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ORIGINAL ARTICLE

RISK FACTORS, CURRENT PRACTICES AND OUTCOME OF MANAGEMENT OF NEONATAL SEPSIS AT NEONATAL INTENSIVE CARE UNIT, EDWARD FRANCIS SMALL TEACHING HOSPITAL BANJUL, THE GAMBIA

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Abstract

Background: Neonatal sepsis is an important cause of morbidity and mortality among neonates in developing countries accounting for 30-50% of total neonatal deaths each year. The first 28 days of life is the most vulnerable time for child survival. Worldwide, neonatal sepsis accounts for an estimated 26% of under-five deaths, with sub-Saharan Africa having the highest mortality rates. Severe neonatal infections such as meningitis may be associated with long-term complications, such as cerebral palsy and mental retardation.

Objective

The aim of the study was to determine the risk factors and outcome of neonatal sepsis at the neonatal intensive care unit (NICU), at the Edward Francis Small Teaching Hospital Banjul (EFSTH).

Materials and Methods

An unmatched retrospective case-control study was conducted among 100 neonates admitted from November to December 2021 at the Edward Francis Small Teaching Hospital NICU. All admitted neonates folders at the NICU were reviewed and data extraction was done on neonates with and without the diagnoses of neonatal sepsis to identify some common risk factors of neonatal sepsis.

Results: Majority of mothers [48(48%)] were aged between 25years and 35years, while 2(2%) of them were < 16years, with a mean age of 30 (0.7). Multiple antenatal visits predominated with 41 (41%) mothers having more than 4 antenatal care visits. Identified probable maternal risk factors included urinary tract infection, prolonged labour, prolonged rupture of fetal membranes and being born outside the health facility. The results revealed that 36% of the mothers were primiparous and the mean parity was 3 (1.6).

Majority of the neonates had early onset neonatal sepsis (57%). The common organisms identified were Staphylococcus aureus, Streptococcal pneumoniae and Escherichia coli, all of which responded well to the antibiotics in routine use in the unit.

Conclusion

The study identified both maternal and neonatal risk factors were strong contributors to developing neonatal sepsis. Antenatal care utilization and giving birth at skilled health facility would reduce the risk factors with appropriate interventions to reduce the risk of developing sepsis.

Keywords: EOS, LOS, Sepsis neonatorum, neonates, blood stream infection

Introduction

Neonatal sepsis or "sepsis neonatorum" is defined as a form of neonatal infection and specifically refers to the presence in a newborn baby of a bacterial blood stream infection (BSI) such as meningitis, pneumonia, pyelonephritis, or gastroenteritis) in the setting of fever.[1]

Neonatal sepsis is divided into two categories: early-onset sepsis (EOS) presenting in the first 72 hours of life and late-onset sepsis (LOS) refers to presentation of sepsis after 72 hours of life.[1]

Early neonatal sepsis, which causes around 8% of all neonatal deaths commonly results from underlying poor quality of obstetric care of pregnant women. In a comprehensive ANC setting, detection of infection in the mother, hygienic management of labour and deliveries, minimized delayed diagnosis and prompt management of infection lead to increased neonatal survival.[2] Group B Streptococcus global colonization of pregnant women (18%) is predominantly responsible for early onset of neonatal sepsis, although E. coli has also recently emerged as a major threat.[3-5] The first 28 days of life are the most vulnerable time for child survival. According to estimates from the United Nations Inter-Agency Group for Child Mortality Estimation,[6] every year, an estimated 2.5 million neonates die in their first month of life, accounting for nearly one-half of deaths in children under 5 years of age. Worldwide, neonatal sepsis accounts for an estimated 26% of under-five deaths, with sub-Saharan Africa (SSA) having the highest mortality rates. Sub-Saharan Africa has an uneven burden of neonatal mortality, leading to an estimated 49.6% of all under-five deaths in 2013.[2,7] The third Sustainable Development Goal for child health aims to end preventable deaths of newborns and children under five years of age by 2030; this goal may not be attained without significant reduction of neonatal mortalities directly related to infection in developing countries.[8]

It has been observed that, asphyxia, prematurity, low birth weight, and other factors such as delivery settings, type of delivery, antenatal care received, newborn mixed feeding and some cultural practices for cord care are believed to contribute to the incidence of neonatal sepsis.[9-1] Early onset sepsis is generally caused by vertical transmission from mothers to infants during the intrapartum period,[12] while late onset sepsis is caused by postnatal horizontal transmission, mainly from organisms acquired after birth.[13,14]

The main aim of this study is to describe the current practice in NICU, in terms of assessing risk factors and appropriateness of antibiotics use according to risk of sepsis

among neonates admitted in the neonatal intensive care unit (NICU) at Edward Francis Small Teaching Hospital in Banjul, Gambia.

