International Journal for Pharmaceutical Research Scholars (IJPRS)

V-10, I-2, 2021 ISSN: 2277 - 7873

RESEARCH ARTICLE

Prevalence of Antimicrobial Resistance Pattern in Tertiary Care Hospital: A Prospective Observational Study

*Foram KamleshKumar Shethia[1], Meghraj Vivekanand Suryawanshi *[2 3], Indermeet Singh Anand[1]*

[1]Department of Pharmacy Practice, Shri Sarvajanik Pharmacy College, Mehsana-384001, Gujarat, India

[2]Department of Pharmaceutics, Shree Dhanvantary Pharmacy College, Kim, Surat-394110, Gujarat, India

[3]School of Pharmaceutical Sciences, Jaipur National University, Jaipur-302017, India

Manuscript No: IJPRS/V10/I2/00001, Received: 07/06/2021, Accepted: 14/06/2021, Published: 06/07/2021

ABSTRACT

To check the prevalence of Antimicrobial Resistance Pattern in Tertiary Care Hospital. It was a single centric prospective observational study. This study collected the data of 250 samples, in patients who were admitted to in-patient department and in whom at least one antibiotic was prescribed. The data such as patient demographics, diagnosis, the laboratory data such as count of White Blood Cells (WBC), C- Reactive Protein (CRP) and Procalcitonin (PCT). The culture sensitivity reports were collected from the Microbiology Department of the hospital. The positive samples were further evaluated for the study. Statistical analysis is done by using Microsoft Excel 2007. In this present study, out of 250 samples, 87 (35%) samples were positive. The most common specimen which had shown highest growth was Tracheal (38%), followed by Blood sample (21%) and third was Urine (15%). The most common organisms which were found to be resistant included Klebsiella Pneumoniae (24%), Acienobacter Baumanii (21%), Pseudomonas Aeruginosa (18.39%) and E Coli (11.50%). The maximum resistance was shown by five groups viz, carbapenem (54%), fluoroquinolones (46%), penicillins (45.51%), cephalosporin (37.12%) and aminoglysocides (33.51%). According to antibiogram, all of these four bacteria had shown highest resistance against fluoroquinolones. The results obtained from this study can guide rationale use of antibiotics which can contribute to effective application of Antimicrobial Stewardship Program. Antimicrobial resistance, Tertiary care hospital, sample, bacteria, Antimicrobial Stewardship Program.

KEYWORDS

Antimicrobial resistance, Tertiary care hospital, sample, bacteria, Antimicrobial Stewardship Program

INTRODUCTION

When micro-organism such as bacteria, viruses, fungi and parasites changes over the period of time and also they no longer respond to the treatment leading to infections difficult to treat, which results in the increasing the spread of infection, the severe illness and death, it is when Antimicrobial Resistance (AMR) occurs.

This leads to the drug resistance, this decreases the effectiveness of the antibiotics and other antimicrobial medicines, therefore leading to difficulty in treating the infection and either

*Address for Correspondence:

Meghraj Vivekanand Suryawanshi,
Department of Pharmaceutics,
Shree Dhanvantary Pharmacy College,
Kim, Surat-394110,
Gujarat, India.

resistance is increased that much that makes impossible to treat the infection. [1]

The first commercialized antibiotic - Penicillin, was come into existence in 1928 discovered by Alexander Fleming. Since then, the new discovery of antibiotics and the resistance were all together. The microorganisms always try to survive and resist the new drugs. In this way, it's difficult to manage the resistance developed by it. [2]

AMR naturally occurs over the period of time, the most common cause is through genetic changes. These antimicrobial resistant organisms are found almost everywhere in people, plants, animals, food and also in the surrounding environment (in soil, air and water).

The organisms are easily transmitted from one individual to another or between the individuals or they are also transmitted from people and animals, also including from food of animal origin.

The main causes of the antimicrobial resistance includes the its misuse and/or its overuse; poor infection and disease prevention and control in health-care facilities and farms; lack of access to clean water, sanitation and hygiene (WASH) for both humans and animals; poor access to quality, vaccines and diagnostics; affordable medicines, lack of enforcement of legislation; and also the lack of awareness and knowledge. [1].

The antimicrobial resistance affects the high, middle as well as low income countries. There are specific type of diseases such as tuberculosis (TB) and gonorrhoea which have high rates of the antimicrobial resistance.

A reliable data estimation of the global scenario of the prevalence of antimicrobial resistance is difficult to know as the data are not collected consistently and systematically.

Yet, the data collected from Europe indicates the excess mortality rate because of the resistant bacteria in the hospital infections which exceeds 25,000 annually, with the annual cost of at least worth €1.5 billion.

Also the data of outpatient from the US indicates that more than 63,000 people die in a year because of resistant bacterial infections.

A combination having the higher rates of infections, less developed health systems and also low quality and improper use of antibiotics, as among the other factors, in turn, it increases the burden of the antimicrobial resistance in middle and low income countries.[3]

It is not easy to get the accurate data of the drug resistance, but though it is predicted that the burden of antimicrobial resistant infection will increase to nearly 10 million deaths per year by 2050 and also it will increase the total GDP loss of $100.2 trillion by 2050 if proper steps are not taken to prevent. [4]

Although antimicrobial resistance occurs usually naturally, it is also occurs by inexistent programmes for infection prevention and control (IPC), misuse of antimicrobial medicines, weak laboratory capacity, inadequate surveillance, insufficient regulation of the use of antimicrobial medicine and poor-quality medicines.

