Research Article

Microbiology & Infectious Diseases

Evaluation of Multidrug Resistance in Bacteria Isolates from a Tertiary Care Hospital in Abakiliki Metropolis

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Received: 16 December 2017; **Accepted:** 19 January 2018

Citation: Alo Moses N, Dike Charles C. Evaluation of Multidrug Resistance in Bacteria Isolates from a Tertiary Care Hospital in Abakiliki Metropolis. Microbiol Infect Dis. 2018; 2(1): 1-4.

ABSTRACT

The indiscriminate use of antibiotics has led to an increase in resistance to antibiotics among bacterial pathogens in developing countries. This is gradually raising great concern globally to the therapeutic management of diseases. The study was conducted to assess multidrug resistance to antibiotics among isolates from different clinical specimen collected from Federal Teaching Hospital II, Abakiliki, Ebonyi State. A total of 40 isolates comprising of 10 isolates each of Escherichia coli, Klebsiella specie, Pseudomonas aeruginosa and Staphylococcus aureus. The isolates obtained from FETHA were identified by standard method and the antimicrobial susceptibility of bacterial isolates was determined by the method of National Committee for Clinical Laboratory Standards (NCCLS) recommended by Kirby-Bauer method. The results showed that 28 of the isolates showed multidrug resistance to the antibiotics used. It was found that all the isolates of Escherichia coli and 7 (70%) isolates of Klebsiella specie were multidrug resistant isolates. Similarly, 6 (60%) isolates of Staphylococcus aureus and 5 (50%) isolates of Pseudomonas aeruginosa showed multidrug resistance to antibiotics. Levofloxacin, Rifampcin and Streptomycin were found to be the effective drug of choice while Chloramphenicol, Ampicillin, Ceporex and Nalixidic acid were found to be the antibiotic to be highly resistant. The study shows that a good percentage of people were infested by multidrug resistance bacterial agents. The findings of the study suggested that stringent guidelines should be established for antibiotic policy within hospitals, encouraging prudent use of antimicrobials.

Keywords

Antibiotics, *Escherichia coli*, *Klebsiella species*, Multidrug resistance, *Pseudomonas aeruginosa*, *Staphylococcus aureus*.

Introduction

Disease in man right from old has been caused by infectious agent and it was thought that with the advent of antimicrobial agents that the battle over disease would have been won but the reverse was the case due to emergence of microorganisms that are resistant to antimicrobial agents [1]. The development of antibiotics has led to the reduction in disease and death rate in man. Antimicrobial agents were able to reduce death and disease rate by inhibiting the activities of microorganism and also hindering their spread. As the popularity and usage of antibiotics increased, bacteria became resistant to these drugs because of its ability to fight against the drugs. The advent of antimicrobial resistance has arisen due to misuse of drugs, prophylactic use, inappropriate and wrong selection of drugs and apart from the problem of management of antibiotics in developing countries, the dominance of counterfeit drugs in circulation, high level of poverty, ignorance, illiteracy and poor hygienic practices in the region has resulted in multi-drug resistance in the region [2]. Bacterial species has developed the ability to resist antimicrobials due to its ability to evolve mechanism that makes it resistant to some and even all anti-microbial agents and this latest development in microbial resistance to antimicrobials has posed a great challenge in treatment of diseases in health care setting [1].

Bacterial resistance can be attributed to arise due to acquisition of plasmids from the environment as well as possession of innate resistance factors in the bacteria and mutation [3]. Although, no clear-cut definition has been propounded for Multidrug resistance,

it is seen as a resistance to many or all antibiotics by bacteria [4]. According to [5], Multidrug Resistance is defined as resistance to two or more antibiotics especially first line antimicrobial agents like Cephalosporins (Cefotaxime, Ceftriaxone and Ceftazidime), Fluroquinolones (Ciprofloxacin and Ofloxacin), Ampicillin, Chloramphenicol and Trimethoprim-Sulfamethoxazole. Multidrug resistance to antimicrobial agents is gradually becoming a global problem that poses a great threat to health care delivery especially in developing countries and this is worsened by the inability of new antimicrobial drugs to be developed that will cater for the antimicrobial drugs that had shown resistance to microorganism [4].

Resistance to antimicrobials is acquired by the bacteria either through gene transfer or spontaneous mutation, while gene transfer involves the transfer of gene encoding for resistance from one organism to another through conjugative transfer of R plasmids, spontaneous mutation occur at rare occasion especially during replication and this mutation may have a significant effect on the resistance to antimicrobials which the organism was once susceptible to [6].

There is need to have an accurate and up to date information as it regards multidrug resistance pattern, incidence of resistance, comparisons of various antimicrobial agents used against different clinical isolates and also the resistance pattern, since it varies from time to time. The aim of the study is to evaluate the multidrug resistance in *Klebsiella species*, *Escherichia coli*, *Staphylococcus aureus* and *Pseudomonas aeruginosa* from different clinical specimen in tertiary care hospital in Abakiliki metropolis, Ebonyi State. This will help to identify the isolate that shows higher number of multi resistance in the metropolis and this will help in creating awareness of the resistance pattern in the area as well as strengthening health care delivery in tertiary care hospital in the area since the study will create a baseline of antimicrobial resistance pattern.