Materials and methods

Study Design

This was an unmatched retrospective case control study conducted among 100 neonates admitted from November to December 2021 at the Edward Francis Small Teaching Hospital NICU. The cases reviewed included newborns with and without risk factors for sepsis and those with a clinical diagnosis of neonatal sepsis.

Neonatal sepsis was diagnosed based on high clinical suspicion and clinical features (of either hyperthermia (≥37.5∘ C) or hypothermia (≤36.5∘ C), fast breathing (≥60 breathes per minute), not feeding well, severe chest in-drawing, movement only when stimulated, convulsion, lethargy, or unconsciousness) as well as blood culture.

Some diagnoses were based only on clinical suspicion due to parents' inability to afford laboratory services.

Risk factors for sepsis, defined according to NICE guidelines (15), were documented in the newborns without a clinical diagnosis of sepsis. Risk factors were categorized into "red flag" and "others" and the number of risk factors in each category recorded. The use of prophylactic antibiotics in babies with documented risk of sepsis was recorded.

All neonates admitted in November and December 2021 at the NICU had their folders retrieved and reviewed, those who fulfilled the criteria for sepsis or had factors for sepsis had their data extraction done, the data were entered into the proforma for analyses.

Inclusion criteria

- All neonates admitted in the NICU with fever or clinically diagnosed sepsis (septic umbilical stump, staphylococcus scalded skin syndrome.
- Neonates born to mothers with prolonged rupture of membrane (PROM), peripartum fever, urinary tract infection (UTI).
- Meconium-stained amniotic fluid (MSAF).

Exclusion criteria

- All babies with severe congenital malformations.
- Surgical babies.
- Neonates with incomplete folder records.

Data was entered into the IBM Statistical Package for Social Sciences Version 22 (SPSS ver. 22) for analysis. The data were presented in cross tabulations to show the distribution of cases. To determine the relations between independent variables and dependent variables, Pearson's chi-squared test and Cramer's V were used for analysis. Statistical significance was declared at $p<0.05$.

Ethical approval for the study was obtained from the Edward Francis Small Teaching Hospital Research and Ethics Committee before commencing with data collection.

Results

In the current study, a total of one hundred and eighty-five (185) neonates were admitted at NICU, out of these 100 folders with

working diagnoses in keeping with sepsis were extracted and reviewed, data extracted and analyzed showed majority of the mothers 48(48%), were aged between the 25-35years, while [only 2(2%)] were aged <16years with a mean age of 30 (0.7) years (see figure 1). Majority of the mothers were housewives or stay-at-home mothers with 78(78%). Also 90 (90%) of the mothers were married which majority, and about 10 (10%) which was the minority were single.

Maternal Characteristics

Delayed commencement of antenatal booking was common with 41(41%) of them booking for antenatal care between 10-20 weeks of gestational age and 4 (4%) did not book for antenatal care. The mean gestational age at booking was 15 (0.9) weeks. Fifty-nine percent of mothers had 0-4 antenatal care visits with a mean number of antenatal care visits of 4 (1.6). There were 36 (36%) primiparous mothers and 41(41%) multiparous mothers (para 2-3) with a mean parity of 3 (1.6). Fifty-one (51%) mothers had no underlining medical condition, 25 had UTI while 5 had pre-eclampsia/eclampsis and 1(1%) had sexually transmitted disease. Most of the mothers 71 (71%) delivered spontaneously per vagina while 29 (29%) had a caesarean section. A greater proportion, 64 (64%) had no complication during delivery while 6 (6%) had meconium-stained liquor. See table 1and figure 1 below.

