BACTERIOLOGICAL SPECTRUM OF CLINICAL SPECIMENS FROM CASES OF NOSOCOMIAL INFECTIONS IN PAEDIATRIC ICU

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ABSTRACT

Objective:

To assess bacteriological spectrum, of isolates from cases of nosocomial infections in pediatric ICU.

Material & Methods:

subjective study that was carried out from November 2009 to September 2010, on two hundred samples which were taken from patients in pediatric ICU, tertiary care hospital who were clinically suspected of having nosocomial infection and processed for the diagnosis and isolation of the infective organisms in the Department of Microbiology, Basic Medical Sciences Institute (BMSI), Jinnah Postgraduate Medical Centre (JPMC),

Result:

Total 200 samples were collected. Out of these 143 samples showed positive results. 138 were of bacterial growth while 5 samples were positive for fungus. Among these 61 were positive for septicemia, 44 positive for UTI and 17 samples were positive for respiratory tract related disease, while 21 positive for miscellaneous samples.

Conclusion:

This study presents a general overview of nosocomial pathogens in Pediatric ICUS and emphasizes the importance of timely clinical and bacteriological monitoring among children especially in patients in critically ill situation.

Keyword:

Nosocomial infections, pediatric ICU

INTRODUCTION

The problem of nosocomial infections should be considered a big issue in hospitals of developing countries like Pakistan where the guidelines for hospital infection control and prevention are not well defined[1].Patients and ICU characteristics in PICUs suggest that the pattern of nosocomial infection may differ from those seen in adult ICUs apart from the age of their patients[2]. The major risk factors in acquiring the nosocomial infection in pediatric patients comprise of[3];

Age less than two years, Severity of underlying disease., Presence of invasive procedures, Length of stay that is prolonged, Overcrowding of patients, Patient nursing contacts.

Bacteremia, Pneumonia and UTI are most common nosocomial infections[4]. Nosocomial infections are caused by viral, bacterial, and fungal pathogens. Viruses are the leading etiologies of nosocomial infections in pediatric patients. Bacterial and fungal infections are less common. Most patients who are infected with nosocomial bacterial and fungal pathogens have a predisposition to infection caused by invasive supportive measures such as intubation and the placement of intravascular lines and urinary catheters. Fungal infections are likely to arise from the patient's own flora[5].

The common pathogens involved are Staphylococcus aureus, coagulase negative Staphylococci, E. coli, Pseudomonas aeruginosa, Klebsiella, Enterococci, Mycobacterium tuberculosis and Candida,Aspergillus fusarium, Trichosporon and Malassezia[,6].

About one third of NIs are considered preventable and as many as 98% deaths from hospital infections may be prevented[7].

A guideline for cleaning hospital environment should include[8]: a) Management of medical waste, b) Isolation precautions, c) Personal hygiene, d) Hand hygiene, e) Disinfection and sterilization, f) Hospital environment cleaning, g) Accidental blood contact or other specimens, h) Surveillance of hospital infections, i) proper use of antibiotics in hospitals.

OBJECTIVE

The purpose of study was to isolate and observe the organisms involved in nosocomial infections in a pediatric ICU of a tertiary care hospital.

MATERIALS AND METHODS

This descriptive study was conducted in the Dept. of Microbiology, BMSI, JPMC Karach. In this study 200 samples were collected from the patients admitted in PICU of tertiary care hospital of Karachi from December 2009 to September 2010. These samples were collected from clinically suspected cases of nosocomial infections.

Specific site related investigations included the following:

All patients aged between 1 month and 12 years hospitalized in pediatric ICU for more than 48 hours were included in the study.

The nature of the samples was blood, respiratory secretions, protected catheter specimen, wounds, pus and urine. Samples were collected from the ICU of Pediatric unit and processed in Microbiology department, BMSI, JPMC, Karachi.