Several intrinsic factors such as gene amplification, point mutation as well as extrinsic factors like horizontal transfer of resistant gene between bacteria within and across species by transposons, integrins or plasmids has contributed for the development of resistance, and this cannot be reduced once developed even after the stopping its usage. Also social factors like deficient hygienic practices, overcrowding and demographic changes contributes to the development of AMR. [5]

In India, the major causes of AMR are the unregulated access to the antibiotics, which also includes the over the-counter sale and sale without prescription or with invalid prescription; rising incomes, and it also includes the preservation of the financial incentives to the providers for prescribing antibiotics, this often can be by the patient demand and their expectations.

The global attention to the AMR issue in India was drawn by the controversy of the nomenclature of the New Delhi Metallo-beta-lactamase-1 (NDM-1), and since then the AMR issue has gained a lot of attention in context to public health concern.

In India, AMR is of special concern as it as it includes the factors like high rates of the bacterial infections, increasing of intensive animal farming, especially in small holder settings with minimal oversight and quality control and also the poor sanitary and hygiene conditions.

This issue related to AMR is now not only limited to the clinical or hospital setting but is also spread to the animal/food/livestock sector, and also the environmental contamination as a source for the spread of resistance genes as well as the antibiotic residues which in turn promotes the selection pressure.[6]

India is one of the nation in which there is highest burden of the infections which are related to bacteria. In India today, the crude mortality from infectious diseases is 417 per 100,000 persons. As a result of which, AMR is likely to be high in India. The resistance not only occur from the older and more frequently used classes of drugs but also is emerging from the newer and more expensive drugs viz, carbapenems.[7]

The higher rates of AMR were observed from toxin-producing E. Coli which were isolated from the calves with diarrhoea in Kashmir Valley and the Gujarat.

All of the strains from the Gujarat were observed to be resistant to at least 3 antibiotics, and also almost half were resistant to 8 or more of the 11 antibiotics which were tested.

Resistance was found everywhere for kanamycin and cephalexin and it was above 50% for 7 of the antibiotics which were tested. [8]

Also antimicrobial resistance for H. pylori treatment is a growing problem in Gujarat. [9]

There is wide availability of the effective antibiotics which is under the threat, and it is jeopardizing the today's modern healthcare. The forecasts of economic costs, which is similar to those 2°C rise in global average surface temperature above the preindustrial levels.

AMR is becoming an urgent need of attention for policy makers, and this in turn raising the pressure to secure international commitments to solve the problem of the AMR. [10]

During this pandemic situation of coronavirus disease 2019 (COVID-19), there are threats which are potentially affecting the antimicrobial stewardship activities leading to antimicrobial resistance. For example, the many of the individuals are presenting with mild disease without pneumonia or moderate disease with pneumonia is receiving antibiotics.

Data published by World Health Organisation (WHO) shows that shows that azithromycin is being widely used with Hydroxychloroquine although it is not yet recommended outside of COVID-19 clinical trials. [11]

Both economically and also for human health and its lives, the cost of the antimicrobial resistance is extremely large.

The new report published (Stemming the superbug tide, 7 Nov 2018) by Organization for Economic Co-operation and Development (OECD) predicts that 2.4 million people in Australia, Europe and North America will die from the infections with resistant microorganisms in the next 30 years as well as it could cost up to US$3.5 billion per year. [12]

AMR leads to global health issues and also contributes to the economic rise. To achieve the issues related to costs, the medical strategy is to reduce the prescribing unnecessary antibiotics, to protect the effectiveness of current antimicrobials in the long term of time. To gain future benefits, economic evaluations of health care interventions can be done for short term costs. [13]

Optimized use and appropriate prescription of antimicrobials gives direction to the principles

of antimicrobial stewardship activities, together with the quality diagnosis and treatment, and the reduction and the prevention of infections. [11]

AMR occurs when microorganisms like bacteria and fungi contribute to develop the resistance which is used for treatment. In this way, microorganisms are continually grow and not killed. AMR can affect any stage of their life, it also affects the veterinary, healthcare as well as it affects the agricultural industries, resulting a urgent threat to global health problems. In the United States (US) in each year at least 2.8 million people are infected with the resistant microorganisms and as a result of which more than 35,000 people die. [2]

Material and Method

Material

This was a Single Centric Prospective Observational Study which had studied the prevalence of antimicrobial resistance pattern.

This study was conducted in Tertiary Care Hospital at Gandhinagar. The data of patients which were admitted to In Patient Department from February 2021 to April 2021 were collected for the study. The sample size of the study was calculated by online sample size calculator and that was 250 samples.

Inclusion criteria

1. Data of all patients who were admitted to in Patient Department were included in the study irrespective of the age.
2. Data of both genders were included.
3. Data of only those patients for whom at least one antibiotic was prescribed and at least one culture report had been sent were included in the study.
4. Culture data of all the sample types (blood, tracheal, urine swab, pus, sputum, fungus, others and tissue) were included in the study.

Exclusion criteria

1. Data of Outpatient Department (OPD) were excluded.
2. The data of patient with incomplete information were excluded.

Data of each patient enrolled in the study were recorded in the paper Case Report Form (CRF) which was prepared for the study.

Prior approval was obtained from Sarvajanik Clinical Research Ethics Committee before the study was initiated. Data collected were kept confidential and it won't be disclosed to anyone.

Data collection procedure

- The study data of each patient was recorded in paper CRF.
- The files of patient were checked for the collection of demographic details as well as the laboratory reports along with WBC count, CRP and PCT level.
- The culture reports were collected from Microbiology Department of the hospital to check the status of the antibiotics.
- The culture reports of patients were collected for the analysis for the AMR resistance pattern.
- The name of isolated organism was collected to identify the common microorganism causing the resistance.
- Type of culture was taken into context to identify which type of culture showed the maximum resistance pattern.
- The name of antibiotics was collected to identify common resistant antibiotics.
- The statistical analysis was done by using Microsoft Excel 2007.

