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Prevalence of neonatal septicaemia in the University of Port Harcourt Teaching Hospital, Nigeria

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Abstract *Background:* Septicaemia is a major cause of morbidity and mortality in the neonatal period. Early detection of neonatal septicaemia is often hampered by its subtle and non-specific symptoms and signs thus a high index of suspicion is needed.

Objectives: To determine the prevalence of neonatal septicaemia, identify the predisposing factors, clinical features and causative organisms in the University of Port Harcourt Teaching Hospital.

Methods: Four hundred and six neonates with clinical suspicion of sepsis were recruited into the study over a six months period. Blood culture was used as gold standard for the diagnosis of neonatal septicaemia.

Results: One hundred and sixty-nine (41.6%) neonates had positive blood culture giving a prevalence rate of neonatal septicaemia as 33.1%. The predominant predisposing factors were out-born delivery (68.0%), birth asphyxia (30.2%) and prematurity (21.4%) while the major clinical features of septicaemia were respiratory distress (30.2%), fever (26.6%) and poor suck (22.5%). *Klebsiella pneumoniae* (65.4%), *Staphylococcus aureus* (15.4%) and *Escherichia coli* (7.7%) were the commonest organisms isolated in neonates with septicaemia.

Conclusion: Prevalence of blood culture-proven septicemia is high, being 33.1%. *Klebsiella pneumoniae* is the predominant cause of neonatal septicaemia in Port Harcourt.

Key Words: Neonatal septicaemia; Prevalence; Port Harcourt.

Introduction

Neonatal septicaemia continues to be an important cause of morbidity and mortality in spite of great advances in antimicrobial therapy, neonatal life support measures and early detection of risk factors.[1,2,3] This is due to high susceptibility of the newborn to infections, attributable to impaired immune defence system especially in the preterm.[4] Neonatal septicaemia accounts for 13%-15% of all neonatal deaths globally.[2] Its contribution is higher in developing countries, where figures of between 30%-50% have been reported.[5-8] Early detection and treatment of neonatal septicaemia is thus an important priority but this is often hampered by its subtle, diverse and non-specific symptoms and signs.[9-12] The organisms responsible for neonatal septicaemia vary across geographical boundaries.[3,4] In addition, one organism or group of organisms may over time replace another as the leading cause of neonatal septicaemia in a particular region.[3] Early treatment with appropriate antibiotics would therefore minimize the risk of severe morbidity and mortality, besides reducing the emergence of multidrug resistant organisms.[3] The present study was therefore carried out to determine the prevalence of neonatal septicaemia, identify associated predisposing factors as well as the bacteriological profile of neonatal septicemia in the Special Care Baby Unit of the University of Port Harcourt Teaching Hospital, Nigeria.

Materials and methods

This study was prospectively carried out in the Special Care Baby Unit of the University of Port Harcourt Teaching Hospital, Nigeria over a six month period, from 1st July to 31st December, 2007. The hospital which is located in the South-South geopolitical zone of Nigeria, serves as a referral and regional intensive care centre.

Five hundred and eleven babies, aged 0-28 days were admitted into the Special Care Baby Unit during the period of study, of which 406 who presented with one or more symptoms/signs suggestive of sepsis or risk factors of sepsis were recruited into the study. The clinical data

of these babies such as age, birth weight, sex, gestational age and place of birth (inborn or outborn) were recorded.

Two milliliter of venous blood was collected from a peripheral vein of all such babies after adequate skin preparation and before the commencement of antibiotics for blood culture. The blood was aseptically introduced into aerobic and anaerobic culture media. The blood culture specimens were processed according to standard methods in the microbiology laboratory.[13] Inoculated blood culture media were considered negative if there was no growth after continuous incubation for up to 7 days, subcultures being made each day. Antibiotic sensitivity was done using Kirby-Bauer disc diffusion method.[13]

Neonates whose samples for investigations had been sent to the laboratories were commenced empirically on intravenous cloxacillin and gentamicin, based on previous antibiotic sensitivity pattern. Clinical response was monitored and therapy changed to another antibiotic (2^{nd} line agent) if response was poor or patient was deteriorating. In the case of a positive blood culture, the 2^{nd} line antibiotic chosen was determined by the susceptibility pattern of the organism isolated.
The clinical details and results of laboratory investigations were recorded in a proforma. The results were analysed using the statistical package, SPSS version 14.0 and Epi-info version 6.04.

