abomasal displacement or abomasal volvulus. Cows were classified as productive, salvaged or terminal based upon previously published data (4). Tests of association of each study parameter to the status at hospital discharge were performed using one way analysis of variance for continuous variables and the Chi-square test of independence

with categorical variables. The Bonferroni test was used for pari-wise comparisons of group means when statistically significant group effects were observed for continuous variables.

## Results

The distribution of outcome for 458 cows comprising the study population was as follows: productive, 346 (75.5%); salvaged, 88 (19.2%); and terminal, 24 (5.2%). Two hundred and eighteen cows (47.6%) had right abomasal displacement, and 240 (52.4%) had abomasal volvulus. The rectal temperature decreased from  $38.9 \pm 0.6^\circ\text{C}$  for productive cows to  $38.3 \pm 1.3^\circ\text{C}$  for terminal cows. The heart rate increased with increasing severity of disease ( $80.9 \pm 18.6/\text{min}$  for productive cows to  $107.5 \pm 18.4$  for cows classified as terminal). The PCV and TS were highest in the salvaged group of cows. Cows in the productive and salvaged groups had metabolic alkalosis ( $\text{BE} = 5.6 \pm 7.0$  mEq/l, and  $4.0 \pm 6.9$  mEq/l, respectively). As the outcome became less favorable there was evidence of superimposed metabolic acidosis, with the BE in terminal cattle,  $-1.5 \pm 9.0$  mEq/l. This decrease in BE concentration was associated with an elevated anion gap concentration in the cows classified as salvaged and terminal. Hyponatremia was increasingly severe in the salvaged and terminal cows, the latter having  $\text{Na}^+$  concentrations of  $131.9 \pm$  mEq/l. All groups of cows were hypochloremic and hypokalemic, with the lowest values observed in the salvaged group.

Considering the surgical criteria evaluated, cattle were more likely to survive if they had right abomasal displacement as opposed to abomasal volvulus, surgical correction by abomasopexy as opposed to omentopexy, did not require fluid decompression of the abomasum, and had normal appearing abomasal serosa.

## Discussion

The low temperature and high heart rate in the more severely affected cattle were most likely a result of de-

*Paper presented at the XVI World Buiatrics Congress, Salvador, Bahia, Brazil, August 13-17, 1990.*

hydration and decreased peripheral perfusion. The rise in PCV and TS in the productive and salvaged cattle probably resulted from hemoconcentration (4); whereas, the low PCV and TS in the terminal group of cattle most likely resulted from vascular injury to the mucosa of the abomasum, subsequent intraluminal hemorrhage, and accumulation of modified transudate in the peritoneal cavity.

The presence of a superimposed metabolic acidosis in cattle with severe or prolonged abomasal volvulus (2,3) is reflected in the lower values of pH,  $\text{HCO}_3^-$ , and BE when compared to cattle classified as productive or salvaged. This metabolic acidosis is probably due to hypovolemia, decreased tissue perfusion and septic shock associated with developing abomasal necrosis.

The decrease in plasma  $\text{Na}^+$  concentration with increased severity of disease is consistent with recent observations (1,5) as well as earlier reports (4). The terminal increase in plasma  $\text{Cl}^-$  concentration may be due to increasingly severe hemoconcentration or decrease in abomasal secretion of  $\text{Cl}^-$ , at the same time as there is strong renal conservation of  $\text{Cl}^-$ . The hypokalemia present in the salvaged group of cattle probably resulted from anorexia, intracellular movement associated with metabolic alkalosis, and loss in urine and abomasal effluent. Cell necrosis and rhabdomyolysis with endogenous  $\text{K}^+$  infusion into the ECF may explain the increase in  $\text{K}^+$  in the terminal cattle (5).

The prognosis for cows with right abomasal displacement was better than for those with abomasal volvulus because the former were less likely to have vascular compromise of the abomasum and consequently less severe metabolic derangements. The higher survival rate for cows with abomasopexy probably reflected our surgeons' preference to use the standing approach for cows with abo-

masal volvulus and the recumbent approach for cows with right abomasal displacement.

### Summary

Clinical, clinicopathologic and surgical data from 458 adult dairy cows with right abomasal displacement or abomasal volvulus were analyzed to determine the association between these variables and outcome, classified as productive, salvaged or terminal. Heart rate was higher in the salvaged and terminal cattle, than the productive cattle. Hyponatremia was increasingly severe in the salvaged and terminal cows. All groups of cows were hypochloremic and hypokalemic, with the lowest values in the salvaged group. Cows in the productive and salvaged groups had metabolic alkalosis. As the outcome became less favorable there was evidence of superimposed metabolic acidosis with elevated anion gap.

### Acknowledgements

*This work was supported by the Harold Wetterberg Foundation and the USDA Animal Health and Disease Program.*

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