Original Article

Drugs Effect on different Strains

Study to Determine the Antimicrobial Sensitivity and Resistance pattern of Various Strains against Commonly prescribed Antibiotics

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ABSTRACT

Objective: The main objective of this study was to determine the sensitivity and resistance of various bacterial strains both gram negative and gram positive against commonly used antibiotics.

Study Design: Experimental / Retrospective study.

Place and Duration of Study: This study was conducted in Hayatabad Medical Complex at Microbiology Laboratory for a period of six month studies from 6.8.2013 to 10.02.2014.

Materials and Methods: The study was conducted in which both in-door and out-door patients were randomly selected for this specified period of time. Bacterial strains used were Staphylococcus Aureus, Escherichia Coli, Pseudomonas Aeruginosa and Proteus Mirabilis against commonly prescribed antibiotics i.e; Ceftraixone, Amoxicillin, Amikacin and Cefepime and to find out the sensitivity and resistance pattern.

Results: Among the selected antibiotics Ceftraixone was found to be sensitive in 84.6% of out-door patients and 75 % of in-patient against Pseudomonas Aeruginosa, 71.4% of out-door patients and 68.4% of in-patients against Escherichia Coli, 52% of out-door patients and 60% in-patient against Staphylococcus Aureus and least sensitive against Proteus Mirabilis 25% out-patients and 16.7% in-patients. Amoxicillin was 40%, 6.6% and 0% sensitive in in-patients and 16%, 17.1%, 0.7% and 0% in out-patients against Staphylococcus Aureus, Escherichia Coli, Pseudomonas Aeruginosa and Proteus Mirabilis respectively. Amikacin was 44%, 35%, 33.3% and 0% sensitive in in-patients and 36%, 37.2%, 32% and 0% in out-patients against Staphylococcus Aureus, Escherichia Coli, Pseudomonas Aeruginosa and Proteus Mirabilis respectively. Cefepime was most sensitive against Proteus Mirabilis 25% in out-door patients and 16.7% in in-door patients while least sensitive against Pseudomonas Aeruginosa both in out-door and in-door patients.

Conclusion: It is concluded from the results obtained that Ceftraixone, Amoxicillin and Amikacin were more than 60% sensitive against the selected strains of bacteria except Proteus Mirabilis while Cefepime is least sensitive i.e; less than 25% against all these antibacterial strains. These results should be considered in future prescribing of antibiotics against these bacterial strains to avoid resistance and to prescribe appropriate treatment for the patients.

Key Words: Antibiotic Sensitivity, Bacterial Strains, In-door Patients, out-door Patients

INTRODUCTION

Antibiotics are an important group of pharmaceuticals used in health care for the treatment and prevention of bacterial infections. The irrational use of drug is a major problem of present day medical practice and its consequences include the development of bacterial resistance to antibiotics, ineffective treatment, adverse effects of the drug and economic burden on the patient and the society. Irrational or misuse of drugs refers to the distribution or consumption of drugs in ways that negate or reduce the efficacy or in situations where they are unlikely to have the desired effect.[1] As accepted by the WHO the rational use of drug requires the patients receive medication appropriate to their clinical needs, in doses that meet their own individual requirements for an adequate period of time and at the lowest cost to them and their community. Antimicrobial resistance (AMR), a growing public health concern where the microorganism is able to survive exposure to antibiotic treatment.[2] This is evident from the first report of vancomycin resistant *Staphylococcus aureus* (VRSA) from the US in 2002, Brazil in 2005, Jordan and India in 2006. Similarly, resistance was reported in the late 1980s, with vancomycin resistant *Enterococci*. Controlling infections is going to be a tough job in developing countries where infectious diseases still hold high morbidity and mortality. Several intrinsic factors such as point mutation, gene amplification and extrinsic factors like horizontal transfer of resistant gene between bacteria within and across species by transposons, integrins or plasmids have been postulated for the development of resistance, which cannot be reduced once developed even by restricting the antibiotic usage.[3] Social factors such as demographic changes, deficient hygienic practices and overcrowding

have been enumerated for the emergence of AMR. Antibiotic resistance has been a low priority area in most developing and many developed countries.[4] Compared with the immediate challenges of HIV/AIDS, tuberculosis, malaria, pneumonia and many other infectious diseases, the loss of antibiotics at some future time does not capture the same attention. Resistance against certain antibiotics is already at high levels in developing countries but the problem has remained largely unknown because relatively few studies were published.[5]

This study has been carried out in an hospital with the aim of determining the commonly prescribed antibiotic susceptibility of *Staphylococcus Aureus, Escherichia Coli, Pseudomonas Aeruginosa and Proteus Mirabilis*, in order to utilize that information to formulate antibiotic policy and appropriate control measures.