Table 1. Distribution of the mothers by clinical variables at EFSTH. n=100

Clinical variables	N	%
Antenatal Booking (weeks)	**Mean**	**15 (SD±0.9)**
<13	5	5
13-26	41	41
27-39	38	38
31-40	12	12
Not booked	4	4
Number of antenatal visits	**Mean 4.5**	**SD (± 1.6)**
0	4	4
1-4	55	55
>4	41	41
Parity	**Mean**	**SD (±1.6)**
Primipara (0-1)	36	36
Multipara (2-4)	41	41
Grandmultipara (>4)	23	23
Maternal Medical Conditions During Pregnancy		
pregnancy induced hypertension	4	4
preeclampsia/ eclampsia	12	12
urinary tract infections	25	25
sexual transmitted diseases	1	1
Gestational diabetes	2	2
Ante or peri-partum hemorrhage	5	5
None	51	51
Place of delivery		
Out born	60	60
Inborn	40	40
Mode of delivery		
spontaneous vaginal delivery	71	71
caesarean section	29	29

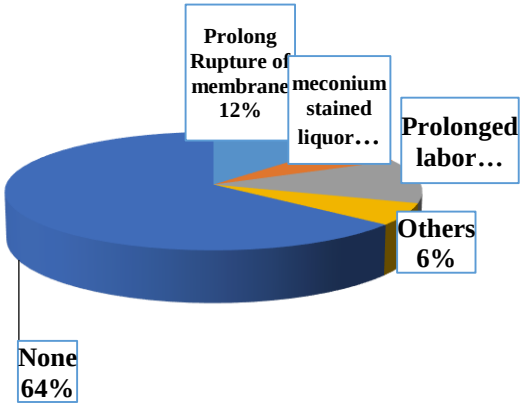

Figure 1. Distribution of the mothers by clinical variables (complications during delivery) at EFSTH

Clinical variables of the neonates evaluated for sepsis

The analysis revealed that majority of the babies 81 (81%) were admitted without culture proven diagnosis of sepsis while only 19 (19%) babies had culture proven diagnosis of neonatal sepsis on admission. Majority of the babies 25 (25%) weighed between 2-2.5kg with a mean of 2.3 (1.6)kg. In 33 (33%) of the neonates APGAR score at 1 minute was not recorded and for those who had their APGAR scores documented, the mean APGAR score at 1 minute was 6(1.8) and at 5 minutes, the mean APGAR score was 5(1.4). Majority of the neonates 74 (75%) cried immediately after birth while 25 (25%) did not cry immediately at birth.

Seventy-three (73%) required no resuscitation after birth and 35 (35%) were admitted in the neonatal intensive care unit for more than 10 days with mean duration of NICU stay of 8 (0.7) days. Laboratory work up was done for 95% of the babies. Indication for admission were preterm with low birth weight (34%), perinatal asphyxia 18% and sepsis 19%, congenital abnormality 10%, meconium-stained liquor 5% and others. There was no documented risk factors in 46 (46%) babies. Majority of the babies, 82 (82%) were treated with a combination of antibiotics (gentamycin and cefotaxime) during their stay at the NICU see (figure 4). Eighty-three (83%) of these babies were discharged home, 16 (16%) died and 1(1%) baby absconded. See table 2.

Table 2. Distribution of the neonate by clinical variables EFSTH November to December 2021. n=100

Clinical variables	N	%
Newborn diagnosed with sepsis		
Yes	19	19
No	81	81
Type of sepsis		
Early onset	57	57
Late onset	43	43
Birth Weight (Kg)	**Mean 2.3**	**SD(±1.6)**
<2500	63	63
2500-4000	30	30
>4000	7	7
APGAR Score at 1minute	**Mean**	**SD (±1.8)**
<7	38	38
>7	29	29
not recorded	33	33
APGAR score at 5 minute	**Mean 5**	**SD (±1.4)**
<7	14	14
>7	47	47
not recorded	39	39
Cry immediately after birth		
Yes	75	75
No	25	25
Resuscitation at Birth		
Yes	27	27
No	73	73

