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Bacteria associated with septicemia in children and their antimicrobial sensitivity pattern, Kano, Nigeria

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Abstract

The study is associated with childhood septicemia and their antimicrobial susceptibility pattern. A total of 2446 samples of blood culture of patients age less than 12 years were cultured from patients admitted into paediatric ward of Aminu Kano between January 2007 to December 2008. Bacteria isolates and their antibiogram were determined. Out of the 2446 patients investigated, 224 (9.2%) yielded significant bacterial growth while 2222 (90.8%) shared no evidence of bacterial growth. One hundred and eleven 111(49.6%) were males and 113(50.4%) were females giving a male to female ratio of 1:1 and the mean age 15 years. The peak of bacteria isolation was high in age group < 1 year 116(51.8%), followed by 8-10 years 28(12.5%) and group 12years 27(12%). Gram negative bacteria were sensitive to gentamycin, ofloxacin, amoxicillin, and resistant to Augmentin, ampicillin, cloxacillin, chloramphenicol. In conclusion, the study has identified the common bacterial pathogens associated with childhood septicemia and their antimicrobial sensitivity pattern.However,more periodic studies for clearer understanding of local epidemiology of childhood septicemia and designing of antibiotic policy to prevent antibiotic resistance should be carried out.

INTRODUCTION

Childhood bacteraemia is a leading cause of morbidity and mortality among children less than 5 years. [1, 2]. In sub-Sahara, it is mostly community acquired infection, with no clear definition, signs and symptoms in most cases. [2,3,4.]

Prevalence varies considerably with time, geographical location , the aetiologic agents and antimicrobial sensitivity pattern. Provisional therapy remains a clinical option in initiation of immediate management, but however there has been an achievable chemotherapeutic effect due to administration of inappropriate antibiotics. Clinical diagnosis of bacteraemia in children can be viewed from the perspective of those factors capable of influencing laboratory result outcome, particularly age of patient, aetiologic agents and underlying clinical conditions [5,6]. Molyneux[12] reported that HIV infected children have more frequent episodes of bacteraemia with high mortality than HIV negative children.

In most reported studies, gram negative bacteria accounted for majority of the causative agents of bacteraemia cases, compared to gram-positive. bacteraemia caused by the member of the enterobacteriacea other than *Escherichia coli* have been associated with increased mortality[7]. *Escherichia coli* and *staphylococcus aureus* are the two commonest clinically significant causes of blood stream infection in the USA and Europe,[4,13,15,16] in contrast to *staphylococcus aureus*, *Klebsiella specie* and *Salmonella specie* in subsaharan Africa[2,3,8,9,10].

Out of positive blood cultures, 50% only represent true blood stream infection. Coagulase negative *Staphylococcus aureus* is rarely isolated in the blood culture; this is only significant in 15% of the cases. The observed antibiotic resistance pattern in blood stream infections emanates from either antibiotic abuse, which is a normal practice in the society and or the use of broad spectrum antibiotics. To reduce the antibiotics resistance, the use of appropriate antibiotics in patient treatment is necessary especially in the case of blood stream infections since initial treatment is empirical, and there is the need for knowledge of the most prevalently isolated agents and their antimicrobial sensitivity pattern. The study is designed to identify the bacterial pathogens causing bacteraemia in children and their microbial sensitivity.

MATERIALAND METHOD

The study was conducted in the medical microbiology laboratory of Aminu Kano Teaching Hospital, between January 2007 to December 2008. Blood specimens were collected from children aged less than 12years on admission at the paediatric wards based on clinical diagnosis suggestive of blood infection. Approximately 2ml of blood was collected from the neonates due to difficulty of blood collection from this group. The samples were aseptically injected into bottle thioglycollate broth and Brain Heart infusion broth each containing 18ml of the broth to give a 1 /10 dilution.

The blood culture bottles were incubated at 37^0C. The bottles were checked regularly for signs of turbidity, indicative of bacterial growth and subculture on blood, chocolates and Mac Conkey agar plates incubated an aerobically and aerobically at 37^0C every 48hours. Evidence of no bacterial growth after 7 days sub culturing is regarded as negative and discarded.

