Bacteriological Profile and Antimicrobial Susceptibility Patterns of Bacteria Isolated from various Culture Samples of Patients Attending RDBP Jaipuriya Hospital, Jaipur

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A B S T R A C T

Bacterial infections are most commonly encountered by clinicians in developing countries. Area-specific monitoring studies done to assess the type of pathogens and their antibiotic sensitivity patterns which help the clinician to opt for best empirical treatment. The hospital based cross sectional study is conducted on various samples collected using sterile techniques from 2474 clinically-suspected cases attending RDBP, Jaipuriya Hospital from Jan 2016 to Dec 2017 and tested bacteriologically using standard conventional procedures. Antimicrobial susceptibility test was performed for the isolated pathogens using Kirby-Bauer disk diffusion method according to Clinical and Laboratory Standards Institute guidelines. Total of 2474 culture samples collected were cultured using standard microbiological techniques. The colonies grown were identified with the help of gram staining and biochemical tests. The antimicrobial susceptibility testing was performed by Kirby-Bauer disc diffusion technique. Out of 2474/ 680 were positive. Gram positive bacteria were isolated 252/680 samples and Gram-negative bacteria were found in 404/680 samples. *Coagulase negative Staphylococcus aureus 108/252* was the predominant in Gram-positive bacteria isolated and *Escherichia coli 255/404* were predominant in Gram negative bacteria. Primary screening of Methicillin-resistant *Staphylococcus aureus (MRSA)* isolates were detected by using cefoxitin disc (30µg) is 43.47% and Extended spectrum β lactamase (ESBL) detection done by the difference of Ceftazidime and Ceftazidime Clavulunate difference is more than 5 mm is 52.35%. The Vancomycin resistant Enterococci (VRE) detection is 21.77%. Antibiotic sensitivity of gram positive bacteria is Linezolid 90.47%, Vancomycin 77.77%, Doxycycline 60% and cefoxitin 45%. Antibiotic sensitivity of gram negative bacteria is Imipenam 87.6%, Gentamicin 47%, Ceftazidime Clavulunate 60%. This study showed that E. coli and Coagulase Negative Staphylococci isolates were the predominant pathogens. Sensitivity of Linezolid, Vancomycin, Doxycyline, Imipenam, Gentamicin, Ceftazidime clavulunate is seen in the bacterial strain found in the Jaipuriya setting. Since drug resistance is an evolving process, routine surveillance and monitoring studies should be conducted to provide physicians the updated and most effective empirical treatment.

Introduction

Bacterial Infections is a major public health problem and causes complications and sometimes leads to fatal septicemia especially in the presence of various precipitating factors like reduce immune system, altered function of organ, burns, and road traffic accidents. Antibiotic resistance is a serious problem that has the potential to drag the world into pre-antibiotic era (1)

The most common cause of this is the irrational use of antibiotics by the people and doctors. Over 95% of all deaths occur in developing and under developing countries (2).

The common bacterial pathogens responsible for infections are Coagulase Negative Staphylococci, *Staphylococcus aureus*, Enterobacteriaceae and *Pseudomonas aeruginosa* (3). There are reports of increasing rate of infection by MRSA, ESBL and VRE as the common cause of nosocomial and community acquired infections (4). Many studies have been conducted to determine the rates of infections caused by MRSA among adults (6). If the local antimicrobial susceptibility data are not available, the chances of haphazard use of antibiotics will be high.

As a result, the rate of drug resistance will increase causing a serious problem. So, in this study, we determined to produce the bacteriological profile in various samples in the population and their antimicrobial susceptibility patterns, as for patients prone to serious infections and for their timely treatment is very necessary.

To find out the bacteriological pattern existing at the RDBP Jaipuriya hospital and the antibiotic sensitivity pattern of these pathogens. To improve the antibiotic policy of the setting, to prevent misuse of antibiotics and prevent development of the resistant strains of pathogen.

The assessment of the type of the bacterial pathogen most commonly affecting the population

Find the antibiotic sensitivity pattern for the pathogens

Materials and Methods

Study design

A hospital based cross-sectional study was conducted using total of 2474 culture samples collected from the patients attending, RDBP Jaipuriya Hospital, Jaipur, from Jan 2016 to Dec 2017 who came to the OPD and were admitted to the hospital.