Methodology

Study Population

A total of 40 clinical isolates of *Escherichia coli*, *Klebsiella species*, *Pseudomonas aeruginosa* and *Staphylococcus aureus* (10 each) were isolated from different clinical samples ranging from urine, stool, sputum, ear swab, aspirate, throat swab from Federal Teaching Hospital, Abakiliki, Ebonyi state, Nigeria between the months of May to June, 2016.

Identification of Isolate

The isolates that were obtained were identified using cultural method, gram staining and biochemical testing like catalase, indole, coagulase, VP test, methyl red and others as explained by Cheesbrough [7]. The isolates were cultured in a Mueller Hinton broth and incubated for 4 hours at 37°C before it was used.

Antibiotic Susceptibility Testing

The bacterial isolates were subjected to antibiotic susceptibility testing, using the Kirby Bauer agar disc diffusion method as described by Cheesbrough [7]. The antibiotics discs (Optun lab) used had different antibiotics impregnated on a disc of about 8 mm. The antibiotic discs used include Ciprofloxacin (10 mcg), Norbafloxacin (10 mcg), Gentamycin (30 mcg), Amoxacillin (20 mcg), Streptomycin (30 mcg), Rifampcin (20 mcg), Erythromycin (30 mcg), Chloramphenicol (30 mcg), Ampiclox (20 mcg), Levofloxacin (20 mcg),, Tarivid (10 mcg), Perfloxacin (10 mcg), Augmentin (30 mcg), Ceporex (10 mcg), Nalixidic acid (30 mcg), Septrin (30 mcg) and Ampicillin (30 mcg).

Measurement of Zone of Inhibition

The zone of inhibition were read by measuring the diameter of the zone of clearance on each antibiotics used. Interpretative charts to determine the sensitive pattern was done using the method described by NCCLS [8] and the Zones of inhibition of 18 mm and above were considered sensitive, 13-17 mm intermediate and <13 mm resistant.

Criterion for Multidrug Resistance

A drug was said to be multidrug resistant if it is resistant to two or more antibiotics. The multidrug resistance pattern for each drug that was MDR were noted and recorded.

Result

The results of the percentage antibiotic resistance of *Escherichia coli*, *Klebsiella species*, *Pseudomonas aeruginosa* and *Staphylococcus aureus* isolated from different clinical specimen showed that the highest resistance to Chloramphenicol was exhibited by *Escherichia coli* and *Staphylococcus aureus* with a percentage resistance of 100% and 50% respectively. *Klebsiella species* showed highest resistance to Ampicillin, with a percentage resistance of 80%, *Pseudomonas aeruginosa* exhibited highest resistance to Norbafloxacin, with a percentage resistance of 40% *Escherichia coli* showed least resistance to Streptomycin, Rifampcin and levofloxacin, with a percentage resistance of 20% each. *Klebsiella species*, *Pseudomonas aeruginosa* and *Staphylococcus aureus* all showed least resistance to Levofloxacin, with a percentage resistance of 10% each (Figure 1).

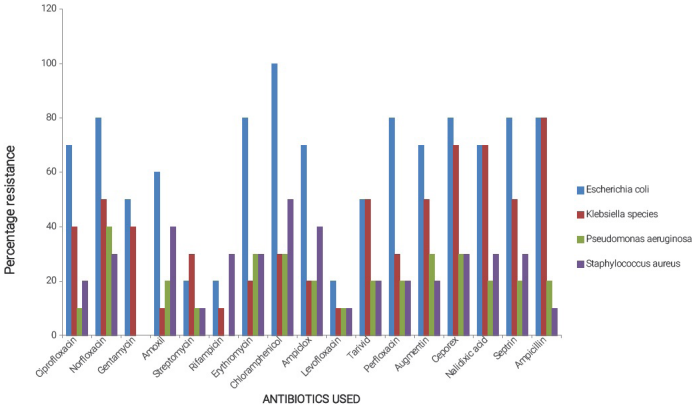

Figure 1: Percentage antibiotic resistance of bacteria isolates used.

Out of the 40 isolates that were tested for Multidrug Resistance, 28 (70%) isolates were revealed to be Multidrug Resistant. Out of the

28 MDR isolates, 10 (35.7%), 7 (25%), 5 (17.8%) and 6 (21.4%) isolates of *Escherichia coli*, *Klebsiella specie*, *Pseudomonas aeruginosa* and *Staphylococcus aureus* were identified as multidrug resistant isolate (Figure 2).

