



ANTIBIOTIC RESISTANCE: CAUSES, CONSEQUENCES, PREVENTION AND CONTROL

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ABSTRACT

Antibiotics are natural products of microorganisms or an equivalent product produced wholly or partially by chemical synthesis required in low concentration. From last 60 years it has worked as a wonder drug to treat various infections. But the use of this drug has decreased due to antibiotic resistance i.e. drug loses its ability to inhibit growth or kill microorganisms effectively. This article emphasizes on various factors contributing towards antibiotic resistance, its consequences and measures that can be taken to control it. The factors contributing to antibiotic resistance include overuse, misuse and underuse of antibiotics. If we wish to continue this wonder drug we urgently need to change the way world uses and prescribes antibiotics otherwise we are heading towards a post-antibiotic era. To overcome the problem of antibiotic resistance we should be committed to take a broad, coordinated approach of multiple sectors human health, animal health and agriculture.

Key words: Resistance, Antibiotic, microorganisms, infections

Introduction

Antibiotics are natural products of microorganisms or an equivalent product produced wholly or partially by chemical synthesis required in low concentration to inhibit the growth or kill microorganisms (Walsh, 2003). Antibiotics are used to treat bacterial and fungal infections (Brooks *et al.*, 2004). In past 60 years antibiotics have played a crucial role in the fight against infectious diseases. This had led to increase in life expectancy due to antimicrobial use. If used properly, antibiotics can save lives. But the use of these wonder drugs has been hampered by the rapid appearance of resistance. Antibiotic resistance occurs when a drug loses its ability to inhibit growth effectively (Levy *et al.*, 2007). Bacteria become resistant and replicate in the presence of antibiotics by developing new genes. Such bacteria are called resistant bacteria and this type of resistance is called acquired resistance.

Causes of Antibiotic Resistance

An extensive range of physiological and biochemical mechanisms are responsible for antimicrobial resistance. Resistance genes can arise by spontaneous mutations in microbial DNA or by natural selection process in the presence of antimicrobials. It can also be transferred from drug resistant microbes to drug sensitive ones (Levy

and Engl, 1993). This change helps to resist the effects of an antibiotics to some extent antibiotic

resistance occurs in a natural way, but misuse, of antibiotics in humans and animals is accelerating the process (Chopra *et al.*, 2002). The cause for antibiotic resistance is overuse, misuse and indiscriminate use of antimicrobials by doctors, nurses and pharmacists and its use in animal husbandry and agriculture. Almost 70-80% of prescriptions are advised unnecessarily by health professionals. Antibiotics do not fight infections caused by viruses, such as common cold, flu, etc. It can cause you more harm than good and further adds to antibiotic resistance. Agriculture sector gives antibiotics to animals for growth promotion or to prevent diseases in healthy animals (Zaman *et al.*, 2017). These antibiotics enter our food chains and contribute towards antibiotic resistance. Antibiotics can be bought for human or animal use without a prescription, and thereby emergence and spread of resistance is made worse. Ready availability of antibiotics over -the-counter and promotion schemes by pharmaceutical manufacturers also leads to promotion of indiscriminate use, thus, increasing the chances of developing resistance. Counterfeit drugs contain the wrong ingredient, or lesser amount of active ingredient also contributes to resistance. In countries without standard treatment guidelines, antibiotics are often over- prescribed by health workers and veterinarians and over-used by public (McDowen and Fedorka, 2002). One should also

be careful when we take antibiotics we should not stop treatment too soon as some bacteria may survive and cause infection again. Each time when

antibiotic is taken sensitive bacteria are killed and resistant bacteria grow and multiply. Thereby increasing population of resistant bacteria (Woodhead and Finch, 2007). Another factor contributing to antibiotic resistance is improper diagnosis also contributes to resistance as there are less number of adequately equipped laboratories. Thereby a physician prescribes antibiotics empirically. At times a patient receives a wrong antibiotic and thereby contributing towards resistance. Certain non antibiotic antimicrobials (NAAM) chemicals can also directly induce antibiotic resistance. These chemicals in large quantities in everyday life can lead to multidrug resistance.

Consequences of Antibiotic Resistance

Approximately 700,000 people a year are dying from antibiotic resistance and thus it has become a major health problem and responsible for life threatening infections. It can affect anyone, in any country and at any age. Antibiotic resistance is most obvious in bacterial infections contributing most to human mortality and morbidity e.g. respiratory infections, diarrhoeal diseases, meningitis, sexually transmitted diseases and hospital acquired infections. Certain resistant species include multi-resistant *Mycobacterium tuberculosis*, multi-resistant-*Salmonella Typhi*, penicillin-resistant *Streptococcus pneumoniae*. These microorganisms with resistance genes are known as superbugs (Lipp *et al.*, 2002). Some new antibiotics are in development but are not effective against the most resistant bacteria. Thus more expensive medicines must be used for treatment that increases health care costs as well as medicines increase economic burden on families and societies. Antibiotic resistance works as a major threat to global health, food security and development today. Pharmaceutical industries have limited interest in production of new antibiotics as within no time it becomes ineffective and make them non-profitable as compared to drugs for lifestyle related ailments. The pipeline for new drugs is drying out and putting achievements of modern medicine at risk.

