Chapter 6
Antibiotic Resistance in the Veterinary Perspective: A Major Challenge in Achieving One Health

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ABSTRACT

Antibiotic resistance is an emerging threat to achieving one health all over the globe. The phenomenon leads to the emergence of drug-resistant microbes previously susceptible to an antibiotic. Drug-resistant microbes are the major reasons for medical complications like patient mortality and treatment failure. Unregulated use of antibiotics in animal husbandry is one of the major reasons for the emergence of antibiotic resistance. The resistance enters the human population mainly through the food chain. The genetic markers associated with drug resistance spread among different bacterial species by horizontal gene transfer mechanisms. Therefore, regulation of antibiotics use in animal husbandry and proper safety measures at farm level are necessary to check drug-resistant microbes entering the food chain. This chapter discusses the antibiotics, antibiotic resistance, genetic mechanisms involved, the spread of resistance, and also the available strategies to combat antimicrobial drug resistance.

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INTRODUCTION

Antimicrobial resistance is the worldwide topic of discussion in the recent decades similar to climatic change as it affects the human and animal well being despite the geography and the developmental status of the countries (Robinson et al., 2016). Antimicrobials can be called as ‘the magic bullets’ against pathogenic microbes infecting human beings and animals. Microbes use various survival strategies such as modification of the target site for action of antimicrobials, protection of the target site, production of deactivating enzymes, overexpression of efflux pumps to escape themselves from the antibiotics resulting in antimicrobial resistance (Munita & Arias, 2016). The increased and inappropriate antibiotic use has created selection pressure among the microbes resulting in emergence of multi-drug resistant (MDR) microbes. The isolation of Extended Spectrum Beta lactamases (ESBL) producing and carbapenam resistant Enterobacteriaceae, colistin resistant E.coli and livestock associated - Methicillin resistant Staphylococcus aureus (MRSA) from farm animals are few examples (Fischer et al., 2013; Liu et al., 2016 & Price et al., 2012). Infection with MDR microbes lead to complications such as treatment failure, morbidity and mortality in humans and in animals. Animal husbandry plays a little but inevitable role in transmission of drug resistance to humans. Use of antimicrobial growth promoters in farm animal production has been reported as a very crucial factor in antimicrobial resistance development. The animal-borne resistant bacteria can get transmitted to human through direct contact, consumption of animal products, food-borne infections and through environmental contamination (FAO, 2016). The drug resistance factors carried by bacteria can be transmitted both vertically and horizontally. Horizontal gene transfer involves transfer of resistance determinants through mobile genetic elements namely plasmids, transposons and phages between closely related or unrelated microbes, among pathogenic and commensal microbes. This mechanism were observed to be the reason of widespread and uncontrollable nature of drug resistance at a faster pace creating an alarming situation, worldwide (Amáible-Cuevas, 2012, Courvalin, 2008). Various epidemiological and molecular tools like Multilocus Sequence Typing (MLST) and Pulse Field Gel Electrophoresis (PFGE) and whole genome sequencing are used to track the source and spread of drug resistant microbes (Harbottle et al., 2006; Woolhouse et al., 2014). Creating awareness among various stakeholders, strengthening surveillance procedures to track the status of antimicrobial resistance, adopting policies to check antimicrobial usage and improved management practices at the farm level will help to address the AMR issue by every country (FAO, 2016).