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Review Article

Review on Antimicrobial Resistance in Human Health

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A B S T R A C T

Day by day microbes are getting resistance towards antibiotics due to unnecessary use, over and under dosing, improper duration of administration. Antibiotic resistance is among one of the major problems in the current scenario of the health care system. More common in developing countries as compared to developed countries. The study aims to improve prescribing patterns to avoid antimicrobial resistance in hospital. In the healthcare system, the trend of antibiotic resistance is being reviewed in the present paper. The primary studies have been screened from different databases, PMC, NLM, Scopus, and Google Scholar etc. All the information has been reviewed and considered after consulting with medical subject headings. Data from the different study shows that highest culture sensitivity in patients taking Amoxicillin, Ceftazidime, Ampicillin. It shows higher resistance drug among patients. Various studies show that organism and microbes have been shown resistance towards antibiotics worldwide, which increase's hospital stay, the economic burden to the patients and condition worsening. To effectively overcome this problem information about the antibiotic use, guidelines and norms were circulated and provided to health care providers. The ultimate goal is to recapitulate the optimal use of antibiotics in human health to reduce antibiotics resistant.

Keywords: Antibiotics, Antimicrobial Resistance, Culture Sensitivity

Introduction

Antibiotic Resistance

Antibiotics are the drugs which inhibit the growth of microorganisms and are used commonly for the prevention of infectious diseases. The first antibiotic, Penicillin, was discovered in 1928 by Alexander Fleming and is currently available to treat various infections.[1] The general classification of antibiotic classes and their drug classification are presented in Table 1.

Antibiotic resistance is one of the leading problems in the current health care system of the world that erodes the effectiveness of antibiotics and prevents the treatment of infectious diseases. Antibiotic resistance occurs when microbes like bacteria, parasites, fungi, become resistant to antimicrobial drugs. Resistance in front of antibiotics is a matter of great concern. Antibiotics are getting resistance due to unnecessary use of antibiotics, even if it's not necessary. Antibiotics work as a boon to humans as they combat against infection. Resistance towards antibiotics is

increasing nowadays, which depends on the amount and the reason for which it is used. Resistance means a bacterium that is not killed by the usual antibiotics with a normal dose.[2] Multidrug resistance is known as resistance to two or more drugs or drug class. The drug-resistant pattern is in gram-positive and gram-negative bacteria and it is difficult to treat or even untreatable infection with an antibiotic. Mainly broad-spectrum antibiotics are liberally and mostly unnecessarily used and cause resistance.[3] Antibiotic resistance is due to the current shortage of brand drugs, lack of diagnostic treatment. Antibiotic uses resistance number is varied from one country to another. It observed that countries with the highest antibiotic consumption have the highest antibiotic resistance rates.[4] The main bacteria to be resistant with drugs are in the same category as they are *Pseudomonas aeruginosa* and *Staphylococcus aureus* and mainly resistant to both broad-spectrum and narrow-spectrum antibiotics.[5] The current study shows a summary of the knowledge from the different studies based on the main microorganism. Antibiotic resistance classifications are presented in Table 2.

Table 1.Classification of antibiotics

S.No.	Antibiotics class	Examples
1.	Aminoglycosides	Amikacin, Gentamycin, streptomycin, Tobramycin, Vancomycin
2.	Cephalosporins	Cefotaxime, Cefazolin, Cefaclor, Cefotoxine, Cephalexine, Cephadrine, Cephapharine
3.	Penicillins	Amoxicillin, Ampicillin, Carbenicillin, Methicillin, Ticardicllin
4.	Macrolides	Erythromycin, Azithromycin
5.	Quinololes	Ofloxacin, Ciprofloxacin, Levofloxacin

Table 2.Antibiotics resistance

S. No.	Antibiotics	Bacteria
1.	Penicillin –R	*Staphylococus*
2.	Tetracycline –R	*Shigella*
3.	Methicilin	*Staphylococus*
4.	Erythromycin	*Staphylococus*
5.	Gentamycin	*Streptococus*
6.	Vancomycin	*Staphylococus*
7.	Cephalexin	*Pseudomonas aurgenousa*
8.	Meropenem	*Acinobacter. s*

Mechanism of Action of Antibiotic Resistance

Bacteria can develop antibiotic resistance through multiple genetic mechanisms. Antibiotic resistance occurs due to several biochemical modifications that lead to inactivation of drugs, alteration of cell-wall proteins, enzymes and receptors that inhibit drug uptake. Antibiotics can get resistant to avoid killing by antibiotics molecules or chemicals [6]. Many infections are caused by resistant to microbes. Resistant bacteria diminish or neutralize the effects of drugs. They fail to recognize standard treatment and result in prolonged illness, health expenditures and risk of death. Antibiotic resistance occurs when bacteria can neutralize an antibiotic by changing its way. Some bacteria can change their structures; hence the antibiotics have no way to attract the bacteria to kill it. If the single bacterium is left for resistant to antibiotics, it can multiply and grow all the bacteria which were killed. Hence there is less chance of curing infections.[7]

Causes of Antibiotic Resistance[8,9]

More use of Antibiotics

The more number of antibiotics prescribed for the treatment of infection, which leads to antibiotic resistance.

Lack of Knowledge

In some developing countries, peoples of urban areas, like farmers and the small vendor have little knowledge concerning the dose and uses of antibiotics and lack of counselling regarding medicine.

Inappropriate use of antibiotics[10]

Increasing resistance caused by excessive use of antibiotics, including long term treatment, and not working on the specific pathogen.

