Section: Microbiology

Original Research Article

TRENDS IN ANTIMICROBIAL SUSCEPTIBILITY OF BACTERIAL PATHOGENS ISOLATED FROM VARIOUS CLINICAL SPECIMENS IN A TERTIARY CARE CENTRE

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ABSTRACT

Background: Antimicrobial resistance (AMR) is a global threat today and has overshadowed the potential gain in reducing deaths due to infections.[1] Throughout their evolution, bacteria have developed versatile resistance mechanisms to antibiotics.[2] Now it is important to know to the susceptibility pattern of our region to give empiric treatment. **Aims & objectives:** To identify the antimicrobial susceptibility pattern of bacterial pathogens isolated from various clinical specimens in our centre.

Materials and Methods: Various samples requested by clinical departments for culture and sensitivity were processed by conventional method and data recorded on registers and WHOnet. Retrospectively data was collected from January 2024 to December 2024 and analysed.

Results: 3,649 bacterial pathogens isolated from 2,183 patients. Blood is 29.4% followed by genital, respiratory, soft tissue, stool, urine and other samples. Aerobic Gram-positive bacteria were 35.3% and aerobic Gram-negative bacteria were 58.6%. Most Gram-positive bacteria are seen to be sensitive for Linezolid and Vancomycin and Gram-negative bacteria for Polymyxin-B and Colistin. Doxycycline and Gentamicin are also giving good response against both.

Conclusion: This study highlights the need of antibiograms in every institute to know the local susceptibility pattern. Also, the requirement of antimicrobial stewardship is necessary to decrease multi drug resistant bugs in hospital environment. It is the duty of every health care worker to input in reducing the resistance of antibiotics in bacteria to reserve the treatment options to future patient care.

Keywords: Antimicrobial susceptibility, multi drug resistant, antibiotics, clinical specimens.

INTRODUCTION

Antimicrobial resistance (AMR) is a global threat today and has overshadowed the potential gain in reducing deaths due to infections. It is estimated that by the year 2050, Asia will have 4.7 million deaths that could be directly attributed to AMR.[1] The causes of antimicrobial resistance are complex and multifaceted. In countries where antibiotics are sold without a prescription or used as growth-promoting substances or prophylactic additives in livestock farming, antibiotic-resistant bacteria develop especially fast.[2] AMR surveillance is essential for establishing baseline data on the prevalence and resistance patterns of microorganisms in hospitals, which aids in selecting appropriate and rational empirical treatments. Appropriate identification of antimicrobial resistance pathogens will help the physicians for proper diagnosis and treatment.[3] The implementation of antimicrobial stewardship programs (ASPs) that promote effective empiric antibiotic therapies will help to reduce bacterial resistance. A useful tool that aids in the selection of appropriate empiric antibiotic therapies is an antibiogram. A hospital antibiogram is a periodic summary of antimicrobial susceptibilities of the local bacterial isolates that are submitted to the hospital's microbiology laboratory. It helps clinicians to

identify local bacterial susceptibility rates, which assist in their selection of empiric antibiotic therapies, and to determine resistance patterns over time within an institution.[4] Controlled use of antibiotics leads to improved microorganism sensitivity to antimicrobial agents The emergence of resistant pathogens and their negative impact on patient survival and healthcare costs need the evaluation of antimicrobial susceptibility in each health centre and hospital in order to control infection.[5]

Aims & objectives

This study is aimed to know the most common organism in clinical samples and to identify the antimicrobial susceptibility pattern of bacterial pathogens isolated from various clinical specimens at our centre to provide the better knowledge of sensitivity pattern of antibiotics to the clinician to give empirical treatment.

MATERIALS AND METHODS

Various samples requested by clinical departments for culture and sensitivity were processed by conventional method. Urine was plated on Cysteine lysine electrolyte deficient agar, cerebrospinal fluid and genital samples were plated on blood, macconkey and chocolate agar, other samples were plated on blood and macconkey agar, incubated for 16-18 hours at 37°C in aerobic incubator. According to biochemicals organisms were identified and they were tested for antibiotic sensitivity by modified Kirby-Bauer disc diffusion methods, following the CLSI guidelines. Patient particulars, sample data and antimicrobial susceptibility recorded on registers and WHOnet. Retrospectively data was collected of one year, from January 2024 to December 2024 and analysed.

RESULTS

3,649 bacterial pathogens isolated from 2,183 patients from January 2024 to December 2024. Male patients were 1264 (57.9%) and female were 919 (42.1%). Median age group of male patients were 45-54 and of female were 35-44.