RESULT

1. Analysis for Total number of Samples

In this present study, the data of 250 samples were collected, out of which 87 (35%) samples were found positive and the remaining were negative (65%).

Further analysis was done from the positive samples which were collected for the study.

Table: 1 Total number of Samples

Positive Culture	Negative Culture	Total no of sample collected
87	**163**	**250**
35%	65%	100%

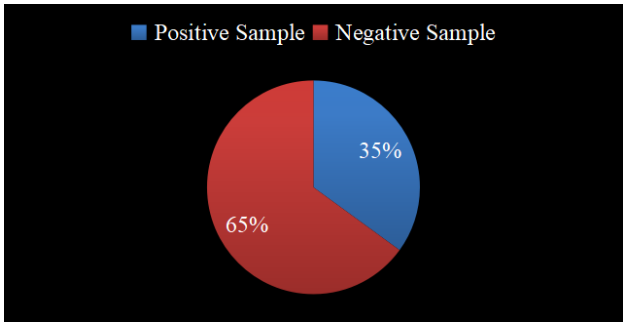

Figure 1 Total number of Samples

2. Analysis for Type of Sample

- Out of the positive samples, the most common samples that were found to be resistant were Tracheal (38%), then Blood (21%), followed by Urine sample (15%).
- The remaining ones were swab, pus, sputum, fungus, others and tissue.

Table 2 Type of sample

Name of sample	Percentage (%)
Tracheal	38
Blood	21
Urine	15
Swab	5.47
Pus	5.47
Sputum	3.44
Fluid	3.44
Fungus	3.44
Others	3.44
Tissue	1.14

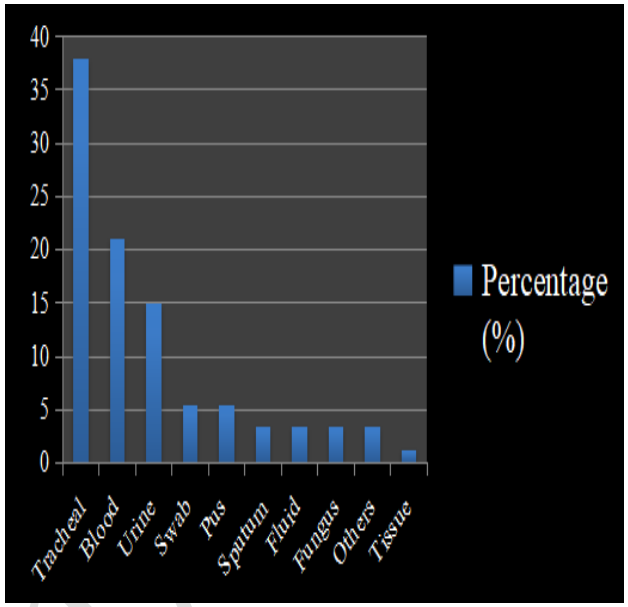

Figure 2 Type of sample

3. Analysis of resistant organisms

- The most common organisms which were found to be resistant included Klebsiella Pneumoniae (24%), Acienobacter Baumanii (21%), Pseudomonas Aeruginosa (18.39%) and E Coli (11.50%).

The complete list of organisms that were found to be resistant is enlisted in Table 3.

Table 3 Name of organism

Name of organism	Percentage (%)
Klebsiella Pneumoniae	24
Acienobacter baumanii	21
Pseudomonas Aeruginosa	18.39
E coli	11.50
Candida parapsilosis	3.44

Candida tropicalis	3.44
Candida albicans	2.29
Enterococcus Faecium	2.29

Proteus mirabilis	2.29
Stenotrophomonas maltophilia	2.29
Acienobacter Sp	1.14
Bacillus Circulans	1.14
Candida sps	1.14
Enterobacter cloacae	1.14
Enterococcus sps	1.14
Ralstonia pickettii	1.14
Serratia marcescens	1.14

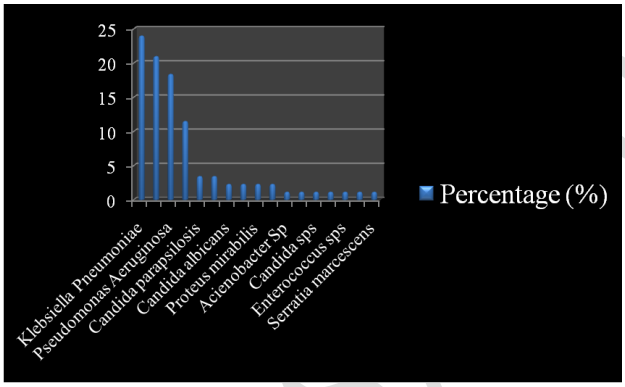

Figure 3 Name of organism

4. Analysis for Resistance among antibiotics

- The maximum resistance was shown by five groups viz, carbapenem (54%), fluoroquinolones (46%), penicillins (45.51%), cephalosporin (37.12%) and aminoglysocides (33.51%).

