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Original Research Article

Factors predisposing to neonatal sepsis in Yenagoa Nigeria

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ABSTRACT

Background: Neonatal unit of the hospital is the hallmark of intensive care hence the full name of the department is neonatal intensive care unit (NICU), and sepsis is prevalent. Predisposing factors to the occurrence of neonatal sepsis is something to be regularly reviewed. This commentary seeks to advance findings from a dissertation on predisposing factors of sepsis NICU.
Methods: This was based on critical review of a mixed method study involving clinical observation and survey approaches using purposive sampling techniques. 66 questionnaires were administered to the health professionals working in the NICU of the two tertiary hospitals. Statistical analysis was in frequency description research method.
Results: 83.3% of the participants were females and 97% are above the age of 18 years old. Using 2.5/5 as benchmark of the Likert scale, results revealed socio-economic, maternal healthcare, neonatal health, and hygienic delivery practice as main predisposing factors with averages over 3.23. The level of healthcare professionals' adherence to general infection control measures was found to be moderate (2.6±0.4 out of 5.00). The result also revealed that mothers and visitors adhered abysmally to the use of personal protective equipment (1.7±0.4 out of 5.0).
Conclusion: The hygiene level of the health workers and mother/visitors to the NICU may likely be a predisposing factor to the occurrence of neonatal sepsis. Infection control compliance monitoring to avoid sepsis among neonates is strongly recommended.

Keywords: Critical care, Infection control, Intensive care unit, Neonates, NICU, Risk factors

INTRODUCTION

Neonatal sepsis is an infection of the blood involving a newborn infant less than twenty-eight days old and consist of a clinical syndrome that may include systematic signs of infection, as well as cardiovascular disease and renal complication.[1,2] Neonatal sepsis remains a leading cause of morbidity and mortality among infants, as well as one of the most common reasons for admission into neonatal intensive care units (NICU).[4] Indeed, neonatal sepsis is one of the unabated problems in public health and the critical care issue cuts across the globe.[5-7] Hence the 'Global Maternal and Neonatal Sepsis Initiative' was launched to improve management of the preventable disease.[3,7] The major cause of neonatal sepsis is bacterial infection but other maternal factors that increase the risk of neonatal sepsis includes chorioamnionitis, delivery before thirty-seven weeks, and prolonged rapture of membranes greater than eighteen hours. A neonate who has sepsis can have inflammation throughout the body which can also progress to organ failure.[8] Sepsis has been a burden to mankind for millions of years and will continue to plague man as long as microorganisms are existing on earth.[9] In 2017, "it was estimated that it had affected 49 million individuals and was related to approximately 11 million potentially avoidable deaths worldwide".[10] A recent

international multisite study has reiterated the fact that neonatal sepsis remains a global concern, and targeted interventions to reduce the incidence rate is required.[11] Thus, research has shown that early recognition and intervention save lives. In a study carried out to determine the clinical features, etiology, and antimicrobial susceptibility pattern in Nigeria tertiary hospital, the report showed that out of eighty-five neonates, 64.7% (55/85) presented early-onset sepsis and 35.3% (30/85) with late-onset sepsis. Gram-negative bacteria is indicated to account for 78.9% of all infection-related sepsis but 100% of the early-onset cases.[12] Nigeria is the most populous country in Africa with one of the highest birth rates, neonatal sepsis incident rates and mortality rate in the world.[13] Nigeria accounts for the highest number of neonatal deaths in Africa and third in the world (after India and China) with sepsis responsible for about 30% to 50% of deaths. In order to combat this situation, effective prevention and management measures need to be taken.[14] With focus on Bayelsa State, 231 (51%) of 450 neonates were reported to be admitted between 2011 and 2013. Among them, 97/231 (42%) were laboratory-confirmed sepsis with blood culture positive, and 52/97 (54%) of isolated organism being Staphylococcus aureus15 This is different from the report of over 78% being Gram-negative bacteria.[12] However, these are high prevalence levels that should be of concern, which inevitably warrants investigation around infection control practices. Therefore, this study sets to investigate the predisposal factors associated with neonatal sepsis, especially focusing on infectious disease control, and the possible ways of managing and preventing neonatal sepsis in our hospital /healthcare centers in Yenagoa metropolis.