MATERIALS AND METHODS

The study was conducted in Hayatabad Medical Complex Peshawar at Microbiology Laboratory for a period of six months in which in-door and out-door patients data were collected. In the selected data both male and female were included. Total 354 isolates were selected out of which 206 were indoor-patients and 148 outdoor-patients for the selected four bacterial strains i.e; Staphylococcus Aureus, *Escherichia Coli*, Pseudomonas Aeruginosa and Proteus Mirabilis and they were studied against the sensitivity of commonly prescribed antibiotics Ceftraixone, Amoxicillin, Amikacin and Cefepime. These were isolated from various clinical samples including pus, sputum, urine, high vaginal swabs, blood, and body fluids. Screening swabs were inoculated into a 7% sodium chloride solution on day one and sub cultured after overnight incubation at 35°C onto Blood agar and MacConkey agar.[6-7] All other samples were directly inoculated onto blood agar and MacConkey agar plates and incubated aerobically at 35ºC for 24 hours. The isolates were identified with standard tests used to identify the selected strains such as Gram stain, catalase, slide and tube coagulase and Staphylase (Oxoid) tests. Antibiotic sensitivity testing was performed using Mueller Hinton agar by standard disc diffusion method recommended by the Clinical and Laboratory Standard Institute (2008),[8-9] for the following antibiotics: Ceftraixone, Amoxicillin, Amikacin and Cefepime.

RESULTS

Over a period of six months total 354 isolates were selected as shown in table 1. Indoor patients were 206 out of which 114 were male patients and 92 were female and 148 were obtained from outdoor patients in which 78 were male patients and 70 were female patients.

Among the selected antibiotics Ceftraixone was found to be sensitive in 84.6% of outdoor patients and 75 % of indoor patient against Pseudomonas Aeruginosa, 71.4% of outdoor patients and 68.4% of indoor patients against *Escherichia Coli, 52% of outdoor patients and 60% indoor patient against* Staphylococcus Aureus and least sensitive against Proteus Mirabilis 25% outdoor patients and 16.7% indoor patients as shown in table 2 and Fig 1-4. Amoxicillin was less sensitive against these bacterial strains as compared to Ceftraixone. Amoxicillin was 40%, 6.6% and 0% sensitive in indoor-patients and 16%, 17.1%, 0.7% and 0% in outdoor-patients against Staphylococcus Aureus, *Escherichia Coli*, Pseudomonas Aeruginosa and Proteus Mirabilis respectively. Amikacin was 44%, 35%, 33.3% and 0% sensitive in in-patients and 36%, 37.2%, 32% and 0% in out-patients against Staphylococcus Aureus, *Escherichia Coli*, Pseudomonas Aeruginosa and Proteus Mirabilis respectively. Cefepime was most sensitive against Proteus Mirabilis 25% in outdoor patients and 16.7% in indoor patients while least sensitive against Pseudomonas Aeruginosa both in outdoor and indoor patients.