Duration of hospital stay (Days) (±0.7)	Mean8	SD
<2	3	3
2-5	29	29
6-10	33	33
>10	**35**	**35**
Were any laboratory investigations done?		
Yes	95	95
No	5	5
Neonatal Diagnosis (reason for admission		
preterm low birth weight	34	34
Neonatal anemia	1	1
risk of sepsis secondary to prolong labor	1	1
bleeding umbilical granuloma	1	1
Severe perinatal asphyxia	19	19
very low birth weight at risk of sepsis	4	4
sepsis\infection	18	18
meconium-stained liquor	5	5
congenital abnormalities	10	10
Macrosomia	3	3
New onset neonatal jaundice	3	3
Low birth weight	1	1
Clinical Diagnosis		
sepsis/ infection	18	18
At risk for sepsis	36	36
Not at risk for sepsis	46	46
Which antibiotics were used		
Cefotaxime	12	12
Gentamycin	1	1
both gentamycin and cefotaxime	82	82
None	1	1
ceftriaxone meropenem gentamycin	1	1
cloxacillin and gentamycin	3	3
Outcome		
Discharged	83	83
Died	16	16
Absconded	1	1

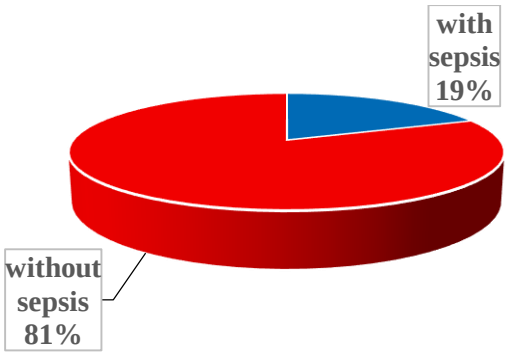

Figure 2. Distribution of the neonates by clinical variables (neonatal diagnosis on admission) n=100

Table 3. Bacterial Organisms identified

Organisms cultured	Numberof Organisms	Percentage frequency
Staphylococcus aureus	7	36.8
Escherichia Coli	3	15.8
Coliforms	9	47.4

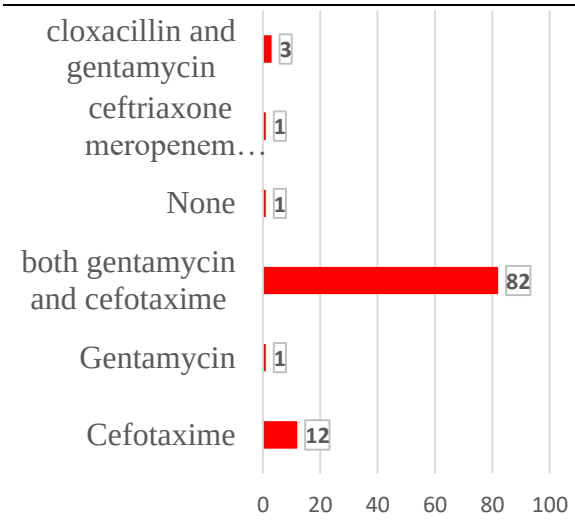

Figure 3. Distribution of the neonates in relation to antibiotics used during admission n=100

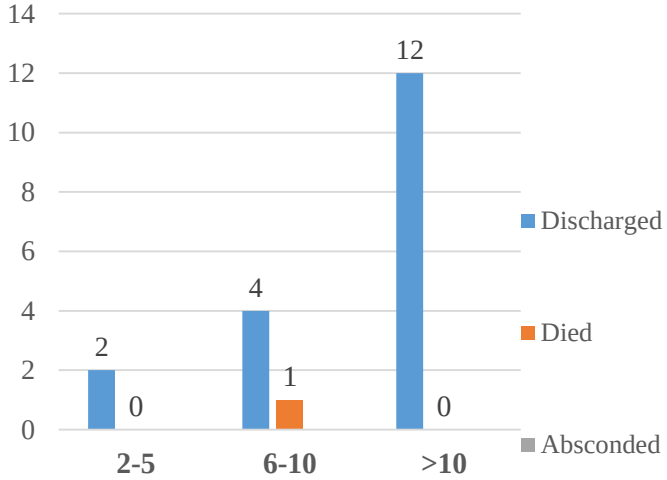

Figure 4. Distribution of Neonates with sepsis : Duration of hospital stay and Outcome