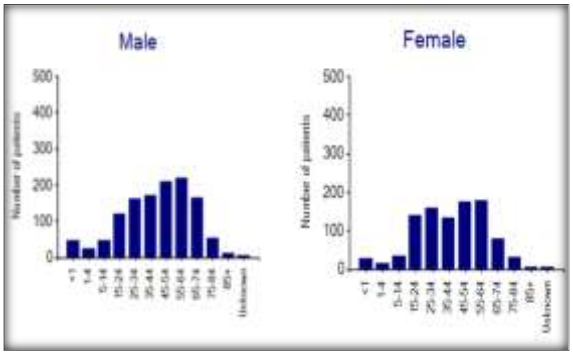

Figure 1: Distribution of the number of patients by gender and age group

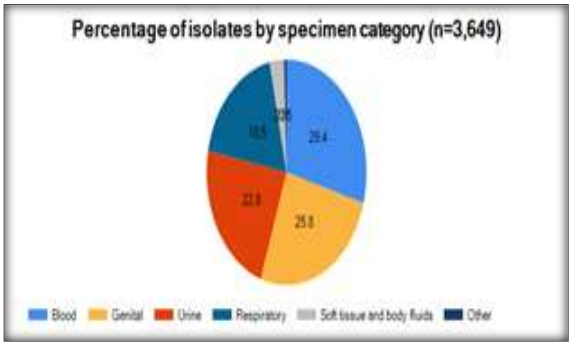

Figure 2: The figure shows the percentage of isolates in specimen

Table 1: The distribution of isolates patients by location

Location	isolates	(%)
CASUALTY	881	24.1
MALE SURGERY WARD	579	15.9
MALE MEDICINE WARD	421	11.5
FEMALE MEDICINE WARD	318	8.7
CHEST &TB	293	8
FEMALE SURGERY WARD	281	7.7
ORTHO	233	6.4
PEDIATRICS	209	5.7
OBST & GYNAE	163	4.5
ENT	113	3.1

Table 2: Table 2: The distribution of the most and common organism results

Organism	isolates	(%)
Staphylococcus aureus	840	23
Escherichia coli	797	21.8
Klebsiella pneumoniae	440	12.1
P.aeruginosa	329	9
CONS	282	7.7
Acinetobacter sp.	233	6.4
Pseudomonas sp.	132	3.6
Enterococcus sp.	87	2.4
Enterococcus faecalis	67	1.8
Candida albicans	54	1.5

Major number of isolates found from casualty followed by surgical, medical, orthopaedic, paediatric and then gynaecology ward as shown in table attached below.

Gram-positive bacteria were 35.3% and aerobic Gram-negative bacteria were 58.6%. 5.9% were fungi. Staphylococcus aureus was the most common organism.

Most prevalent sample is blood (29.4%) followed by genital, respiratory, soft tissue, stool, urine and other sample.

Table 3: The table shows commonest organism in every specimen

Specimen category	Most common organism (%)
Blood	Staphylococcus aureus - (54%)
Genital	Escherichia coli - (23%)
Other	Acinetobacter sp. - (20%)
Respiratory	Klebsiella pneumoniae - (25%)
Soft tissue and CNS	Escherichia coli - (25%)
Urine	Escherichia coli - (47%)

Staphylococcus aureus is commonest in blood, Escherichia coli in genital, urine and soft tissue but Klebsiella pneumoniae in Respiratory samples.

1289 Gram positive organisms isolated from all specimens found most susceptible to Linezolid Vancomycin and Minocycline followed by Doxycycline.

Table 4: Shows susceptibility pattern for Gram positive bacteria in cumulative samples

Antibiotic name	%R	%I	%S
Penicillin G	85.5	0.1	14.4
Ampicillin	49.3	0	50.7
Ampicillin/Sulbactam	33.3	0	66.7
Piperacillin/Tazobactam	0	0	100
Cefoxitin	73	0.2	26.8
Gentamicin-High	58.9	0	41.1
Gentamicin	43.4	3.4	53.2
Ciprofloxacin	81.9	3	15.1
Levofloxacin	80.7	2.4	16.9
Fosfomycin	82.7	0	17.3
Clindamycin	46.3	1.9	51.7
Colistin	0	0	100
Erythromycin	82	1.6	16.4
Nitrofurantoin	32.2	0.5	67.2
Linezolid	4.7	0	95.3
Vancomycin	1.8	0	98.2
Doxycycline	24.1	5	70.9
Minocycline	8.1	0.7	91.2
Tetracycline	78.9	0	21.1

2139 Gram negative organisms isolated from all specimens found most susceptible to Colistin and Polymyxin B.

Table 5: Shows susceptibility pattern for Gram negative bacteria in cumulative samples