Table No.1: Total number of isolates obtained from indoor and outdoor patients

Total Number of Male and Female In-Patients against various Bacterial Strains				
	Staphylococcus Aureus	***Escherichia Coli***	***Pseudomonas Aeruginosa***	***Proteus Mirabilis***
Male	24	68	14	08
Female	26	52	10	04
Total	**50**	**120**	**24**	**12**
Total Number of Male and Female Out-Patients against various Bacterial Strains				
	Staphylococcus Aureus	***Escherichia Coli***	***Pseudomonas Aeruginosa***	***Proteus Mirabilis***
Male	20	30	22	06
Female	30	40	04	02
Total	**50**	**70**	**26**	**08**

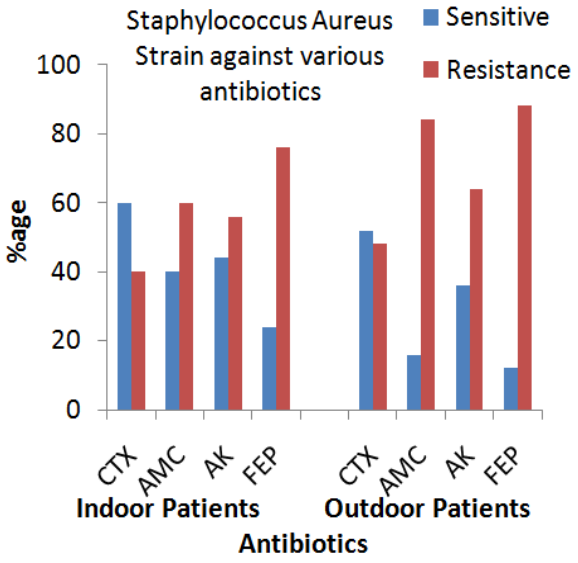

Figure No.1: %age of Indoor and outdoor Patients Sensitivity against bacterial strains

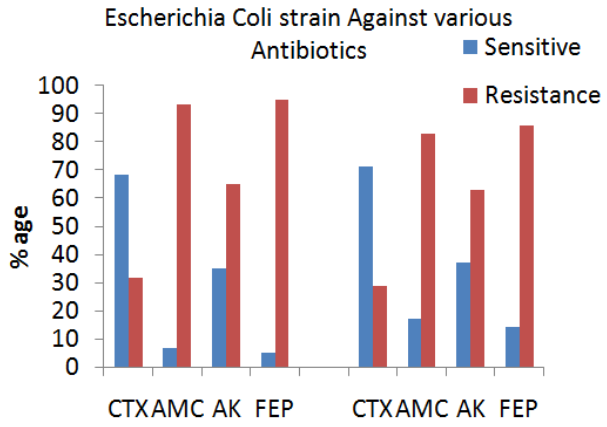

Figure No.2: %age of Indoor and outdoor Patients Sensitivity against bacterial strains

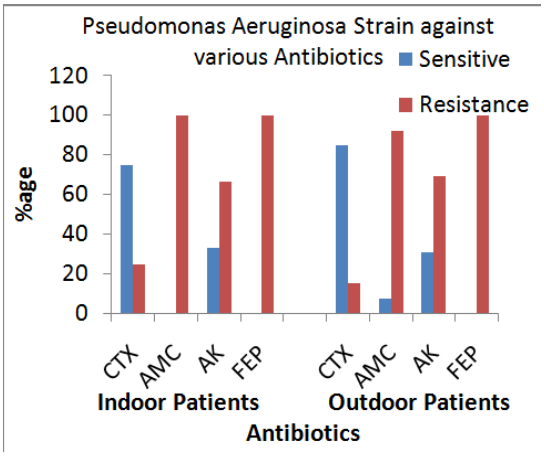

Figure No.3: %age of Indoor and outdoor Patients Sensitivity against bacterial strains

Table No.2: Percentage of Antibiotic Sensitivity and Resistance against various strains of microorganisms

Percentage of Antibiotic Sensitivity and Resistance against various strains of microorganisms								
Bacterial Strains	***Staphylococcus Aureus***				***Escherichia Coli***			
	IP		OP		IP		OP	
Antibiotics	**S%**	**R%**	**S%**	**R%**	**S %**	**R%**	**S%**	**R%**
CTX	60.0	40.0	52.0	48.0	68.4	31.6	71.4	28.6
AMC	40.0	60.0	16.0	84.0	6.6	93.4	17.1	82.9
AK	44.0	56.0	36.0	64.0	35.0	65.0	37.2	62.8
FEP	24.0	76.0	12.0	88.0	05.0	95.0	14.3	85.7
Bacterial Strains	***Pseudomonas Aeruginosa***				***Proteus Mirabilis***			
	IP		OP		IP		OP	
Antibiotics	**S%**	**R%**	**S%**	**R%**	**S %**	**R%**	**S%**	**R%**
CTX	75.0	25.0	84.6	15.4	16.7	83.3	25.0	75.0
AMC	00.0	100	07.7	92.3	00.0	100	00.0	100
AK	33.3	66.7	30.8	69.2	00.0	100	00.0	100
FEP	00.0	100	00.0	100	16.7	83.3	25.0	75.0
IP= Indoor Patient, OP= Outdoor Patient, S= Sensitive, R= Resistance, CTX=Ceftraixone, AMC=Amoxicillin, AK=Amikacin, FEP= Cefepime								