All the samples except urine were inoculated on Blood and MacConkey medium for 18-24 hours at 37°C. Urine samples were inoculated on CLED agar. Blood samples collected in blood culture bottles were subcultured on chocolate agar also. Growth was then observed on the culture plates, noting its size, colour, shape, consistency and surface. On blood agar plate, type of hemolysis was also observed. On MacConkey medium lactose fermentation was observed.

If the growth was suspected for Candida then it was subcultured on Saboraud Dextrose Agar (SDA) and observed after 48 hours along with microscopy. Candida species was suspected by observing Gram positive budding yeasts and confirmed by Germ tube test.

RESULT

Distribution of total specimens according to age groups i.e., 1 month to 6 months 25(12.5%),6 months to 1 year 39 (19.5%), 1 year to 2 years 36 (18%), 2 to 5 years 48 (24%) and 52 (26%) specimens from patients >5 years of age.

Table 1 shows that out of these 200 specimens 75 (37.5%) were blood samples, 50 (25%) were urine samples, 15 (7.5%) of peritoneal dialysis fluid and 15 (7.5%) pus, 10 (5%) of endotracheal tube aspirate, 10 (5%) intravenous canula tips, 10 (5%) Folley's catheter tips, 10 (5%) ventilators and 5 (2.5%) of tracheostomy tubes.

Table 2 depicts that septicemia was suspected in 42.5% (n=85; 75 blood and 10 I/V canula), Urinary tract infection in 30% (n=60;50 urine and 10 Folley's caheter), Respiratory tract infection in 12.5% (n=25;10 ETT, 10 ventilators), pus (wound infection) in 15 (7.5%), while peritoneal dialysis fluid infection suspected in 15 (7.5%).

Among 200 specimens cultured, growth of organisms was observed in 143 (71.5% samples. Out of 143 growth positive samples, 138 (96.5%) were bacteria while 5 (3.5%) were fungi. Out of 138 bacterial growth, 104 (75.4%) were Gram negative while 34 (24.6%) were Gram positive.

The distribution of microorganisms isolated from 54 samples of blood showed 39 (72.2%) Gram negative organisms 15 (27.8%) Gram positive. In 38 isolate from 50 samples of urine, Gram positive were found in 9 (27.3%) and Gram negative in 24 (72.7%). In 10 isolates from peritoneal dialysis fluid specimens, all were Gram negative. Out of total 11 positive pus samples, Gram positive cocci were 5 (45.4%) while remaining 6 (54.6%) were Gram negative bacilli. Out of total 8 endotracheal tube aspirate samples, all were Gram negative bacilli. Out of total 7 isolates from I/V cannula tip specimens, Gram positive cocci were 4 (57.1%) while Gram negative bacilli were 3 (42.9%). Out of total 6 Folley's catheter tip isolates, Gram positive cocci were found in 1 (16.7%) and Gram negative bacilli in 5 (83.3%). Six isolates from ventilator samples, all were Gram negative bacilli. Among total 3 tracheostomy tube

specimens isolates, which were all Gram negative bacilli.

Table 3 shows that among these 143 organisms,16 (11.2%) were Staphylococcus epidermidis, 12 (8.4%) were Staphylococcus aureus, 03 (2.1%) were Staphylococcus saprophyticus and 03 (2.1%) were Enterococcus species. Whereas among gram negative bacilli, Enterobacter species 35 (24.5%), E.coli 27 (18.9%), Pseudomonas aeruginosa 21 (14.7%), Klebsiella species 14 (9.8%), Proteus mirabilis 4 (2.8%), Acinetobacter baumannii 2 (1.4%) and Proteus vulgaris 1 (0.7%) were isolated, while 05 (3.5%) were fungi (Candida albicans).

