Antibiotics - Is there a Need for Antibiogram?

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ABSTRACT

Antibiotic resistance is a global problem, the solutions are entirely local issue. The anti-microbiological data revealed an alarming increase in the incidence of antibiotic resistant, Methicillin-resistant Staph.aureus and other resistant bacteria in many upgraded and Speciality Hospital in many developing countries. The disturbing fact has been a major driver for framing antibiotic policy to improve the hospital infection control. Education about the specific use of antibiotics both in hospitals and in community is vital if we are to tackle resistance to antibiotics effectively. Increase in monitoring, surveillance and imparting knowledge of infection control principles and practices will be able to bring down the rate of antibiotics resistance. Microbial isolates and antimicrobial susceptibility testing pattern were studied in cumulative samples from ICU (n=1773), Surgery ward (n=1446), Medicine ward (n=1092), Cardiac centre (n=719), Collection centre (n=1522) from Super speciality hospital in developing country. Pus samples (n=5544), Urine samples (n=3204) Respiratory samples (n=1297) and Blood samples (n=903) were analysed and results of antimicrobial susceptibility testing pattern were worked out. The antibiogram should be monitored by a control unit under strict supervision of Experts.

KEY WORDS: Antibiogram, Antibiotics

الملخص

المقاومة للمضادات الحيوية مشكلة عالمية, ويكون الحل محليا . بيانات مضادات الميكروبات في المستشفيات التخصصية في بعض البلدان النامية توضح زيادة مقلقة في معدل حدوث المقاومة للمضادات الحيوية, مثل بكتريا المكورات العقدية المقاومة لعقار الميثيسيلين. هذه الحقائق ادت الي تكوين سياسات لاستخدام المضادات الحيوية للتحكم في العدوي. التوعية بالاستخدام الامثل والدقيق للمضاد الحيوي في المستشفيات وفي المجتمعات من الوسائل الحيوية للحد من المقاومة للمضادات الحيوية بصورة فاعلة. ايضا المراقبة والتقصي والمعرفة لأساسيات وممارسات السيطرة علي العدوي يخفض من مستوي المقاومة للمضادات الحيوية.**المنهج:** تم عمل دراسة وذلك بعزل البكتريا وعمل اختبار الحساسية للمضادات الحيوية لعينة تراكمية عددها 1773 مريض بالعناية المركزة وعدد 1446 من قسم الجراحة و1092 من قسم الباطنية و719 من مركز القلب و1522 من مركز التجميع بإحدى المستشفيات التخصصية بدولة نامية . كانت عينات الصديد 5544 وعينات البول 3204 وعينات الجهاز التنفسي 1297 وعينات الدم 903 وقد تم تحليل العينات واستخراج النتائج لاختبار حساسية المضادات الحيوية . يجب عمل التخطيط والرصد والمراقبة للمضادات الحيوية من قبل وحدة تحكم و بإشراف دقيق وصارم من الخبراء.

INTRODUCTION

The rapid increase in the incidence of antimicrobial resistance in recent years has deemed it a major public health concern. Improper treatment of infections due to resistance to conventionally prescribed antibiotics has led to increased morbidity and mortality. The Antibiotic resistance is a global problem, the solution are entirely local issue. Briefly, an antibiogram as defined by the Clinical and Laboratory Standards Institute is an overall profile of the antibiotic susceptibility of an organism to a collection of antimicrobial agents routinely tested and used. Most hospitals issue once a year an “Antibiogram chart”, which is a summary of the most important antibiotic resistance pattern of that hospital for the year [1].

The anti-microbiological data revealed an alarming increase in the incidence of antibiotic resistant, Methicillin resistant Staph aureus, and other resistant bacteria in many Hospitals. The antibiogram gives useful information for the selection of an empiric antibiotic treatment with specific bacteria [2,3]. Measuring resistance to antibiotics enables epidemiologists and healthcare providers to monitor trends, develop guidelines for optimal empiric therapy, and provide impetus for and ascertain the success of educational efforts promoting the judicious use of antibiotics as antimicrobial resistance is not uniform [4, 5].

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Alternatively, consistently accurate data can not only result in the successful remedy of an infection, but also provide clinicians and health professionals with confidence in their therapeutic prescribing and their ability to treat [6]. Lack of standardization in the construction of antibiogram can result in misinterpretation of data and inappropriate prescribing of empiric antimicrobial therapy. Guidelines for antimicrobial susceptibility testing and the presentation of cumulative test data antibiogram are available for many hospitals [7,8,9,10,11].

