

ANTIMICROBIAL STEWARDSHIP IN VETERINARY MEDICINE: IN NEED OF URGENT IMPLEMENTATION

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Antimicrobial resistance (AMR) has emerged as a major public health problem and is considered as one of the greatest threats to human and animal health. To prevent emergence and spread of health-care associated antimicrobial resistant organisms, formulation of strategies are quite essential of which antimicrobial stewardship remains most vital. 'Antimicrobial stewardship' can be defined as a 'coherent set of actions' which confirms effective therapeutic availability of antimicrobials during necessity. Formation of a national veterinary stewardship policy is required with species wise therapeutic guidelines, formulation of online and offline courses for veterinarians and para-veterinarians, monitoring of antibiotic use and surveillance of current antibiotic resistance pattern in animal/fish associated bacteria. Good stewardship practice (GSP) is collection of active and motivated exercises for judicious antimicrobial use. The GSP consists of '5R' i.e. responsibility, reduction, refinement, replacement and review. Indian Council of Agriculture Research in collaboration with FAO framed 'Indian network for fishery and animal antimicrobial resistance (INFAAR)', a national network of veterinary laboratories to generate data on antimicrobial resistance specific to livestock and fisheries.

Key words: Antimicrobial resistance, INFAAR, Stewardship, Veterinary medicine

By the mid-20th century discovery of antibacterial drugs resulted in to dramatic improvement in human and animal health, and productivity so much, so that scientists and planners entered in euphoria that bacterial diseases would be considered as historic events within a short time. However, that euphoria didn't exist long as bacteria

started adopting clever mechanisms and showing its manifestation of resistance against various newly developed drugs also. The resistance mechanisms pose a great threat to the health issues in both human and animals. Antimicrobial resistance (AMR) has now emerged as a major public health problem throughout the globe. The resistant

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bacteria causing different infections cannot be eliminated easily as limited therapeutic options exist that lead to prolonged illness, even death. Longer period of infectivity associated with treatment failure increases the chance of exposure of resistant microbes to the population. Emergence of multi-drug resistant microorganisms due to misuse and abuse of drugs created the situation more complex.

Possible way out to combat antimicrobial resistance

In 2006, Centre for disease control and prevention, CDC (USA) guideline stated that emergence of multi-drug resistance can be controlled in paying great attention to judicious antimicrobial use. Subsequently, in 2009 CDC launched 'Get smart for healthcare campaign' to promote improved use of antibiotic in in-patient settings. In 2015, the White House published the national plan for combating antibiotic-resistant bacteria with five main goals to – i) Curb antibiotic resistance, ii) Strengthen antimicrobial resistance surveillance, iii) Advance development of rapid diagnostics, iv) Accelerate research targeting novel therapeutics and v) collaborate with other countries to strengthen prevention, development and surveillance efforts (Antimicrobial Stewardship Programme Guideline, Indian Council of Medical Research, 2018).

As per World Health Organization (WHO) antimicrobial resistance is one of the greatest threats to human health, whereas about 50% of antimicrobial use has been found to be inappropriate. Hence, to prevent emergence and spread of health-care associated antimicrobial resistant organisms,

formulation of strategies are essential. Successive implementation of the effective strategies encompasses a) effective clinical antimicrobial stewardship, b) meticulous hand hygiene and c) surveillance and monitoring of antimicrobial resistance, especially multidrug resistant (MDR) organisms. Antimicrobial stewardship includes the evidence based education of physicians about appropriate drug, dose, dosing interval and duration. De-escalation and optimizing campaigns should be taken to educate and inform the public about the specific indications for antibiotic use, origin and spread of antimicrobial resistance and what needs to be done to control it (Antimicrobial Stewardship Programme Guideline, Indian Council of Medical Research, 2018).

Definition and utility of antimicrobial stewardship

'Antimicrobial stewardship' can be defined as a 'coherent set of actions' which confirms effective therapeutic availability of antimicrobials during necessity (Dyar *et al.*, 2017). The 'coherent set of actions' incorporates the therapeutical knowhow i.e. selection, dose, route of administration and duration of antibiotics to a concept of responsibility (Goff, 2011). This coordinated intervention is designed to improve and measure the appropriate use of antimicrobial agents by promoting the selection of optimal antimicrobial drug regimen including dosing, duration of therapy and route of administration as per the Infectious Diseases of America (IDSA), the Society for Healthcare Epidemiology of America (SHEA) and the Pediatric Infectious Diseases Society (PIDS) (Fishman, 2012).

The aim of the stewardship programme includes an approach to judicious antibiotic use in patients minimizing the toxicity and suitable conditions for the generation of resistant bacteria. It also encompasses a Government initiated multifaceted approach including policies, guidelines, surveillance of resistant organisms, mass awareness campaign and audit of practice.