Isolation, identification, and antimicrobial susceptibility testing

The samples were subjected to bacteriological culture following standard conventional microbiological techniques (7). The colonies grown were identified with the help of colony morphology, Gram's staining, and biochemical tests (8). The antimicrobial susceptibility testing was performed by modified Kirby-Bauer disc diffusion technique following clinical and laboratory standards institute guidelines (9).

Primary detection of MRSA, ESBL, VRE strains

Methicillin Resistant Staphylococci aures isolates were detected by using cefoxitin disc (30 μg) sensitivity pattern in MHA (9) Extended spectrum β lactamase strain were detected by noting the zone difference b/w Ceftazidime and Ceftazidime clavulunate more than 5 mm. Vancomycin Resistance Enterococci is seen by noting Vancomycin resistance in Enterococci antibiotic pattern.

Quality control

For quality control, *S. aureus* (ATCC 25923) and *E. coli* (ATCC 25922) were used.

Data analysis

The data were analyzed by using statistical package for the social sciences version 16.00. *P* value < 0.05 was considered as statistically significant.

Results and Discussion

Profile of culture samples

Total of 2474/680 positive, Urine culture 2040/500 positive and others were sputum, pus, throat culture, tissue, body fluid sample are 434/180 Samples obtained from both OPD 1973/2474 (79.7%) and IPD 501/2474(20.25)

Bacteriological Profile of culture samples

Out of 680 growth positive samples, Gram-positive bacteria were isolated from 252 /680(37.05) samples and Gram-negative bacteria were found in 404 /680 (59.41) samples. Among Gram-positive isolates, 108/252 (42.85%) were Coagulase negative s*taphylococcus* and 86/252 (34.12%) were *Staphylococcus aureus* others are streptococci, enterococci. Similarly, among Gram-negative isolates, the most prevalent bacteria isolated were *Escherichia coli*, 255/404(62%) followed by *Klebsiella pneumoniae*, 71/404 (17.57%) other organism detected is *Acinetobacter* spp, *Citrobacterspp,* Proteus *mirabilis* Candida is also isolated pathogen (Table 1).

Antibiotic susceptibility patterns of S. aureus

Highest rate of susceptibility was seen toward linezolid (90.47%) followed by vancomycin (77.77%) and doxycycline (60%) (Table 2). Isolates that were resistant to cefoxitin, screened as methicillin-resistant S. aureus is 43.47% done by seeing the resistance of cefoxitin 40 µg in Muller Hinton Agar. Vancomycin resistant enterococci isolates are 21.77% seen by noting the resistance of vancomycin (Table 3).

Table.1 Bacteriological profile of pathogen isolated

Total Gram negative organism	**404**
Escherichia Coli	**255**
Klebsiella	71
Proteus	14
Enterobacter spp	27
Citrobacter spp	7
Acinetobacter spp	5
Pseudomonas Spp	25
total gram Positive organism	**252**
Coagulase Negative *Staphylococci*	**108**
Staphylococcus aureus	86
Streptococcus	15
Enterococcus	43
Candida	24

Table.2 Antibiotic sensitivity pattern of bacteria isolated

Antibiotic sensitivity for gram positive organism	percentage of sensitivity for GPC
Linezolid	90.47
Vancomycin	77.77
Doxycycline	60
Cefoxitin	45
Antibiotic sensitivity for gram negative organism	percentage of sensitivity for GNB
Imepenam	87.6
Gentamicin	47
ceftazidime clavulunate	60

Table.3 Superbug isolated from the hospital setting

Extended Spectrum beta lactamase ESBL organism % in GNB	52.35%
Methicillin Resistant *Staphylococci aureus* MRSA organism %in GPC	43.47%
Vancomycin resistant *Enterococci* VRE % in GPC	21.77%

Table.4 Comparison of my study with other studies in case of organism isolation

Staphylococci comparison with other similar studies		*Escherichia coli* comparison with other similar studies	
My study	34%	My study	63.11%
Bhatta *et al.,*	60%	Shrestha *et al.,*	80%
Shrestha *et al.,*	41.31%	Payam *et al.,*	43.50%
Garba *et al.,*	44%		

Table.5 Comparison of my study with other studies in case of antibiotic resistance