Properly prepared antibiogram are important in the monitoring and control of antimicrobial resistance. The disturbing fact has been a major driver for framing antibiotic policy and improvement of hospital infection control. The present collaborative study aims to determine if existing hospital antibiogram could be used to estimate the percent of specific, drug-resistant in multiple sites in one Medical College with Super specialty Hospital in developing countries in order to see the solution to the arising problems and its implications for the other applicable places

METHODS

Study Design: A 2 years collaborative follow up study was done with Department of Microbiology, Dayanand Medical College Hospital, Ludhiana, India which is one type of Super speciality Hospital in developing country.

Data collection: A request for antibiogram from 2008-2010 were sent to all laboratory facilities performing microbiological culture and antimicrobial susceptibility testing in the above study place in order to examine and report the status of antimicrobial resistance to prepare cumulative antibiogram.

Sample size: Microbial isolates and antimicrobial susceptibility testing pattern were studied in the following sample size from ICU (n=1773), Surgery ward (n=1446), Medicine ward (n=1092), Cardiac centre (n=719) and Collection centre (n=1522). Also subgroup of various samples namely: - Pus samples (n=5544), Urine samples (n=3204) Respiratory samples (n=1297) and Blood samples (n=903) were also studied.

Analysis: We obtained aggregated data within antimicrobial susceptibility and the status of antimicrobial susceptibility in the individual antibiogram was evaluated using criteria from the Clinical Laboratory Standard Institute [1,2].

Careful monitoring was done regarding the production and distribution of antibiotic culture plates. Antibiograms were evaluated on the basis of antimicrobial susceptibility testing pattern of Gram +ve and -ve isolates.

Limitation: In this study, we were unable to examine the role of laboratory error or differences in susceptibility testing methods.

RESULTS

The percentage of antimicrobial susceptibility testing of gram –ve isolates were high in Amikacin, Netlimicin, Piperacillin+Tazobactum, Cefoperazone+ Sulbactam, Imipenem and Meropenem. Also, the percentage of antimicrobial susceptibility testing of gram +ve isolates were high in Erythomycin, Gentamycin, Amikacin, Clindamycin, Lincomycin, Vancomycin and Teicoplanin (Table 1 & 2).

Table1: Percentage of Antimicrobial Susceptibility Testing of Gram-ve Isolates to different Antibiotics

Antibiotic	E coli	Pseudo	Acino	Klebsiella
Genta	35	30	15	30
Amika	78	41	22	68
Netl	68	34	48	53
Cipro	14	37	10	18
Cephlex	16	4	3	12
Ceftz	22	31	10	16
ceftx	20	30	8	14
Cefpz	19	31	7	8
Pipera	13	38	7	11
Piper/tazo	80	66	77	24
Cepz+sulb	72	46	47	61
Imip	99	75	68	96
Mero	97	68	58	90
Cotri	15	16	19	19

In Surgical wards the antimicrobial susceptibility testing pattern for gram–ve isolates were Amikacin, Netilmicin, Piperacillin, Piperacillin+Tazobactum, Cefoperazone+ Sulbactam, and Imipenem whereas Erythromycin, Gentamycin, Amikacin, Netilmicin and

Vancomycin were for for gram + isolates (Fig 3, 4).

Table 2: Percentage of Antimicrobial susceptibility testing of gram+ve isolates to different antibiotics

Antibiotic	Staph. aureus	Enterococcus
Pen	27	13
Eryth	50	24
Oxa	41	-
Genta	52	20
Amika	51	28
Netl	27	28
Cipro	41	22
Clinda	74	-
Linco	100	100
Vanco	100	96
Teico	98	97

In ICU the antimicrobial susceptibility testing pattern for gram–ve isolates were Amikacin, Piperacillin+Tazobactum and Imipenem whereas Amikacin, Netilmicin and Vancomycin were for gram + isolates (Table 3, 4 and Fig 1, 2).

