

Research Article

Prevalence, Clinical Presentation and Risk Factors of Neonatal Sepsis in Two Regional Hospitals in Cameroon

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Abstract

Background: Neonatal sepsis continues to be a pertinent public health issue, especially in developing nations where access to high-quality healthcare and sanitation facilities is restricted. As antimicrobial resistance escalates, managing the disease effectively in our context may pose a substantial challenge. The objective of this research was to ascertain the frequency, clinical characteristics and predisposing factors of neonatal sepsis in two referral medical facilities in the Southwest region, Cameroon.

Methods: We conducted a prospective cohort study at the Buea and Limbe regional hospitals. Neonates were consecutively sampled and followed up until their discharge from the hospitals and data for our study variables were recorded. Multivariate logistic regression model was used to assess risk factors associated with neonatal sepsis. Data was analysed using R version 4.2.3 and Statistical Package for Social Sciences (SPSS) version 26.0.

Results: A total of 207 neonates were included in our study out of 293 that were sampled. Of the 207, 110 neonates (53.14%) were diagnosed with neonatal sepsis, yielding a prevalence of 37.54%. Majority of the participants were males (57.49%), with a male: female ratio of 1.4:1. The median age in days was 8 days (IQR: 7 days) and a median birth weight of 3100g (IQR: 600g). Fever (96.36%), signs of respiratory distress (61.34%) and absent primitive reflexes (30.28%), were the most common clinical features identified in neonates diagnosed with neonatal sepsis. Maternal fever [OR:3.182, (1.519-7.045)] and vaginal delivery [OR:2.553, (1.127-4.589)], were significantly associated with having neonatal sepsis. The mortality rate was 5.45%, with the average length of hospitalization being 8.88 ± 2.99 days. Most of the neonates 97 (88.18%) fully recovered at the end of our study.

Conclusion: The prevalence of neonatal sepsis in these hospitals is high with maternal fever and vaginal delivery identified as major risk factors and a mortality rate of 2.90% was also

identified in the study. A protocol for managing all maternal fever and vaginal deliveries should be developed to reduce infection transmission.

Keywords: Neonatal Sepsis; Prevalence; Risk Factors; Outcome; Regional Hospitals Limbe

Introduction

Neonatal sepsis denotes a medical state marked by a systemic and severe inflammatory cascade in response to microbial invasion in neonates, especially in those with a compromised immune system, typically manifesting within the initial month postpartum [1]. It is a complex and multifaceted condition that poses significant challenges to healthcare systems and providers worldwide.

Globally, neonatal sepsis remains a formidable and persistent public health concern, affecting predominantly low- and middle-income countries where access to quality healthcare services, including diagnostic tools, treatment options and adequate prenatal care, may be limited [2]. According to the World Health Organization (WHO), sepsis, including neonatal sepsis, is estimated to have a substantial impact on the health of newborns and young children, with over 30 million cases reported annually worldwide [3].

In Africa, neonatal sepsis, a life-threatening condition, contributes to a considerable burden to this vulnerable population. The prevalence of neonatal sepsis varies across different regions and is influenced by a myriad of factors as earlier mentioned [4]. The pooled prevalence of neonatal sepsis in Africa, as reported in studies and research conducted in various countries, was found to be approximately 19.1% [5]. In Cameroon, specific prevalence rates may vary based on local epidemiological data available. In fact, studies conducted in Cameroon have shed light on the high burden of the condition within the country. For instance, a study conducted in a tertiary care hospital in Yaounde reported a prevalence rate of 46.3% amongst hospitalized neonates [6].

Neonatal sepsis may stem from diverse aetiologies, encompassing various modes of transmission. These include maternal transmission during parturition, postnatal exposure to pathogens within healthcare facilities or the community or intrauterine infection [7]. The diagnosis of neonatal sepsis relies on evaluating clinical signs of infection, which can manifest as fever or hypothermia, tachycardia and other system-specific signs of infection. Additionally, an assessment of leucocyte count relative to age is performed, with an elevated or suppressed leucocyte count indicating a potential diagnosis of neonatal sepsis [8].

Associated factors like prematurity and delayed treatment are often associated with a poor prognosis in cases of neonatal sepsis. For instance, Very Low Birthweight (VLBW) infants are found to have a higher risk of developing chronic lung disease, while Extremely Low Birthweight (ELBW) infants are at a greater risk of experiencing neurodevelopmental issues, including hearing and visual deficits, cerebral palsy and impaired psychomotor and mental development [9].

The Sustainable Development Goal (SDGs) 3, aiming to ensure healthy lives and promote well-being for all at all ages, includes a sub-target 3.2 which aims to end preventable deaths of newborns and children under five years of age by 2030. All countries aspire to reduce neonatal mortality to at least 12 per 1000 live births and under-five mortality to as low as 25 per 1000 live births [10]. However, the reality is stark: today a child born in Sub-Saharan Africa is still 10 times more likely to die in the first month compared with a child born in a high-income country. In 2018, 2.5 million children died within the first 28 days of life globally. In the same year, countries in Sub-Saharan Africa had the highest mortality, with 28 neonatal deaths per 1000 live births [11].