Table 4 Resistance among antibiotics

Class	% Resistance
Carbapenem	54
Fluoroquinolons	46
Penicillin	45.51
Cephalosporin	37.12
Aminoglycoside	33.51

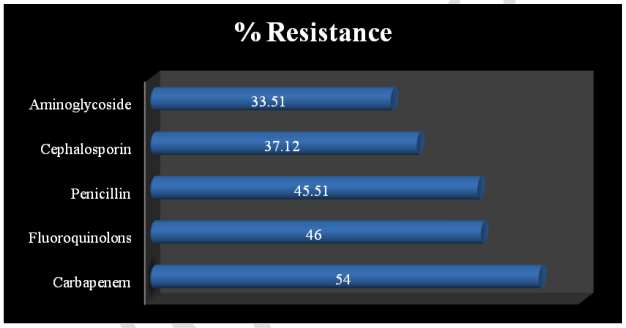

Figure 4 Resistance among antibiotics

- From the abovementioned classes of antibiotics, the top three drugs from each class that showed highest resistance are enlisted in Table 5:

Table 5 Top Resistance

Class	Top Three Antibiotics
Carbapenem	Imipenem, Doripenem, Meropenem
Fluoroquinolons	Ofloxacin, Levofloxacin, Ciprofloxacin
Penicillin	Ticarcillin, Piperacillin, Ampicillin
Cephalosporin	Cefipime, Ceftazidime,

	Cefoperazone + Sulbactam
Aminoglycoside	Gentamicin, Tobramycin, Neitilimycin

3. Antibiogram of Organism to Antibiotic

Table 6 Antibiogram of Klebsiella Pneumoniae

Antibiotics	% Resistance
Imipenem	71
Doripenem	76
Meropenem	71
Ofloxacin	86
Levofloxacin	90
Ciprofloxacin	86
Cefipime	71
Ceftazidime	71
Cefoperazone + Sulbactam	76
Gentamicin	67
Tobramycin	71
Neitilimycin	48

i). Klebsiella Pneumoniae

- According to the data obtained, Levofloxacin (90%), followed by Ofloxacin and Ciprofloxacin (86%) had shown maximum resistance against Klebsiella Pneumoniae.
- These results indicate that Klebsiella Pneumoniae show the maximum resistance to fluoroquinolones.
- The complete list of antibiotics that were found to be resistant against Klebsiella Pneumoniae is mentioned in Table 6.

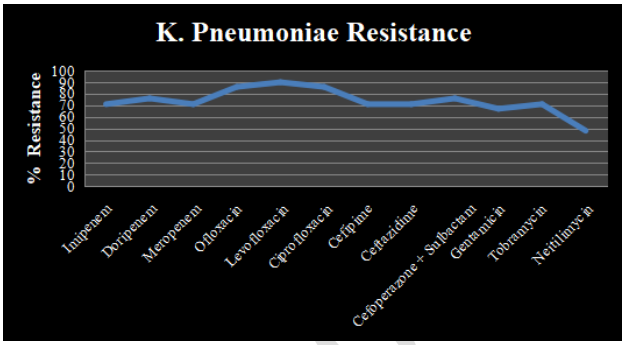

Figure 5 Antibiogram of Klebsiella Pneumoniae

- According to the data obtained, Tracheal specimen (33%), followed by urine specimen (29%) had shown maximum growth of Klebsiella Pneumoniae.

Table 7 Sample Growth of Klebsiella Pneumoniae

Sample	% Resistance
Tracheal	33
Blood	14
Urine	29

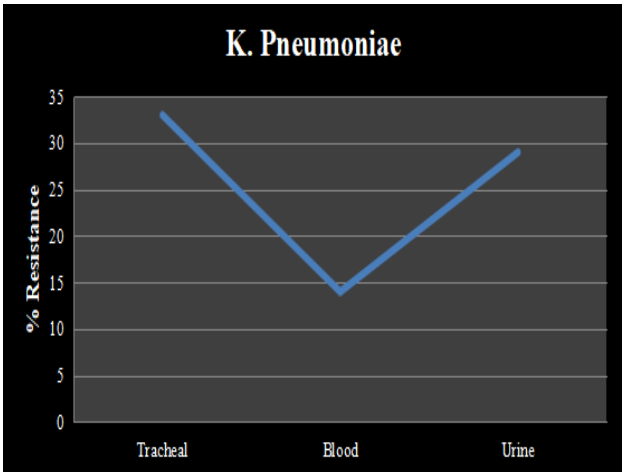

Figure 6 Sample Growth of Klebsiella Pneumoniae

ii). Acienobacter baumanii

- It was observed that Acienobacter Baumanii was resistant to all the antibiotics as shown in Table 8 and figure 7.0.

Table 8 Antibiogram of Acienobacter baumanii

Antibiotics	% Resistance
Imipenem	100
Doripenem	100
Meropenem	100
Ofloxacin	100
Levofloxacin	100
Ciprofloxacin	100
Cefipime	100
Ceftazidime	100
Cefoperazone + Sulbactam	100
Gentamicin	100
Tobramycin	100
Neitilimycin	100

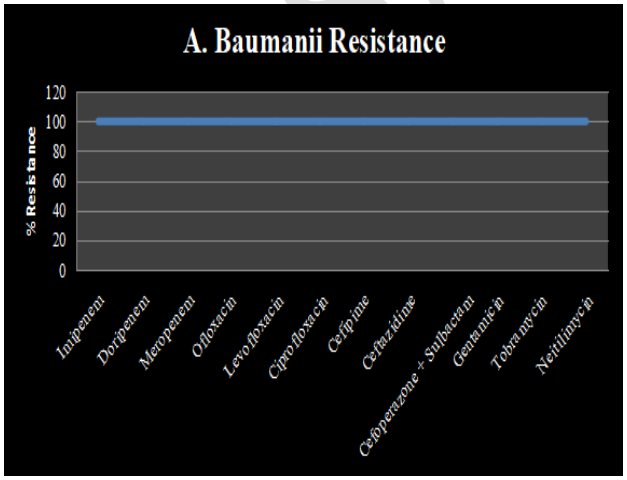

Figure 7 Antibiogram of Acienobacter baumanii

- According to the data obtained, Tracheal specimen (81%), followed by blood specimen (9.5%) had shown maximum growth of Acienobacter Baumanii.