The Objectives to review neonatal sepsis causes and preventive critical care management in Yenagoa Bayelsa State. Specific objectives were Identify the predisposing factors of neonatal sepsis, including the influence of socio-economic level of mothers on the occurrence of sepsis in neonates. Assess the level of staff adherence to general infection preventive rules. Assess the level of mother's/visitor's adherence to rules guiding the NICU.

METHODS

Study design

This was achieved using mixed methods approach involving both qualitative and quantitative data collection. The sampling design adopted for this study was purposive method, because all the respondents were those present at the period of the study and willing to participate. The qualitative method was observational vis-a-viz field observation which involved viewing and recording of sampled respondents. The quantitative method was Likert scaled survey, which allowed participants answer questions administered through questionnaires.

Ethical approval

Ethics clearance was granted by the department of Public and Community Health Novena University Delta State, as well as the ministry of Health and the two health facilities (Niger Delta Teaching Hospital Okolobiri and Federal Medical Centre) in Bayelsa State.

Area of study

The area for this study is Yenagoa metropolis in Bayelsa State Nigeria, and the facilities concerned were The Federal Medical Centre, Yenagoa, and the Niger Delta Teaching Hospital Okolobiri. These are the facilities with ICU in Yenagoa metropolis.

Study period

This study was carried out within January 2020 to May 2021.

Instrument of data collection

The instrument for collection of data in this study included participatory observation and questionnaire. The participatory aspect was achieved by obtaining permission to visit the NICU of each hospital and observe roles played. The participants observed were doctors, nurses/midwives and other staff working in the IUC unit, as well as mothers/visitors of the hospitalized children. Observations of adherence were graded on likert scale of 1-3 and followed different checklists.

Hospital staff

Correct use of personal protective equipment (PPE), environmental cleanliness, hand hygiene, injection safety and sterilization of reusable instruments

Mothers/visitors

Correct use of PPE and hand hygiene. Others were wiping of breast with before feeding the baby, removal of shoes before entering the NICU and keeping of reasonable distance from the neonates.

Statistical analysis

Data collected were presented in frequency distribution tables, and bar charts. Descriptive statistic using mean, standard deviation and percentages was used to answer the research questions. SPSS version 25 was used as the statistical package of analyzing the data**.**

RESULTS

Demographic variables of respondents

One is a Teaching Hospital and the other a Federal Hospital. In the teaching hospital, a total of 37 respondents representing 56.1% were sampled and the

federal hospital, a total of 29 respondents representing 43.9% of the sample size was sampled. When classified based on gender, 16.7% (11) of the respondents were male and remaining 83.30% (55) were females. A total of 33 (50%) of the respondents were medical doctors, 32 (48.5%) also were nurses/midwives, and one (1) respondent representing 1.5% was a medical laboratory scientist. When asked to assess the level of education of majority of the mothers whose babies are in the ICU having sepsis, 4.5% of them believe that most of the women do not have any form of formal education, 27.3% felt they are generally in the primary level, 42.4% have the opinion that the women whose babies have sepsis do have secondary education and 25.8% are of the opinion that most of them have tertiary education. The age range of the women whose babies are in ICU as opined by majority (43.9%) of the respondents is 25-32 years. 27.3% are of the opinion that most the mothers are between the ages of 18-25 years, 21.2% believe some of the age range of 33-39 years, 4.5% are of the opinion that some are above 40 years and 3.0% believe that few are them are less than 18 years old. In all the women whose babies are in the ICU are believed to have secondary education and are between the ages of 25-32 years of age.

Table 1: Mean and standard deviation of factors predisposing neonates to sepsis.

