

Antibiotic Susceptibility Patterns of Gram positive Organisms Isolated from Cases of Nosocomial Infections in a Paediatric ICU

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ABSTRACT

Aim: To determine the antibiotic susceptibility patterns of Gram positive organisms isolated from cases of nosocomial infections in a pediatric ICU.

Setting: This study was carried out from November 2009 to September 2010 on 200 samples taken from patients in pediatric ICU of a tertiary care hospital, in the Department of Microbiology, Basic Medical Sciences Institute, Jinnah Postgraduate Medical Centre.

Method: This study was carried out from November 2009 to September 2010 on 200 samples taken from patients in pediatric ICU of a tertiary care hospital who were clinically suspected of having nosocomial infection and were processed for isolation of the microbes and their antibiotic susceptibility in the microbiology department Basic Medical Sciences Institute (BMSI) Jinnah Postgraduate Medical Centre (JPMC).

Result: Out of 200 suspected cases having nosocomial infection, 138 samples showed bacterial growth. Among these 138 isolates, 34(23.78%) were Gram positive for which antibiotic susceptibility was determined.

Conclusion: Resistance to conventional antibiotics is a significant and increasing problem worldwide.

Keywords: Nosocomial, antibiotic susceptibility, PICU Gram positive.

INTRODUCTION

“Nosocomial infections” (NIs) are those that are acquired in a hospital setting, thus contributing to the morbidity and mortality of patients. Microbiologic surveillance and assessment of antimicrobial resistance routinely done at a proper time is vital for managing “nosocomial infection”¹. The ultimate outcome for patient is prolonged hospital stay, unnecessary excessive use of antimicrobial agents, and expanded restorative expense².

The word “Nosocomial” is derived from the Greek word “Nosokomeion” meaning hospital “nosos means disease, Komeo means to take care of”. This sort of infection can also be recognized as “hospital acquired infection” (or in generic terms, health care associated infection)³.

Hospital acquired infections, also known as Health Care related infections, incorporate nearly all clinically obvious infections that do not originate from a patient's original admitting diagnosis. Within hours after admission, a patient's flora begins to obtain attributes of the surrounding bacterial pool. Most

infections that get to be clinically obvious after 48 hours of hospitalization are considered hospital-acquired. Infections that happen after the patient's discharge from the hospital can be considered to have a nosocomial origin if the organisms were obtained during the hospital stay. Within hours of admission, colonies of hospital strains of bacteria develop in the patient's skin, respiratory tract, and genitourinary tract⁴.

Hospitalized patients, especially those admitted to intensive care units (ICUs) are more vulnerable to suffer from nosocomial infections on account of their underlying illness, consequent debilitation of humoral and cellular immunity and the fact that they undergo invasive procedures resulting in breakdown of their characteristic natural defence barriers⁵.

It is known since long that health professionals along with their routine medical equipments, although unintentionally, sometimes act as vectors of disease, spreading new infections among their patients⁶. Several studies have shown physician's stethoscope to be an important vector of infection and Madar et al.⁷ found 85% of sampled stethoscopes to be colonized with Staphylococcus species and Marinella found colonization of all stethoscopes with CoNS⁸.

MATERIAL AND METHODS

This prospective study was conducted in the Dept. of Microbiology, BMSI, JPMC in suspected cases of nosocomial infection. All patients aged between 1

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month and 12 years hospitalized in pediatric ICU for more than 48 hours were eligible for inclusion in the study. In this study 200 samples were collected from the patients admitted in Pediatric ICU of tertiary care hospital of Karachi from December 2009 to September 2010. The nature of the samples was blood, pus urine, respiratory secretions, protected catheter specimen and wounds. These samples were collected from clinically suspected cases of nosocomial infections. Antimicrobial susceptibility for different species of organisms was performed by in vitro disc diffusion method according to CLSI⁹.

Principle of disc diffusion method: Since 1966, when described as the first standardized method, the disc diffusion test of Kirby Bauer has been widely used in clinical laboratories. The method was modified later. Briefly a McFarland 0.5 standardized suspension of bacteria is swabbed over the surface of an agar plate and paper disc containing single concentration of each antimicrobial agent is placed onto the inoculated surface within 15 minutes. After overnight incubation, the diameters of the zones produced by antimicrobial inhibition of bacterial growth were measured and the size of zone is inversely proportional to the minimum inhibitory concentration of the organism and the isolate is interpreted as susceptible, intermediate or resistant to a particular drug according to present criteria. McFarland turbidity 0.5 standard containing 99.4ml of

1% v/v solution of sulphuric acid and 0.6ml of 1% w/v solution of barium chloride is used for comparison of test suspension. The present criteria have been specified by the National Committee for Clinical Laboratory Standard for disc diffusion testing recommended by World Health Organization¹⁰.

