Bacterial Isolates in Blood Cultures of Children with Suspected Septicaemia in a Nigerian Tertiary Hospital

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Citation

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Abstract

Background: Septicaemia is a common condition in children with a resultant high morbidity and mortality. The gold standard for diagnosis of septicaemia is the isolation of bacterial agents from blood cultures. Objectives: To determine the common aetiology of septicaemia in children and their antibiotic susceptibility pattern. Methods: A retrospective study with a review of blood culture reports of paediatric patients aged 0-15 years, suspected of septicaemia, from October 2006 to October 2008 in the Medical Microbiology department of Aminu Kano Teaching Hospital Kano. Kano. Nigeria was carried out. Results: Out of a total of 3840 blood culture samples, only 18.2% was culture positive. Gram – negative and gram – positive bacteria constituted 69.3% and 30.7% respectively. The most prevalent bacterial isolates were Escherichia
coli (44.3%) and Staphylococcus
aureus(30.7%). Escherichia
coli were sensitive to Ceftriaxone, Ciprofloxacin, Gentamycin and Clavulinate – Amoxyl . Conclusion: The commonest bacterial isolate from blood culture of children with suspected septicaemia in Kano is Escherichia
coli. The most sensitive and preferable among the tested antibiotics is Ceftriaxone. Rational use of antibiotics with regular antibiotic susceptibility surveillance studies is recommended to maintain high antibiotic therapeutic profile.

INTRODUCTION

Septicaemia, a symptomatic bacteraemia, is a common condition in children with a resultant high morbidity and mortality [1,2]. Children with septicaemia present with fever, difficulty in breathing, tachycardia, malaise, refusal of feeds or lethargy. It is a medical emergency that requires urgent rational antibiotics therapy. The gold standard for diagnosis of septicaemia is the isolation of bacterial agent from blood culture [3]. Neonatal blood culture positive rates ranging from 25 – 55% has been documented in previous studies carried out within Nigeria [3,4]. In Nigeria, the outcome of treatment of neonatal septicaemia has remained poor, with reports of mortality of 33% to 41% from two tertiary hospitals in the country [4,5,6].

As neonatal septicaemia is a life threatening emergency, the knowledge of epidemiological and antimicrobial susceptibility pattern of common pathogens in a given area helps to inform the choice of antibiotics. Predominance of either the gram- positive or gram- negative bacterial isolates is influenced by geographic location and changes in time; so also is the antibiotic susceptibility pattern influenced by location and time. Some bacteria commonly isolated include Escherichia coli, Klebsiella pneumonia, Enterobacter species, Pseudomonas aeruginosa and Staphylococcus aureus.

The determination of the bacterial profile and their antibiotic sensitivity pattern will guide in the infection control and rational use of antibiotic in this locality. We report the pattern of bacterial isolates in children with clinical diagnosis of septicaemia seen at Aminu Kano Teaching hospital in the North –western Nigeria.

MATERIALS AND METHODS

The present retrospective study was on paediatric age group less than 15 years, with septicaemia, and their antibiotic sensitivity pattern from 2006 to 2008 in Aminu Kano Teaching Hospital.

Blood samples were collected following thorough cleaning of the venous site with 70% alcohol and subsequently followed by providone iodine. The rubber cap of each of the

culture broths bottles was immediately cleaned with 70% alcohol, the used needle replaced with a newer needle and the venous blood injected into Brain heart Infusion and Sodium thioglycolate broths in the ratio of one part of blood to five parts of the broth. The blood samples were categorized into different age – groups of the individual patients; A, B and C (0 to 28 days, > 28 days to <1 year and 1 year to < 15 years respectively). The blood culture broths were immediately sent to the laboratory, where they were incubated at 37 ° C for 7 days. Three sub-cultures were made; at 24 hours, 72 hours and on the 7th day on MacConkey, Blood and Chocolate agar media and incubated in appropriate temperature and atmospheres according to standard procedures [7]. Organisms isolated were identified by conventional methods [7]. Antibiotic susceptibility tests were done against locally available antibiotics by using disk diffusion method in accordance with NCCLS(now, CLSI) criteria, and similarly interpreted[8]. Controlled strains; Staphylococcus aureus ATTC 25923, Escherichia coli ATTC 25922 and Pseudomonas aeruginosa ATTC 27853 were used.

