Preliminary Validation of a 'Calf-Side' Test for Measurement of Serum IgG in Dairy Calves

S. Stewart, *BSc;* **S. Godden,** *DVM, DVSc;* **M. Schrupp,** *BSc*
Department of Veterinary Population Medicine, University of Minnesota, St. Paul, MN 55108

© Copyright American Association of Bovine Practitioners; open access distribution.

Introduction

The importance of adequate passive transfer (APT, IgG ≥ 10 mg/mL at 24-48 h) of immunoglobulin (Ig) for newborn calves is widely known in the dairy industry. Failure of passive transfer (FPT) is associated with increased risk of morbidity, mortality, reduced growth rate, and decreased production at first lactation. The gold standard test is measurement of serum IgG concentrations in an accredited veterinary laboratory using either RID or turbidimetric immunoassay (TIA) methods. Laboratory measures are accurate but expensive ($6 to $12 per sample), plus take time to ship samples and wait for results. A common on-farm test is to measure serum total protein (TP) concentrations using a hand held refractometer to indirectly predict serum IgG concentrations. This approach is inexpensive and rapid but is less accurate than direct IgG measurement in a laboratory. Calloway and others (2002) reported that serum TP concentrations of 5.0 g/dL had a sensitivity and specificity of 0.89 and 0.84, respectively, in detecting calves with FPT. Ideally, the industry would have available an accurate, rapid, convenient, and inexpensive calf-side test to measure serum IgG concentrations. The Midland BioProducts QTII™ Bovine Serum IgG test is a portable hand-held chemistry analyzer that works on the principle of a TIA method (Midland BioProducts Inc., Boone, IA). The chemistry analyzer weighs about 2 lb (0.91 kg), is about the size of a 1 L bottle and costs $1,950.00 as a one time purchase. Test kits are available in sets of 5 at approx. $7.50 per test for the bovine species IgG. Test kits are also available for other bovine analytes including serum albumin, total protein, calcium, magnesium and phosphorus. It takes approx. six minutes to run one test. The objective of this study was to describe the test characteristics of the MBC QTII™ Bovine Serum IgG test.

Materials and Methods

This study was conducted at the University of Minnesota (St. Paul, MN), using 178 frozen serum samples collected for a previous study from calves ranging between one to seven days of age. Serum samples were thawed at room temperature, gently agitated, split into two equal aliquots, and labeled with a unique calf ID number. The first set of samples was tested using the MBC QTII™ IgG TIA method in accordance with manufacturer's directions. The second set of samples was sent to the Midland BioProducts laboratory for IgG testing using a TIA method. Immunoglobulin G results from the MBC QTII™ test were then compared against laboratory results (gold standard).

Results

The Pearson's Correlation Coefficient (r) between the MBC QTII™ and laboratory IgG test results was 0.77 ($P < 0.0001$). Of 178 samples tested, the true prevalence of APT of IgG was 97.7% (174 of 178) according to the lab TIA test using IgG ≥ 10.0 mg/mL as the cut-point. The apparent prevalence of APT using the MBC QTII™ test was 93% (165 of 178). The sensitivity, specificity, predictive value of a positive test, and predictive value of a negative test for the MBC QTII™ test to predict APT was 94.8%, 100%, 100%, and 31%, respectively. The overall accuracy of the MBC QTII™ IgG test was 95%. Despite these favorable results, given that only 2.3% (4 of 178) of the calves tested had FPT, these results should be considered preliminary and should be interpreted with caution.

Significance

Preliminary data suggest the Midland BioProducts QTII™ IgG test is more accurate than measuring serum TP by refractometry and more time efficient than submitting serum samples to an accredited veterinary diagnostic laboratory for IgG testing. As such, this test has good potential for adoption for measuring calf serum IgG concentrations on farms or in private veterinary clinics. However, further evaluation using a larger sample set with greater biological variation in serum IgG values is necessary to complete the evaluation of this test. This work is ongoing.