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EC PHARMACOLOGY AND TOXICOLOGY
Opinion

Microbial Terrorism: Need for Call to Action in Livestock

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Received: August 07, 2017; **Published:** September 06, 2017

In the 18th century of the world history, scientists discovered the potent miracle drug "antibiotics" which saved millions of lives. On the contrary, we are at the threshold of an era where bacterial infections might no longer be successfully treated with currently available antibiotics. We are now facing a dramatic challenge where microorganisms are becoming extremely resistant to existing antibiotics and research in development of new antibiotic molecule is getting dry. This depreciation is because it is intrinsically difficult to find new antibiotics with novel mechanisms of action and a high cost/benefit and risk/benefit ratio (length of development, low selling prices, and short treatments) discourage big pharmaceutical companies from investment. Furthermore, the drug firms around the globe are now minimizing their research budgets to survive and sustain in the industry, which is the major reason of drug pipeline running almost dry today.

Therefore, antibiotic resistance has been called one of the world's most demanding public health problems. Today, every continent and country face the menace of antibiotic resistant 'super bug,' though the extent and the severity of the problem varies.

Although the majority of antibiotic use occurs in agricultural settings, relatively little attention has been paid to how antibiotic use in farm animals contributes to the overall problem of antibiotic resistance as pathogenic-resistant organisms propagated in these livestock are poised to enter the food supply and could be widely disseminated in food products. Commensal bacteria found in livestock are frequently present in fresh meat products and may serve as reservoirs for resistant genes that could potentially be transferred to pathogenic organisms in humans. As these resistant genes and ultimately bacteria getting disseminated in human and livestock population through food chain, we now face a dramatic challenge resulting from two combined problems. First, microorganisms are becoming extremely resistant to existing antibiotics, second, no new antibiotic research class is being developed and antibiotic pipeline has become extremely dry. This depreciation is because it is intrinsically difficult to find new antibiotics with novel mechanisms of action and a high cost/benefit and risk/benefit ratio (length of development, low selling prices, and short treatments) discourage big pharmaceutical companies from investment.

The practices of treating all animals in a group if one falls ill (metaphylaxis) and of treating animals when they are exposed to conditions that make them likely to fall ill (prophylaxis) increases the amount of antimicrobials used and as such would encourage resistance. However, if only treating sick animals results in more serious and frequent illnesses, prophylaxis and metaphylaxis may reduce the total amount of antimicrobial used.

In order to search for an alternative solution to the chronic problem of AMR, it is important that Pharma companies and research centres should take up R and D at a much higher pace and a greater level. Central and State governments should support and allocate budgets to support projects on AMR. There are very few pharmaceutical industries(less than 5 in India) who are focusing their research plans to combat AMR. Antibiotics solely can never be a solution for superbugs and thus, scientists are exploring novel therapeutic approaches. Various alternative strategies under development are plasmid containing engineered DNA to destroy genes of pathogens, antimicrobial peptides like protegrins, defensins, immunotherapy with cytokines, etc but research in these fields is a long way to go. Researchers have also explored various nanosized carriers as drug delivery systems for antibiotics which have shown proven effectiveness against antibi-

otic-resistant bacteria but this research is yet to be tested clinically for its impact on resistant clinical isolates. European society has also launched its strategies by considering AMR as national threat. However, there is no functioning national antibiotic policy or a national policy to contain antimicrobial resistance (AMR) in India. 'The Chennai Declaration: A roadmap to tackle the challenge of antimicrobial resistance' published in the latest edition of *Indian Journal of Cancer* has recommended that an Infection Control Team (ICT) be made mandatory in all hospitals, however, the issue of antimicrobial use in veterinary or agricultural settings is still unanswered.

AMR has snowballed to a serious public health concern with economic, social and political implications. The problem of changing resistance patterns will remain an ongoing threat for both developed and developing countries. Resistance to some agents can be overcome by modifying the dosage regimens (e.g., using high-dose therapy) or inhibiting the resistance mechanism (e.g., beta-lactamase inhibitors), whereas other mechanisms of resistance can only be overcome by using an agent from a different class. Understanding of the mechanisms of action of various agents can help clinicians to identify the agents that will increase the likelihood of achieving optimal outcomes. However, large number of commercial preparations, unethical drug promotions by pharmaceutical houses and irrational use of broad spectrum antibiotics as empiric therapy by clinicians are the important reasons for irrational prescription and rising AMR in clinical practice. Thus, it is highly recommended that practicing physicians should become aware of the magnitude of existing problem of AMR and help in fighting this deadly threat by rational prescribing. For this all institutions big or small should join hands and compile data of resistance. This will help the medical and veterinary fraternity to draft more effective infection control and Antibiotic stewardship programmes in their respective hospitals and can be an effective tool in controlling AMR menace.

Volume 4 Issue 3 September 2017