TABLE 1:
DISTRIBUTION OF SPECIMENS ACCORDING TO NATURE OF SAMPLE(N=200)

Type of sample	Number	Percent
Blood	75	37.50%
Urine	50	25.00%
Fluid (P.D.)	15	7.50%
Wound infection (Pus)	15	7.50%
ETT aspirate	10	5.00%
I/V canula tip	10	5.00%
Folley's catheter tip	10	5.00%
Tracheostomy tube	5	2.50%
Ventilator	10	5.00%

TABLE 2:
DISTRIBUTION OF SPECIMENS ACCORDING TO TYPE OF NOSOCOMIAL INFECTION(N=200)

Type of sample	Number	Percent
Septicemia	85	42.50%
Urinary tract infection	60	30.00%
Respiratory tract infection	25	12.50%
Wound infection (Pus)	15	7.50%
Peritoneal dialysis fluid	15	7.50%

TABLE 3:
DISTRIBUTION OF TOTAL ISOLATED MICRO-ORGANISMS(N=143)

Micro-organism	Number	Percent
Enterobacter	35	24.50%
E.coli	27	18.90%
Pseudomonas aeruginosa	21	14.70%
Staphylococcus epidermidis	16	11.20%
Klebsiella species	14	9.80%
Staphylococcus aureus	12	8.40%
Candida	5	3.50%
Proteus mirabilis	4	2.80%
Staphylococcus saprophyticus	3	2.10%
Enterococcus species	3	2.10%
Acinetobacter baumannii	2	1.40%
Proteus vulgaris	1	0.70%
Total number	143	100

DISCUSSION

Patients in ICUs especially in Pediatric intensive care units (PICUs) have an increased risk of developing nosocomial infections. This comparatively high rate of PICU infections are mostly related to the main risk factors.

No significant difference was observed as far as the gender predominance is concerned as shown in results in which female patients were 50.5% and males were 49.5% which is consistent with the study of Nguyen. According to Nguyen, hospital acquired infections have no gender predominance and can affect both sexes equally[5]

During study maximum patients 50% (n=100) suspected of developing nosocomial infections were under the age of 2 years, while 24% were 2-5 years, and >5 years were 26%, which is in accordance with the study of Asl HM and Nateghian and found age under two years along with others is a major risk factor for acquiring nosocomial infections[9].

Deep et al[10] stated that percentages of isolates is different in various studies. The percentage of isolates was 60.6% in a study by Naz and

Sprangua[11] while it was 40.3% in study by Deep et al[9] while in our study the percentage of isolates was 71% which is closer to the study by Naz and Sprangua[11].

In the present study the nature of samples was blood, urine, respiratory (endotracheal tube aspirates, tracheostomy tube aspirates, and ventilator swabs), tips of I/V cannula and urinary catheters, pus and peritoneal dialysis fluid. This is mostly in accordance with study of Deep et al[10], in which same kind of samples were included.

In our study ventilated patients developed nosocomial infections more commonly than the non-ventilated patients. The incidence of Ventilator Associated Pneumonia (VAP) increased with the duration of ventilation as also shown by Tullu and Deshmukh[12]. All patients who developed nosocomial pneumonia had ET/TT colonized. Thus, the risk of nosocomial pneumonia increases if endotracheal tube/ tracheostomy tube (ET/TT) is colonized. Our study corroborated this fact as proven by Schaberg et al.[13]

Present study observed nosocomial pneumonia, bacteremia and UTIs as the common sites of NI which is consistent with the study of Raymond and Aujard[14], Abramczyk et al[3] and Lee et al[4].

Raymond and Aujard[14] described nosocomial pneumonia as the most common type of NI at 53%. However, our study reflects the blood stream infections (42.5%) as the most common nosocomial infection followed by UTIs (30%) and pneumonia (LRTI) (12.5%). This partially coincides with study by Richards et al[2],describing three major infection sites represent 64% of all reported infections, primary blood stream infections were most frequent but followed by pneumonia and UTIs. In a study by Lee et al[4], UTI was seen as most common (30.2%) nosocomial infection since 2004, possible reason was prolonged use of Foley's catheter.