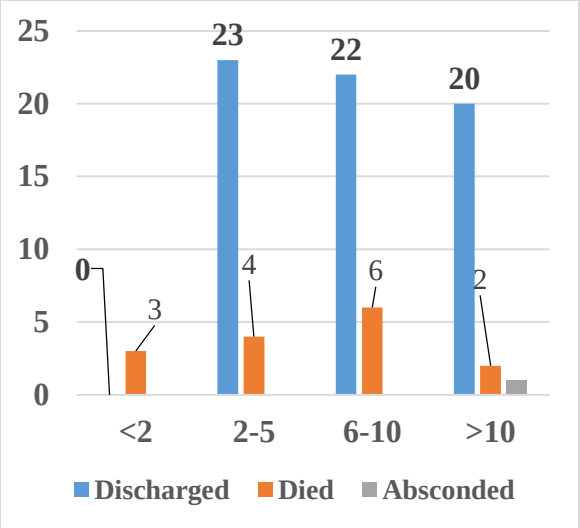

Figure 5. Distribution of Neonates without sepsis : Duration of hospital stay and Outcome.

Discussion

The present study sought for and documented the risk factors associated with neonatal sepsis at NICU and the antibiotic management of these neonates. It revealed that more than half (57.9%) of the cases had early onset neonatal sepsis (<3 days) and this was in agreement with the finding by Jabari et al.[12] in Tanzania. Our finding, however contrasted with findings from earlier studies conducted in Ethiopia by Gebrehiwot et al.[13] and Woldu et al.[14] which revealed 81.8% and 81.4%, respectively. The early onset sepsis (EOS) in the present study could be due to ascending infections from the maternal perineum due to bacterial colonization or probably due to direct contact with microorganisms with the newborns body during the delivery process. The presence of PROM could have predisposed to this. The study also revealed that APGAR scores at the first and fifth minutes were low in a significant number of babies and this may also have increased the risk for sepsis. Similar findings were also observed in other previous studies in Ethiopia and Ghana.[13,15]

The study also shows that 60% of the neonates were born outside EFSTH or referred from other hospitals, these are more likely to develop infection as a result of poor hygienic conditions associated with out-of-hospital delivery as well as during transportation to the hospital. Evidence shows that resuscitation at birth is a risk factor for early-onset neonatal sepsis among patients especially among preterm babies, including term newborns.[11,16] Poor practices and non-adherence to guidelines by health professionals during resuscitation may predispose the neonate to a greater risk of sepsis. This might not apply to the current study which showed that only a few of the babies required active resuscitation.

Utomo et el.[17] in 2010 from Indonesia found cesarean section delivery was associated with increased risk of developing neonatal sepsis, which was contrary to the finding in the current study. It may the fact that newborns delivered through CS are not exposed to vaginal and fecal bacteria, but they often experience prolonged hospital stay and late initiation of breastfeeding.[18,19] Late initiation of breastfeeding after CS may deny the neonate the protective effect of colostrum against different pathogenic microbes that have harmful effects on the survival of the newborn baby and its ability to provide immunity for the neonate.[20,21] The present study findings disagree with Siakwa et al.[11] where they found mode of delivery not to be significantly associated with neonatal sepsis (p=0.18).

The study findings by Siakwa et al.[11] in Ghana and Gebremedhin, Berhe et al.[12] in Ethiopia did observe lack of antenatal care

service utilization as a risk factor of neonatal sepsis. However, the finding in the present study, contrary to the above study findings by both the Ghana and Ethiopia researchers did not observe difference in neonatal sepsis between women who utilized antenatal care and mothers who did not utilize antenatal care. This may be attributable to the small size of the sample in this study. The majority, 96 (96%), of mothers who utilized ANC services had neonates among cases, though antenatal care utilization is vital in lessening the risk factors of adverse birth outcome including newborn sepsis but that was not the case in the present study. It is however noteworthy that booking for ANC was quite late and this may impact negatively on the benefits of antenatal care.

The study also showed that 99 (99%) of all the neonates admitted at the NICU with suspicion of sepsis were all receiving intra-venous antibiotics even when there was a risk of developing sepsis. This indiscriminate antibiotic use serves as ingredient for developing anti-microbial resistance among babies.

Conclusion and Recommendations

The study observed that most of the neonates had early onset of sepsis. Therefore, encouraging mothers to utilize antenatal care services more efficiently might help identify the risk factors and possible interventions to minimize the risk factors of adverse birth outcomes including neonatal sepsis.

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Conflicts of Interest: The authors declare no conflict of interest.