Main factors	Specific factors (variables)	Mean	SD
Socio-economic factors	Level of education of mothers	3.62	0.49
	Poor feeding habits of mothers	3.49	0.61
	The living condition such as place of domicile	3.56	0.5
	Delivering at home	3.68	0.56
Maternal healthcare	Maternal GBS colonization	3.38	0.78
	Premature rupture of membranes	3.65	0.57
	Preterm rupture of membranes	3.58	0.56
	Prolong rupture of membranes	3.65	0.51
	Maternal urinary tract infection	3.47	0.73
	Chorioamnionitis	3.47	0.68
	low Apgar score	3.15	0.79
	maternal fever greater than 38ºC	4	4.92
	poor or no prenatal care	3.44	0.61
	Poor maternal nutrition	3.15	0.77
	History of recurrent abortion	2.97	0.78
	Maternal substance abuse	3.12	0.71
Neonatal health status	Low birth weight of neonates	3.12	0.76
	Congenital anomalies	3	0.8
	central venous catheterization	3.38	0.65
	meconium staining	3.41	0.74
Hygiene during delivery	Incorrect hand washing practice by health practitioners during delivery of babies	3.5	0.61
	Improper disinfection of delivery equipment and facilities	3.67	0.51
	Inappropriate umbilical cord care	3.73	0.48
	Inappropriate eye care of the infant	3.43	0.61

Table 2: level of staff adherence to the general infection preventive rules.

	Teaching hospital		Federal hospital		Both	
HCP's assessment of themselves	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
Hand Hygiene Performed correctly	3.00	0.00	2.84	0.17	2.90	0.15
PPE used correctly	3.00	0.00	3.00	0.00	3.00	0.00
PPE (gloves) used correctly	3.00	0.00	2.87	0.30	2.92	0.24
PPE (gown) used correctly	2.00	0.00	2.00	0.00	2.00	0.00
PPE (facial mask) used correctly	3.00	0.00	2.40	0.42	2.63	0.44
Injection safety observed correctly	3.00	0.00	2.97	0.08	2.98	0.06
Environmental cleaning	2.00	1.73	3.00	0.00	2.63	1.06
Sterilization of reusable instruments	1.71	1.49	2.26	0.26	2.05	0.86
Researcher's observation	**N**	**%**	**N**	**%**	**N**	**%**
Very poor	1	2.7	1	3.4	2	3
Poor	2	5.4	3	10.3	5	7.6
Fair	4	10.8	15	51.7	19	28.8
Good	28	75.7	9	31	37	56.1
Excellent	2	5.4	1	3.4	3	4.5
Total	37	100	29	100	66	100

Table 3: level of mothers' and visitors' adherence to the general infection control rules.

	Teaching hospital		Federal hospital		Both	
HCP's assessment	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
Hand Hygiene performed correctly	3.00	0.00	1.60	0.55	2.13	0.84
PPE used correctly	2.00	0.00	1.56	0.45	1.73	0.41
Others*	2.67	0.00	2.67	0.00	2.67	0.00
Researcher's observation	**N**	**%**	**N**	**%**	**N**	**%**
Very poor	0	0	4	13.8	4	6.1
Poor	13	35.1	13	44.8	26	39.4
Fair	10	27	8	27.6	18	27.3
Good	11	29.7	4	13.8	15	22.7
Excellent	3	8.1	0	0	3	4.5
Total	37	100	29	100	66	100

*(wiping of breast with wipe or clean water before feeding the baby, removal of shoes before entering the ICU and keeping of reasonable distance from the neonates).

Research question one

To answer the research question one, the opinions of the health workers were sought on the different factors that could predispose neonates to sepsis. Table 1 shows the relative levels of factors that predisposes neonates to sepsis. For instance, using a benchmark of 2.50 mean score, table shows the respondents agreed that the level of education of mothers can contribute to neonatal sepsis (3.62/5.00±0.49). Figure 1 show comparison of the factors that predispose neonates to sepsis in the hospitals used. The figure shows for instance that perception of neonates' healthcare to contribute to sepsis is higher at teaching hospital (3.30) compared to federal hospitals.