The goal of antimicrobial stewardship is 3-fold. The first goal is to work with health care practitioners to help each patient receive the most appropriate antimicrobial with the correct dose and duration. The Optimal antimicrobial therapy rests upon 4D's, viz. right drug, right dose, de-escalation to pathogen-directed therapy and right duration of therapy (Joseph and Rodvold, 2008). The second goal is to prevent antimicrobial overuse, misuse and abuse. The third goal is to minimize the development of resistance (Doron and Davidson, 2011).

Implementation of stewardship program in veterinary medicine can decrease the occurrence of resistance, antibiotic associated adverse effects and treatment costs besides improving clinical success as observed in human studies (Deuster *et al.*, 2010; Toth *et al.*, 2010; Davey *et al.*, 2013).

Strategy

Formation of a national veterinary stewardship policy is required with species wise therapeutic guidelines, formulation of online and offline courses for veterinarians (may be under continuing veterinary education program) and paraveterinarians, monitoring of antibiotic use and surveillance of current antibiotic resistance pattern in

animal/fish associated bacteria (Hardefeldt *et al.*, 2018). The stewardship intervention in animal/fishery sector is difficult to implement due to insufficient numbers of veterinarians or fishery officers, limited access to education and training, limited communication between academic and community veterinarians/fishery officers, restricted diagnostic tools and laboratory support, competition between veterinary practitioners, and sales of antibiotics without consultation and prescription. Even in developed countries such as in United States little laboratory support is available for stewardship program and data of antibiotic consumption for companion and food animals is not available (Grayzel *et al.*, 2015). In US antimicrobial stewardship is considered as a threat to meat industry in the forms of affordability of meat, consistency of supply chain, and profits (D'Angeli *et al.*, 2016).

Good stewardship practice (GSP)

Good stewardship practice (GSP) is collection of active and motivated exercises for judicious antimicrobial use (Prescott and Boerlin, 2016). The GSP consists of '5R' i.e. responsibility, reduction, refinement, replacement and review. In veterinary practices, 'responsibility' is a mutual approach between the practitioner with the selection of a proper antibiotic and the owner by following the instructions for proper use of the antibiotic and other management practices (Page *et al.*, 2014). 'Reduction' is defined as improvement of biosecurity strategy, use of vaccine, providing balanced feed, maintenance of proper hygiene, selection of genetically disease resistant flock which can minimize the infectious diseases and subsequent use of antibiotics (Swaggerty

et al., 2014; Murphy *et al.*, 2017). Introduction of biosecurity practices among the backyard poultry farmers in West Bengal reduced the infection rate in birds and improved the egg production (Samanta *et al.*, 2015, 2018). 'Refinement' is the accurate diagnosis of an infection of bacterial origin followed by prescription of the appropriate drug in proper dose, and route, and for the exact period. 'Replacement' is the use of alternative approach in place of antibiotics if sufficient evidence is there for efficacy and safety. The alternative approach in livestock and poultry includes use of probiotics, prebiotics, synbiotics, bacteriophages, essential oils, antimicrobial peptides, immunoglobulins, spray dried immune plasma, teat sealing paste during dry period and artificial bovine cytokines (Torrallardona, 2009; Ghosh *et al.*, 2012; Gadde *et al.*, 2015; Chowdhury *et al.*, 2018). 'Review' is a continuous process of evaluation for all the interventions taken. Progress is measured for each objective with the available data associated with antibiotic consumption in food or companion animals, correlation between the consumption and resistance pattern in the bacteria, quality of antibiotics used, control of infectious diseases, and moreover, improvement of each intervention (Dunn and Dunn, 2012; Kallen and Prins, 2017). The example of GSP was detected in Netherlands which reported 58% decrease in antibiotic sales in animal sector during 2009-15 and it was associated with reduced

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- Guidelines to minimize antimicrobial resistance**
- In India, Prevention of Food Adulteration Rules, 1955-part XVIII prescribed limit for antibiotics to be used in fisheries. Food safety and standards authority of India (FSSAI) has framed the regulations to ban the use of certain antibiotics and pharmacologically active substances in fisheries (NAP-AMR, 2017-21). Indian Council of Agriculture Research (ICAR) in collaboration with FAO framed a national network of veterinary laboratories to generate data on antimicrobial resistance specific to livestock and fisheries. The network is known as 'Indian network for fishery and animal antimicrobial resistance (INFAAR)'. Currently, the network has 21 members from ICAR institutions and agricultural/veterinary Universities. Based on the data generated out of INFAAR activities it is hoped that successful strategies like antimicrobial stewardship in veterinary medicine will be given a shape for Indian perspective to address and mitigate the AMR issues in future.
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