Table 9 Acienobacter baumanii Growth in Sample

Sample	% Resistance
Tracheal	81
Blood	9.5
Urine	0

iii) Pseudomonas Aeruginosa

- Pseudomonas Aeruginosa showed highest resistance to Ofloxacin (50%), followed by Cefoperazone + Sulbactam (37.5%). The complete list of antibiotics along with their level of resistance is listed in Table 10.

Table 10 Antibiogram of Pseudomonas Aeruginosa

Antibiotics	% Resistance
Imipenem	33
Doripenem	33
Meropenem	33
Ofloxacin	50
Levofloxacin	33
Ciprofloxacin	25
Cefipime	0
Ceftazidime	33
Cefoperazone + Sulbactam	37.5
Gentamicin	33
Tobramycin	3
Neitilimycin	25

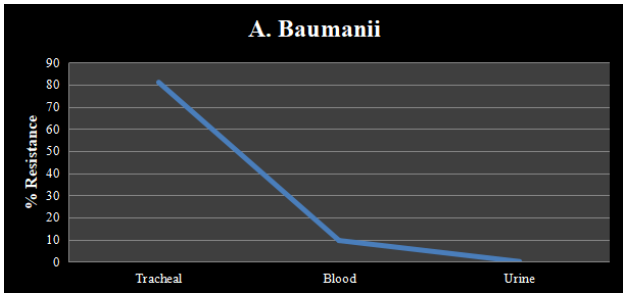

Figure 8 Sample Growth of Acienobacter baumanii

iii) Pseudomonas Aeruginosa

- Pseudomonas Aeruginosa showed highest resistance to Ofloxacin (50%), followed by Cefoperazone + Sulbactam (37.5%). The complete list of antibiotics along with their level of resistance is listed in Table 10.

Table 10 Antibiogram of Pseudomonas Aeruginosa

Antibiotics	% Resistance
Imipenem	33
Doripenem	33
Meropenem	33
Ofloxacin	50
Levofloxacin	33
Ciprofloxacin	25
Cefipime	0
Ceftazidime	33
Cefoperazone + Sulbactam	37.5
Gentamicin	33
Tobramycin	3
Neitilimycin	25

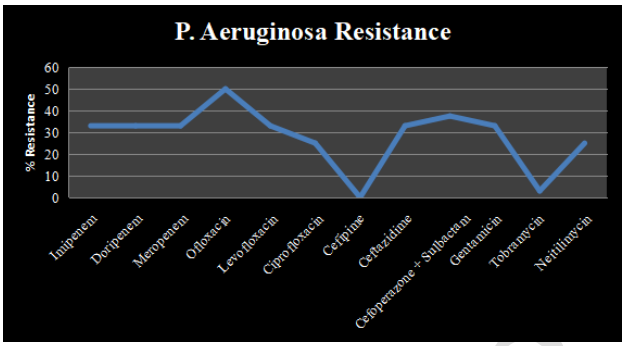

Figure 9 Antibiogram of Pseudomonas Aeruginosa

- According to the data obtained, Tracheal specimen (33%), followed by urine specimen (24%) had shown maximum growth of Pseudomonas Aeruginosa.

Table 11 Pseudomonas Aeruginosa Growth in Sample

Sample	% Resistance
Tracheal	33
Blood	9.5
Urine	24

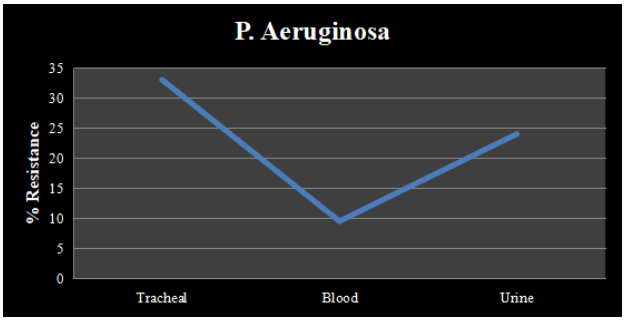

Figure 10 Pseudomonas Aeruginosa Growths in Sample

iv) Escherichia Coli

Escherichia Coli showed maximum resistance to Levofloxacin (80%). The complete list of antibiotics along with their level of resistance is listed in Table 12.

Table 12 Antibiogram of Escherichia Coli

Antibiotics	% Resistance
Imipenem	30
Doripenem	30
Meropenem	30
Ofloxacin	70
Levofloxacin	80
Ciprofloxacin	70
Cefipime	70
Ceftazidime	50
Cefoperazone + Sulbactam	40
Gentamicin	30
Tobramycin	30
Neitilimycin	30

According to the data obtained, Tracheal specimen, blood and urine specimen had shown maximum growth of Escherichia Coli.