Results

There were 511 admissions into the Special Care Baby Unit during the period of study. Of these, 406 neonates were investigated for septicaemia.

Characteristics of Neonates with Positive Blood Culture: The characteristics of neonates with positive blood culture are shown in Table 1. One hundred and sixty nine (41.6%) neonates had positive blood culture, giving a prevalence rate of blood culture proven septicaemia among neonates admitted into the Special Care Baby Unit as 33.1%. There were 120 (45.5%) males and 49 (34.5%) females, with a M:F ratio of 2.4:1. Fifty six (41.5%) neonates had birth weights less than 2.5 kg and 111 (41.0%) were greater than 2.5 kg. Outborn neonates with septicaemia accounted for 115 (45.5%) while the inborn neonates, 52 (34.0%). Of 115 outborn neonates with septicaemia, 43 (37.4%) were delivered by traditional birth attendants (TBA), 30 (26.1%) in other hospitals, 18 (24.3%) in maternity homes and 14 (12.2%) in churches. There were 1,368 live births during the period of study, giving an incidence rate of septicaemia among inborn babies as 38.0 per 1000 live births. One hundred and ninety five inborn babies (48.0%) were admitted during the period of study, giving the prevalence rate of septicaemia in inborn babies in the Special Care Baby Unit as 26.7%. Thirteen (68.4%) post term, 85 (49.7%) preterm and 71 (32.9%) term neonates had positive blood culture. There were 120 (42.1%) neonates with early onset septicaemia (onset of illness within the first 72 hours of life) and 49 (40.5%) with late onset septicaemia (onset of illness after 72 hours of life).

Table 1: Characteristics of Neonates with Positive Blood Culture

Characteristics	Study Population n = 406	Positive Blood Culture n = 169	% of study Population	$\chi 2$	Pvalue
Sex					
Male	264	120	45.5	4.55+	0.03
Female	142	49	34.5		
Birth weight (kg)					
<2.5	135	56	41.5	0.01+	0.92
≥2.5	271	111	41.0		
Place of birth					
Inborn	153	52	34.0	5.18+	0.02
Outborn	253	115	45.5		
GA at birth (weeks)					
Preterm	171	85	49.7	17.03+	0.00
Term	216	71	32.9		
Post term	19	13	68.4		
Age at onset of Illness (hours)					
≤72	285	120	42.1	0.09+	0.76
>72	121	49	40.5		
Weight for gestation:					
*(*n = 240)*	*(**n = 105)*				
AGA	164	67	40.9	2.26++	0.32
SGA	45	24	53.3		
LGA	31	14	45.2		

GA = Gestational age
SVD = Spontaneous vertex delivery
AGA = Appropriate for gestational age
SGA = Small for gestational age
LGA = Large for gestational age

Clinical Features: Respiratory distress (30.2%), fever (26.6%), poor suck (22.5%) and jaundice (14.2%) were the commonest clinical features observed in neonates with positive blood culture while the least was abdominal distension (3.0%) (Table 2).

Table 2: Clinical Features of Septicaemia in Neonates with Positive Blood Culture

Clinical Features	Positive Blood Culture n = 169 No (%)	Negative Blood Culture n = 237 N (%)	χ^2	p value
Respiratory distress	51 (30.2)	84 (35.4)	1.23^{+}	0.27
Fever	45 (26.6)	64 (27.0)	0.01^{+}	0.93
Poor suck	38 (22.5)	36 (15.2)	3.52^{+}	0.06
Jaundice	24 (14.2)	54 (22.8)	4.68^{+}	0.03^{*}
Hypothermia	14 (8.3)	12 (5.1)	1.71^{+}	0.19
Convulsion	9 (5.3)	10 (4.2)	0.27^{+}	0.63
Vomiting	8 (4.7)	6 (2.5)	1.44^{+}	0.23
Irritability	6 (3.6)	4 (1.7)	0.75	0.38
Lethargy	6 (3.6)	4 (1.7)	0.75	0.38
Abdominal distension	5 (3.0)	7 (3.0)	0.09	0.77

*= Statistically significant
+ = df = 1

Predisposing Factors: The predominant predisposing factors to septicaemia in neonates was outborn delivery (68.0%) followed by birth asphyxia (30.2%), prematurity (21.4%) and prolonged rupture of foetal membranes greater than 24 hours (17.8%) while peripartum pyrexia (7.1%) and foul smelling amniotic fluid (7.1%) were the least (Table 3).

