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CAUSES AND COMPLICATIONS OF ANTIBIOTIC (ANTIBACTERIAL) RESISTANCE

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ABSTRACT

An antibiotic is a medicine that kills bacteria or prevents their growth. Antimicrobial resistanceoccurs when bacteria change over time and do not respond to drugs; this makes the infection more difficult to treat and increases the risk of infection, serious illness, and death. Over the years, infections have devolved and some infections are difficult to treat due to the resistance developed by these bacteria. Antibiotics are specific to the type of infection they treat.They are not interchangeable from one disease to another. Antibiotics are generally safe and have few side effects when used incorrectly. Doctors can evaluate each patient individually to determine the correct antibiotic, dose, and duration of treatment. The discovery of antibiotics and related drugs in the 19th century reduced the threat from infectious diseases. Diseases caused by the immune system (immune compromised) are resistantto treatment, causing long-term illness and an increased risk of death. Not only developing countries are facing problem of drug resistance, but also developed countries are facing the consequences of anti-bacterial drugs resistance. Developed countries are affected due to vas population. Failure to develop effective vaccine to the disease and treat it in early stage may cause the infection to persist for a long time.

1. INTRODUCTION

The first antibiotic, penicillin (discovered by Sir Alexander Fleming in 1928), was able to effectively treat bacterial infections, especially those caused by Staphylococcus and Streptococcus, without harming the host. Antibiotics first became difficult shortly after penicillin became widely resistance in the 1940s. Currently, more than 95% of S. aureus strains worldwide are resistant to penicillin. The first response to penicillin resistance was the development of methicillin, semisynthetic penicillin.

In the late 1940s and early 1950s, the discovery and introduction of broad-spectrum antibiotics such as streptomycin, chloramphenicol, and tetracycline ushered in the era of antibiotic therapy. This antibiotic is effective against all types of bacteria, including Gram-positive and Gram- negative bacteria, enteric bacteria, and Mycobacterium tuberculosis. Synthetic antibacterial drugs such as sulfonamides (sulfonamides) and antibiotics such as para-aminosalicylic acid (PAS) and isoniazid (INH) are also increasingly used.However, after the 1953 Shigella epidemic in Japan, several strains of Shigella dysenteriae resistant to chloramphenicol, tetracycline, streptomycin, and sulfonamides were isolated. By the late 1980s, even methicillin-resistant Staphylococcus aureus had become widespread in many hospitals and difficult to treat. Until recently, vanillin was a reliable drug in the treatment of infections caused by many enterococci, but vanillin declined to emerge in the mid-1980s.

A study by Gaynes shows that vanithromycin resistance increased more than 20-fold from 1989 to 1995. Antibiotic resistance in another community-acquired pathogen, Neisseria gonorrhoeae, has also changed dramatically. For a number of years, Penicillins were the drug of choice to treat Gonorrheae but in 1976, the plasmid mediated Beta lactamase of E.coli was found in Neisseria Gonorrhoeae isolates in Africa and Asia. Development of antibiotic resistance was first reported in animal models in 1940s and subjectively reported among patients in the 1970s. Today drug resistant strains of Mycobacterium tuberculosis are threatening to outbreak in one of the world's most prevalent infectious diseases. Without antibiotics, some medical procedures such as organ transplants, chemotherapy, and surgery are risky, so antibiotic is the best means of treating bacterial infection by not disturbingorgans physically and reduce risk of surgery and chemotherapy treatments, therefore treating infections and minor injuries requires more than antibiotics. However, without widely used antibiotics, more expensive medications, longer treatment times,and longer hospital stays can lead to high medical and care costs, ultimately leading to life- threatening injuries. The advent of vaccines has led the world to consider how this can be prevented. More research is needed to ensure immediate solutions to drug resistance are found. How does antibiotic resistance develop? Answer, Antibiotics are often associated with overuse, misuse, and failure to develop new drugs by the pharmaceutical industry due to reduced financialsupport and regulation.When antibiotics used correctly, they can save lives. But resistance against antibiotics are agrowing problem. This happens when bacteria mutate and become resistant to antibiotics.Bacteria can continue to multiply and multiply. Every time you take antibiotics, there is a risk ofbacteria becoming resistant.Resistant infections

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can be difficult and sometimes impossible to treat. They can spread to other people. Methicillin-resistant Staphylococcus aureus (MRSA) is one example.According to the World Health Organization (WHO) 2019 report, antibiotics are responsible for700,000 deaths; this number is expected to rise to 20 million by 2050 and costs more than $2.9 trillion.

Therefore, it has become a big problem, a big threat to our life and work.Some pharmaceutical companies have stopped researching antibiotics and developing new antibiotics due to unlimited change in structure and composition of some bacteria. Despite unfortunate circumstances, many new technologies have the power to make things better. Thereis also a lot of research that will help discover and develop new antibiotics.

2. REASONS BEHIND ANTIBIOTIC RESISTANCE

1. Genetic mutation

Mutations in a few base pairs (point mutations) can occur during bacterial replication and lead tochanges in one or more amino acids in important targets (enzymes, cell wall or cell structure), as well as controlling genes or chromosome structure, resulting in new formations. Newly developed vaccines could render antibiotics ineffective against infections that can last for years.

2. Genetic material transfer

Attacks from other species or genera may be collected from previously affected organisms. Most antibodies against bacteria are carried on plasmids and other cell types that can spread to different types of bacteria. Weakened organisms can pass on copies of their genes to other weakened organisms. Stimulated bacteria can accumulate new DNA and become resistant bacteria.