Bacteria isolates were identified and confirmed by standard bacteriological procedures [11]. The antimicrobial sensitivity pattern was done by disc diffusion technique. The following discs were used: Cotrimoxazole(COT), Chloramphenicol (CHL), Cloxacillin (CXC), Erythromycin (ERY) ,Gentamycin (GENT),Augmentin(AUG),Streptomycin(STR),Ofloxacin (OFX), Peflotab (PEF), Ciprotab (CIP), Resophin (CRO). Control test were set up using *staphylococcus aureus* NCTC 1048 for gram-positive bacteria and *Escherichia Coli NCTC 10896 for gram negative bacteria.* Bacteria isolates were regarded as

Table 1. Bacteria Pathogens isolated from 224 Blood Cultures

Bacteria total cases	(%)
Escherichia coli	121 (54%)
Klebsiella pneumonia	12 (54%)
Pseudomonas aeruginos	2 (0.9%)
Staphylococcus aureus	37(16.5%)
Proteus Vulgaris	7 (3.1%)
Proteus mirabilis	21 (9.4%)
Salmonella typhi	2 (0.95)
Klebsiella specie	5(2.2%)
Coagulase negative Staph aureus	9(4.0%)
Streptococcus *specie*	5 (2.2%)
Streptococcus pneumonia	3 (1.3%)

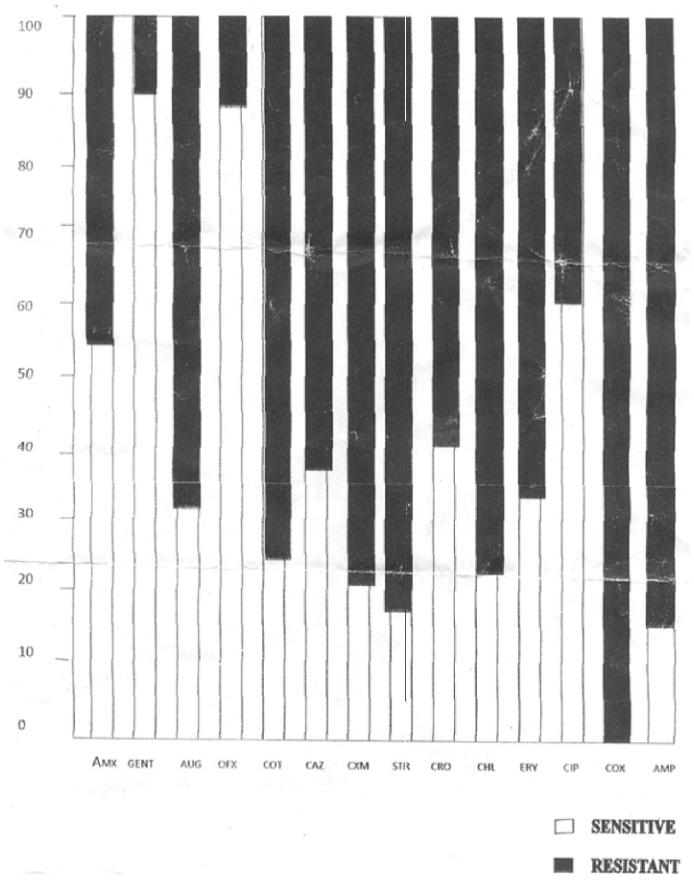

Fig. 1. Pattern of antimicrobial sensitivity test on 224 bacterial isolates

sensitive when the zone of inhibition measured using a calibrated ruler was compared to that of control bacteria.

RESULTS

Of the 2446 blood culture specimens, 224(9.2%) yielded significant bacterial growth while 2222 (90.8%) showed no evidence of bacterial growth. Out of the 224 positive patients, 111 (49.6%) were males and 113 (50.4%) were females giving a male to female ratio of 1:1. The mean age (SD) of the patients was 2.9 +1.24. The distribution of bacterial pathogens isolated as presented on table 1 shows gram-negative bacteria accounting for 75.9% of total bacteria isolated compared to 24.1% of gram-positive bacteria.

Escherichia coli was the commonest pathogen isolated accounting for 121(54%), followed by *staphylococcus aureus* 37(16.5%). *Proteus mirabilis* accounted for 21(9.4%) of the isolate,while *Klebsiella pneumonia was* 12(5.4%), and the least was *salmonella typhi* 2(0.9%) and *Pseudomonas aeroginosa* 2(0.9%) respectively. No anaerobic organisms were encountered in this study. The bacteria isolates distribution according to age is shown on table 2(0.9%) and *Pseudomonas aeroginosa* 2(0.9%) respectively. The bacteria isolates distribution according to age is shown on table 2. The peak of bacteria isolation was high in the age group < 1 year 116 (51.8%), followed by 8-10 years 28(112.5) and age group age 1-2 years 27(12.0%). The prevalence of bacteria isolates especially *Escherichia coli* was high in age group < 1 year compared to other groups. The study shows a significant difference between age and bacterial infection ($p<0.001$) shown on table 2. The antimicrobial sensitivity pattern of bacteria isolates shared sensitivity to Gentamycin, Ampicillin, and resistance to Augumentin, Cloxacillin and Chloramphenicol.