Table 3: Predisposing Factors to Septicaemia in Neonates with Positive Blood Culture

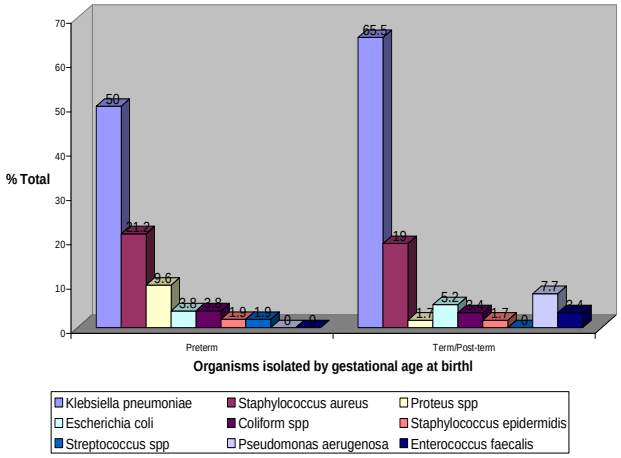
Predisposing Factors	Positive Blood Culture n = 169 No (%)	Negative Blood Culture n = 237 No (%)	χ^2	p value
Outborn delivery	115 (68.0)	138 (58.2)	4.05$^+$	0.04*
Birth asphyxia	51 (30.2)	72 (30.4)	0.00$^+$	0.97
Prematurity	37 (21.4)	47 (19.8)	0.26$^+$	0.61
PROM	30 (17.8)	68 (28.7)	6.45$^+$	0.01*
Peripartum pyrexia	12 (7.1)	21 (8.9)	0.41$^+$	0.52
Foul smelling Amniotic fluid	12 (7.1)	36 (15.2)	6.19$^+$	0.01*

*= Statistically significant
PROM = Prolonged rupture of membranes
$^+$ = df = 1

Causative Organisms

The commonest organism isolated from blood culture was *Klebsiella pneumoniae* (58.2%), followed by *Staphylococcal aureus* (20.0%), *Escherichia coli* (8.1%) and *Proteus spp* (5.5%) while the least common organism isolated was *Streptococcus spp* (0.9%).
Klebsiella pneumoniae (50.0%) and *Staphylococcus aureus* (21.2%) were the commonest organisms isolated in both preterm and term/post-term neonates (Fig 1).

Fig 1: Distribution of Organisms in Preterm and Term/ Post-Term Neonates



Antibiotic Sensitivity Pattern

The antimicrobial susceptibility testing of *Klebsiella pneumonia* and *Staphylococcus aureus*, the commonest gram negative and positive organisms respectively showed least sensitivity to the penicillins (3.8% - 22.2%), moderate sensitivity to the cephalosporins (14.3% - 66.7%) and high sensitivity to the quinolones (77.1% - 90.9%)

Fig 2:

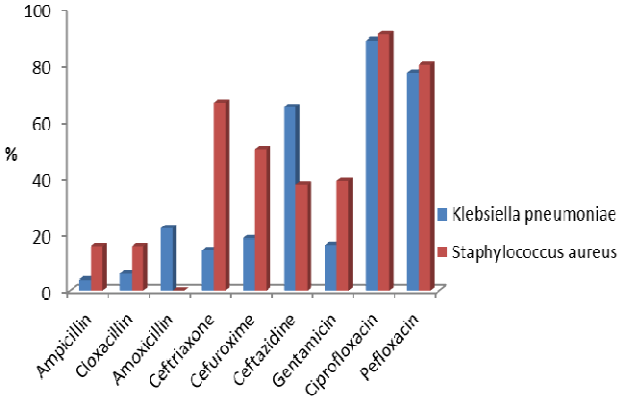


Figure 2: Antibiotic sensitivity pattern

Outcome

Of 169 neonates with blood culture proven septicaemia, 138 (81.7%) were discharged home, 6 (3.6%) were discharged against medical advice while 25 died giving a mortality rate of 14.7%.

