

Research Summaries 4

Single-drug and Multi-drug Resistance Exhibited by Gram-positive Mastitis Pathogens

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Introduction

Bovine mastitis is caused by a variety of pathogens, and treatment of bovine mastitis accounts for the greatest usage of antimicrobials on dairy farms. The possibility of increased resistance caused by usage of antimicrobials for treatment of bovine mastitis is a potential concern for veterinarians. The objective was to describe antimicrobial resistance of gram-positive mastitis pathogens isolated from cases of bovine mastitis.

Materials and Methods

Isolates were obtained from clinical and subclinical cases of mastitis enrolled in a clinical trial that included 22 commercial dairy herds (Lago *et al*, 2006). Duplicate quarter milk samples were collected and microbiological procedures were performed using NMC guidelines. Minimum inhibitory concentration (MIC) values were determined using broth micro-dilution.

Results

Of the 260 isolates included in this study, 66 (25.3%) did not exhibit resistance to any antimicrobials, 88 (33.3%) exhibited single-drug resistance (SDR), and 106 (40.8%) exhibited multi-drug resistance (MDR). Of 166 coagulase-negative staphylococci (CNS), 40 (24.0%) did not exhibit resistance to any antimicrobials, 54 (32.5%) exhibited SDR, and 72 (43.3%) exhibited MDR. Among the 38 *Streptococcus* spp, seven (18.4%) did not exhibit any resistance, 17 (44.7%) exhibited SDR, and 14 (36.8%) exhibited MDR. Of *Staphylococcus aureus* (n = 32), no resistance was exhibited by 17 (53.1%), 14 (43.7%) isolates exhibited SDR, and one (3.1%) isolate exhibited MDR; this isolate exhibited resistance to nine of the 11 antimicrobials. Of other pathogens (n=24), two (8.3%) did not exhibit any resistance, three (12.5%) exhibited SDR, and 19 (79.1%) exhibited MDR. Of the 86 CNS and *Streptococcus* spp exhibiting MDR, 33 different patterns were observed. The distribution of MDR was 50 (58.1%) to two antimicrobials, 18 (20.9%) to three antimicrobials, seven (8.1%) to four antimicrobials,

two (2.3%) to five antimicrobials, one (1.1%) to six antimicrobials, three (3.4%) to seven antimicrobials, three (3.4%) to eight antimicrobials, and two (2.3) to ten antimicrobials. The combination of MDR to sulphadimethoxine and tetracycline (32.5%), pirlimycin and tetracycline (9.3%), and ampicillin, penicillin and sulphadimethoxine (9.3%) accounted for 51.1% of all MDR combinations. Of MDR exhibited by CNS and *Streptococcus* spp, more than one third of isolates were resistant to tetracycline (55.8%), sulphadimethoxine (53.4%), penicillin (52.3%), pirlimycin (40.6%), and ampicillin (39.5%). Very few MDR isolates exhibited resistance to cephalothin (4.6%), enrofloxacin (5.8%), and ceftiofur (6.9%). MDR was associated with parity, case type, and pathogen (P < 0.03). Isolates recovered from cows of parity > 1 were 2.6 times more likely to exhibit MDR as compared to isolates recovered from parity 1. Isolates recovered from farms enrolling cases of clinical mastitis were 2.7 times more likely to exhibit MDR as compared to isolates recovered from farms enrolling cases of subclinical mastitis. CNS were 2.9 times more likely to exhibit MDR as compared to *Streptococcus* spp. MDR was not associated with exposure to treatment with cephalirin sodium (P = 0.19).

Significance

Fewer isolates exhibited susceptibility to all tested antimicrobials as compared to isolates exhibiting either SDR or MDR. Most of the SDR observed in our study were attributable to tetracycline and sulphadimethoxine rather than compounds routinely used for intramammary therapy. While MDR was observed for all tested antimicrobials, only a few antimicrobials contributed to the majority of MDR. Parity, case type, and pathogen type were identified as potential risk factors that may be associated with MDR. Further studies are needed to examine the nature of the relationship between the identified risk factors and MDR and additional farm related risk factors such as the history of antimicrobials used on the farm. Veterinary practitioners should be aware of antimicrobial usage on dairy farms and use judicious practices when prescribing antimicrobials for use in food producing animals.