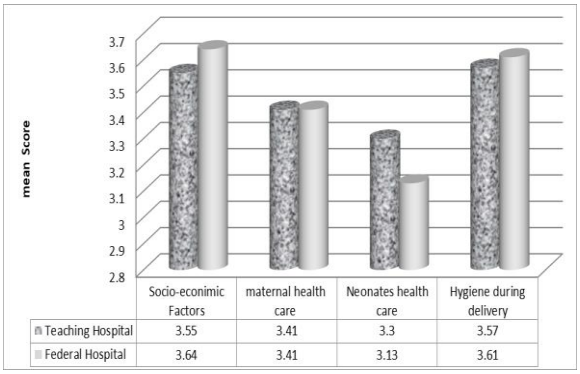

Figure 1: Mean of factors predisposing neonates to sepsis.

Research questions two

What is the level of staff adherence to the general infection preventive rules? To answer this research question, an observation checklist was used to assess the health practitioners. For each of the preventive rules, the check was to determine if the staff adhered fully, partially or did not adhere to the general infection prevention rule. The mean scores of the level of adherence are presented in Table 2. For instance, the staff adhered fully to hand hygiene performance (3.00±0.00), use of PPE is mixed while adherence to environmental cleanliness and sterilization are partial. The health workers were also asked to assess the level of staff adherence in the hospital sampled. In the teaching hospital, 2.7% of the respondents rated their level of adherence as very poor, 5.4% as poor, 10.8% also as fair, 75.7% rated the level of adherence as good and the remaining 5.4% rated their level of adherence as excellent. In the Federal hospital, 3.4% rated their level of adherence as very poor, 10.3% as poor, 51.7% also as fair, 31.0% rated the level of adherence as good and the remaining 3.4% rated their level of adherence as excellent (Table 2).

Research question three

What is the level of mother's and visitor's adherence to rules guiding NICU in Bayelsa State? To answer this research question, an observation checklist was used to observe the mothers and visitors visiting the neonates. The mean scores of the level of adherence is presented in Table 3.

In both hospitals, wiping of breast with wipe or clean water before feeding the baby, removal of shoes before entering the NICU and keeping of reasonable distance from the neonates (2.67±0.00) was also fully adhered to, while hand hygiene rules (1.60±0.00) and the use of personal protective equipment (1.56±0.00) were partially adhered to. In all, mothers and visitors adhere partially to general infection prevention rules. The health workers were also asked to assess the level of mother/visitor adherence in the hospital sampled. The result of their assessment is presented in Table 3. The results show, for instance, that 6.1% of the respondents rated their level of adherence as very poor, but 22.7% rated the level of adherence as good, while 4.5% rated their level of adherence as excellent (Table 3).

DISCUSSION

The result obtained from this study revealed that socio economic variables, maternal healthcare, neonates' health

status and the hygiene during delivery are all major factors that could predispose neonates to sepsis. One of the socioeconomic factors that can be a predisposal factor to neonatal sepsis is poor feeding habits of mothers or baby. This finding is similar to another study report that neonates who do not breastfeed are susceptible to sepsis as breastfeeding can act as protection against neonatal sepsis especially in a high-risk population.[16] Another study also found that when a mother does not eat healthy during pregnancy or after birth, the fetus or neonate will in turn be deficient in necessary food nutrients that can help fight diseases.[17]

Another socio-economic factor that predisposes a neonate to sepsis is delivering at home and also the level of the mother's education. There have been quite some literatures that uneducated mothers and those with only primary school education also had high proportions of culture proven sepsis, but educational status is given little or no attention hence the significance of this finding. The environment where they live and poor feeding were factors that contributes seriously to the occurrence of neonatal sepsis.[18,19]

Objective 1

The mother health status as found in this study could predispose neonates to sepsis are varied, including but GBS colonization, and urinary tract infection, among others (Table 1). This finding is in line with reports from some other studies on health status of the mother as a possible predisposing factor to a neonate having sepsis.[20] It has been known that the health of a mother can adversely predispose a neonate to on healthy situation.

