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Antibiotic Susceptibility Pattern of Bacteria Isolates in Neonates at a Children Hospital, Nigeria

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ABSTRACT

Blood-stream infection is one of the leading causes of neonatal mortality. Neonatal septicemia is a common complication for neonates in neonatal intensive care unit around the world. The aim of this study was to isolate and identify the bacteria responsible for neonatal septicemia and to determine the susceptibility pattern of isolates in Outreach Children's hospital in Festac town, south-western Nigeria. 432 blood samples were collected for this study. The samples were processed in accordance with standard protocols. Antibiotic susceptibility of isolates was done by disc diffusion technique according to British Society for Antimicrobial Chemotherapy. Blood culture reports were positive in 22.2% cases. Early-onset sepsis was present in 65.6% and late-onset sepsis was observed in 34.4% of the cases. The most common isolates were Klebsiella spp 34.3% and S.aureus 28.1%. Gram-negative isolates were mostly susceptible to ofloxacin 90%, followed by

ciprofloxacin 65%. Best overall susceptible antibiotics among Gram-positive isolates were ciprofloxacin 83.3% and ceftazidine 83.3%. In conclusion, this present study showed that both Gram-negative and Gram-positive bacteria were responsible for neonatal septicaemia and the majority of the isolates were multidrug resistant. This urges us to take infection prevention measures and to conduct other large studies for appropriate empiric antibiotic choice.

Keywords: *Antibiotic susceptibility, bacterial isolates, neonates, Nigeria*

INTRODUCTION

Bloodstream infection is one of the leading causes of neonatal mortality and morbidity and it often has a rapid and exploding course [1]. Neonatal septicemia is a common complication for neonates in neonatal intensive care units around the world [2].

The incidence is much higher in developing countries than in developed world [3]. According to World Health Organisation estimates, there are about 5 million neonatal deaths a year, with 98% occurring in developing countries [2]. The neonatal mortality rate is defined as the number of neonates dying in first 28days of life per 1000 live births. This was estimated as 44 per 1000 live births in sub-Sahara Africa, four times more than the rate in Europe (11 per 1000 births) [4]. Before the discovery of antibiotics, the mortality from septicemia was 90%, but it reduces to 24-58% after antibiotics came to use [5].

The highest rate of neonatal septicemia occur in low birth weight neonates, especially in neonates with severe birth asphyxia, maternal bleeding, toxaemia, precipitous delivery, or maternal infection [6].

Neonatal sepsis is caused by a variety of organisms, ranging from Gram-positive bacteria, Gram-negative bacteria and sometimes yeasts [7]. The major cause of neonatal sepsis in the developing countries is Gram-negative bacteria and these organisms have developed increased resistance over the last 20 years, therefore posing a major problem in managing neonates with sepsis [8-11].

The age of onset of neonatal sepsis is broadly divided into two types: Early-onset sepsis (<72hrs) and late-onset sepsis (≥72hrs-28days) [2].

It is essential to conduct periodic review of organisms responsible for neonatal septicemia for the appropriate management of neonates. Proper management and early diagnosis of neonatal septicemia could reduce the mortality and morbidity substantially. Against this background, this study was undertaken to study the bacteriological profile and antibiotic susceptibility pattern of the isolates in septicemia neonates

PATIENTS AND METHODS

Study Population

The analysis was conducted on 432 newborns (age 0-28days) admitted with clinical symptoms and risk factors suggestive of neonatal septicemia in Outreach Children's Hospital, Festac Town,

Lagos, Southwest Nigeria, between January 2012-February 2014. Signs and symptoms of sepsis included: respiratory distress, convulsions, jaundice, temperature instability and feeding difficulties. The main risk factors considered were: prematurity (gestational age <37weeks), low birth weight (<2.5kg), respiratory distress, and neonatal jaundice.

Isolation of Etiologic Agents and Antimicrobial Susceptibility Testing

Blood culture samples were collected with all aseptic precautions for culture and sensitivity. Ethical approval was obtained from the Institution Ethical Committee. With strict adherence to Helsinki Declaration on research bioethics, the participants' parents were given the option to exclude their babies from participating in the study. 3ml of blood was collected into the vial (bottle) in Bactec 9050, an instrumented blood culture system. When the Bactec system detects microbial growth, it gives alarm sound that continues until the positive bottle is removed.

Subcultures were done on MacConkey agar, blood agar and chocolate agar. The chocolate agar plates were incubated in candle jar, while the blood agar and MacConkey agar plates were incubated aerobically.

Significant bacteria isolates were identified by Gram staining and confirmed by the pattern of biochemical reactions using the standard technique [12]. Blood culture broths that yielded no microbial growth within seven days were reported as culture negative.

Antimicrobial susceptibility test was performed using disc diffusion method described by the British Society for Antimicrobial Chemotherapy [13].

Data analysis was carried out using Statistical Package for Social Sciences (SPSS) version 19.0 for Windows.

RESULTS

Of 432 neonates screened, blood culture reports were positive in 96 cases (22.2%). Early-onset sepsis cases were found to be about two times higher than late-onset sepsis. Out of 96 cases, 63(65.6%) had early onset sepsis while 33(34.4%) had late-onset sepsis. The most common isolates at the early-onset and late-onset of sepsis were the Gram-negative and Gram-positive organisms respectively (Table 1).

Klebsiella spp.(34.3%) and Staphylococcus aureus (28.1%) were the most common Gram-negative and Gram-positive organisms while Proteus spp.(3.1%) and coagulase negative staphylococcus (CONS) (9.4%) were the least common organisms (Table 2).

