Section: Anesthesiology

Research

ASSESSMENT OF PREVALENCE OF STAPHYLOCOCCUS AUREUS AS A PREDOMINANT PATHOGEN IN THE NEONATAL ICU

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Abstract

Background: To assess prevalence of staphylococcus aureus as a predominant pathogen in the neonatal ICU. **Materials and Methods:** Ninety- six neonates who developed sepsis were recruited. The neonatal septicaemia was categorized according to its time of onset as early -onset sepsis (0-7 days) and late-onset sepsis (8-28 days). All the blood cultures were collected from the peripheral veins. The colonies which were isolated were identified on the basis of their colony morphology, their gram staining patterns, and their standard biochemical tests. **Result:** Out of 96, boys constitute 52 and girls 44. In 64 cases, organism was isolated in first subculture, 20 in second and 12 in third and subsequent subcultures. The difference was significant (P< 0.05). Organism isolated were staphylococcus aureus 34 in early onset sepsis and 22 in late onset sepsis, Klebsiella pneumoniae 6 in early onset sepsis and 4 in late onset sepsis, coagulase negative staphylococcus 15 in early onset sepsis and 5 in late onset sepsis, acinetobacter baumannii 3 in early onset sepsis and 1 in late onset sepsis, Escherichia coli 2 in early onset sepsis, Pseudomonas aeruginosa 1 in early onset sepsis, Citrobacter diversus 1 in early onset sepsis and enterobacter cloacae 2 in early onset sepsis. The difference was significant (P< 0.05). **Conclusion:** In maximum cases, organism isolated were staphylococcus aureus followed by Klebsiella pneumoniae, coagulase negative staphylococcus, acinetobacter baumannii, Escherichia coli, Pseudomonas aeruginosa, Citrobacter diversus and enterobacter cloacae.

INTRODUCTION

Septicaemia in neonates is one of the major causes of morbidity and mortality among the newborns.[1] It can be defined as “a clinical syndrome which is characterized by systemic signs and symptoms and bacteraemia during the first month of life”. It is labelled as “early onset” disease, if it presents during the first 5-7 days of life and as “late onset” if it occurs after the first week of life.[2] The factors which are associated with sepsis in newborns include: low birth weight, foetal distress, a low Apgar score, the requirement of mechanical ventilation, umbilical catheterization and a history of preeclampsia in the mothers.[3,4]

Staphylococcus aureus infections represent a significant clinical burden for infants worldwide and were recently found to be the second most common cause of late-onset sepsis in very-low birth weight (VLBW) infants admitted to neonatal intensive care units (NICUs).[5] The molecular characteristics of and risk factors for S. aureus colonization and infection have been described for NICU populations across the globe and have increased our knowledge of the global burden.[6,7] The present study assessed prevalence of staphylococcus aureus as a predominant pathogen in the neonatal ICU.

MATERIALS AND METHODS

Ninety- six neonates who developed sepsis were recruited in this study. Parental consent was obtained before starting the study. Institutional clearance certificate was obtained before starting research.

The neonatal septicaemia was categorized according to its time of onset as early -onset sepsis (0-7 days) and late-onset sepsis (8-28 days). All the blood cultures were collected from the peripheral veins. 2-3 ml of blood was inoculated into brain-heart

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infusion broth and were incubated at 37°C. Subcultures were done on blood and MacConkey's agar plates on days 1,2,3,5,7 and 10. The colonies which were isolated were identified on the basis of their colony morphology, their gram staining patterns, and their standard biochemical tests. Staphylococcus aureus ATCC 27853 was included as the control strain. The results were compiled and subjected for statistical analysis using Mann Whitney U test. P value less than 0.05 was set significant.

RESULTS

Out of 96, boys constitute 52 and girls 44 [Table 1].

In 64 cases, organism was isolated in first subculture, 20 in second and 12 in third and subsequent subcultures. The difference was significant (P< 0.05) [Table 2].

Organism isolated were staphylococcus aureus 34 in early onset sepsis and 22 in late onset sepsis, Klebsiella pneumoniae 6 in early onset sepsis and 4 in late onset sepsis, coagulase negative staphylococcus 15 in early onset sepsis and 5 in late onset sepsis, acinetobacter baumannii 3 in early onset sepsis and 1 in late onset sepsis, Escherichia coli 2 in early onset sepsis, Pseudomonas aeruginosa 1 in early onset sepsis, Citrobacter diversus 1 in early onset sepsis and enterobacter cloacae 2 in early onset sepsis. The difference was significant (P< 0.05) [Table 3].