WHO (2018) also stated that it is necessary to improve the mother health and nutrition before delivery in order to avoid diseases and improve the health of the unborn baby.[21] The results show that neonate's health status is a key factor in predisposition to neonatal sepsis. This finding is similar to that of another report on factors associated with an increased risk of neonate revealed that low birth weight among others can predispose a neonate to sepsis.[22] It was also found in the study that factors related to healthcare practitioner's hygiene during delivery, such as incorrect hand washing practice and improper disinfection of delivery equipment and facilities, could predispose a neonate to sepsis.[22,23]

Objective 2

It was found in this study that the staff of the hospitals sampled, adhered to the general infection preventive rule in the ICU where neonates with sepsis are kept. Sepsis is a disease condition with multiple causative organisms, and people with sepsis can present various signs and symptoms at different times, therefore it is necessary to prevent it by adhering to the rules for preventing such diseases.[24] The research participants specifically noted that neonates can be infected through contaminated hand of caregivers and equipment; hence it is necessary to adhere to rules of infection control in NICU. In this study the healthcare workers adhered quite well to PPE practices, though the correct use protective gown and adequate sterilization of reusable instruments were suboptimal. This observation aligns with another report in the literature that the healthcare workers' compliance with infection control rules is still partial.[25] Further evidence in support of this finding is the report that 60% of health workers follow the guideline laid for sepsis management in Nigeria.[26]

Objective 3

It was also found in this study that mothers and visitors adhere partially to general infection prevention rules. This could be because most of them as found in the study were not educated and therefore lack knowledge on the guidelines that could prevent infection in the NICU. Also, some of these rules may not have been presented to them by the healthcare workers, thereby making them ignorant of such rules guiding disease prevention on the NICU. As observed from the study, most healthcare workers stated that illiteracy is a major cause of sepsis and noted that mothers hardly attend the lecture session in the antenatal care and postnatal care session, thereby making them oblivious of all they need to know to prevent sepsis in their newborn babies. This interpretation is supported by the report of meta-analysis which indicated that one of the risk factors of neonatal sepsis is less than ANC visits.[18] Sepsis is caused by organism; therefore, it is necessary for all stakeholders caring for newborn to be enlightened on how to prevent these organisms from infecting the neonates. This includes visitors, hence there is infection control precautions meant for visitors, which necessarily requires the healthcare workers to enforce. This report advances that there is a gap in knowledge and practice of the healthcare workers around enforcement of the necessary infection control guidelines in NICU.[27]

Brief note on implications for preventive medicine

Two implications are imperative to mention. First, sepsis is infection in the blood. Thus, there is no gainsaying the fact that neonatal sepsis is strongly associated with cardiovascular complications.[1,28] Brief epidemiological indication for a literature highlighted that among 231 neonates investigated for sepsis between 2011 and 2013, 42% of the items were blood culture positive.[15] This is the proportion of a patient population requiring preventive critical care, which could feedforward to reduce the burden of cardiovascular emergency. Secondly, it is known that the burden of sepsis includes high morbidity and mortality. One report from Nigeria indicated higher prevalence respiratory distress and up to 32% death of babies affected with neonatal sepsis.[29] Thus, it can be inferred that improving intensive critical care of neonates by compliance to infection control practices would be seeking to prevent death of over one-third of neonatal patients.

Three major constrains constituted limiting factors in the study. First was the COVID-19 pandemic restriction, which created complexities in processes at the health facilities. The second is a flow on effect of the COVID-19 being impact of prolonged time it took for the different ethical approvals to be ready. Third factor was financial constrain including cost of transport logistics.

CONCLUSION

The socio-economic variables of a mother can predispose a neonate to sepsis. Factors relating to both the maternal and neonatal health status can predispose a neonate to sepsis. However, this report advances that compliance to infection control practices by healthcare professionals as well as implementation of the general infection rule for visitors in the NICU are still suboptimal for many checklist indicators. This observation may be transferrable to other critical care departments of the hospital services and calls for continuous review of policies around monitoring of infection control.

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