3. Selective pressure

Selection pressure can be defined as an environment that allows organisms with new mutationsor new traits to survive and grow. When treated with antibiotics, microorganisms are destroyedor survive if antibiotics fail to kill bacteria. The survivors will proliferate and the newly createdbacteria will quickly replace the microbial community as the dominant form.

4. Inaccurate diagnosis

During diagnosing an infection, doctors sometimes can give out inaccurate information about the correct problem or disease. These conditions lead to greater incorrect selection and miss treatment, this increased resistance to antibiotic.

5. Inappropriate prescription of antibiotics

Doctors may prescribe antibiotics when they don't know whether a virus or bacterial infection is causing the disease. Antibiotics do not prevent disease or prevent infection caused by virus hence the drug can affect the body and cause resistance to some antibiotics.

6. Self-medication

In the South Asian region of the world, antibiotics are widely used without a doctor's prescription. Self-administration of antibiotics (SMA) can lead to inappropriate drug use, put patients at risk for adverse reactions, mask underlying signs of disease, and lead to increasedmicrobial resistance.

7. Misuse and overuse of antibiotics If a person does not take antibiotics successfully, some bacteria spread and become resistant to antibiotics. In 1945, antibiotic researcher Alexander Fleming once again warned the public against overuse of antibiotics because he knew the dangers of over using antibiotics.

Hospital Environment

Every day, thousands of patients, staff and visitors come to the hospital; each has their own microbiota and colonizing bacteria on their clothes and bodies. Germs can spread if the hospital does not have systems and procedures to help keep the environment clean. As a result, antimicrobial resistance develop helped its emergence and spread.

Agricultural procedures

Antibiotics are used as growth promoters in industrialized animal farming. Treating animals with certain antibiotics, just like humans, can cause bacteria to develop resistance. Antibiotics found in farm animals can infect humans, can easily be transmitted to humans through food, and spread into ecosystems through animal feces. In humans, this can lead to chronic, irreversible, long-termcomplications.

Availability of few new antibiotics

The pharmaceutical industry's invention of new antibiotics, which had previously been effective in combating antibiotic resistant bacteria, had largely slowed due to technical challenges, a lack of knowledge, and important difficulties in combating bacteria.

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3. HOW RESISTANCE DEVELOPS

The Antimicrobial resistance happens when bacteria develop the ability to defeat the drugs designed to kill them. That means the germs are not killed and continue to grow. Resistant infections can be difficult, and sometimes impossible, to treat. The antimicrobial-resistant germs can survive and multiply. These surviving germs have resistance traits in their DNA that can spread to other germs.

Table.1 showing defense strategies used by bacteria to resist against the effects of antibiotics.

MECHANISM OF RESISTANCE	DESCRIPTION
Restriction to access ofthe antibiotic	Bacteria restrict entry by changing the login or restricting the loginnumber. Example: Gram negative bacteria have a membrane that protects them from the environment. These bacteria can use this membrane toselectively block the entry of antibiotics.
Get rid of the antibiotic	Bacteria modify or break down antibiotics using enzymes and proteins that break down the drugs. Example: Klebsiella pneumoniaeproduces an enzyme called carbapenemase that digests carbapenems and beta-lactam drugs.
Change the targets forthe antibiotic	Many antibiotics are designed to eliminate and destroy some (or their target) bacteria. The bacteria change the target of the antibiotic so thatthe antibiotic can get in and do its job. Example: E. coli with the mcr-1 gene is able to add compounds to theoutside of the cell wall so that colistin cannot attach to it.
Bypass the effects of theantibiotic	Bacteria develop new cellular mechanisms that evade antibiotictargets. Example: Some strains of Staphylococcus aureus may bypass theeffects of trimethoprim

4. HOW TO MINIMIZE PROBLEM OF ANTIBIOTIC RESISTANCE

Increases research and discovery on new antibiotics.

More researches should be done on antimicrobial resistance. This will help on discovery of new methods and drugs on which may help to treat resistance organisms. Also more discovery of new means of fighting against bacteria are highly needed

Vaccination

Vaccination against bacterial infection helps to reduce the risk of acquiring bacterial infections. This helps to keep the community safe from infectious disease. Mumps, Tetanus, meningitis, Tuberculosis are the examples of bacterial diseases which can be vaccinated.

Using Bacteriophage therapy Bacteriophages are virus that infect and destroy bacteria. These phages control the host's protein production process, instructing the host organism to make its own bacteria. Using phages, viruses can be targeted by phage DNA manipulation. Phages are of great interest due to their natural adaptations and growth potential that help reduce the number of harmful organisms. Phage particles are narrow-spectrum agents, meaning they have internal mechanisms that allow bacteria. Optimizing the use of antimicrobial medicines.

Also Health provider, dispenser and patient need to be educated on how to use and miss use antibiotics so as to reduce the risk of may resistance. The correct dosage should be given to the patient; also unnecessary treatment should be stopped. Treatment should be made only when needed**.**

5. CONCLUSION

As the use of antibiotics increases worldwide, the risk of antibiotic resistance also increases. Species will adapt to the effects of the drug over the course of natural evolution and pass thesetraits on to future generations of organisms. This is of great concern to the healthcare and pharmaceutical industry. Problems with bacterial diseases arise from the current lack of effective treatment, effectiveprevention and new antibiotics; therefore development of new treatments and alternative antimicrobial treatments is necessary. If the bacteria found to be resistant to antibiotics, your doctor should try other medications. Ifnew medications may cause more serious side effects, effective measures should be taken to ensure appropriate treatment.

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