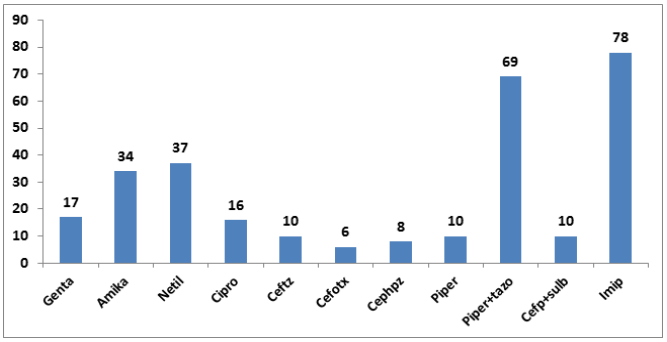


Figure 1: Sensitivity Pattern of G-ve Isolates from ICU (n=1542)

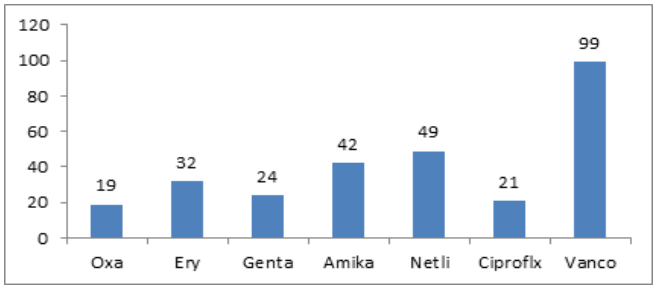


Figure 2: Sensitivity Pattern of G+ve Isolates from ICU (n=231)

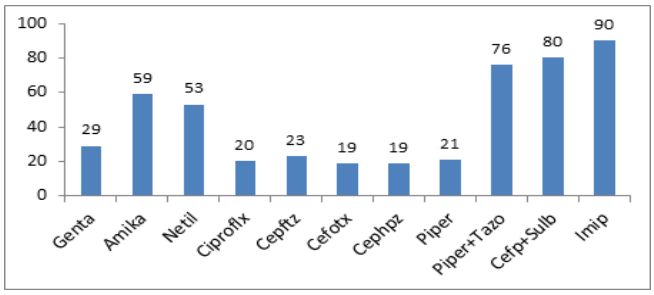


Figure 3: Sensitivity Pattern of G-ve Isolates from Surgery wards (n=1098)

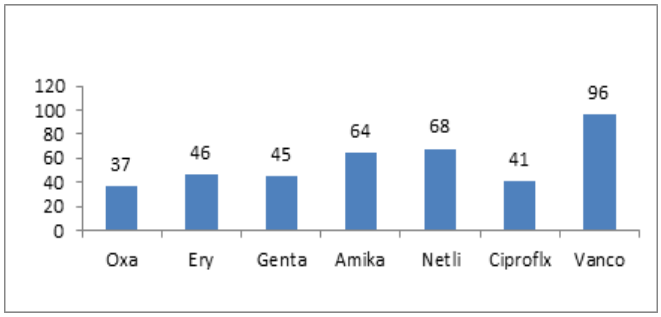


Figure 4: Sensitivity Pattern of G+ve Isolates from Surgery wards (n=348)

Table 3: Culture Reading from ICU

Org./ Antibio	Genta	Amk	Netil	Cipro	Ceptz	Ceftx	Cefpz	Pipera	Piper+ Tazo	Cefp+ Sulb	Imip
Acineto	10	13	40	4	1	2	1	2	76	8	65
Pseudo	23	33	26	32	24	22	24	28	66	44	72
E. coli	21	58	45	10	7	6	5	3	63	14	97

Table 4: Culture reading from ICU

Org./Antibio	Oxa	Ery	Genta	Amik	Netil	Cipro	Vanco
S.aureus	25	38	33	55	79	22	100
Enterococcus	--	18	14	6	10	12	96

In Medical wards the antimicrobial susceptibility testing pattern for gram–ve isolates were Amikacin, Netilmicin, Piperacillin+Tazobactum, Cefoperazone+ Sulbactam and Imipenem whereas Oxacillin, Gentamycin, Amikacin, Netilmicin and Vancomycin were for gram + isolates (Fig 5,6).