MRSA comparison with other similar studies		ESBL comparison with other similar studies	
My study	43.47%	My study	52.35%
Kshetry *et al.,*	37.60%	Michael *et al.,*	28%
Subedi *et al.,*	15.40%	Pooja *et al.,*	91.70%
Sanjana *et al.,*	39.60%		
Dibah *et al.,*	46.30%		
Tiwari *et al.,*	69.10%		

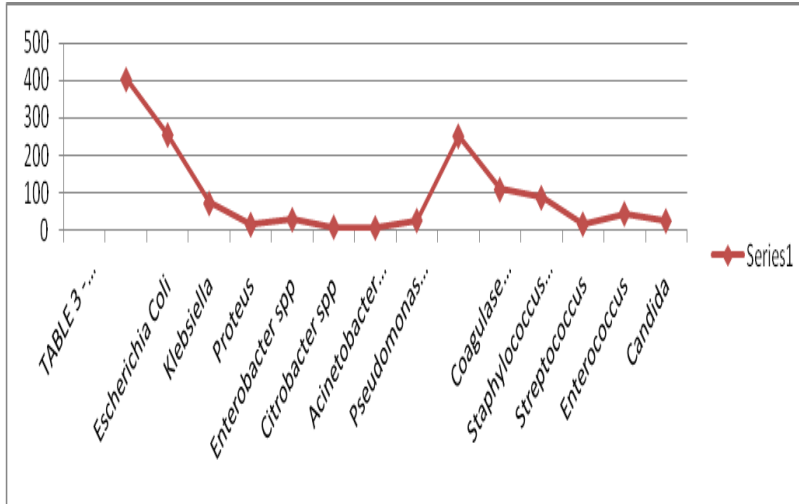**Chart.1** Bacteriological profile of pathogen isolated

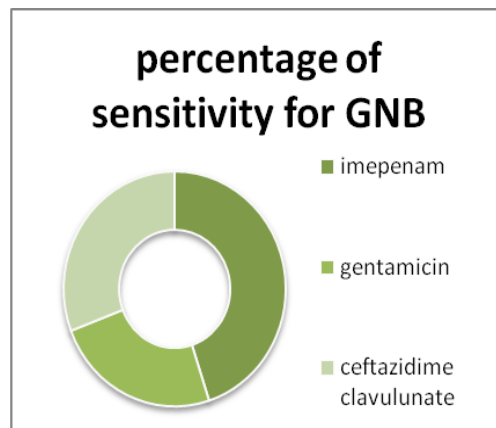**Chart.2** Antibiotic sensitivity pattern GNB

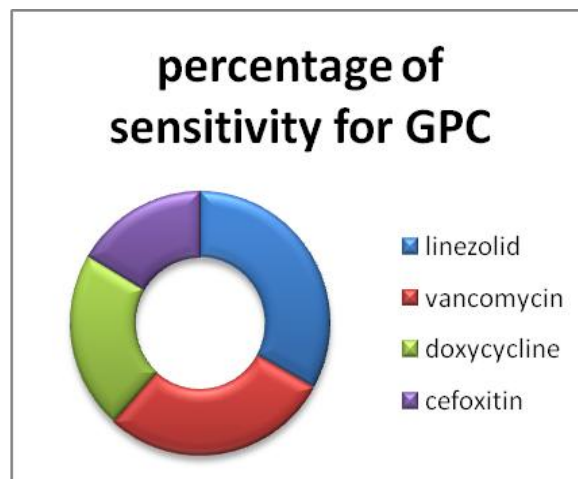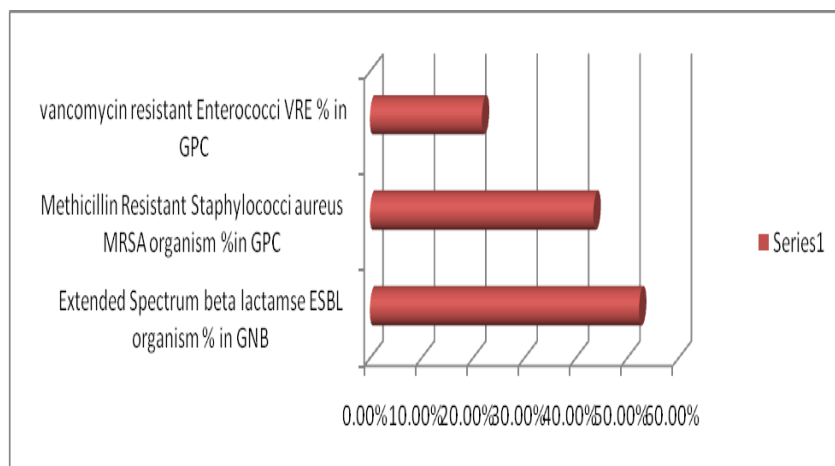**Chart.3** Antibiotic sensitivity pattern GPC