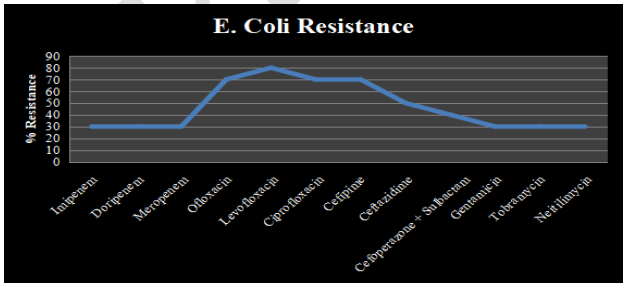

Figure 11 Antibiogram of Escherichia Coli

Table 13 Escherichia Coli Growth in Sample

Sample	% Resistance
Tracheal	5
Blood	5
Urine	5

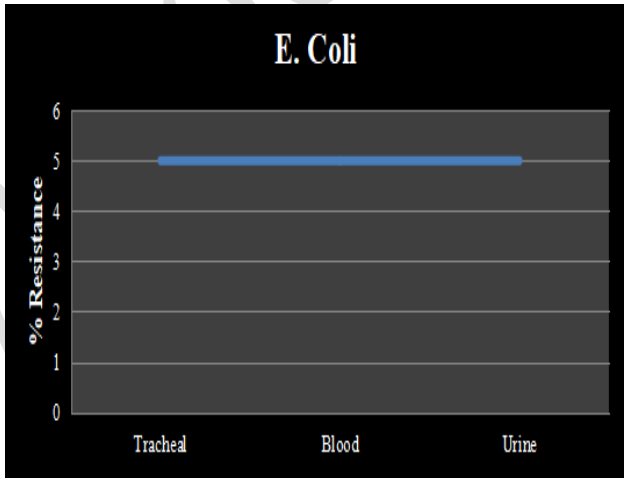

Figure 12 Escherichia Coli Growth in Sample

Highlighted = Maximum Percentage of antibiotic that is resistant to particular organism.

This antibiogram shows that fluoroquinolons group of antibiotics are resistant to the entire organisms.

Apart from the fact that maximum resistance is shown by carbapenem group.

Table 14 Antibiogram (n = 250)

Name of Antibiotic	Bacteria Name			
	Klebsiella Pneumoniae	**Acienobacter baumanii**	**Pseudomonas Aeruginosa**	**Escherichia Coli**
	Resistance of Antibiotic in %			
Imipenem	71	100	33	30
Doripenem	76	100	33	30
Meropenem	71	100	33	30
Ofloxacin	86	100	50	70
Levofloxacin	90	100	33	80
Ciprofloxacin	86	100	25	70
Cefipime	71	100	0	70
Ceftazidime	71	100	33	50
Cefoperazone + Sulbactam	76	100	37.5	40
Gentamicin	67	100	33	30
Tobramycin	71	100	3	30
Neitilimycin	48	100	25	30

DISCUSSION

As per present study results, the maximum resistance was shown against antimicrobials such as imipenem, doripenem, meropenem, then second most resistant group was flouroquinolones, then penicillin (ticarcillin, piperacillin, ampicillin), then cephalosporin and least resistance was shown by aminoglycoside group of antibiotics. According to the study conducted by Saravanan R [14], et al, showed the maximum resistance against commonly used first line antimicrobials such as co-trimoxazole, ampicillin, amoxicillin, amoxyclav, fluoroquinolones, third generation cephalosporins and nalidixic acid. These results were not in line with the study results with the present study. According to Mohammed MA et al [15], they found that Cephalothin (80.6%) and Ampicillin (90.0%) were highest resistance. These results were also not in line with the present study.

As per present study results, the most common isolates were Klebsiells pneumoniae (24%), then Acienobactor baumanii (21%), Pseudomonas aeruginosa (18.39%) and E.coli (11.5%). A study performed by Kaur N et. al, in patients with urinary tract infection (UTI), they found that the most common bacterial isolates were E.coli (45.4%) followed by Klebsiella (16.7%) and Enterococcus spp (13.2%). Isolation of candida (21.1%) was found in four of the patients, and that were maximum from ICU of 63.1%. [16] These results were not in with the present study. A study carried out by Veena Kumari HB, et. al, their study showed that most common isolates were non fermentative gram negative bacilli which was followed by P. Aeruginosa and Klebsiella spp. The results obtained from this study are as similar as present study. [17] The most frequently bacteria which were isolated were Staphylococcus aureus (n = 100; 22.8%), Klebsiella pneumoniae (n = 65; 14.8%) and Escherichia coli (n = 41; 9.3%). The results of this study are found similar to the present study. [18]

A study performed by Saxena [19], the Klebsiella species and Acinetobacter species were resistant to beta lactam group of antibiotics such as cephalosporins and piperacillin-tazobactam, while as per the present study, the the Klebsiella pneumoniae and Acinetobacter baumanii were resistant to fluoroquinolones of antibiotics such as olfoxacin, levofloxacin and ciprofloxacin. According to another study carried out by Moremi N, et. al, in their study, third generation cephalosporins had shown most resistance against high proportion of gram-negative isolates. [18] As per this study conducted, the flouroquinolones had shown most resistance against the resistant isolates.

In a retrospective study conducted by Warren C, et. al [20], in which they evaluate the antibiotic susceptibility patterns of pathogens in laboratory of Ndola teaching hospital. They collected the 693 total specimens. They found that the common specimens were urine (58.6%), blood (12.7%) and wound swabs (8.5%), but according to the present study the common specimens were found to be tracheal (38%), then followed by blood (21%) and then urine (15%). This study was done for 5 years. They evaluated the types of bacterial isolates and their AMR profile. The study was performed at Debre Markos Referral Hospital, Northwest Ethiopia. They found that the common samples in which growth was shown in stool culture 68 (28.3%) followed by urine (23.3%), ear discharge (22.5%) and wound swabs at (10.8%) whereas the results of present study wasn't in the line with the above study results. [21]

In a study carried out by Yaw Effah C, et. al [22], the K. pneumoniae was found to be resistant to amikacin (40.8%), aztreonam (73.3%), ceftazidime (75.7%), ciprofloxacin (59.8%), colistin (2.9%), cefotaxime (79.2%), cefepime (72.6) and imipenem (65.6%). But according to the present study, the K. pneumoniae was found to be resistant to imipenem (71%), doripenem (76%), meropenem (71%), ofloxacin (86%), levofloxacin (90%), ciprofloxacin (86%), cefipime (71%), ceftazidime (71%),

cefoperazone + sulbactam (76%), gentamicin (67%), tobramycin (71%) and neitilimycin (48%). The results from both the studies are differing. Yet, it can be said that K. Pneumoniae had shown the resistance to imipenem.