The results were analysed using SPSS 11.0 statistical software; chi – square (X^2) was used to compare associations between proportions and p-values <0.05 were considered significant at 95% confidence limit. Formal approval was obtained from the hospital ethical committee.

RESULTS

A total of 3840 blood culture samples collected, among which 700(18.2%) were culture positive. Gram-negative bacteria were 69.3% of the total isolates and gram-positive were 30.7%. The commonest bacterial isolates were Escherichia coli (44.3%), Staphylococcus aureus(28.6%) and Klebsiella species(14.3%). Gram –negative and Gram –positive bacteria were in the ratio of about 2:1(Table I).

Bacterial isolates according to age groups; A (neonates), B(>28 days to <1 year) and C(1 year to <15 years) were 25.7%, 17.4% and 12.7% respectively. Escherichia coli predominated in all the three age groups by 55.1%, 40.2% and 30.0% in groups A, B and C respectively. This was followed by Staphylococcus aureus accounting for 27.6%, 34.5% and 25.0% in groups A, B and C respectively. The least prevalent isolate was Haemophilus influenza found only in age group C, and accounted for only 1% of isolates in this age group (Table I).

Escherichia coli was sensitive to Ceftriaxone,Ciprofloxacin, Gentamycin and Clavulinate+Amoxyl by 90%, 90%,80% and 80% respectively. Ninety percent of Staphylococcus aureus was sensitive to Cefuroxime , while 90%, 90% and 85% were sensitive to Ceftriaxone , Clindamycin and Clavulinate+ Amoxyl respectively (TableII).

Figure 1

Table I. Distribution of blood culture bacterial isolates in three age groups in Oct.2006 –Oct.2008 in Aminu Kano Teaching Hospital. Kano.

BACTERIA	AGE GROUPS			
	GROUP A (neonates) (%)	GROUP B (>28/7,<12/12) (%)	GROUP C (1-<15yrs)(%)	TOTAL (%)
Escherichia Coli	180 (55.1)	70(40.2)	60(30.0)	310 (44.3)
Staphylococcus aureus	90 (27.6)	60 (34.5)	50 (25.0)	200(28.6)
Klebsiella spp	40(12.3)	30(17.3)	30(15.0)	100(14.3)
Proteus spp	14(4.4)	6(3.5)	15 (7.5)	35(5.0)
Salmonella spp	-	2(1.1)	28(14.0)	30(4.3)
Streptococcus pneumonia	1(0.3)	2 (1.1)	7(3.5)	10 (1.4)
Pseudomonas aeruginosa	-	3(1.7)	5(2.5)	8(1.1)
Enterococcus spp	1(0.3)	1(0.6)	3 (1.5)	5(0.7)
Haemophilus influenza	-	-	(2(1.0)	2(0.3)
Total Isolates	326(25.7)	174(17.4)	200(12.7)	700(18.2)
sterile(negative) cultures	944(74.3)	826(82.6)	1370(87.3)	3140(81.8)
Total cultures	1270 (33.1	1000 (26.0)	1570 (40.9)	3840

Figure 2

Table II. Bacterial isolates and antibiotic sensitivity pattern among study population in Aminu Kano Teaching Hospital 2006-2008

DRUGS	BACTERIAL ISOLATE								
	**E. coli 310 (%)	S. aureus 200 (%)	Klebsiella spp. 100(%)	Proteus spp 35 (%)	P. aeruginosa 8(%)	Salmonella spp. 30(%)	S. pneumonia 10(%)	Enterococcus spp. 5(%)	H.influenza 2 (%)
*PEN.	-	-	-	-	-	-	5(50)	3(60)	-
AMP.	155 (50)	-	45(45)	21(60)	1(13)	21(70)	5(50)	-	2 (100)
CHLO	40 (12.9)	100 (50)	42 (42)	10 (29)	1(13)	24 (80)	6(60)	2(40)	2 (100)
ERYTH.	-	100 (50)	-	-	-	-	6(60)	1(20)	2 (100)
GENT.	248 (80)	160 (80)	49 (49)	23(65)	4(50)	24(80)	7(70)	4(80)	2 (100)
CIPRO.	279 (90)	-	70 (70)	28 (80)	27 (90)	9 (90)	3 (60)	3 (60)	2 (100)
CEFTR.	279 (90)	160 (80)	-	21 (60)	-	27 (90)	8 (80)	-	2 (100)
CEFTA.	279 (90)	-	70 (70)	-	8 (100)	–	-	-	-
CEFU	-	180 (90)	56 (56)	-	-	24 (80)	8 (80)	4 (80)	2 (100)
CLAV+ AMOX.	248 (80)	170 (85)	70 (70)	20 (57)	5 (63)	24 (80)	8 (80)	4 (80)	2 (100)
CLND.	-	180 (90)	-	-	-	-	-	-	-
COTR.	155 (50)	-	-	16 (45)	1 (13)	17 (55)	4 (40)	1 (20)	1(50)
CLOX.	-	140 (70)	-	-	-	-	-	-	-

