

Comparison of a Histological Grading Scheme with Serum ELISA to Predict the Severity of Johne's Disease Infection

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INTRODUCTION:

Mycobacterium avium ssp. paratuberculosis (MAP), the etiological agent of Johne's disease, has become one of the most important infectious agents in dairy herds today due to both serious economic, as well as possible food safety issues associated with the disease. In the 1996 NAHMS dairy study it was found that MAP infection existed in 22% of U.S. dairy herds with disease prevalence greater than 10%. There is evidence that the prevalence of Johne's disease has increased further, and the disease could be considered an epidemic in the U.S. In addition to MAP's role in Johne's disease, significant research points to a causative role of MAP in the debilitating human Crohn's disease. If MAP is indeed a zoonotic agent, then infected cattle could represent a human health and food safety threat. It may take a cow 4-6 years after exposure to MAP to exhibit clinical signs, and not much is known about the tissue dissemination of the infectious agent during subclinical infection. With such a high prevalence on U.S. dairies, tissues from infected cows are likely entering the human food chain as ground beef. Testing all edible tissues for presence of infection would be impractical. However, an alternative method for identifying cattle with disseminated infection at slaughter would facilitate removal of at-risk carcasses before they enter the human food chain. The objective of this study was to correlate the histological grade of inflammation in intestinal tissue samples from infected cattle with previous MAP serum positive ELISA test results in order to determine whether the ELISA could be used to predict severity of infection with MAP.

MATERIALS AND METHODS:

Twenty dairy cows were obtained from 4 Colorado dairies with history of MAP infection (past ELISA positive with varying degrees of clinical signs). Cows were given a clinical score based on presence of disease indicators like weight loss and diarrhea. Feces and blood samples were collected for culture and ELISA testing, respectively. Cows were then euthanized, and tissues were collected at necropsy. Tissues were given a gross score based on observed pathological changes, and H & E slides of ileum, jejunum, mesenteric LN, and ileoceocolic LN were evaluated according to a histological grading scheme that characterizes granulomatous inflammation on an 8 point scale. This grading scheme classifies granulomatous inflammation of tissues into 4 categories of negative, mild, moderate, and severe. Preliminary statistics were run to see if a relationship existed between the histological grade of the tissue and previous ELISA (IDEXX) test results. Clinical and gross scores given to cows were also compared to ELISA results. Spearman correlation coefficients were determined for the 4 tissues, gross and clinical scores. A regression model was constructed to evaluate the association between the ELISA S/P ratio and gross, clinical, and histopathological grades.

RESULTS:

Using a general linear model to describe the data showed no significant association between histopathological grades of cow tissue and serum ELISA results. Gross and clinical scores compared to ELISA also demonstrated no significant association. The Spearman correlation coefficients relating jejunum with ileum, jejunum with mesenteric lymph node, and jejunum with gross score, as well as ileum with jejunum, and lastly relating ileoceocolic lymph node with both ileum and mesenteric lymph node all ranged from .81-.87.

CONCLUSIONS/DISCUSSION:

Preliminary statistical analyses of these results demonstrate there is good correlation among tissue inflammation, but too much disparity between serological response and tissue response in MAP infected cows to support our hypothesis. There were however some trends in the data supporting our line of thinking for continued work on this project. The small sample size limited our ability to find a relationship between these variables. Further study with a larger sample size and a wider range of ELISA scores is ongoing. Specifically evaluating the presence of MAP in non-gastrointestinal tissues versus ELISA results would provide more direct information about the predictability of disseminated infection. The high correlation of inflammation between tissues may provide utility in limiting the scope of tissues examined in future studies.