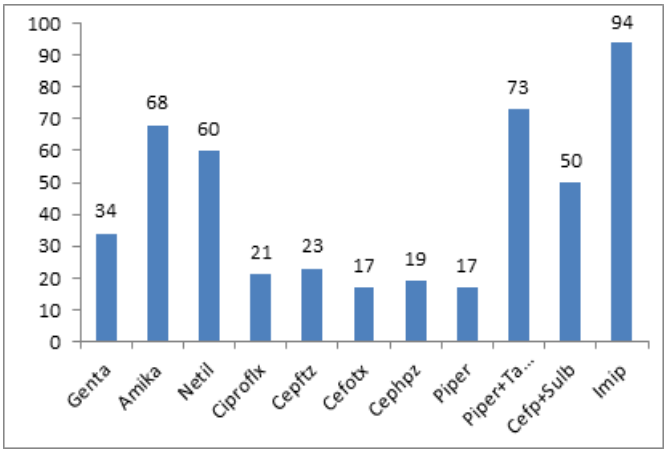


Figure 5: Sensitivity Pattern of G-ve Isolates from Medical wards (n=852)

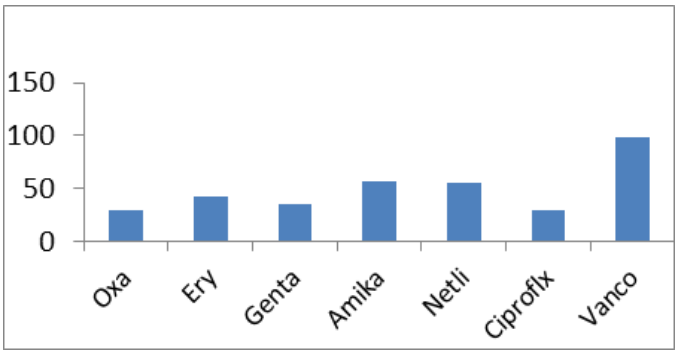


Figure 6: Sensitivity Pattern of G+ve Isolates from Medical wards (n=240)

In Cardiac centre the antimicrobial susceptibility testing pattern for gram –ve isolates were Gentamycin, Amikacin, Netilmicin, Piperacillin+Tazobactum, Cefoperazone+ Sulbactam, and Imipenem whereas Amikacin, Netilmicin and Vancomycin were for gram+ isolates (Fig 7,8).

In Collection centre the antimicrobial susceptibility testing pattern for gram –ve isolates were Amikacin, Netilmicin, Piperacillin+Tazobactum, Cefoperazone+ Sulbactam, and Imipenem whereas Amikacin, Netilmicin and Vancomycin were for gram+ isolates (Fig 9,10).

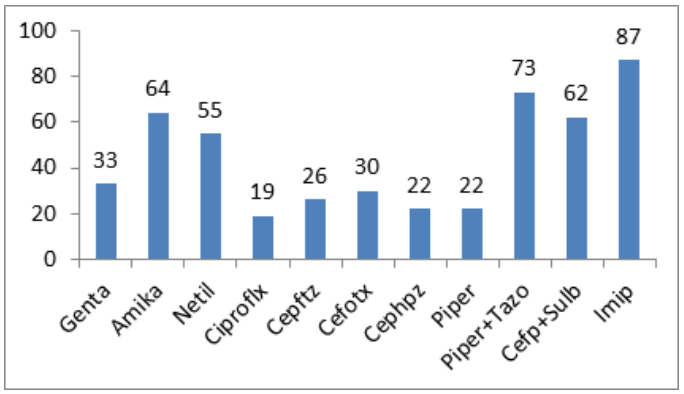


Figure 7: Sensitivity Pattern of G-ve Isolates from Cardiac Centre (n=592)

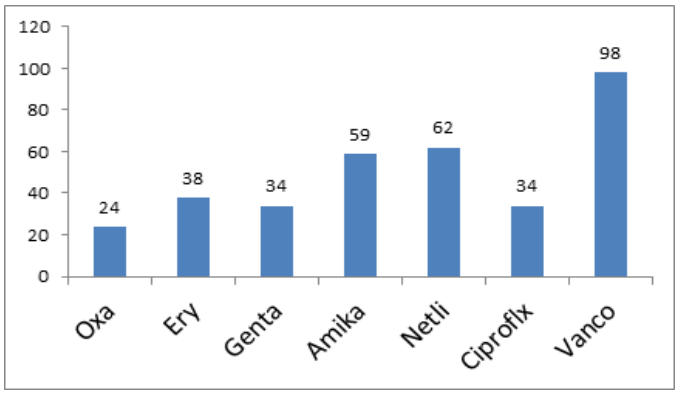


Figure 8: Sensitivity Pattern of G+ve Isolates from Heart Centre (n=127)