Table 1: Patients distribution

Total- 96		
Gender	**Boy**	**Girl**
Number	52	44

Table 2: Organism isolated on subcultures

Subcultures	**Number**	**P value**
First subculture	64	0.02
Second subculture	20	
Third and subsequent subcultures	12	

Table 3: Organisms isolated from cases of early and late onset sepsis

Organism	**Early onset sepsis**	**Late onset sepsis**	**Total**	**P value**
Staphylococcus aureus	34	22	56	0.03
Klebsiella pneumoniae	6	4	10	
Coagulase negative staphylococcus	15	5	20	
Acinetobacter baumannii	3	1	4	
Escherichia coli	2	0	2	
Pseudomonas aeruginosa	1	0	1	
Citrobacter diversus	1	0	1	
Enterobacter cloacae	2	0	2	
Total	64	32		

DISCUSSION

The incidence of neonatal sepsis which has been reported in the literature varies from 1-506/1000 live births.[8] In India, according to the National Neonatal Perinatal Database (NNPD) 2002-03, the incidence of neonatal septicemia has been reported to be 30/1000 live births.[9] To initiate the appropriate antibiotic treatment, it is extremely important to diagnose the cases in time.[10,11] The uncertainty which surrounds the clinical approach to the treatment of neonatal septicaemia can be minimized by microbiology section undertaking periodic epidemiological surveys on the aetiological agents and their antibiotic sensitivity patterns, which lead to the recognition of the most frequently-encountered pathogens in a particular neonatal setting.[12] The present study assessed prevalence of staphylococcus aureus as a predominant pathogen in the neonatal ICU.

Our results showed that out of 96, boys constitute 52 and girls 44. In 64 cases, organism was isolated in first subculture, 20 in second and 12 in third and subsequent subcultures. Sharma et al,[13] studied the most commonly encountered bacterial pathogens which caused neonatal sepsis Blood specimens for culture were drawn from 311 newborns who were admitted in an NICU with sepsis. The isolates were identified by doing standard biochemical tests. The antibiotic resistance patterns of the isolates were studied by the Kirby Bauer disc diffusion technique. A total of 131 organisms were isolated from the 311 blood cultures. These included Staphylococcus aureus (n=68), Coagulase Negative Staphylococcus (CoNS) (n=30), Klebsiella pneumoniae (n=10), Acinetobacter baumannii (n=9), Escherichia coli (n=05), Enterobacter cloacae (n=04), Citrobacter diversus (n=02), Pseudomonas aeruginosa (n=02) and Candida (n=01). Staphylococcus aureus was the main pathogen in both early and late-onset sepsis. On antibiotic sensitivity testing, 57.35% of the Staphylococcus aureus isolates were found to be methicillin resistant. More than 90%-gram negative rods were resistant to amikacin. The resistance to the third generation cephalosporins varied between 50-55%. The resistance to ciprofloxacin was quite high; however, most of the isolates were susceptible to levofloxacin. A majority of the isolates were

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susceptible to piperacillin-tazobactum and imipenem.

We observed that organism isolated were staphylococcus aureus 34 in early onset sepsis and 22 in late onset sepsis, Klebsiella pneumoniae 6 in early onset sepsis and 4 in late onset sepsis, coagulase negative staphylococcus 15 in early onset sepsis and 5 in late onset sepsis, acinetobacter baumannii 3 in early onset sepsis and 1 in late onset sepsis, Escherichia coli 2 in early onset sepsis, Pseudomonas aeruginosa 1 in early onset sepsis, Citrobacter diversus 1 in early onset sepsis and enterobacter cloacae 2 in early onset sepsis. Geng et al,[14] described the molecular epidemiology of S. aureus isolated from neonates. S. aureus isolates were characterized by staphylococcal chromosomal cassette (SCCmec) type, staphylococcal protein A (spa) type, multilocus sequence type (MLST), sasX gene, antimicrobial susceptibility and cytotoxicity. Logistic regression assessed risk factors for colonization. Results Overall, 92 (17%) infants were colonized with S. aureus and 20 (3.7%) were diagnosed with culture-positive S. aureus infection. Of the colonized infants, 70% (64/92) harbored methicillin-susceptible S. aureus (MSSA), 30% (28/92) harbored methicillin-resistant S. aureus (MRSA) while 70% (14/20) of infected infants were culture-positive for MRSA, 30% (6/20) were culture-positive for MSSA. Risk factors for colonization included female sex, age 7–28 days, higher birthweight and vaginal delivery.

Karthikeyan et al,[15] studied 96 consecutive inborn neonates with blood culture proven bacterial sepsis. Lethargy with refusal of feeds (28%), fever (28%) and respiratory distress (31.3%) were the major presenting features. Half of them (n=48) were of early onset (<48 hours) and the remaining half were of late onset (> 48 hours). Staphylococcus aureus (n=59, 61.5%) was the predominant pathogen and 66% of them were methicillin resistant followed by Klebsiella pnemoniae (n=24, 21.9), Escherichia coli (n=13, 13.5%) and streptococci (n=3, 3.1%). Antibiotic resistance was common, with the sensitivity to various antibiotics being ampicillin 19%, gentamicin 21.6%, cefotaxime 32.8%, amikacin 50%, chloromycetin 59.6% and ciprofloxacin 90.3%.

CONCLUSION

In maximum cases, organism isolated were staphylococcus aureus followed by Klebsiella pneumoniae, coagulase negative staphylococcus, acinetobacter baumannii, Escherichia coli, Pseudomonas aeruginosa, Citrobacter diversus and enterobacter cloacae.

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