How Antibiotics Work[9]

- Inhibition of protein synthesis
- Inhibition with protein membrane synthesis
- Interference with metabolic reaction
- Interfere with DNA synthesis
- Interferes with cell wall synthesis
- Inhibits an enzyme

Method of Collecting Data

Different search engines like PUBMED, NIH (National Institute of Health), NLM (National Library of Medicine), SCOPUS and Virtual Health Library (VHL), Biblioteca Virtual en Salud (BVS), some research articles and online databases were searched. Some books were also selected for this topic. Primarily search for information about the topic was conducted in the Indian context and data from other countries was also considered. The keywords used for the search were antibiotic resistance, strategies to overcome the problem, challenges etc. The data which were published

between 2008–2019 in the English language was preferred for this write up.[11] A total of 15 papers were included in the analysis. In a different study, data was collected from different articles. This was applied according to particularities.

toring and prevention activities.[13,14] All the evidence shows the need to produce new antibiotics to cure the multi-drug-resistant. In the previous study shows that methicillin is more resistant to *Pseudomonas aeruginosa* because these bacteria are processed in their resistance capability due to uncontrolled use of pharmaceutical drugs.[15] Another factor that could be taken in more focus that, environmental factors characterized by weakened people in need of high complexity care, including antibiotics. This may lead to resistance of antimicrobial.[16-18] All of the studies show that mainly *Staphylococcus aureus, Pseudomonas aeruginosa* bacteria were founded to be resistant against antibiotics. Antibacterial resistance is shown in Figure 1.

Table 3.The frequency of antibiotics resistance

Antibiotics	Country	Year	Resistant%	Objectives
Ampicillin	Nepal	2017	82.52 %	*Staphylococcus aureus*
Ceftazidime	India	2017	90.6 %	*Pseudomonas aeruginosa*
Cephalexin	India (Gujarat)	2008	94.64 %	*Pseudomonas aeruginosa*
Cefazolin	India	2008	83.93 %	*Pseudomonas aeruginosa*
Penicillin	Southern India	2017	86.5%	*Staphylococcus aureus*
Gentamycin	India	2017	63.9%	*Escherichia coli*
Meropenem	India	2017	83.5%	*Acinetobacter spp.*

Effects of Antimicrobial Resistance

Antibiotics are one of the biggest inventions of medicine; they can increase the patient life span and his/her safety. According to the studies analyzed, the human behaviour, lifestyle and hands are the main reservoirs of the microorganism. In recent year's bacteria are more powerful against antibiotics. The main bacteria are *Pseudomonas aeruginosa* and *Staphylococcus aureus* is a matter of great concern[12] and the main focus to antibiotic resistance is MRSA and VRE. Many types of antibiotic resistance result in strains with multi-drug resistance phenotypes, and treatment option for that pathogen is becoming limited. The frequency of antimicrobial resistance is tabulated in Table 3. *Staphylococcus aureus* and *Enterococcus sp.* are the most common gram-negative bacteria which develop antimicrobial resistance. Methicillin-Resistant *S. Aureus* (MRSA) is a universal cause of gram-positive antibiotics resistance. MRSA is a leading cause of human infection in many countries. Vancomycin-resistant Enterococci (VRE) has a lower epidemiological effect then MRSA. Although VRE worldwide prevalence is relatively low. The gram-negative antibiotic resistance is more serious than with the gram-positive, resistance phenotypes among gram-negative are more prevalent as *Pseudomonas aeruginosa, Acinetobacter* sp, and *Enterobacteriaceae*. Also, multidrug resistance gram-negative are prevalent including *Escherichia coli* and *Neisseria gonorrhoeae. Staphylococcus aureus* and *Enterobacter* species created a worldwide pandemic infection are responsible for a big threat. While *Streptococcus pneumoniae* and *Mycobacterium tuberculosis* are responsible for an epidemic respiratory infection. The most common serious gram-negative infection is hospital-acquired and the common pathogen is *Enterobacteriaceae* (mostly *Klebsiella pneumoniae*), *Pseudomonas aeruginosa* and *Acinetobacter*. Bacterial resistance is a serious threat and demand moni-

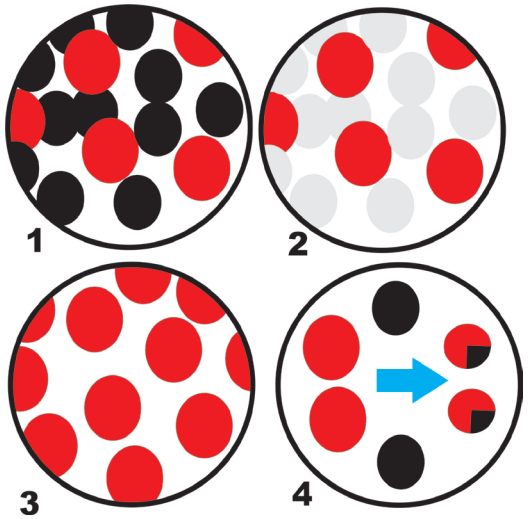

Figure 1.Antibacterial resistance 1) Red colour implies drug resistant bacterias and black colour represents immune bacteria in human body; 2) Antibiotics can kill bacteria but not to drug resistant bacteria; 3) Resistant bacteria have free space to multiply; 4) Bacteria can transfer their drug resistance power to other bacteria.

Conclusion

Every year developing and developed countries like India, Nepal, China and the USA are experiencing bacterial resistance. The bacteria are rapidly resistance to spectrum

antibiotics which are commonly used in hospital and health care system. The main purpose of this study is for the protection of unwanted used of antibiotics to weakened people, which leads to antimicrobial resistance that could lead to affect the health and quality of life of people[4].

Organism and microbes have been shown resistance towards antibiotics worldwide which increases hospital stay, the economic burden to the patients and condition worsening. Educational program and awareness campaign are required. Research, Diagnostic tools, exposures, screening, solution should be implanted.[11]

Conflict of Interest: None

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