*PEN=Penicillin;AMP=Ampicillin; CHLO=Chloramphenicol;ERYTH=Erythromycin; GENT=Gentamycin;

CIPRO=Ciprofloxacin; CEFTR=Ceftriaxone; CEFT=Ceftazidime;

CEFU=Cefuroxime;CLAV+ AMOX=Clavulinate+Amoxycillin;

COTR=Cotrimoxazole;CLOX=Cloxacillin

**E. coli=Escherichia coli;S.aureus=Staphylococcus aureus;

P.aeruginosa=Pseudomonas aeruginosa

S.pneumonia=Streptococcus pneumonia;

H.influenza=Haemophilus influenza;spp=species

DISCUSSION

The rate(18.2%) of bacterial isolation in the blood culture of children in this study was relatively low compared to some previous studies done in Nigeria, namely ; Calabar (44.9%) [4] , Ilorin (30.8%) [5] and Ife (55%) [6] . In India (Madhu et al, 2002) [9] recorded a relatively low rate (22.9%) of positive blood cultures among children. In the present study, a 25.7% rate of bacterial isolation was from group A (neonates), while 17.4% and 12.7% were from blood cultures of group B(age > 28 days to <1 year) and group C (age 1 year to <15 years) , respectively. The 25.7% rate of bacterial isolation among neonates in the study was similar to a 22% isolation rate in a previous study done in Abuja, Nigeria [3]. The higher incidence of septicemia in neonates compared to other pediatric age groups may be related to immaturity of the immune system.

We report a total of 69.3% of gram- negative bacterial isolation, with predominance of Escherichia coli (44.3%). Similarly, prevalence of Gram –negative bacterial aetiology of septicaemia in children has been recorded by several other Nigeria authors [3,4]. On the other hand, some Nigerian authors had recorded preponderance of Staphylococcus aureus as bacterial cause of septicaemia in neonates [5,7].

Gentamycin which is a relatively cheap and an easily available drug is 70.7% effective against the gram- negative bacilli(GNB) and 76.7 % effective against the gram- positive cocci(GPC) in the study. This is similar to a study done in Calabar, claiming 80% effectiveness [4]. Gentamycin is routinely used synergistically with a beta- lactam antibiotic or vancomycin for empirical therapy in infective endocarditis[11].

Ciprofloxacin is 82.9% effective across all the bacterial isolates tested in vitro in the study. Ciprofloxacin is not routinely recommended for paediatric use except in special cases where the benefits out – weigh the short term risk of joint toxicity, such as in cystic fibrosis [11].

The present study revealed that Ceftriaxone can be used as a drug of choice for empirical treatment of septicaemia in children in the locality. Ceftriaxone is 81.4% effective across all the bacterial isolates tested in vitro in this study. This finding is similar to a previous work done in Kano,2002 -2003 with Ceftriaxone having about 96.0% effectiveness across all tested bacterial isolates [5]. Ceftriaxone, a third generation cephalosporin, is generally very well tolerated in children. Prolonged use of Ceftriaxone has been associated with the formation of gall-bladder sludge, which usually resolves after drug therapy is discontinued. The superior broad activity of this agent against enterobacteriacea has recently been challenged by Extended Spectrum Beta-lactamase enzyme (ESBL) plasmid mediated resistance. This is as a consequence of point mutations in the TEM or SHV genes, representing a widening threat to the utility of these agents [11].

We recommend a rational use of antibiotics especially in this tender age group in order to achieve a relative high level antibiotic activity against the offending bacterial organisms.

In conclusion, Escherichia coli is the commonest bacterial isolate responsible for septicaemia in all paediatric groups. Finally, in the absence of antibiotic susceptibility report, Ceftriaxone should be considered as a first choice of reliable antibiotics for empirical treatment of septicaemia in this age group in Kano community and environs.

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