In a prospective study carried out by Gill MK, et. al [23], K. Pneumoniae was studied from January 2019 to July 2019 in North India. They studied 194 non-repeat isolates. Most of them, they were multi drug resistant, ESBL and Carbapenemase producers. They show 100% showed resistance to Ampicillin. These results are somewhat are in line with the present study, as in the present study, the K. Pneumoniae had been shown highest resistance to imipenem (carbapenems), followed by fluoroquinolones.

A cross sectional study performed by Motbanior H, et. al, in 238 patients [24] showed following results. They collected blood, urine and swab specimens. They only performed study on Acinetobacter baumannii and Pseudomonas aeruginosa isolates. They were 100% resistant to ampicillin and piperacillin. A. baumannii isolates were 33.3% against meropenem and 44.5% resistance against ciprofloxacin while as per present study, Acinetobacter baumannii had shown 100% resistance to group of antibiotics such as carbapenem (mostly to imipenem, doripenem and meropenem), also it had shown the resistance to fluoroquinolones, penicillin, cephalosporins and also to aminoglycoside. As per their study, P.aeruginosa isolates showed against ciprofloxacin of 36.4 % and 45.5% resistance against meropenem. But as per present study, Pseudomonas aeruginosa had shown highest resistance to ofloxacin group of about 50%.

The results of the study carried out by Al-Samaree Y. M, et. al, had shown that Acinetobacter baumannii was highest resistant to Piperacillin (94%), this result is not in line with the present study. [25]

In a study by Thapa DB, et. al [26], E. coli isolates were resistant to Ampicillin (100%) Co-trimoxazole (86.40%), Doxycycline (46.60%), Levofloxacin (45.63%), Nitrofurantoin (26.21%) and Amikacin (10.68%). And others were resistant to multidrug resistance to two or more antimicrobials. But as per present study, the E. coli isolates were highly resistant to Levofloxacin (80%), followed by ofloxacin, ciprofloxacin and cefipime (each of about 70%).

In this retrospective data collection by Kibret M, et. al [27], they review the culture of specimen of urine, ear discharge, eye discharge and pus swab from wounds. They analyzed total of 3149 specimen culture reports. Among them, 446 (14.2%) had shown E. coli growth. They found that, urine samples had shown maximum growth of E. coli of 45.5%, but as per present study, the tracheal, blood and urine samples shown the same growth of E. coli. E. coli was highly resistant to erythromycin (89.4%), amoxicillin (86.0%) and tetracycline (72.6%), these results are not in with the present study as per present study, the E. coli showed highest resistance to levofloxacin (80%).

In a study by Javiya VA, et. al [28], the highest growth of Pseudomonas aeruginosa was found in urine, pus and then sputum. But as per present study conducted the highest growth was observed in tracheal specimen, then urine followed by blood.

CONCLUSION

The antibiotic groups which showed the maximum antibiotic resistance pattern were carbapenem, fluoroquinolones, penicillins, cephalosporin and aminoglysocides. The antibiogram shows that the fluoroquinolons group of antibiotics are resistant to the all the tested organisms. By using this data, the particular centre or hospital can use this data to guide the consultant/doctor to select proper antibiotics with help of microbiologist. This data can be useful for further future analyzes related to rational use of antibiotics which can contribute to effective application of Antimicrobial Stewardship Program. Apart from the fact that maximum resistance is shown by carbapenem group. After The antibiogram shows

that the fluoroquinolons group of antibiotics are resistant to the all the tested organisms. And before the sentence By using this data, the particular centre or hospital can use this data to guide the consultant/doctor to select proper antibiotics with help of microbiologist.

ACKNOWLEDGEMENT

I want to express my kind gratitude to Mr. Nipul Kapadia and Mr. Sanket Shah, as they had been my mentors at study site (Apollo Hospital). Without their guidance, this won't be accomplished.

ETHICS DECLARATIONS

Shethia Foram, Suryawanshi Meghraj declares no conflict of interest.

HUMAN AND ANIMAL RIGHTS AND INFORMED CONSENT

This article does not include studies conducted by any of the authors on human or animal subjects.

AUTHOR'S CONTRIBUTION

Shethia Foram – Conceptualization, literature search and writing of the manuscript
Suryawanshi Meghraj- Conceptualization, literature search, writing, and reviewing of the manuscript

REFERENCE

1. WHO. (2020). Antimicrobial Resistance. https://ahpsr.who.int/publications/i/item/global-action-plan-on-antimicrobial-resistance
2. Centers for Disease Control and Prevention. (2019). Antibiotic/Antimicrobial Resistance (AR/AMR)(2018). *Online information available at https://www. cdc. gov/drugresistance/about. html (accessed October 2019)*.
3. WHO. Antimicrobial resistance –a global epidemic. https://www.wto.org/english/news_e/news16_e/heal_29aug16_e.pdf
4. Chokshi, A., Sifri, Z., Cennimo, D., & Horng, H. (2019). Global contributors to antibiotic resistance. *Journal of global infectious diseases*, *11*(1), 36.
5. Raghunath, D. (2008). Emerging antibiotic resistance in bacteria with special reference to India. *Journal of biosciences*, *33*(4), 593-603.
6. WHO (India) and Ministry of Health & Family Welfare Government of India. (2016). Antimicrobial resistance and its containment in India. https://www.who.int/docs/default-source/searo/india/antimicrobial-resistance/amr-containment.pdf?sfvrsn=2d7c49a2_2
7. Chakravarty A., Kumar D. A.. (2018). Prevalence and Antimicrobial Resistance Pattern of Bacterial Isolates in a Tertiary Care Hospital of Assam. India. International Journal of Medical Science and Innovative Research. 3, 291-299.
8. Centre for Disease Dynamics, Economics & Policy. Antibiotic Use and Resistance in Food Animals, Current Policy and Recommendations. https://www.cddep.org/wp-content/uploads/2017/06/india_abx_report-2.pdf
9. Pandya, H. B., Agravat, H. H., Patel, J. S., & Sodagar, N. R. K. (2014). Emerging antimicrobial resistance pattern of Helicobacter pylori in central Gujarat. *Indian journal of medical microbiology*, *32*(4), 408-413.
10. Roope, L. S., Smith, R. D., Pouwels, K. B., Buchanan, J., Abel, L., Eibich, P., ... & Wordsworth, S. (2019). The challenge of antimicrobial resistance: what economics can contribute. *Science*, *364*(6435).
11. Getahun, H., Smith, I., Trivedi, K., Paulin, S., & Balkhy, H. H. (2020). Tackling antimicrobial resistance in the COVID-19 pandemic. *Bulletin of the World Health Organization*, *98*(7), 442.
12. Hofer U. (2018). The cost of antimicrobial resistance. Nature Review Microbiology
13. Holmes, E. A., & Hughes, D. A. (2019). Challenges for economic evaluation of health care strategies to contain

