

Investigation of the relationship between differential somatic cell count and milk culture

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Introduction

Milk culture is the gold standard for detection of intramammary infections (IMI) in dairy cows. Somatic cell count (SCC) is widely used for diagnosing subclinical mastitis, but its predictive value for detecting IMI is limited. Differential SCC (DSCC) provides information about the changes in the relative abundance of different cell types during the inflammatory response and is a potential alternative for the identification of quarters with IMI. However, its ability to detect IMI is unclear and requires further investigation. Thus, the objective of this study was to investigate the predictive value of DSCC in the identification of quarters with IMI.

Materials and Methods

This observational study enrolled 409 cows from 1 dairy farm in Minnesota between September 2019 and March 2020. Quarter milk samples were collected at dry off and submitted for bacterial culture. IMI was defined as the growth of any culturable isolate. Major-IMI was defined as an IMI caused by *Streptococcus* spp. and *Streptococcus*-like organisms, *Staphylococcus aureus* or coliforms. The DSCC (Neutrophils [NEU], Lymphocytes [LYM] and Macrophages [MAC] count and their relative abundance [%]; QScout MLD. AAD, Durham, NC) were measured on-farm, within 2 hours of sample collection. A receiver operating characteristic curve was built to determine the optimal cut-off for each cell type measured by DSCC, using the Youden index, to predict IMI and major-IMI. Sensitivity (Se), specificity (Sp), positive predictive value (PPV), negative predictive value (NPV) and area under the curve (AUC) were reported for the selected cut-offs.

Results

The prevalence of IMI and major-IMI was 42.2% and 30.0%, respectively. For NEU, the optimal threshold on the absolute scale was 61,000 cells/mL for quarters with IMI (Se=38.1%, Sp = 79.7%, PPV = 57.8%, NPV = 63.8%, AUC = 0.60) and 66,000 cells/mL for major-IMI (Se = 34.8%, Sp = 78.0%, PPV = 40.4%, NPV = 73.6%, AUC = 0.56). In addition, the best cut-off for NEU%

was established at 49.2% for detection of IMI (Se = 57.6%, Sp = 47.2%, PPV = 44.4%, NPV = 60.3%, AUC = 0.51) and 46.1% for major-IMI (Se = 66.1%, Sp = 36.9%, PPV = 31.0%, NPV = 71.8%, AUC = 0.49). For LYM, the optimal cut-off on the absolute scale was 16,000 cells/mL for identification of quarters with IMI (Se = 50.6%, Sp = 67.1%, PPV = 52.9%, NPV = 65.0%, AUC = 0.60) and 23,000 cells/mL for major-IMI (Se = 37.5%, Sp = 75.5%, PPV = 39.6%, NPV = 73.8%, AUC = 0.56). Additionally, for LYM%, the best cut-off point was 18.3% for pinpointing quarters with IMI (Se = 51.0%, Sp = 55.6%, PPV = 61.1%, NPV = 41.4%, AUC = 0.52) and 17.8% for major-IMI (Se = 51.7%, Sp = 52.4%, PPV = 71.7%, NPV = 31.8%, AUC = 0.51). For MAC, the optimal cut-off on the absolute scale was 23,000 cells/mL for identification of IMI (Se = 46.7%, Sp = 68.3%, PPV = 54.3%, NPV = 61.3%, AUC = 0.56) and 23,000 cells/mL for major-IMI (Se = 44.5%, Sp = 64.3%, PPV = 35.0%, NPV = 72.9%, AUC = 0.52). The MAC% threshold was determined to be 27.3% for quarters with IMI (Se = 55.0%, Sp = 50.9%, PPV = 58.1%, NPV = 47.8 %, AUC = 0.50) and at 29.2% for major-IMI (Se = 51.8%, Sp = 57.3%, PPV = 73.7%, NPV = 33.9%, AUC = 0.53).

Significance

Our results showed a low predictive ability of DSCC in the identification of quarters with IMI or major-IMI. Based on our findings, DSCC needs to be used with reservation if the intent is to identify quarters with IMI.