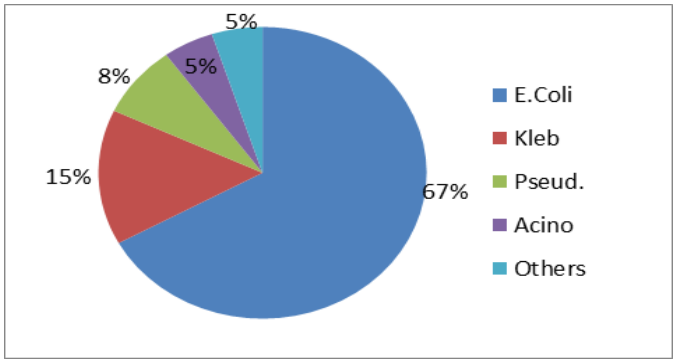


Figure 9: G-ve Isolates from Collection Centre

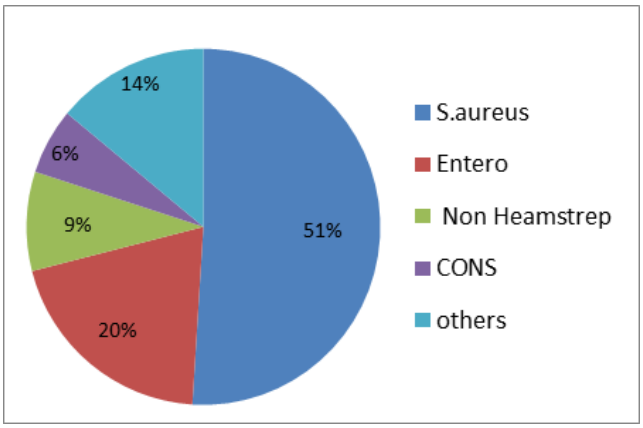


Figure 10: G+ve Isolates from Collection Centre

In pus samples the antimicrobial susceptibility testing pattern for gram–ve isolates were Piperacillin+Tazobactum, and Imipenem whereas Amikacin, Netilmicin, Clindamycin and Vancomycin were for gram + isolates (Fig 11, 12).

In urine samples the antimicrobial susceptibility testing pattern for gram–ve isolates were Amikacin, Netilmicin, Norfl, Piperacillin+Tazobactum, Cefoperazone+ Sulbactam and Imipenem whereas Nitrofurantoin are for gram + isolates (Fig 13, 14).

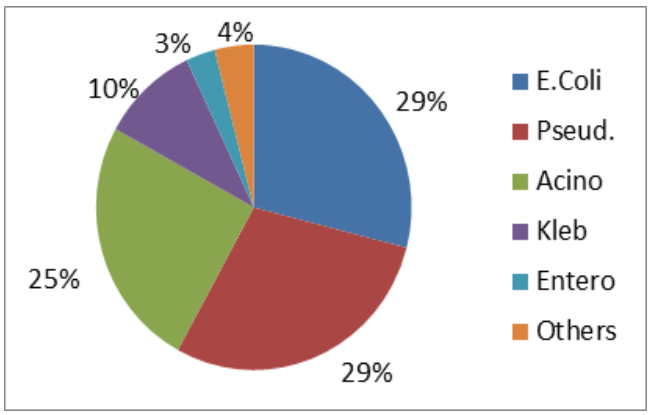


Figure 11: G-ve Isolates in Pus samples

In Respiratory samples the antimicrobial susceptibility testing pattern for gram–ve isolates were Piperacillin+Tazobactum, and Imipenem whereas Erythromycin, Amikacin, Netilmicin and Vancomycin were for gram + isolates (Fig 15, 16).

