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Study of bacteriological profile and antibiotic resistance pattern of different organism isolated from pediatric and neonatal ICU at a Tertiary Care Hospital in Solapur Maharashtra

Dr. Anu Sharma[1], Dr. NK Shaikh[2], Dr. DP Danave[3], Dr. Sonal Agarwal[4]

[1] Assistant Professor, Department of Microbiology, Dr. VMGMC Solapur, Maharashtra, India
[2] Associate Professor, Department of Microbiology, Dr. VMGMC, Solapur, Maharashtra, India
[3] Assistant Professor, Department of Microbiology, Dr. VMGMC Solapur, Maharashtra, India
[4] Post Graduate student, Department of Microbiology, Dr. VMGMC, Solapur, Maharashtra, India

Abstract
Introduction: Throughout the world multi-drug resistant nosocomial infections are one of the leading causes of deaths and morbidity amongst hospitalized patients. Microbiology reports supports in diagnosis and plays a vital role in determining the outcome and duration of the hospital stay for patients admitted in ICU. Regular surveillance of pathogens and its resistance pattern should be determined.
Objectives: The aim of the study was to find out the bacteriological profile and antibiotic sensitivity pattern of organisms causing infection in patients admitted in Pediatric (PICU) and Neonatal ICU (NICU).
Material & Method: Study was conducted from August 2018 to January 2019, total of 397 samples received in Microbiology from PICU & NICU. All samples were processed for culture and sensitivity, identification was done as per standard protocols and antibiotic susceptibility testing was done as per CLSI guidelines.
Results: Out of 397 samples, 154(39.0%) samples were culture positive. The number of Gram-negative and Gram-positive organisms isolates were 118(76.12%) and 36 (23.22%) respectively. The most frequent Gram-negative organisms (n=118) isolated from PICU & NICU were *Acinetobacter spp.* 29(24.58%) followed by *Klebsiella spp.* 28 (18.06%), *Pseudomonas aeruginosa* 25 (21.2%), *E.coli* 21 (18%), *Citrobacter koseri* 5(4.23%). Among gram positive organisms (n=36) of Staphylococcus aureus were 30(83.33%) of which MRSA were 17 (47.22%), MRCONS were 10(28%) and MSSA were 3(8.33%). *Enterococcus faecalis* isolated were 6(16.66%). Antibiotic sensitivity pattern among gram negative isolates showed maximum resistance to Amikacin 85%, and least resistance was shown by Cotrimoxazole 32%. Among gram positive bacteria 100% sensitivity was seen for Vancomycin & Linezolid.
Conclusion: Adherence of strict infection control measures, bundle care and regular antibiotic rotation should be followed in order to prevent antibiotic resistance.

Keywords: PICUs, NICU, Antimicrobial agents, multidrug resistant, CONS

Introduction

Multi drug resistant nosocomial infections are one of the most common causes of death & morbidity among hospitalized patients especially in ICU set up as such patients are highly vulnerable for developing infections [1, 2]. There are various factors which predispose these patients to infections like invasive devices, immune-suppressive status & comorbid illness [3, 4, 5].

Patients admitted in ICU have five to seven fold higher risk of nosocomial infections as compared with average patient and about 20-25% of all nosocomial infections develop in ICU[6]. These infections are usually due to multi drug resistant strains present in ICU, which may prolong hospital stay of the patient thus overburdening patient due to increase cost of treatment.

Aim & Objective

The aim of the present study was to find out the bacteriological profile and antibiotic sensitivity pattern of organisms causing infection in patients admitted in Pediatric and Neonatal ICU in tertiary care hospital in Solapur Maharashtra.

Material & Method

The study was carried out from August 2018 to January 2019 in the Microbiology department of a tertiary care teaching hospital in Solapur, Maharashtra. Various clinical samples send for culture sensitivity from Pediatric & neonatal ICU were included in the study. All samples were processed on blood agar, MacConkey agar identification was done on the basis of their growth characteristics on the respective media's, gram stain, along with various biochemical tests as per standard protocol [7]. The antibiotic susceptibility testing was done by Kirby Bauer disk diffusion method and zone of inhibition was interpreted as per CLSI guidelines [8].

Results

Total of 397 samples received in Microbiology department from Pediatric and Neonatal –ICUs. Out of 397 samples, 154(39.0%) samples were culture positive. The number of Gram-negative and Gram-positive organisms isolates from NICU & PICU were 118(76.23%) and 36 (23.37%) respectively. Males 98 (63.83%) were more commonly affected by infections as compared to females 65 (42.20%).

Samples received from PICU were 102 of which growth was seen in 22 (21.57%) samples. Samples received from NICU were 295 and growth was seen in 133 (45.08%). Majority of isolates from NICU (n=133) were from blood 103 (77.44%) followed by miscellaneous samples like pleural fluid, ET secretion, ascitic fluid were 17(13%), urine 8(6.01%) and CSF 5(4%). Among culture positive PICU samples (n=21) growth was noted from blood 9(43%) followed by urine 7(33.33%) and miscellaneous samples 5(24.0%).

The most common Gram-negative organisms (n=118) isolated from PICU & NICU were *Acinetobacter spp.* 29(24.58%) followed by *Klebsiella spp* 28 (18.06%), *Pseudomonas aeruginosa* 25 (21.2%), *E.coli* 21 (18%), *Citrobacter koseri* 5(4.23%).

Among gram positive organisms (n=36) of *Staphylococcus aureus* were 30(83.33%) of which MRSA were 17 (47.22%), MRCONS were 10(28%) and MSSA were 3(8.33%). *Enterococcus faecalis* isolated were 6(16.66%).