In the present study bacterial growth was found in 138 specimens while fungal growth was seen in 5 cases. Among bacteria the incidence of Gram positive and Gram negative represent 24.6% and 75.4% of nosocomial pathogens respectively. This partially coincides with the study by Raymond & Aujard[14], showing isolation of Gram positive and Gram negative to be 30-47% and 40-48% respectively.

Enterobacter species was reported with increasing frequency throughout 6 years examined particularly in respiratory tract infection and were the most frequently involved Gram negative pathogens after P. aeruginosa in surgical site infections and eye, ear, nose and throat infections and bacteremias as well[2].

This study is consistent with the present study in which we found Enterobactor species as the major nosocomial pathogen in PICU making 24.5% of isolated micro-organisms. The Entrobacter spp. was isolated in most of specimens but in our study majority was isolated from blood (37.03%) followed by urine (18.2%).This observation is also similar to Wang et al[15].

Blood and I/V cannula samples were 85 in total, distribution of organisms was Gram negative including Enterobacter as most common (32.8%) followed by Klebsiella, E.coli, P. aeruginosa, Proteus spp., and A. baumannii and Gram positive cocci including Staphylococcus aureus and Staphylococcus epidermidis. A study by Deep et al[10] showed Staphylococcus aureus, CoNS, Klebsiella and Pseudomonas as the dominant isolates.

The study by Becerra et al[16] isolated candida spp. as the most common organism in PICU with blood stream infection that is in contrast to studies by Gray et al[17] and Yogra et al[18] showing CoNS as the principle causing agent. This observation is also in contrast to the present study in which Enterobacter spp; is the most common organism. Extensive use of broad spectrum antibiotics has been implicated as the cause of high prevalence of candida as observed by Marodi and Johnston[19]. Candidal spp. accounted for 13.3% nosocomial infections in the study by Lee et al[4] and C. albicans was the most common cause. This finding is similar to reports showing a rate of 7%-17% by Grohskoph et al[20] and Urrea et al[21].

E.coli is the most common organism amongst nosocomial UTI in the present study, which is in accordance with the study by Urrea et al[21]

.The study by Richards et al[2] observed that P.aeruginosa and C.albicans were commonly re-

ported in UTIs associated with urinary catheters. While candida was dominantly found in study by Matlow et al[22].

The respiratory related samples were 25 in which growth was isolated in 18 cases showing Pseudomonas 8(44.4%), E.coli 4 (22.2%), Klebsiella 3(16.7%) and Enterobacter 3 (16.7%). In a study by Richards et al[2] Pseudomona aeruginosa was the most frequent isolate (22%), which is consistent with the present study.

In the present study 15 pus samples showed growth in 11 cases. The isolated Gram positive organisms include Staphylococcus aureus 2 (18.2%), Staphylococcus epidermidis 3 (27.3%) and Gram negative bacilli include E.coli 2(18.2%), Enterobacter 2(18.2%) and Pseudomonas 2 (18.2%).

There were 15 peritoneal dialysis fluid samples in the present study which showed growth in 10 cases and the organisms were only Gram negative bacilli including E.coli 5 (50%), Enterobacter 3 (30%), Pseudomonas aeruginosa 2 (18.2%).The Gram positive organisms were 24.6% of the total organisms isolated in present study. Coagulase negative Staphylococcus (CoNS) has been documented to be a common cause especially of bacteremia in PICU at 9.5-50% by Frank et al[23].

This study presents a general overview of nosocomial pathogens in Paediatric ICUS and emphasizes the importance of timely clinical and bacteriological monitoring among children especially in patients in critically ill situation. Frequent hand washing and good aseptic techniques should be reinforced for all health care personnels. A team headed by microbiologist or infectious disease physician and including nursing and scientific staff is a need for every hospital and especially PICU. It should be the job of such team to monitor the levels of nosocomial infection and to respond to incidents as they arise by identifying the source of infection and its mode of spread so that a strategy to break the cycle of infection can be devised.

Thus this study helps health professionals to have an insight into the nosocomial infections and institute various interventional strategies to decrease the occurrence of these infections.

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