DISCUSSION

Escherichia coli and *Staphylococcus aureus* were the common bacteria pathogen isolated in this study, similar to other reported pattern in the USA and Europe,[4,13,14,15], in contrast to *Staphylococcus aureus, Klebsiella species* and Salmonella enteric in sub-saharan[8,9,10,12]. Karlasoki et al[7] reported that coagulase negative *Staph aureus* isolated from blood cultures may often be as a result of contaminants (>85% are clinically not significant). Thus in this study the coagulase negative *Staph aureus* isolated may be a result of contaminant during collection of samples or due to cross infection in the neonatal age group, thus the need for hygienic measures.

In this study, Gram negative bacteria accounted for 75.9% of the total bacteria isolated as against 24.1% from gram positive bacteria. This is in agreement to other studies where the members of the family of the enterobacterecae are predominant [9,15,16]. This result however, does not conform with that of the surveillance network (TSN) data-base USA where the frequency of isolation is 78.1% gram-positive bacteria and 21.9% gram-negative bacteria 7. The prevalence of bacterial isolates in this study is 9.2%. The findings is low when compared with other studies elsewhere in Nigeria [9,15,16] and outside Nigeria [12,17,18].

Table 2. Bacteria Pathogens isolated according to Age Group.

Bacteria	<1yr	2yrs	2-4yrs	4-6yrs	6-8yrs	8-10yrs
Gram positive bacteria	22	8	1	3	4	1
Coagulase negative S. aureus	5	-	1	-	3	-
Streptococcus pneumonia	1	2	-	-	-	-
Streptococcus specie	1	2	-	-	-	-
Gram negative bacteria						
Escherichia coli	57	11	2	15	16	20
Klebsiella pneumonia	8	1	1	0	2	0
Pseudomonas aeroginosa	1	-	-	-	-	-
Proteus mirabilis	12	3	1	2	1	2
Proteus vulgaris	5	-	-	1	-	1
Klebsiella specie	4	-	-	-	-	1
Salmonella typhi	-	-	-	-	-	2
Total	116(51%)	27(12.0%)	6(2.7%)	21(9.4)	26(11.6)	28(12.5)

It is note worthy to consider that it is difficult to compare the prevalence of bacteria isolation in children. This is because a lot of factor influence blood culture result outcome, apart from the difference in studies. The non isolation of pathogen from 2222 blood specimen may be as a result of self medication practice which will invariably suppress or hinder bacterial solution press or hence making positive septicemia case negative [19,20].

The timing of blood specimen collection is crucial in diagnosis of septicemia. It is advised that blood temperature is $<38^0$C or WBC 15,000mm^3/ml or <1,0000mm^3/ml. The volume of blood added to the culture bottle is also of importance in the isolation rate of bacteria. It is suggested that 3-5mls/bottle is appropriate but due to difficulty in neonatal collection of blood clinically, it may not be possible[23].

The high bacteria isolation in children of age group 5years is in agreement with reports in sub-saharan African countries[3,8,20,24]. This high rate is attributed to the presence of underlying disease condition [16,20,24], increased virulence of bacteria pathogens and reduced immunity of the patients.

The overall pattern of the antimicrobial sensitivity patterns similar to reported cases [9,15,16] with resistance to the community. Available antibiotic such as cloxacillin and Augmenting but with high sensitivity to quinolones like ofloxacin and aminoglycosides such as gentamycin can be used for childhood septiceamia[20]. These antibiotics can be used singly or in combination[15,16,19]. The advantage of antimicrobial agents combination in childhood septicemia is that it helps to cure a wide range of poly-microbial infection and they may prevent the emergence of resistance and also may have addictive or synergistic antimicrobial activity[7, 20]. In this study, all the isolates were resistant to cloxacillin[20]. This outcome will not be far from the fact that this antibiotic has been abused overtime due to wrong prescription and indiscriminate use.

Empirical antibiotic thereby still remains the effective and efficient way for the treatment of childhood septiceamia[25]. However to achieve the desired chemotherapeutic effect in the administration of antibiotic, adequate knowledge of clinical presentation, prevalent aetiologic agents and their antimicrobial susceptibility pattern common to the local environment is

obtained from evaluation of childhood septicemia.

CONCLUSION

In conclusion, the prevalence of childhood septicaemia is high with difference in the isolate rate between age groups. The need for periodic review of the aetiologic agents associated with childhood septicemia for better understanding especially antibiotic resistance cannot be overemphasized.

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