Emerging Threat of Antimicrobial Resistant Superbugs

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Fighting pathogenic organism had been the main objective to treat infections since ancient times. Moulds and other plants had been used to treat infections by Greeks and Indians. Similarly mouldy bread had been used for treating wound and infection in Greece and Serbia. Russians peasants used to cure wounds by using warm soil. Turtle shells and snake shell soups, mixed with bear had been in use for patients cure by Sumerian doctors. Ophthalmic infections, sued to be healed by Babylonian doctors using sour milk mixed with frog bile. Oil cake (sweetmeat) had also been in use, both as desiccant and antibacterial in Sri Lankan army[1]. All this practice leads to the innovation of antibiotics[1].

Antibiotics are drugs/ agents fighting against infections caused by microbes. These agents either kill or inhibit the growth of pathogenic organisms. The first known antibiotic penicillin was discovered by Alexander Fleming in 1927. With the innovative use of antibiotics in 1940s, recovery from infective diseases and rates of deaths has been dramatically reduced in medical care[2]. The term "antimicrobial agent" is referred to natural as well as synthetic compounds. The word "antibiotic" is also used to refer to both. Though, antibiotics have numerous beneficial effects, but their frequent use has led to the emergence of antibiotic resistance. Anti-microbial resistance is the characteristics of microbes, resisting the action of an antibiotic. Reducing or eliminating the effectiveness of drug by acquiring a change of bacteria, leads to resistance of the organisms towards antimicrobial drugs, designed for treating or prevention of infections. The bacteria keep on surviving and continue to proliferate causing to be more dangerous and threatening.

The emerging trend of frequently wide scale use of anti-microbial in humans, animals and agriculture is believed to be the major cause of emergence of antimicrobial resistant pathogens and hence their spread globally. Antibiotic resistance is being considered to be a highly pressing public health issue. It is feared that almost every type of bacteria has become stronger and less responsive to antibiotic treatment. Bacteria, resistant to antibiotics can immediately spread to healthy members of a family, schoolmates, and co-workers. This cause to threaten the community with a strange strain of infectious disease, that becomes difficult to cure and more expensive to treat. Antibiotic resistance can cause significant danger and suffering for pediatric and geriatric community who are susceptible to common infections. It is a common misconception that a person's body becomes resistant to specific drugs. Whereas the reality is that, microbes, become resistant to the drugs, not the humans.

Resistance to an antibiotic is noted when a microorganism changes in a way that reduces or eliminates the effectiveness of antibiotic agent. The organism, thus modified, keeps on surviving continue its reproduce leading to severe harm. An organism may acquire this ability through several mechanisms. Some bacteria may develop the ability of neutralizing the antibiotic before its action. Others can pump the antibiotic rapidly out. Whereas some can cause to change the antibiotic attack site so it cannot affect the function of the bacteria[3].

During the course of antibiotic therapy, sometimes a bacterial strain survives because of having the capability to either neutralize or can escape the action of the antibiotic. Bacteria can neutralize the effect of an antibiotic by the following means.

1. By producing enzymes or proteins that can alter or destroy the antibiotics.
2. By developing new cellular mechanism that avoid using the antibiotic's target.
3. By restricting access through changing or limiting the entryways.

A resistant microbe have the ability to increase in number rapidly and to replace those bacteria which were killed, due to its higher rate of reproduction. Frequent exposure to antibiotics increases the pressure of making the strains resistant. Moreover, bacteria that were susceptible, may develop resistance by genetic mutation or by incorporation of pieces of DNA

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from other organisms that codes to cause resistance. The DNA coding to resist may easily transfer as single transferable material. Thus a bacteria can acquire resistance to many antimicrobial agents because of getting one piece of DNA. Resistance traits can be inherited generation to generation. They can also pass directly from germ to germ by way of mobile genetic elements. Plasmids are circular DNA that act as mobile genetic elements, that can move between cells. Transposons are the small pieces of DNA that can get incorporated into DNA of a cell, causing an overall change of genomic material. These can move from chromosomes to plasmids and back. Phages viruses that attack germs carry DNA to vector, leading to change the genetic make up[4]. The three common mode of transferring genetic material from one germ to another are:

A) Transduction. Resistance causing DNA can be transferred from one organism to another via phages.
B) Conjugation. Contac of these organisms with each other may also lead to Transfer of genetic material.
C) Transformation. Microorganism can pick up a resistant DNA piece from nearby live or dead microbes.

If an organism develops resistance to many drugs, then it becomes difficult, rather impossible to treat the infections, caused by that particular microbe. A person with resistant strain infection can pass it to another person. Thus, a hard-to-treat illness can be spread easily. In some cases, the illness can lead to serious disability or even death[5].

Repeated and improper uses of antibiotics are primary causes of the increase in drug-resistant bacteria[6]. Increase in the use of antibiotic increases the chances of development of antibiotic-resistant bacteria. Every time a an antibiotic use can kill sensitive bacteria, but resistant organisms may be left, which grow and multiply rapidly..

Health experts are of the opinion that it is high time to formulate ways to make awareness among all health partners, students, public and the media.

Pakistan Institute of Medical Sciences (PIMS) and National Institute of Health (NIH), observed 'World Antibiotic Awareness Week' from November 13-19. The key objectives of the event were to improve awareness and understanding of antimicrobial resistance through effective communication, education and training. It was highlighted, that Pakistan too is facing the rising problem of anti-microbial resistance. It is mainly because of the inappropriate use with associated higher morbidity, mortality and costs.

A global action plan to tackle Antimicrobial resistance, was jointly endorsed by participants of the World Health Assembly in Geneva in its 68th session on May 2015. They agreed to develop a national action plan through joint and collaborative efforts of all the stakeholders adopting one health approach. National institute of health, Islamabad, under the auspices of the Ministry of National Health Services keeps on encouraging all health partners, students, public and the media to join hands and to keep on the activities in order to create antibiotic resistance awareness in the general public. The theme for this year is “Seek advice from a qualified healthcare professional before taking antibiotics”. During a weeklong activities awareness material was distributed for human and animal health sectors. Seminars and awareness walks, among others were included. Such type of awareness activities is need of the hour to educate the health care providers and the masses, before we are left with no choice.

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