Organ transplantation, surgeries such as caesarean operations and chemotherapy without effective antibiotics become dangerous.

Prevention and Control

If we wish to continue this wonder drug we urgently need to change the way world uses and prescribes antibiotics otherwise we are heading towards a post-antibiotic era in which common injuries can once again kill us. Antimicrobial resistance is a natural phenomenon and this process is accelerated by human activities. Without behavioural change antibiotic resistance remains a major threat as antibiotic resistance is accelerated by misuse and overuse of antibiotics as well as poor hygiene. Behavioural changes must also include actions to reduce spread of infections through vaccination, hand washing and good food hygiene as it has been rightly said prevention is better than cure (Keller and Stiehem, 2000). Various measures can be taken at all levels of society to reduce impact and reduce spread of resistance. One of the measures that can be taken to prevent and control spread of antibiotic resistance by using antibiotics when prescribed by a certified health professional. The health professional should ensure that it should be prescribed and dispensed when they are required according to current guidelines. They should report antibiotic –resistant infections to surveillance teams. Other measures include to prepare food hygienically and consume foods that have been produced without the use of antibiotics for growth promotion or disease prevention in healthy animals like chicken, honey, etc. Agriculture sector should promote and apply good practices at all stages of production and processing of foods from animal and plant sources. New antimicrobials should be prepared by non profit making organisations. Other methods of disease prevention like vaccination should be used to reduce use of antibiotics for example effective method to treat pathogenic bacterial infections is phage therapy (Monk *et al.*, 2017). To overcome the problem of antibiotic resistance we should be committed to take a broad, coordinated approach of multiple sectors human health, animal health and agriculture. There should be a national action plan to fight against antibiotic resistance. There should be proper surveillance teams to check for

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antibiotic resistance infections. Policies should be strengthened for implementation of programmes to regulate and promote the appropriate use and disposal of antibiotics as the knowledge regarding antibiotic resistance is scarce. Last but not the least another important factor that can help to overcome this problem is that if we increase intake of immuneboosters that help to strengthen our immune system. The cause of infection is that our immune system is weak. If we are able to take natural immunobooster as part of diet our chances of getting infected can be reduced. Some of the immunboosters include probiotics, oats, Vitamin E rich foods: nuts and oils, sweet potato and raw spinach, beta-carotene rich vegetables such as carrots, mushrooms, omega-3 fatty acids rich foods (Hoskinson *et al.*, 1992)

Conclusion

This article emphasised on optimal use of antibiotics in human and animal health that would automatically decrease the rate of development of antibiotic resistance. To stop overuse and misuse of antibiotics domestic and global policies need to be implemented and adhered to. Research should be on new antimicrobials and its alternatives should be carried with the help of non profit organisations. Last of all a healthy life style will help to strengthen immune system and the chances of getting infected would automatically be reduced.

References

Brooks GF, Butel JS and Morse SA.(2004). Jawetz, Melnick, and Adelberg's Medical Microbiology, 23rd Edition. Mc Graw Hill Companies, Singapore.

Chopra R, Alderborn G and Podczek F. (2002). The influence of pellet shape and surface properties on the drug release from uncoated and coated pellets. *International Journal of Pharmacology* 239:171-178.

Hoskinson CD, Chew BP and Wong TS (1992). Effects of injectable β -carotene and vitamin A on lymphocyte proliferation and polymorphonuclear neutrophil function in piglets. *Biological Neonate*.62:325-336.

McEwen SA and Fedorka-Cray PJ (2002). Antibiotics use and resistance in animals. *Clinical Infection and Disease*.34:93-106.

Monk BJ, Herzog TJ and Kaye SB. 2017. Trabectedin plus pegylated liposomal doxorubicin in recurrent ovarian cancer. *Journal of Clinical Oncology*. 28: 3107-3114.

Keller MA and Stiehm ER (2000). Passive immunity in prevention and treatment of infectious diseases. *Clin. Microbiol. Rev.* 13: 602–614.

Levy SB and Engl N (1993). The antimicrobial paradox. How miracle drugs are destroying the miracle. *Journal of Medicine* 328:1792

Levy SB, Chadwick DJ, Goode J and Chichester, UK (2007). Antibiotic Resistance: Antibiotic Resistance: An Ecological Imbalance, in Ciba Foundation Symposium 207- antibiotic Resistance: Origins, Evolution, Selection and Spread. *Clinical Microbiology Review* 13: 602-614.

Lipp EK, Huq A and Colwell RR (2002). Effects of global climate on infectious disease: the cholera model. *Clin Microbiol Rev.*15(4):757-70.

Walsh C (2003). Antibiotics: actions, origins, resistance. 1st Ed.ASM Press, Washington, DC.345.

Woodhead, M. and Finch, R (2007). *Journal of Antimicrobial Chemotherapy*.60(1): i53-5

Zaman SB, Hossain N and Ahammed S (2017). Contexts and oppurtunities of e-health technology in medical care. *Journal of Medical Research and Innovation* (1): 1-4.