

Serum Amyloid-A and Haptoglobin Concentrations and Liver Fat Percentage in Lactating Dairy Cows with Abomasal Displacement

H. Guzelbektes¹, DVM; I. Sen¹, DVM, PhD; M. Ok¹, PhD; P.D. Constable², BVSc, MS, PhD, DACVIM; A. Coskun¹, DVM, PhD

¹Department of Internal Medicine, Faculty of Veterinary Medicine, University of Selcuk, Konya, Konya, Turkey 42079

²Department of Veterinary Clinical Sciences, School of Veterinary Medicine, Purdue University, West Lafayette, IN 47907

Introduction

Serum amyloid-A (SAA) and haptoglobin are positive acute phase proteins in cattle that are produced by the liver in response to endogenous release of glucocorticoids and pro-inflammatory cytokines. Recent studies have indicated that SAA provides a more sensitive test of inflammation and bacterial infection in cattle than hematological analysis and clinical examination. Albumin is a negative acute phase protein in cattle. We hypothesized that the serum concentration of SAA and haptoglobin would be increased, and the serum concentration of albumin would be decreased, in cows with left displaced abomasum (LDA), right displaced abomasum (RDA), or abomasal volvulus (AV), relative to healthy dairy cows. The basis for our hypothesis was the presence of nutritional stress in cattle with LDA, RDA, and AV, as well as the presence of peritonitis in some cattle with AV. We confined our investigation to cattle that did not have clinical evidence of inflammation or bacterial infection, such as mastitis, metritis, or pneumonia, in order to minimize the confounding effect of clinical disease on the acute phase response.

Materials and Methods

We examined 54 adult dairy cows in early lactation that had LDA (n = 34), RDA or AV (n = 11), or were healthy on physical examination (control, n = 9). Inflammatory diseases or bacterial infections were not clinically apparent in any animal. Jugular venous blood was obtained from healthy cows and immediately before surgical correction of abomasal displacement in cows with LDA or RDA/AV. Serum amyloid-A and haptoglobin concentrations were determined using a sandwich ELISA. Liver biopsy samples were obtained in cows with LDA or RDA/AV. Paraffin fixed formalin sections of liver were examined under light microscopy and the percentage volume of visible fat in hepatic parenchymal cells were estimated using a stereological point counting method. For cows with displaced abomasum, Spearman's correlation coefficients were calculated to explore the association between the concentrations of SAA ([SAA]), haptoglobin ([haptoglobin]), and albumin

with other study variables, including hematologic and serum biochemical factors, and liver fat percentage. $P < 0.05$ was considered significant.

Results

Clinical or hematologic evidence of inflammation or bacterial infection were not evident in any cow. Geometric mean [SAA] was markedly increased ($P < 0.0001$) in cows with LDA (55 mg/L; 95% confidence interval [CI], 13 to 227) or RDA/AV (90 mg/L; 95% CI, 46 to 177) relative to healthy controls (12 mg/L; 95% CI, 3 to 43). Geometric mean haptoglobin concentration was slightly increased ($P = 0.0021$) in cows with LDA (70 mg/L; 95% CI, 22 to 229) or RDA/AV (88 mg/L; 95% CI, 37 to 208) relative to healthy controls (36 mg/L; 95% CI, 14 to 92). In contrast, the serum concentration of albumin was similar for all three groups. Cows with displaced abomasum had mild to moderate hepatic lipidosis, based on liver fat percentages of $9.3 \pm 5.3\%$ (mean \pm standard deviation [SD], LDA) and $10.8 \pm 7.7\%$ (RDA/AV). The strongest association of [SAA] was with liver fat percentage ($r = 0.55$, $P < 0.0001$). Likewise, the strongest association of serum [haptoglobin] was with liver fat percentage ($r = 0.42$, $P = 0.0041$).

Significance

This was the first study to document increased [SAA] in cattle with abomasal displacement, and the second study to document increased serum [haptoglobin] in dairy cows with LDA or RDA/AV. The results indicated that [SAA] in lactating dairy cows with LDA or RDA/AV is markedly increased and positively associated with liver fat percentage. The results confirmed the findings of previous studies that serum [haptoglobin] is increased in cattle with abomasal displacement and positively associated with liver fat percentage. Our findings demonstrate that an increase in [SAA] or [haptoglobin] in cattle with LDA or RDA/AV is not specific for inflammation or bacterial infection in the post-parturient dairy cow, and that an increase in [SAA] or [haptoglobin] may indicate the presence of hepatic lipidosis in cattle with abomasal displacement.