The potential use of MALDI Sepsityper™ technology for rapid diagnosis of septicemia in dairy calves

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Introduction

Neonatal calf diarrhea is the leading cause of calf mortality in the United States and can be associated with more severe sequela including septicemia. The current preferred method for diagnosing septicemia in these patients is culture-based and can take a week or more to provide bacterial identification. Therefore, this method is impractical to use when rapid treatment is necessary. In most instances, farm personnel give antibiotics empirically without confirmation of sepsis or identification of the causative agent, raising concerns over unnecessary or suboptimal antibiotic administration. A more recent alternative method for diagnosing bacteremia involves utilization of a Sepsityper™ kit in conjunction with matrix assisted laser desorption/ ionization-time of flight mass spectrometry (MALDI-TOF MS), though this has not been employed extensively in veterinary medicine. This kit provides the ability to prepare a small sample of positive blood culture fluid for rapid bacterial identification, ultimately detecting bacteria causing sepsis 1 to 3 days sooner than traditional diagnostic measures. The sensitivity and specificity of this method for diagnosing septicemia has not been established in veterinary medicine. Therefore, the objective of this study was to ascertain these values and compare the use of Sepsityper with MALDI to current culture-based methods of detecting sepsis in diarrheic dairy calves. We hypothesized that the Sepsityper method would demonstrate more rapid and sensitive results for detecting bacteremia than traditional culture-based methods.

Materials and Methods

Dairy calves under 21 days were enrolled in the study according to the presence of diarrhea and dehydration or depression. Aseptic blood samples were collected from enrolled calves, and 10 mL of blood was inoculated in a blood culture bottle (BCB) with indicator top. Bottles were incubated at 35˚C and monitored for 5 d following inoculation to assess turbidity and fluid translocation into the indicator top, which defined a positive BCB. Blood culture fluid from positive BCBs was analyzed by Sepsityper with MALDI and traditional culture to media-based isolation and identification methods.

Results

A total of 112 calves were enrolled in the study, and 22 samples positive on blood culture were analyzed. Preliminary results show that the Sepsityper method identified bacteria in 59% (n=13/22) of cases positive on BCB, while the culture-based method identified bacteria in 82% (n=18/22) of enrolled calves. Because the need for culturing to media was eliminated, the method utilizing Sepsityper was capable of providing results at least 24 hours sooner than traditional culture-based methods . Of the 13 positive cases identified by Sepsityper, 10 identifications agreed to the genus and species level with the culture-based method. Two samples were identified by Sepsityper and not culture-based methodology. A single sample was identified to the same genus, but different species level by the two methods. There was a total of 12 bacterial species identified, equally distributing under gram-negative and gram-positive classification. The most commonly isolated organisms include Salmonella spp. (n=3) and Bacillus licheniformis (n=3).

Significance

Despite a potentially lower diagnostic sensitivity, the method utilizing Sepsityper provided results sooner and with comparable accuracy to current culture-based methods. Therefore, the use of Sepsityper may play an important role when rapid diagnoses and treatment decisions are required.