Discussion

The 33.1% prevalence of culture proven neonatal septicaemia in our SCBU is comparable to figures of 31.7% and 34.4% reported in Calabar[8] and Jos,[14] Nigeria respectively. It is higher than the 27.8% observed in Bangladesh[15] and 10.7% in Ogun State,[16] Nigeria and much higher than 5.0%, 6.5% and 8.9% reported in Saudi Arabia,[17] London[11] and Iraq[18] respectively. These differences could be a reflection of the different population characteristics and varying predisposing factors.

In the present study, septicaemia was often observed in males than females. This is in line with the general concept of greater male susceptibility to infection.[19,20] This is also consistent with earlier observations in studies conducted within and outside Nigeria.[5,18,21,22] This pattern is however not universally reported[8,16] indicating that other poorly understood factors may be operational.

Out born delivery observed in the present study as an important risk factor to septicaemia has also been observed by several authors.[6,8,22] This is not surprising as most deliveries outside the hospital are usually supervised by traditional birth attendants whose unhygienic methods contribute to infections as observed in our study.

The clinical features of neonatal septicaemia are usually vague and non-specific and thus a high index of suspicion on the part of the doctor is of essence. In the present study, the commonest clinical features of septicaemia were respiratory distress, fever, poor suck and jaundice. This finding agrees with the report by Mustafa et al[23] in Pakistan and Njokanma and colleagues[16] in Ogun State, Nigeria. In contrast, Missallati and colleagues[24] in the Middle East, found lethargy and poor suck as the

commonest clinical features while Omene[5] in Benin, Nigeria found jaundice and fever as the commonest clinical features. These differences in the clinical features of sepsis confirm the diverse and non-specific nature of presentation. The result of the present study which showed a predominance of *Klebsiella pneumonia* followed by *Staphylococcus aureus* and *Escherichia coli* agrees with previous study in Port Harcourt[25] and other parts of Nigeria.[6,16,22,26] This is contrary however to other studies also carried out in Nigeria[14,27,28,29] These differences could be due to the fact that organisms vary from place to place as well as over time within the same locality.[3]

Critical review of the antimicrobial sensitivity of *Klebsiella pneumoniae* and *Staphylococcus aureus*, the two commonest gram negative and positive organisms respectively, showed least sensitivity to the commonly used penicillins followed by gentamicin. There was however moderate sensitivity to the cephalosporins and very high sensitivity to the quinolones. The observed very poor sensitivity to the penicillins was also observed in a previous study in Port Harcourt,[26] Illorin[28]Ile-Ife[29] in Nigeria and Iraq[18]. The sensitivity to gentamicin in the present study was also poor, below 50%. This was also observed by other researchers.[16,18,22,26,27,29] A moderate sensitivity of 58.3%-66.7% was however observed in Illorin, Nigeria.[28] The present study recorded moderate sensitivity to the cephalosporins as observed in Lagos[22] while other studies[26,28,29] recorded much higher sensitivities. This study thus shows that antibiotic sensitivities differ from region to region as well as at different times in the same hospital. This could be attributed to the development of resistant strains as a result of indiscriminate use of antibiotics. The observed high resistance rates to the penicillins and gentamicin is not surprising as these drugs have been the first line antibiotics for several years followed by the cephalosporins for both prophylaxis and treatment of neonates with septicaemia in our hospital. This therefore calls for regular review of empiric antibiotics in suspected cases of neonatal septicaemia in the SCBU. It is pertinent to note that the predominant organisms showed very high sensitivity to the quinolones as observed by other researchers.[22,26,29] This is however not surprising as the quinolones are usually not used commonly in the paediatric age group because of their inadequate safety margin.

In view of the result of our study, we therefore recommend a combination of the cephalosporins and gentamicin as first line therapy in the management of neonates with suspected septicaemia while awaiting culture and sensitivity result.

Conclusion

The high prevalence of septicaemia in the newborn, the diverse and non-specificity of its clinical features, the changing pattern of organisms causing infection, the emerging bacterial resistance and the potential for poor outcome therefore calls for periodic surveys of neonatal units.

Author's Contributions

West BA: Conceived the research Contributed to methodology, recruitment of subject, planning and collection of samples and other data Contributed to data analysis and discussion

Tabansi PN: Contributed to methodology, planning of research and data analysis Supervision and cross-checking of correctness of data collection, Contributed to writing and proof reading of the manuscript

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