antimicrobial resistance. *Antibiotics*, *8*(4), 166.
14. Saravanan, R., & Raveendaran, V. (2013). Antimicrobial resistance pattern in a tertiary care hospital: an observational study. *Journal of basic and clinical pharmacy*, *4*(3), 56.
15. Mohammed, M. A., Alnour, T. M., Shakurfo, O. M., & Aburass, M. M. (2016). Prevalence and antimicrobial resistance pattern of bacterial strains isolated from patients with urinary tract infection in Messalata Central Hospital, Libya. *Asian Pacific journal of tropical medicine*, *9*(8), 771-776.
16. Kaur, N., Sharma, S., Malhotra, S., Madan, P., & Hans, C. (2014). Urinary tract infection: aetiology and antimicrobial resistance pattern in infants from a tertiary care hospital in northern India. *Journal of clinical and diagnostic research: JCDR*, *8*(10), DC01.
17. Kumari, H. V., Nagarathna, S., & Chandramuki, A. (2007). Antimicrobial resistance pattern among aerobic gram-negative bacilli of lower respiratory tract specimens of intensive care unit patients in a neurocentre. *Indian journal of chest diseases and allied sciences*, *49*(1), 19.
18. Moremi, N., Claus, H., & Mshana, S. E. (2016). Antimicrobial resistance pattern: a report of microbiological cultures at a tertiary hospital in Tanzania. *BMC infectious diseases*, *16*(1), 1-7.
19. Saxena, S., Priyadarshi, M., Saxena, A., & Singh, R. (2019). Antimicrobial consumption and bacterial resistance pattern in patients admitted in ICU at a tertiary care center. *Journal of infection and public health*, *12*(5), 695-699.
20. Warren C, Manyepa M, Chikwanda E, Daka V, Chileshe J, Tembo M, Kasongo J, Chipipa A, Handema R, Mulemena A. J. (2019). Evaluation of antibiotic susceptibility patterns of pathogens isolated from routine laboratory specimens at Ndola Teaching Hospital: A retrospective study. PLOS ONE
21. Abebe, M., Tadesse, S., Meseret, G., & Derbie, A. (2019). Type of bacterial isolates and antimicrobial resistance profile from different clinical samples at a Referral Hospital, Northwest Ethiopia: five years data analysis. *BMC research notes*, *12*(1), 1-6.
22. Effah, C. Y., Sun, T., Liu, S., & Wu, Y. (2020). Klebsiella pneumoniae: An increasing threat to public health. *Annals of clinical microbiology and antimicrobials*, *19*(1), 1-9.
23. Gill M. K., Kaur A, Khanna A. (2019). Antibiogram of Klebsiella pneumoniae isolated from various clinical samples of hospitalized patients in a tertiary care hospital of North India.Tropical Journal of Pathology & Microbiology. 5
24. Motbainor, H., Bereded, F., & Mulu, W. (2020). Multi-drug resistance of blood stream, urinary tract and surgical site nosocomial infections of Acinetobacter baumannii and Pseudomonas aeruginosa among patients hospitalized at Felegehiwot referral hospital, Northwest Ethiopia: a cross-sectional study. *BMC infectious diseases*, *20*(1), 1-11.
25. Al-Samaree, M. Y., & Al-Khafaji, Z. M. (2016). Antibiogram of Acinetobacter baumannii isolated from Baghdad Hospitals. *Int. J. Adv. Res. Biol. Sci*, *3*(4), 238-242.
26. Thapa, D. B., & Chapagain, A. (2020). Antibiogram of Escherichia coli Isolated from Avian Colibacillosis in Chitwan District of Nepal. *International Journal of Applied Sciences and Biotechnology*, *8*(1), 52-60.
27. Kibret, M., & Abera, B. (2011). Antimicrobial susceptibility patterns of E. coli from clinical sources in northeast Ethiopia. *African health sciences*, *11*, 40-45.
28. Javiya, V. A., Ghatak, S. B., Patel, K. R., & Patel, J. A. (2008). Antibiotic susceptibility patterns of Pseudomonas aeruginosa at a tertiary care hospital in Gujarat, India. *Indian journal of pharmacology*, *40*(5), 230.

HOW TO CITE THIS ARTICLE

Shethia, F. K., Suryawanshi, M. V., Anand, I. S. (2021). Prevalence of Antimicrobial Resistance Pattern in Tertiary Care Hospital: A Prospective Observational Study. *International Journal for Pharmaceutical Research Scholars, 10(2);01 - 17.*

THIS PAGE IS INTENTIONALLY LEFT BLANK.