Chart.4 Superbug isolated from hospital settings

Antibiotic susceptibility patterns of gram-negative bacilli

Highest rate of susceptibility was seen toward Imipenam (87.6%), followed by Ceftazidime clavulunate (60%) gentamicin (47%) (Table 2). The ESBL strain detected in 52.35% detected by noting the zone difference b/w Ceftazidime and Ceftazidime clavulunate more than 5 mm (Table 3).

Infection is one of the most common and serious complications among the hospital acquired infection. It increases the length of hospital stay and accounts for the mortality rate up to 70–80% (12, 13). The growth positivity reported by Bhatta and Lakhey (60%) was higher to our finding (14)

As in our study, Bhatta and Lakhey (14), Shrestha and Basnet (15), and Garba *et al.,* (18) (Table 4) also reported the *S. aureus* to be the most prevalent bacteria isolated from the cases of wound infections. In hospital the sources of *S. aureus* may be the inanimate objects, health care workers, and other patients. Further, due to presence of the *S. aureus* as normal flora of human body, the endogenous infections are also possible. The relatively higher resistance of the bacteria isolated from the children to the commonly used antibiotics is a matter of great concern. The prevalence of MRSA reported in our study was in accordance with that reported by Subedi and Brahmadathan (15.4%) (19). However, higher rates were reported by Kshetry *et al.,* (37.6%) (6), Sanjana *et al.,* (39.6%) (20), Dibah *et al.,* (46.3%) (21), and Tiwari *et al.,* (69.1%) (22) (Table 5). In a recent study from Nepal, Adhikari *et al.,* also reported higher rate of MRSA in comparison to our study (23). The difference in the rates of isolation of MRSA in different studies might be due to the difference in the level of irrational use of antibiotic, level of hygiene maintained in different hospitals, and effective implementation of hand hygiene program. But the high rate of isolation of MRSA from the children indicates a serious problem. The treatment of infection caused by MRSA may require the use of reserve drug, vancomycin. The use of vancomycin in children may cause the emergence of the vancomycin-resistant Gram positive bacteria, leaving little or no option for the treatment of serious infections caused by those superbugs.

In my study the predominant gram negative bacterial infection is of Escherichia coli which is in common with Payam Behzadi *et al.,* (24) and Shrestha *et al.,* (15) (Table 4).

The ESBL strain common causing infection found was in correspondence with Pooja Shakya et al., (25) and Michael Osthoff et al., (26) (Table 5). Due to irrational use of antibiotics the drug resistant organism is emerging which is directly causing infection in people.

Limitations of the study

Because of resource constraints, we were unable to use molecular level analysis to confirm our results. Further, multicenter study including larger numbers of samples would have generated more significant results.

In conclusion, this study showed that *E. coli* and Coagulase Negative Staphylococci isolates were the predominant pathogens isolated at the Jaipuriya settings Sensitivity of Linezolid, Vancomycin, Doxycyline, Imipenam, Gentamicin, Ceftazidime clavulunate is seen in the bacterial strain is maximum. Since drug resistance is an evolving process, routine surveillance and monitoring studies should be conducted to provide physicians the updated and most effective empirical treatment.

Recommendations

1) Hand washing and proper sterilization techniques along with personal protective measures should be taken.
2) Culturing of sample should be sent before giving antibiotics as may give false negative results.
3) Pathogens should be identified and proper antibiotics should be give

Abbreviation

CLSI: Clinical and Laboratory Standards Institute
ATCC: American Type Culture Collection
MRSA: Methicillin-resistant *Staphylococcus aureus*
MIC: Minimum inhibitory concentration.

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