Table 3 and 4; show the antibiotic susceptibility pattern of Gram-negative andGram-positive organisms. Gram-negative isolates were mostly susceptible to ofloxacin (90%), followed by ciprofloxacin (65%) and ceftazidine (65%). Best overall susceptibility among Gram-positive isolates was ciprofloxacin (83.3%) and ceftazidine (83.3%).

Table 1: Effect of Age on the distribution of microbial isolates

Age	Number of Gram-positive isolates	Number of Gram-negative isolates
(<72hrs)	16	47
(≥72hrs-28days)	20	13

Table 2: Number of microbial isolates from culture positive neonates (n=96)

Organisms	Frequency of isolation (%)
Klebsiellaspp	33 (34.4)
Escherichia coli	18 (18.8)
Pseudomonas spp	6(6.2)
Proteus spp	3(3.1)
Staphylococci aureus	27(28.1)
Coagulase negative staphylococcus (CONS)	(9.4)

Table 3: Antibiotic susceptibility of gram-negative organisms

Antibiotics	Resistant (%)	Sensitive (%)
Ciprofloxacin	21(35)	39(65)
Ofloxacin	6(10)	54(90)
Ceftazidine	21(35)	39(65)
Cefixime	48(80)	12(20)
Cefuroxime	57(95)	3(5)
Gentamycin	51(85)	9(15)
Tetracycline	48(80)	12(20)
Augumentin	51(85)	9(15)
Chloramphenicol	57(95)	3(5)
Co-trimoxazole	42(70)	18(30)
Amoxicillin	54(90)	6(10)
Sparfloxacin	57(95)	3(5)
Ampicillin	57(95)	3(5)

Table 4: Antibiotic susceptibility of gram-positive organisms

Antibiotics	Resistant (%)	Sensitive (%)
Ciprofloxacin	6(16.7)	30(83.3)
Ceftazidine	6(16.7)	30(83.3)
Cefixime	27(75.0)	9(25.0)
Streptomycin	24(66.7)	12(33.3)
Erythromycin	18(50.0)	18(50.0)
Gentamycin	15(41.7)	21(58.3)
Tetracycline	33(91.7)	3(8.3)
Cefuroxime	21(58.3)	15(41.7)
Amoxicillin	33(91.7)	3(8.3)

DISCUSSION

Septicemia is a major cause of mortality in neonates and children [14]. For effective management of septicemia cases, study of bacteriological profile along with the antimicrobial susceptibility pattern plays a noteworthy role [15],[16]. Out of the 432 clinically suspected cases of sepsis in our study, blood culture reports were positive in 96 cases with positivity rate of 22.2%. This result is in tandem with that of values previously reported in Nigeria and other developing countries [1],[2],[15],[17].

In this study, the incidence of Gram-negative and Gram-positive organisms was 62.5% and 37.5%, respectively. There were 63(65.6%) isolates from early-onset septicemia cases, while 33(34.4%) were from late-onset septicemia. Out of 63 isolates in early-onset septicemia, 47(78%) were Gram-negative isolates.

It was reported by Vergnano et al [18] that the most often implicated pathogens in neonatal sepsis in developing countries differ from those seen in developed countries. In neonatal sepsis, Gram-negative organisms are more common and are mainly represented by Klebsiella, E.coli, Pseudomonas, and Salmonella. Of the Gram-positive organisms, S.aureus, CONS, Streptococcus pneumonia, and S.pyogenes are most commonly isolated [18].

The predominant Gram-negative organism isolated in this study was Klebsiella spp (34.4%). Similar observations were made by other researchers [2],[15],[19],[20]. Of the organisms isolated, S.aureus (28.1%) was the predominant Gram-positive isolates.

Antibiotic resistance is a global problem. Multi-drug resistant bacteria causing neonatal sepsis in developing countries are increasing [21]. The wide availability of over-the-counter antibiotics and the indiscriminate use of broad-spectrum antibiotics may explain this situation [15]. The epidemiology of neonatal sepsis is extremely variable therefore; it is difficult to compare antibiotic resistance between countries [18].

In this study, maximum sensitivity among Gram-negative isolates was observed in ofloxacin (90%). Ciprofloxacin (83.3%) and ceftazidine (83.3%) were observed to be the most sensitive antibiotics to Gram-positive isolates. Generally, fluoroquinolones exhibited very high activity against all isolates tested, with the exception of sparfloxacin which showed little activity against Gram-negative isolates. Similar observations have been made by previous group of researchers [22]. Some members of cephalosporin also showed adequate sensitivity. Despite the high sensitivity of fluoroquinolones observed in this study, the fluoroquinolones are contraindicated in children [23].

The analysis of drug resistance pattern showed that, Gram-negative isolates were resistant to ampicillin (95%), chloramphenicol (95%) and sparfloxacin (95%). Among Gram-positive isolates, high resistance was observed in tetracycline (91.7%) and amoxicillin (91.7%). Other studies have also reported the greater prevalence of resistance to commonly used

antibiotics [22],[24]. Resistance was observed to be against the commonly abused antibiotics such as ampicillin, chloramphenicol and amoxicillin.

CONCLUSION

This study showed that Klebsiella spp is the most common Gram-negative bacteria while S.aureus is the commonest Gram-positive bacteria associated with neonatal septicemia in a private hospital in Festac town, south-western part of Nigeria. Klebsiella spp was found to be resistant to amoxicillin, ampicillin, chloramphenicol and sparfloxacin while S.aureus showed resistant to amoxicillin and tetracycline, thus indicating that the use of these drugs might not be effective. Therefore extreme caution is required in the selection of antibiotic therapy. In view of this, antibiotic policy should be formulated in the hospital. We also advise that there should be a public health education on the dangers of indiscriminate use of antibiotics, which is currently considered to be a menace in Nigeria society and which has been responsible for ineffectiveness of most commonly used antibiotics.

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