RESULT

Total two hundred samples were included in the study. Among these 200 samples, 143(71.5%) showed the growth of the organisms and no growth was observed in 57(28.5%) samples. Among the total 143 isolates, bacterial growth was observed in 138 cases while in 5 (3.49%) cases fungal growth was observed. In the bacterial isolates, Gram negative was 104(72.73%) and Gram positive were 34(23.78%).

Table 1 shows susceptibility/resistance pattern of Gram positive cocci isolated from PICU during this study. Most of the organisms show 100% sensitivity to teicoplanin and vancomycin. Staphylococcus aureus is resistant to methicillin (50%) and 75% resistant to cefaclor and erythromycin. Resistance of Staphylococcus epidermidis is 75% to cefaclor, ciprofloxacin, erythromycin and gentamicin each and highest resistance to penicillin (81.2%). Staphylococcus saprophyticus and Enterococcus also show considerable resistance.

Table 1: Susceptibility pattern of gram positive organisms isolated during the study

Antibiotics	S. Aureus (n=12)		S. Epidermidis (n=16)		S.Saprophyticus (n=3)		Enterococcus (n=3)	
	S	R	S	R	S	R	S	R
Cefaclor (30µg)	25.0%	75.0%	25.0%	75.0%	33.3%	66.7%	33.3%	66.7%
Ciprofloxacin(50µg)	58.3%	41.7%	25.0%	75.0%	33.3%	66.7%	33.3%	66.7%
Erythromycin (50µg)	25.0%	75.0%	25.5%	75.0%	33.3%	66.7%	33.3%	66.7%
Gentamycin (10µg)	33.0%	67.0%	25.0%	75.0%	66.7%	33.3%	33.3%	66.7%
Methicilin (5µg)	50.0%	50.0%	68.8%	31.2%	66.7%	33.3%	-	-
Penicillin (10IU)	50.0%	50.0%	18.8%	81.2%	0.0%	100.0%	33.3%	66.7%
Teicoplanin (30µg)	100.0%	0.0%	93.7%	6.3%	100.0%	0.0%	100%	0.0%
Tetracycline (30µg)	41.7%	58.3%	31.3%	68.7%	33.3%	66.7%	33.3%	66.7%
Vancomycin (5µg)	100.0%	0.0%	93.7%	6.3%	100.0%	0.0%	100.0%	0.0%

DISCUSSION

The introduction and excessive utilization of antibiotics for treatment have prompted antibiotic resistance in microorganisms that is quick and is expanding day by day, especially in human pathogens. Likewise, an inclination towards an expanded number and seriousness of gram positive infections has been seen in the most recent decade.

Gram positive bacteria are exceptionally critical pathogens, both within and outside the hospital environment. These pathogens, including "Methicillin resistant Staphylococcus aureus", "Vancomycin

resistant Enterococcus", "Vancomycin intermediate" and "resistant S. aureus", Coagulase negative staphylococcus (CoNS) and Penicillin-resistant Streptococcus pneumoniae, have turned into a genuine issue in view of their extended resistance rates, bringing about increased "morbidity and mortality"¹¹. Susceptibility to resistant strains is a treatment challenge.

The main issue to manage resistance among gram-positive pathogens requires observation to determine the level of the problem and recognize

epidemiological elements involved in the advancement and spread of resistance^{12,13}.

Total two hundred samples were included in our study. Among these 200 samples, 143(71.5%) showed the growth of the organisms and no growth was observed in 57(28.5%). The Gram positive organisms were 34 (23.78%) of the total organisms isolated in present study.

In our study among 31 Staphylococcal isolates, majority 19 (61.3%) were coagulase negative Staphylococci (CoNS), and 12 (38.7%) were coagulase positive Staphylococci. However, CoNS comprised 55.9% of Gram positive organisms (34) and 13.8% of total bacteria (138) isolated in present study, other Gram positive bacteria were Staphylococcus aureus (n=12) and Enterococcus faecalis (n=3).

Coagulase negative Staphylococcus (CoNS) has been documented to be a common cause especially of bacteremia in PICU at 9.5-50%¹⁴.