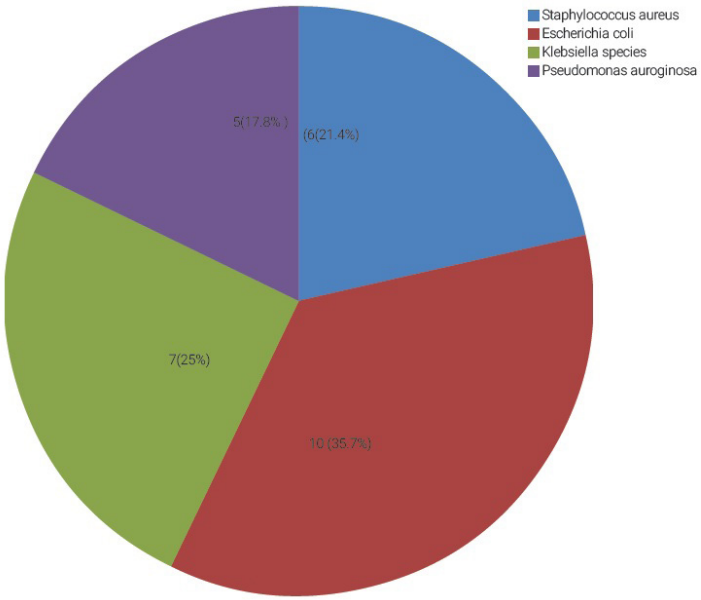

Figure 2: Percentage frequency of Multidrug Resistant (MDR) isolates among bacteria isolates of interest.

Discussion

Bacteria resistance to antibiotics has been reported to be a global challenge in health care delivery especially in developing countries like Nigeria and hence the need to evaluate multidrug resistance pattern at a regular basis. According to Muthoni, factors such as misuse, overuse, wrong selection of drugs, lack of adequate and reliable laboratory examination prior to administration of drugs has greatly contributed to the emergence of multidrug resistant isolates in this part of the world [9]. Also, the practice of self-medication in developing countries like Nigeria has also been linked to play a great role in development of antibiotic resistance. This is because people resort to treatments in hospitals, only after self-medication had failed and once this community acquired resistant strain come in contact with hospital acquired isolate, genetic information that codes for resistant strain are transferred to them [10]. Despite the advent of new drugs, antibiotic resistance still poses a great threat globally.

Out of the 40 isolates of bacteria that were enrolled in the study, 28 (70%) showed Multi drug resistance to antibiotics that was used in the study. This is almost in agreement with the findings of [11] and [12] who observed that the percentage of MDR isolates were about 75% and 60% of the overall isolates isolated from clinical specimen, although their isolates were obtained from urinary and respiratory specimen only. The result obtained from this work is in contrast to similar work carried out by [13] and [10], where they reported that only 15.9% and 21.4% respectively were MDR resistant isolates among the bacterial isolates obtained from clinical specimen. The high percentage of MDR isolate that was observed in this study is worrisome and this calls for proactive action to combat this menace, since it poses a great challenge to the government and health care delivery.

Among the 28 isolates implicated in Multidrug resistance, higher predominance was observed in isolates of *Escherichia coli*, with a percentage of 35.7% (10), followed by *Klebsiella species*, with a percentage of 25% (7), *Staphylococcus aureus* with a percentage of 21.4% (6) and *Pseudomonas aeruginosa* with a percentage of 17.8% (5) and this is in line with the work of [11], who reported similar result in their findings. The result obtained by [13] was almost similar to that obtained from our findings, although it differed a little, with *Escherichia coli*, followed by *Staphylococcus aureus*, *Klebsiella species* and *Pseudomonas aeruginosa*. The study is in contrast with the findings of [14] reported a higher occurrence of MDR in *Staphylococcus aureus*.

All isolates of *Escherichia coli* were highly resistant to Chloramphenicol (100%), followed by Erythromycin (80%), Ceporex (80%), Ampicillin (80%), Septrin (80%), Augmentin (70%) and this to an extent agrees with [15]. The high resistance to these antibiotics especially Chloramphenicol and Erythromycin could be as a result of its overuse and its easy accessibility to patients.

Conclusion

Multidrug resistance to antibiotics is gradually becoming a global challenge in health care delivery especially in developing countries like Nigeria. The result of this study has shown that the prevalence of multidrug resistant isolates in the study area is alarming and hence the need for regular monitoring. There is need for government to ensure that surveillance program is carried out on a regular basis to allow for adequate monitoring of resistance to antibiotics. The overuse, misuse, prophylactic use, wrong use, self-medication by patients when they fall sick, sale of counterfeit drugs and lack of reliable laboratory results has been said to be factors that has and will still be contributing to the emergence of MDR isolates. There is great need for relevant bodies to rise up to task of setting up measures that will curb this menace.

The high multidrug resistance rates observed in the study area calls for the need for antibiotic policy to be reviewed and substituted with effective policy in Abakiliki Metropolis. Due to high rate of susceptibility of these antibiotics to bacteria, Levofloxacin, Rifampcin, Streptomycin, Perfloxacin and Tarivid are hereby recommended as drug of choice in treatment of diseases in Abakiliki metropolis. Also, further studies should also consider the inclusion of the demographic data (age, sex, level of education, occupation) of the subject, since this will help in better understanding of multidrug resistance.

Furthermore, multidrug resistant strains should be subjected to genetic studies in order to understand the mechanism of resistance in bacteria. I highly recommend that researchers and government (ministry of health) should rise up to the task of developing an antibiotic use road map, like other developed countries of the

world, which will guide the effective use of antibiotics in the country.

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