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Antimicrobial Resistance: Alarming Universal Concern

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Antibiotics are drugs used to treat bacterial infections. Antibiotics and similar drugs, together called antimicrobial agents, have been used for the last 70 years to treat infectious diseases. Since the 1940s, these drugs have greatly reduced illness and death from infectious diseases. Originally, an antibiotic is a substance produced by one microorganism that selectively inhibits the growth of another. Synthetic antibiotics, usually chemically related to natural antibiotics, have since been produced that accomplish comparable tasks. However, these drugs have been used so haphazardly and for so long that the infectious organisms the antibiotics are designed to kill have adapted to them, making the drugs less effective. Today, the evolution of antibiotic resistance by important pathogens has rendered these original antibiotics and most of their successors largely ineffective, and if replacements are not found, the golden age of antibiotics will soon come to an end [1].

Selman Waksman first used the word antibiotic as a noun in 1941 to describe any small molecule made by a microbe that antagonizes the growth of other microbes. The history of antibiotic breakthrough happened from Arsphenamine also known as Salvarsan in 1911 to ceftazidime/avibactam in 2015. In 1926, Alexander Fleming discovered penicillin, a substance produced by fungi that appeared able to inhibit bacterial growth. In 1939, Edward Chain and Howard Florey further studied penicillin and later carried out trials of penicillin on humans (with what were deemed fatal bacterial infections). Fleming, Florey and Chain shared the Nobel Prize in 1945 for their work which ushered in the era of antibiotics.

Superbugs

Bacteria carrying genes that allow them to survive exposure to the antibiotics that are currently used are called superbugs. This means that infections caused by these bacteria are harder to treat, although they are not necessarily more severe or infectious. The concerning fact is that the gene that carries antibiotic resistance can be passed between bacteria, allowing for the creation of bacteria that carry resistance genes to many different antibiotics, a superbug.eg. Methicillin resistant Staphylococcus aureus (MRSA), NDM-1 strain.

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Antibiotic resistance

Antibiotics strictly target bacteria, but it is sometimes difficult to differentiate between viral and bacterial infections without costly tests. It is often less time-consuming and more cost effective to proactively prescribe antibiotics, rather than take precautions and prescribe only the correct treatment. Antibiotic resistance occurs when bacteria change in response to the use of these medicines by either enzymatic destruction/modification or altered target or decreased uptake etc., Antibiotic resistance is rising to dangerously high levels in all parts of the world. New resistance mechanisms are emerging and spreading globally, threatening our ability to treat common infectious diseases [2].

Reasons for development of antibiotic resistance

The use of antibiotics has saved millions of lives, but its pervasive use to treat any infection, whether serious, minor, or even viral has leads to the increase in antibiotic resistance. Another issue with antibiotics is the inability to monitor patient intake. Antibiotic dosages are designed to eradicate entire populations of the pathogens. When antibiotics are not taken for the entire prescribed course, pathogenic bacteria can adapt to the presence of low dose antibiotics, and eventually form a population that is completely resistant to the antibiotic regardless of the dosage [3].

Antibiotic usage is also not exclusive to humans. Everyday, antibiotics are used to treat livestock and fish to prevent infections. Similar to overuse in humans, uncontrolled use of antibiotics creates a reservoir of bacteria that could become resistant, thus rendering the antibiotic useless. As a result of cities becoming more densely populated, people are exposed to more pathogens all the time. Hospitals and clinics are seeing more and more patients with infections, and it is not always possible to curb the spread of a pathogen in a population. Identification, isolation or treatments of all infectious diseases are not often feasible, resulting in the addition of more pathogens to the local community [4]. Lack of hygiene and poor sanitation in urban centers become an ideal breeding ground for bacteria. Concisely the following reasons are attributed for the development of antibiotic resistance:

- Over-prescription of antibiotics
- Patients not finishing the entire antibiotic course
- Overuse of antibiotics in livestock and fish farming
- Poor infection control in health care settings
- Poor hygiene and sanitation
- Absence of new antibiotics being discovered

Approaches to prevent and control the spread of antibiotic resistance:

- Antibiotics should be administered to animals under the veterinary supervision
- Antibiotics should not be used for growth promotion or to prevent diseases.
- Vaccinate animals to reduce the need for antibiotics and use alternatives to antibiotics when available.
- Follow and promote good practices at all steps of production and processing of foods from animal and plant sources.
- Improve biosecurity on farms and prevent infections through improved hygiene and animal welfare.

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