A study by Khadri and Alzohairy¹⁵ on Staphylococcal isolates revealed that 69.8% were coagulase positive Staphylococci and 30.2% were coagulase negative Staphylococci (CoNS). In present study, most of Gram positive organisms demonstrated very good sensitivity to teicoplanin and vancomycin.

MRSA has become a major hospital pathogen in human medicine¹⁶. In present study, 6 out of 12 Staphylococcus aureus were resistant to methicillin (50%), 6 out of 19 CoNS were also resistant to methicillin (31.5%). This is in accordance with Khadri and Alzohairy (2010)¹⁵, showing 54.2% staphylococci resistant to methicillin and CoNS resistant to methicillin were 39.4%.

MRSA is of concern not only because of its resistance to methicillin but also because it is generally resistant to many other chemotherapeutic agents¹⁷. Six methicillin resistant Staphylococci were also resistant to penicillin in present study which is in accordance with study by Khadri and Alzohairy¹⁵ showing 100% resistance to penicillin.

The susceptibility of Staphylococcus aureus for erythromycin was 25% in present study which is slightly more than the study by Bayram and Balci¹⁸ showing 14% susceptibility. The susceptibility of Staphylococcus aureus for gentamicin was 33% which is slightly more in present study than that in the study by Khadri and Alzohairy¹⁵ which was 27%. The cephalothin was 70% resistant by coagulase positive staphylococci in the study by Khadri and Alzohairy¹⁵, present study showed almost similar result i.e. 75% for cefaclor used in study.

A study by Bayram and Balci¹⁸ showed higher resistance of Staphylococcus aureus to tetracycline (86%) and ciprofloxacin (78%) which is not in

accordance with present study. However the resistance rate was comparatively less in case of tetracycline (61%) and ciprofloxacin (40%) in study by Khadri and Alzohairy¹⁵ which is in accordance to present study (i.e. 58.3% and 41.7% respectively).

Present study showed 100% sensitivity of Staphylococcus aureus for teicoplanin and vancomycin. This partially coincides with study by Bayram and Balci¹⁸ showing vancomycin 100% sensitive against Staphylococcus aureus. Staphylococcus epidermidis and Staphylococcus saprophyticus showed high resistance to penicillin i.e. 81.2% and 100% in present study which is also in accordance with the Khadri and Alzohairy's study¹⁵, showing 93% resistance and this is also corroborated by Bayram and Balci¹⁸ (98.6%).

The resistance rate of coagulase negative staphylococci (CoNS) in the study of Khadri and Alzohairy¹⁵ was; erythromycin (76%), cephalothin (69%), gentamicin (69%), ciprofloxacin (68%) and tetracycline (65%). Staphylococcus epidermidis in present study showed resistance as; erythromycin (75%), cefaclor (75%), gentamicin (75%), ciprofloxacin (75%) and tetracycline (68.7%) i.e. more or less similar to the study of Khadri and Alzohairy¹⁵.

In case of Staphylococcus saprophyticus the resistance rate in present study was found to be; erythromycin (66.7%), cefaclor (66.7%), gentamicin (33.3%) and ciprofloxacin (66.7%) which is almost in accordance to the study by Khadri and Alzohairy¹⁵ however more resistance was observed for gentamicin in the above study.

The resistance rate of Enterococci was also high for most of drugs. Bayram and Balci¹⁶ showed penicillin G (84.1%), augmentin (77.3%), erythromycin (86.4%), ciprofloxacin (81.8%) and tetracycline (84.1%). A high resistance of Enterococci is also observed in present study i.e. 66.7% resistance to above tested drugs except augmentin which was not tested. Like other gram positive cocci, Enterococcus also showed (100%) sensitivity to teicoplanin and vancomycin.

Thus this study helps health professionals to have an insight into the nosocomial infections and institute various interventional strategies

CONCLUSION

Antimicrobial resistance is emerging as a serious threat thus limiting treatment options especially for critically ill PICU patients.

A well designed hospital infection control strategy, including good hygiene, microbiological monitoring and nosocomial control will greatly reduce the risk of nosocomial infection due to antimicrobial resistant organisms.

Avoidance of injudicious, indiscriminate use of antibiotics is the key in limiting emergence and spread of drug resistance among nosocomial pathogens. The antimicrobials like vancomycin and teicoplanin were found most effective and thus can be useful as long as they are employed in appropriate dosage and regime.

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