Antibiotic name	%R	%I	%S
Penicillin G	100	0	0
Ampicillin	90.8	1.6	7.6
Amoxicillin/Clavulanic acid	73.9	11.1	15
Ampicillin/Sulbactam	65.8	7.9	26.2
Piperacillin/Tazobactam	62.2	11.9	25.9
Cefuroxime	89.2	4.9	5.9
Cefuroxime	52.2	13	34.8
Ceftazidime	74.6	4.7	20.7
Ceftriaxone	85.8	3.5	10.7
Cefotaxime	87.9	2.7	9.4
Cefepime	66.1	7.3	26.6
Cefoxitin	0	0	100
Aztreonam	67.5	9.1	23.4
Imipenem	63.1	7.1	29.8
Meropenem	50.2	4.1	45.8
Amikacin	57.5	16.1	26.4
Gentamicin	63.1	8	28.9
Tobramycin	54.9	9.3	35.8
Ciprofloxacin	78.5	4	17.4
Levofloxacin	74.7	6.4	18.9
Trimethoprim/Sulfamethoxazole	77.1	1.6	21.3
Fosfomycin	22.5	0	77.5

Clindamycin	0	0	100
Colistin	0.5	1.6	97.9
Polymyxin B	0	2.6	97.4
Erythromycin	100	0	0
Nitrofurantoin	34.1	4.1	61.9
Linezolid	0	0	100
Vancomycin	0	0	100
Doxycycline	56.7	3.1	40.2
Minocycline	57.3	14.3	28.4
Tetracycline	70.3	3.3	26.5

DISCUSSION

55.3 % males and 44.7 % females were found in study of Mohammad Kamruzzaman et al,[3] and of Hadi Hamishehkar et al,[5] is similar to our study.

The most frequent isolate recovered was Staphylococcus aureus in study of Nicholaus P Mnyambwa et al,[6] and in Vishal L Handa et al,[7] as in our study.

Most prevalent sample is blood which is similar to study of Devendra Vinaykumar Deshmukh et al.8 but dissimilar to Hadi Hamishehkar et al,[5] in which respiratory samples are commonest.

Escherichia coli is commonest in urine but Klebsiella pneumoniae in respiratory samples found in this study as same in Vishal L Handa et al.[7]

Staphylococcus aureus is commonest in blood, Escherichia coli in urine found in this study as same in Waleed K. Abdulsahib et al.[9]

Gram positive organisms isolated from all specimens found most susceptible to Linezolid Vancomycin found in this study is similar in Rudrajit Paul et al,[10] and in Yadav Bhavana.[11]

The current study showed a high Ampicillin, Amoxicillin, Erythromycin, Ciprofloxacin, Tetracycline, Doxycycline and Gentamycin resistance in gram negative bacteria as also showed in Abdelmalek M. Amran et al,[12] N. Ramakrishna et al,[13] and in Anteneh Amsalu et al.[14]

Most prevalent gram-negative organisms isolated from all specimens are Escherichia coli, Klebsiella pneumoniae, Pseudomonas aeruginosa found most susceptible to Colistin and Polymyxin B.

Most isolates of Gram positive bacteria are seen to be sensitive for Linezolid and Vancomycin.

Apart from these two antibiotics Minocycline, Doxycycline, Ampicillin and Sulbactam, Gentamicin and Clindamycin are also giving good response against Gram positive bacteria.

In addition, urinary infections can be treated empirically by Fosfomycin and Nitrofurantoin as also reflected in study of Waleed K. Abdulsahib et al.[9]

These antibiotics can be used as a reserve for the empirical therapy in patients in our hospital if gram positive infections are suspected before culture and sensitivity report become available. As soon as sensitivity report reach to clinician, antibiotic can be continued or changed accordingly.

Most isolates of Gram negative bacteria are found to be sensitive for Polymyxin-B and Colistin.

Doxycycline, Meropenem and Gentamicin are the three other antibiotics are available for empirical therapy in case of Gram negative infection suspicion in patient of our hospital before culture and sensitivity report become available. As soon as sensitivity report reach to clinician, antibiotic can be continued or changed accordingly.

Meropenem also found most sensitive in study of Waleed K. Abdulsahib et al,[9] for gram negative bacteria.

In addition, urinary infections can be treated empirically by Fosfomycin and Nitrofurantoin.

Piperacillin and Tazobactam is giving good response especially in case of Pseudomonas species infections.

All Antibiotics those are selected empirically must be reevaluated and readjusted according to culture and sensitivity report as MDR and pan resistant species also encountered during reporting.

CONCLUSION

As MDR and pan resistant species are not uncommon nowadays in hospital or clinical settings especially in critical care settings due to many reasons like unknown pathogens, unknown group of pathogens, unknown sensitivity of pathogens, unknown previous drug classes and doses, random course and doses of drugs by clinicians, over the counter drugs, etcetra.

The break in vicious cycle of antimicrobial resistance can happen by strict discipline of antimicrobial stewardship.

Conflict of interest: None.

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