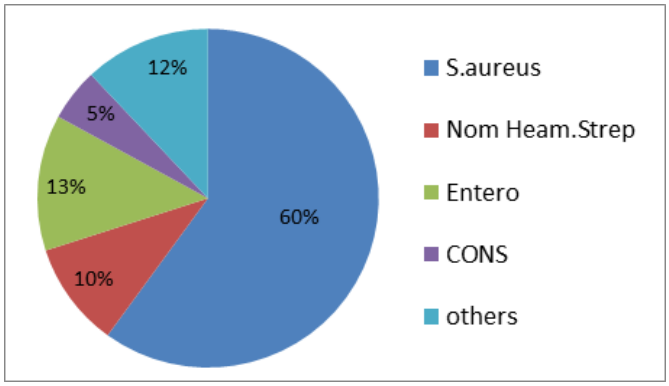


Figure 12: G+ve Isolates in Pus samples

In Blood samples the antimicrobial susceptibility testing pattern for gram–ve isolates were Chloromycin, Amikacin, Piperacillin+Tazobactum, Cefoperazone+ Sulbactam and Imipenem whereas Oxazolidinones, Erythromycin, Chloramfenicol, Amikacin, Netilmicin, Ciprofloxacin and Vancomycin were for gram + isolates (Fig 17, 18).

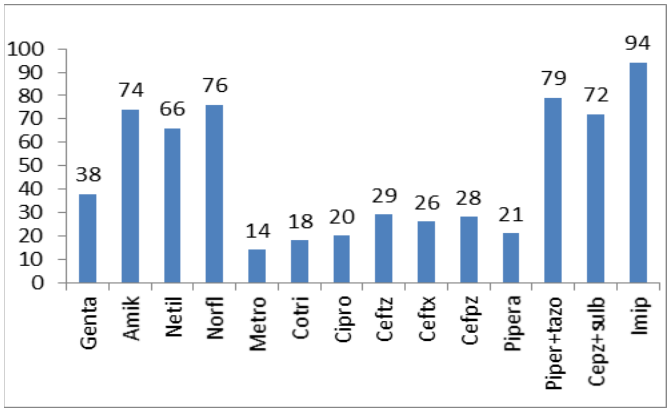


Figure 13: Sensitivity Pattern of G-ve Isolates in Urine samples (n=2565)

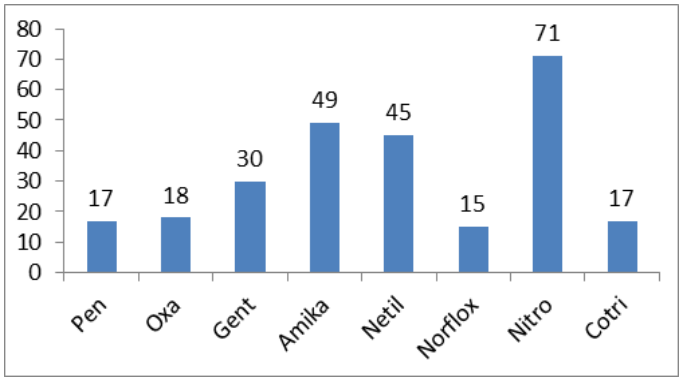


Figure 14: Sensitivity Pattern of G+ve Isolates in Urine samples (n=639)

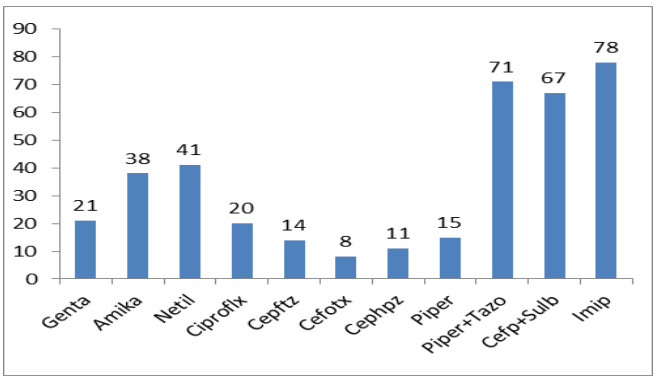


Figure 15: Sensitivity Pattern of G -ve Isolates in Respiratory samples (Sputum,Tracheal Secr. & BAL) (n=1212)

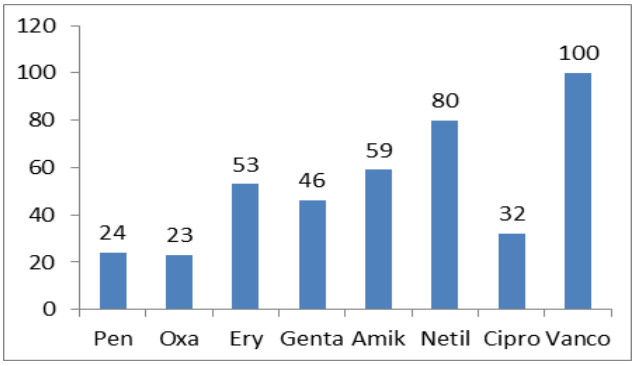


Figure-16, Sensitivity Pattern of G+ve Isolates in Sputum, Tracheal Secr. & BAL samples (n=85)