Overall antibiotic susceptibility pattern among gram negative isolates showed maximum resistance to Amikacin 85% followed by Ciprofloxacin 78%, Cefotaxime 66% Imipenem 63%, Piperacillin tazobactam 50%, however least resistance was seen for Cotrimoxazole 32%.

ESBL(Extended spectrum beta lactamases) production was detected in 40% of Enterobacteriaceae while Carbapenem resistant Enterobacteriaceae (CRE) were detected in 22.22% of isolates, of which 7(13%) were MBL (Metallo beta lactamases) producer. Among non-fermenter gram negative bacilli (n=54), ESBL producer were 18.51% isolates while MBL production was seen in 46.3% of isolates.

Among gram positive isolates 100% sensitivity was seen for Vancomycin & Linezolid, overall resistance to Clindamycin, Cotrimoxazole & Erythromycin was 50% respectively. Maximum resistance was seen in Gentamicin 25% & Ciprofloxacin 25%.

Discussion

The most important goal for any ICU should be reduction in antimicrobial resistance which will ensure improvement in patient's outcome and reduces hospital stay & economic burden from the patient. Infection caused by multi drug resistant organism (MDRO) constitutes a serious problem for patient's admitted in intensive care unit world- wide. The incidence of nosocomial infection varies in different ICU's in different set ups. In the present study (including PICU & NICU) out of 397 samples received for culture & sensitivity, culture positivity rate was 39%.Studies done by Akash Deep *et al*. [9] & Patel Bhaumik V [10] shows similar results. However studies done by Zaveri Jitendra R [11] showed low culture positivity rate as compared to the present study.

In the present study gram-negative organisms outnumber gram-positive organisms. Gram negative isolates from NICU & PICU were 118(76.23%) and 36 (23.37%) respectively. Majority of studies done by Akash deep *et al.* [9], Patel Bhaumik V [10], Zaveri Jitendra R [11], Satyajeet K Pawar *et al*, [12] are in concordance to the present study where gram negative organisms are most commonly isolated from intensive care units.

In the present study males 98 (63.83%) were more commonly affected as compared to females 65 (42.20%) similar results were reported by Akash Deep *et al*. [9] this can be attributed to suppression of cell mediated immunity in malnourished children, presence of indwelling catheter, prolong steroid treatment and low birth weight baby these factors predispose to nosocomial infection, however reasons for male preponderance are not fully understood.

The present study shows majority of isolates were obtained from blood culture followed by other samples. Studies by various workers shows that neonates & Pediatric age group are more prone to blood stream infection as they are more vulnerable and in ICU setting indwelling catheters, prematurity, malnourishment further increases the risk of blood stream infection.

The most frequent Gram-negative organisms (n=118) isolated from PICU & NICU were *Acinetobacter spp.* 29(24.58%) followed by *Klebsiella spp* 28 (18.06%), *Pseudomonas aeruginosa* 25 (21.2%), *E.coli* 21 (18%), *Citrobacter koseri* 5(4.23%). Among gram positive organisms (n=36) of *Staphylococcus aureus* were 30(83.33%) of which MRSA were 17 (47.22%), MRCONS were 10(28%) and MSSA were 3(8.33%). *Enterococcus faecalis* isolated were 6(16.66%). Studies done by Akash deep *et al*. [9], Patel Bhaumik V [10], Zaveri Jitendra R [11], Satyajeet K Pawar *et al*. [12] shows that most common infections in ICU settings are predominantly due to gram negative bacteria as these are present in majority in the hospital environment and are often multidrug resistant.

Overall antibiotic susceptibility pattern among gram negative isolates showed maximum resistance to Amikacin 85% followed by Ciprofloxacin 78%, Cefotaxime 66% Imipenem 63%, Piperacillin tazobactam 50%, however least resistance was seen for Cotrimoxazole 32%. High sensitivity to Cotrimoxazole in the present study points out that there is a need of regular antibiotic rotation policy as mutations are commonly induced in bacteria due to selective pressure from specific group of antimicrobials. Antibiotic rotation may reduce the problem of resistance to higher antibiotics to some extent.

ESBL(Extended spectrum beta lactamases) production was detected in 40% of Enterobacteriaceae family isolates by CLSI combined disc test [8], similar results were seen by Patel Bhaumik V [10], while Carbapenem resistant Enterobacteriaceae (CRE) were detected in 22.22% of isolates, of which 7(13%) were MBL (Metallo beta lactamases) producer confirmed by Modified Hodge test [8]. Among non-fermenter gram negative bacilli (n=54), ESBL producer were 18.51% isolates while MBL production was seen in 46.3% of isolates.

Among gram positive isolates 100% sensitivity was seen for Vancomycin & Linezolid, overall resistance to Clindamycin, Cotrimoxazole & Erythromycin was 50% respectively. Maximum resistance was seen in Gentamicin 25% & Ciprofloxacin 25%.

The pattern of organism causing infection and their antibiotic susceptibility pattern vary widely from country to country as well as from hospital to hospital and even among ICU's within one hospital. Analysis of variation in antibiogram even among wards & ICU's within same hospital is important as it will be helpful in knowing the local antibiotic resistance pattern, which will guide in formulation of effective antibiotic policy and implementation of antibiotic stewardship program which will result in rational use of empirical therapy in critically ill patients.

Conclusion

Nosocomial infections and antimicrobial resistance is major determinant in patient's outcome especially in ICU set up as patients admitted in ICU are critically ill & vulnerable to infections. Strict adherence to infection control measures, regular HAI surveillance, implementation of antibiotic policy and antibiotic stewardship are important steps to improve patient outcome in such conditions.

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