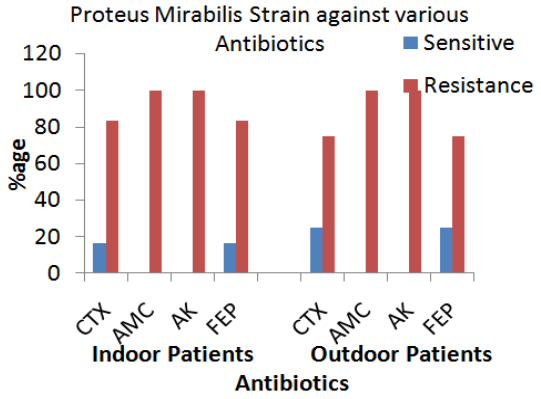

Figure No.4: %age of Indoor and outdoor Patients Sensitivity against bacterial strains

DISCUSSION

Antimicrobial agents are among the most commonly used drugs in hospitalized patients. The emergence of antimicrobial resistance is of great concern as it increases the likelihood of drug interactions/side effects and cost of therapy due to use of newer antibiotics. Resistance may also be responsible for *Staphylococcus Aureus* prolonged hospital stays and can affect prognosis. The problem of resistance in a hospital is difficult to understand without the knowledge of antimicrobial use pattern.[10-11] Monitoring the use of antimicrobial and review of sensitivity pattern are, therefore, important.

Organisms were isolated in 59.6 % out of cultures investigated. *Escherichia Coli* was the predominant organism isolated from this study compared with, *Pseudomonas Aeruginosa*, respectively. While *Proteus Mirabilis* was the least organism isolated.[12]

The isolation pattern of organisms appears to vary with time and hospital settings.[13] Our data showed that there were more Gram-negative than Gram positive isolates. This is not surprising since the former are known to

develop resistance more rapidly and extensively than the latter.[14-15]

In our study it was found that *Staphylococcus Aureus* was sensitive up to 60.0% against Ceftraixone, 40% against amoxicillin, 44.0% against Amikacin and 24.0% against Cefepime in indoor patients which is a bit higher %age as compared to outdoor patients as shown in Table 2 and Fig.1. *Whereas Escherichia Coli shows more sensitivity as compared to Staphylococcus Aureus* against Ceftraixone and in outdoor patients 71.4% sensitive. while 17.1%, 37.2% and 14.3% against amoxicillin, Amikacin and Cefepime respectively while indoor patient shows fewer sensitivity as shown in Table.2 and Fig 2. As shown in Fig 3 and Table 2 *Pseudomonas Aeruginosa* was highly sensitive against Ceftraixone, about 84.6% in outdoor patient while it is completely resistance against Amoxicillin and Cefepime and 30.85 sensitive against Amikacin as shown in Fig 3 and Table 2.

Similarly *Proteus Mirabilis* also showed least sensitivity among all the isolates against antimicrobial agents. *Proteus Mirabilis* was 25.0% sensitive against Ceftraixone and Cefepime while it is completely resistance against Amoxicillin and Amikacin as shown in Fig 4 and Table 2.

CONCLUSION

It is concluded from the present study that Ceftraixone showed promising results and was most sensitive against all the selected isolates whereas Cefepime showed least sensitivity and were mostly resistance against all the selected microorganisms. Antimicrobials like Cefepime have developed resistance to such a level that, prescribing them would definitely lead to treatment failure.[16] Development of resistance against Cefepime can be predictable, which might be due to wide spread use.

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