DISCUSSION

Most hospitals and laboratories routinely generate antibiogram; therefore, obtaining this information is relatively easy. The present study suggests that antibiogram may be an adequate method for conducting drug-resistant surveillance, illustrating the comparability of aggregated antibiogram and provided site specific point estimates of antibiotic resistance similar to the studies of antimicrobial susceptibility testing study conducted in various sites to detect resistance trends over time [8,9]

Antibiogram may be able to follow trends in antimicrobial resistance [10]. At the present juncture, we could not document the ability of antibiogram to detect trends. Drawbacks include the inability to evaluate resistance to multiple drugs. Relatively few drugs can be evaluated because of laboratory variations in antibiotics selected for susceptibility testing.

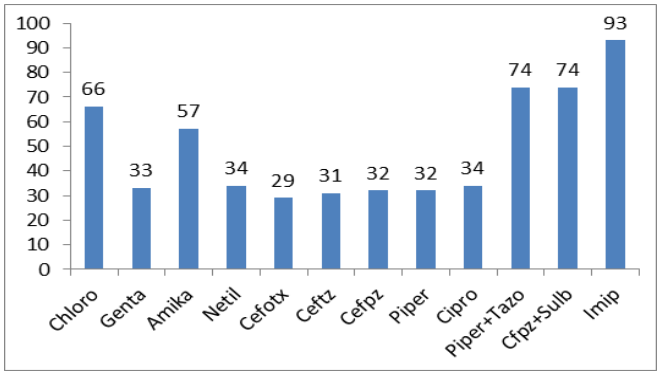


Figure 17: Sensitivity Pattern of G-ve Isolates in Blood samples (n=432)

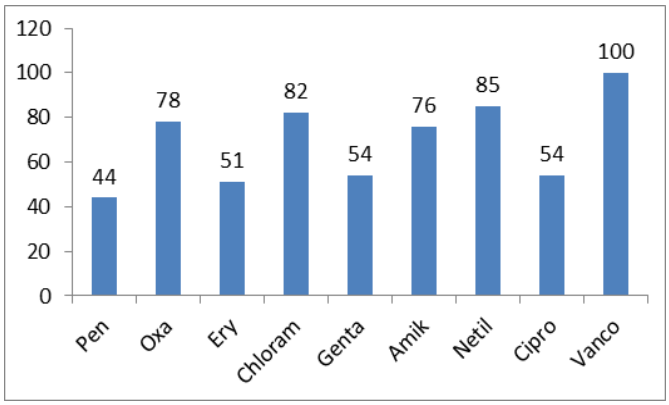


Figure 18: Sensitivity Pattern of G+ve Isolates in Blood samples (n=471)

They might encourage hospital laboratories to standardize their susceptibility panels to facilitate aggregation of results. These findings are also supported by various studies [12, 13, 14]. It is important that the recommended reports generated should be informed to clinicians while choosing antibiotic treatment regimen. Expert from Microbiologist and Pharmacist should think seriously for the addition of extra antibiotics plate culture for wide antimicrobial susceptibility testing.

CONCLUSION AND RECOMMENDATIONS

Aggregating antibiogram is useful for infections in hospital-acquired infections. Evaluation of antibiogram collected from different hospitals and clinics need to improve communication.

Online and update Medical Education is required to educate and making aware to the treating doctors in order to reduce resistance pattern and reduction of infections. Clinicians and researchers are now acknowledging the importance of preventing resistant infections through appropriate use of antibiotics.

Microbiologist and Pharmacist should think seriously in hospital laboratories to standardize their susceptibility panels with addition of extra antibiotics plate culture for wide antimicrobial susceptibility testing report to make easier for clinician in choosing the best antibiotics and will avoid misused and will prevent antibiotics resistance. Education about the specific use of antibiotics both in hospitals and in community is vital if we want to tackle resistance to antibiotics effectively. Increase in monitoring, surveillance and imparting knowledge of hospital infection control principles and practices will be able to bring down the rate of nosocomial infections. *"We learn now". "Now is the time to fight".*

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