# Antimicrobial Drug Resistance – A global concern

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Abstract

Antimicrobial drug resistance is a natural phenomena. It is exacerbated by under use and over use of antimicrobials. Microorganisms develop resistance by various mechanisms and resistant genes are incorporated to the organism and genetic transfer of resistance occurs. Infection caused by resistant microbes fails to respond to treatment and selection of resistant strains occurs. Veterinary antimicrobials also contribute to development of resistance in human. Antimicrobial drug residues after treatment of infectious diseases and with the use of antimicrobial growth promoters in animal pose greater risk of development of antimicrobial drug resistance in human beings. In order to prevent development of drug resistance proper withdrawal time for the food of animal origin should be followed. Removal selection pressure can cause reversion of resistant strains to susceptible. Indiscriminate use of antimicrobial agents should be avoided.

**Key words**: Antimicrobial, resistance, microorganism, drug residues, Growth promoters.

## Introduction

Antimicrobials are used in animals and humans to treat and prevent microbial infections. The use of these drugs combined with improvement in sanitation, housing and nutrition and advent of widespread immunisation programmes have led to a dramatic drop in death from diseases that were previously widespread, untreatable and frequently fatal. Indiscriminate use of antimicrobials, the emergence and spread of antimicrobial resistance is now threatening to undermine our ability to treat infectious diseases and save lives.

Antimicrobial resistance is a natural phenomena. It is difficult to predict how quickly resistance will develop as it depends on the type of antibiotic, type of bacteria, level of exposure to the antibiotic and ability of the resistant bacteria to survive and replicate. The antimicrobial drug resistance is exacerbated by several factors including abuse, under use or misuse of antimicrobials, poor patient compliance and poor quality of drug. Antimicrobial resistance makes it harder to eliminate infection from the body. Hence it is essential to learn about the potential danger of antibiotic resistance.

## Development of antibacterial drug resistance

During the growth of microorganisms they adapt to their environment. If anything stops from growing and spreading them they evolve new mechanisms to resist antimicrobials by changing their genetic structure. Bacterial resistance to antimicrobial agent may be due to failure of the drug to reach target or the drug may be inactivated by bacterial enzymes or the target site may be altered so that the antimicrobial agent cannot bind to it. The failure of the drug to reach the target site may be due to impermeability of the bacterial cell membrane that will prevent influx of the drug. Hydrophilic antibiotics are transported across the cell membrane via aqueous channels or pores made up of specific proteins called “porins”. Some bacteria are deficient in these channels and hence resistant to these antimicrobial agents. The transport mechanism of certain drugs are energy dependent and hence do not operate in an anaerobic environment. After reaching the target it must exert its action, which is either death or arrest the growth of the microorganism.

Methods of acquiring resistance by the microbes

Microbes acquire resistance which can be transferred to generation to generation or to the same generation mainly by four methods viz. mutation, conjugation, transduction, and transformation. Mutation is the stable and heritable genetic change that occurs spontaneously and randomly among microorganism. It is not induced antimicrobial agents. Conjugation occurs through sexual contact by formation of a bridge or sex pilus. It is the most common mechanism among gram negative bacilli. This method of resistance transfer is important because multiple drug resistance can be transferred by this method. Transduction is the transfer of gene carrying resistance through the agency of a bacteriophage. Transformation is the method in which resistant bacteria may release resistance carrying DNA in to the medium and this may be imbibed by another sensitive organism. A number of resistant genes have been associated with large

transferable extra chromosomal DNA element called plasmid which may be DNA mobile elements such as transposomes. These are responsible for rapid development of resistance. Resistance once acquired by way of the above mechanisms became prevalent due to selection pressure of a widely used antimicrobial agent.

**Consequence of drug resistance**

An inevitable side effect of the use of antibiotic is the emergence and dissemination of resistant bacteria. Infection caused by resistant microbes fails to respond to treatment resulting in prolonged illness finally leading to death. Close contact with these individuals results in spread of resistant strains making more individuals at a risk of severe illness. In veterinary practice this will lead to economic loss. Because once the antimicrobial drug is recognized as resistant, the clinician will switch over to another antimicrobial agent, which may pose financial burden to the farmers. Moreover it may increase the duration of treatment there by reducing the productivity of the animal.

**Factors that encourage spread of resistant**

There are several factors that contribute to the indiscriminate use of antimicrobials. The important factors are knowledge, expectation, and interaction of prescribers and patients, economic incentives and regulatory environment. Patient related factors are the major driving force of inappropriate antimicrobial use. For example many patients believe that new and expensive drugs are more efficacious than older agents. This leads to development of resistance against both new and old antimicrobials. Antimicrobial self medication is another major factor contributing to resistance. Self medicated antimicrobials may be unnecessary, inadequately dosed and may not contain adequate amount of active drug. Patient compliance with the recommended treatment is another problem. The patient may forget to take medication, interrupt the treatment when they feel better, unable to complete the full course of the treatment; all these factors create an ideal environment for microbes to develop resistance..

**Use of antimicrobials in veterinary medicine**

Antimicrobials are used in animals to treat and prevent bacterial infection and to improve production efficiency in food producing animals. In veterinary practices, in most cases, there may not be any facility to identify the most sensitive antimicrobial agent. Hence empirical therapy is mostly practised. There is an extensive use of antimicrobials in veterinary practice, which contribute much to the development of resistance in human beings by way of consumption of meat, milk and animal products. Moreover the use of antibiotic growth promoters (AMGP) in feed is a usual practice in case of meat producing animals. Food borne pathogens are also a concern in human being.

**Alternatives to antimicrobials in food animals**

Alternatives to antibiotics in food animal production include management practices that reduce likely hood of infections and also increase production efficacy. To slow the development of resistance, the antimicrobial use in feed should be restricted. Established steps to prevent and control infectious disease include improved husbandry practices, quarantine and other bio security measures and vaccination. Other measures include genetic selection to enhance disease resistance, use of antiseptics such as teat dipping to prevent mastitis, vector control and use of probiotics and other competitive organism to exclude pathogen. Moreover control of viral and other infection can reduce secondary bacterial infection, thus reducing need for antimicrobial therapy.

**Prevention of antimicrobial drug resistance**

The development of drug resistance can be prevented by discouraging indiscriminate, inadequate and unduly prolonged use of antimicrobial agents. This would minimize selection pressure and resistant strains will get less chance to get propagated. While selecting antibiotics for treatment, prefer rapidly acting specific narrow spectrum antimicrobial agents whenever possible. When prolonged therapy is indicated, a combination of antimicrobial agent may be tried. To safeguard public health, the selection and dissemination of resistant bacteria should be controlled. This can be achieved to some extend by reducing the amount of antibiotics used in animals. Another veterinary perspective is discontinuing the practice of routinely adding AMGP to animal feed.

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