Evaluation of the use of the California Mastitis Test, last test somatic cell count, or a computer automated algorithm for detecting intramammary infection at dry-off

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Introduction

Selective dry cow therapy (SDCT), the identification and treatment of only cows or quarters that have or are at risk for an infection over the dry period, constitutes a prudent strategy when considering antibiotic use. Milk culture by a professional lab, which takes ≥ 1 day and may not be accessible to all dairies, is currently recognized as the gold standard for determining intramammary infections (IMI). Identification of cows or quarters for SDCT requires timely and cost-beneficial diagnostics with acceptable sensitivities (Se) and specificities (Sp) to decrease under, as well as over-treatment of animals at dry-off (DO). For this purpose, our objectives were to explore the test characteristics of the California Mastitis Test (CMT), use of the last-test DHIA somatic cell count (LTSCC), and use of an automated algorithm (ALG) based on sequential somatic cell count (SCC) and mastitis events to identify IMI in quarters and cows at DO using 2 categories of IMI (all or only major pathogens).

Materials and Methods

A subset of cows (2 NY dairies, n=141; 2 CA dairies, n=183) from a SDCT trial were subjected to quarter-level CMT immediately after milking, 2-3 d prior to DO. CMT results, interpreted by research staff, were dichotomized (a score of trace or more = positive). A cow with 1 or more positive quarters was a positive cow. LTSCC within 5 wks of DO was retrieved from Dairy Comp 305 (DC305). The threshold used as a proxy for an IMI was ≥ 200,000cells/mL. Additionally, an automated algorithm based on DC305 data was used to identify infected cows: cows having > 1 mastitis event during the current lactation or a SCC >200,000cells/mL at any point during lactation. Quarter IMI status was defined by laboratory culture and MALDI-ToF of a single quarter-level milk sample taken prior to CMT. A cow was classified as having an IMI if culture indicated that ≥ 1 quarter was infected. A major IMI was defined as any positive culture that was not *Corynebacterium* spp, *Bacillus* spp, or Non-aureus *Staphylococcus*. Tabular methods were used to calculate Se, Sp, positive and negative predictive values (PPV, NPV), accuracy (Ac), and agreement (Kappa) of each test relative to laboratory culture.

Results

Mean milk yield and ln (SCC) for all cows in the trial at the test before DO was 61 lb (27.7 kg) (SD 20) and 4.4 lb (2 kg) (SD 1.2). The average DIM at DO was 325 d (SD 46). Overall proportions of IMIs at the cow and quarter levels each were 18%; IMI with major pathogens constituted 5% of cows and 4% of quarters. Proportions were similar for 3 of the 4 farms, with 1 herd (representing 1/3 of cows in the data set) having 34% of cows with IMIs (8% major pathogens). Se, Sp, PPV, NPV, and Ac at the quarter level for CMT were 32%, 82%, 28%, 85%, and 73% for all pathogens and 26%, 80%, 5%, 97%, and 78% for major pathogens, respectively. At the cow level these values were 60%, 65%, 53%, 70%, and 63% for all pathogens and 63%, 56%, 7%, 97%, and 56% for major pathogens. Se, Sp, PPV, NPV, and Ac for LTSCC at the cow level were 34%, 83%, 58%, 65%, and 63% for all pathogens and 25%, 77%, 5%, 95%, and 74% for major pathogens, respectively. Se, Sp, PPV, NPV, and Ac for ALG at the cow level were 73%, 52%, 51%, 74%, and 60% for all pathogens and 69%, 43%, 6%, 96%, and 44% for major pathogens, respectively. Kappa (vs lab culture) for most tests ranged from 0.006-0.18 in the "poor" category of agreement. The highest Kappa were "fair" for ALG at 0.23 and cow-level CMT at 0.24 (all IMI).

Significance

All tests performed similarly, with ALG having a numerically higher cow-level Se for detection of an IMI at DO and LTSCC a higher Sp. Outcomes when these tools are used in a SDCT program continue to be explored; recent studies have shown that suboptimal characteristics of each particular test may or may not produce negative outcomes, and also might depend on herd-level characteristics. Additionally, economic considerations should be evaluated.