Antimicrobial resistance in bacterial isolates from endometritis in cows and pneumonia in calves in Denmark

Egle Kudirkiene and John E. Olsen

Section for Veterinary Clinical Microbiology, Department of Veterinary and Animal Sciences (IVH), University of Copenhagen

Background: Calf pneumonia and cow endometritis are costly diseases in cattle industry worldwide as well as in Denmark. Both diseases are multifactorial, challenging to control and often requires antimicrobial therapy. In Denmark, they are the second and third most common reason for use of antimicrobials in the cattle industry. The main bacterial pathogens associated with calf pneumonia are Pasteurella multocida (PM), Mannheimia haemolytica (MH) and Histophilus somni (HS) and Mycoplasma bovis. Meanwhile, Escherichia coli (HS), Trueperella pyogenes (TP) and Fusobacterium necrophorum (FN) are considered the main pathogens causing endometritis in cows. There is currently a lack of knowledge on the antibiotic resistances of these bacteria in Denmark, despite the need of such knowledge to guide effective antimicrobial therapy in the cattle farms.

The aim: to investigate the phenotypic antimicrobial resistance of bacterial pathogens associated with calf pneumonia and cow endometritis, and to determine the genetic antimicrobial resistance mechanisms in resistant isolates.

Methods and Results: In total 159 tracheal and 30 endometrial samples were collected in period from September 2016 to December 2017, and in period from October 2017 to January 2018, respectively and subjected to bacterial isolation on blood agar. Positive isolates identified by MALDI-TOF (PM=40, MH=25, HS=25, EC=15, TP=11) were subjected to antibiotic resistance testing using commercial sensititre BOP06F plates. Results were interpreted according to CLCI standards. This revealed that 49.0% of calf pneumonia associated pathogens were sensitive to all 19 tested antibiotics, 40.0% to one antibiotic, 8.9% to two antibiotics, and only 2.2% representing two PM isolates were characterized as multi drug resistant showing resistance to the members of four classes of antibiotics (aminoglycosides, tetracycline, macrolides and sulfonamides). In contrast to isolates from pneumonia, 92% of the tested EC and TP isolates from cow endometritis were resistant to more than two and up to ten antibiotics included in the test. Resistances to penicillin, gentamycin, clindamycin, danofloxacin, tetracycline, chlortetracycline and sulphadimethoxine were the most common among these isolates. Both horizontally transferred genes and chromosomally associated resistances were identified in whole genomes sequences of resistant isolates using ResFinder and CARD databases, however the genetic explanation of some resistances was not found, and thus requires a deeper analysis of the genomes.

Conclusion: We found low antibiotic resistance among the pathogens causing calf pneumonia and relatively high resistance of the pathogens causing cow endometritis in Denmark. The resistance mechanism for the majority of the isolates was identified and will be used for the development of resistance diagnostics tests and as guidance for improved antimicrobial therapy of these cattle diseases in the future.