In Cameroon, a country facing its own set of challenges in healthcare, there is notable lack of comprehensive data on the prevalence and clinical profile of neonatal sepsis. However, despite this lack of data, neonatal sepsis remains a major contributor to neonatal mortality in the country. Hence, the objective of this study was to provide more data and shed light on the prevalence and clinical characteristics of neonatal sepsis; identifying potential areas where interventions may be targeted. So, this study was designed to determine the prevalence, clinical characteristics and risk factors of neonatal sepsis among newborns at the Buea and Limbe Regional Hospitals.

Material and Methods

During a period of four months from 5th of January 2024 to 15th of April 2024, we conducted a prospective cohort study at the Buea Regional Hospital (BRH) and Limbe Regional Hospital (LRH). A consecutive sampling technique was used to enrol our participants. These neonates were followed up until they were discharged from the hospital. The RHL is the principal referral level hospital in the region and the BRH is the second referral level hospital in this region with each having at least one specialist in pediatrics, obstetrics and gynecology, internal medicine and surgery. Apart from these specialists, there is a huge turnover of patients in these health facilities. The study involved all term and preterm neonates admitted to the neonatology units of the Buea and Limbe Regional Hospitals, Southwest Region of Cameroon, during the study period who had complete information and excluded neonates receiving ambulatory care on outpatient basis. The minimum sample size was obtained using Cochrane formula using a prevalence of 37.6 % from a study conducted in Yaounde [12]. This gave us an estimated sample size of 359 neonates.

Ethical and administrative clearance was obtained from the Institutional Review Board (IRB) of the Faculty of Health Sciences

(FHS), University of Buea. After this, administrative approval was obtained from the Regional Delegation of Public Health of the South-West Region and administrative boards of the BRH and LRH. Limbe Regional hospitals. A total of 4 research assistants were trained on the different aspects of the study, how to obtain consent first, then conduct interviews with caregivers (face-to-face) and follow-up of the neonates till they were discharged from hospital. Two research assistants, fluent in both French and English were selected from each of the hospitals respectively to ease the burden of work. We carried out a thorough review of clinical and paraclinical findings of neonatal admissions in the BRH and LRH, using a structured questionnaire that was pretested at Mutengene Baptist Hospital. The prevalence of neonatal sepsis was determined by reviewing the number of cases of neonatal sepsis diagnosed during the study period. A diagnosis of neonatal sepsis was made based on documented infection (clinical suspicion based on signs and symptoms or positive hemoculture) with or without two or more signs of systemic inflammatory response syndrome. SIRS criteria (score 0-4) were calculated according to the International Paediatric Sepsis Consensus (Abnormal body temperature, $< 36^{\circ}\text{C}$ or $> 38.5^{\circ}\text{C}$ [13]. Abnormal heart rate, tachycardia > 180 bpm or bradycardia < 100 bpm. Respiratory distress, respiratory rate $> 60/\text{min}$ or need for mechanical ventilation. Haematological impairment, white blood cells $> 15,000/\text{mm}^3$ or $< 5,000/\text{mm}^3$ and Positive inflammatory markers. The questionnaires were checked for completeness and data was entered using Kobo toolbox. A backup USB drive was used to save the data. Study variables were summarized using frequency distribution tables for categorical variables and descriptive statistics for continuous variables respectively. Simple logistic regression was used to identify potential predictors for our multivariate analysis. Variables with a p-value less than 0.2 were entered into our multiple logistic regression model. Adjusted odds ratios of 95% CIs and p-values at $p < 0.05$ was set to be significant.

Results

A total of 293 neonates were seen during our study period: 168 at the BRH and 125 at the LRH. Of these, 86 were not included in the study because their parents did not consent. Therefore, 207 neonates were included in our study. Out of the 207 neonates, 119 were males (57.49%) and 88 (42.51%) were females, giving a male: female ratio of 1.4:1. The median age in days was 8 days (IQR: 7 days) and a median birth weight of 3100 g (IQR: 600 g) as seen in Table 1. The mean age of the mothers was 27.36 ± 5.18 years, with majority of them having attained tertiary education (54.10%). A total of 110 neonates met our diagnostic criteria for neonatal sepsis, yielding a prevalence of 37.54% as illustrated in Fig. 1. The Buea Regional Hospital documented a significantly elevated prevalence of neonatal sepsis, standing at 64 (58.18%) while the Limbe Regional Hospital had a prevalence of 46 (41.81%). The most common clinical features seen in those with neonatal sepsis were fever 106 (96.36%), signs of respiratory distress 67 (61.34%) and jaundice 23 (21.10%) as shown on Table 2. The most frequently describable maternal factors were maternal fever during labour 52 (48.60%), prolonged labour 47 (42.73%), premature rupture of membranes 22 (20.37%) and prolonged rupture of membranes 25 (22.75%). Out of the 110 neonates diagnosed with sepsis, 10 had low birthweight (9.10%) and 3 were born with comorbidities (2.73%).

Premature rupture of membranes, fever during labour, gestational age and vaginal delivery were the factors which had p-values less than or equal to 0.05 (the latter being the cut-off p-value for transfer of variables to the multivariate analysis). These factors were transferred to a multiple logistic regression model to control for confounders. Based on our multivariable analysis, neonates born to mothers with a fever during labour had a significantly higher odds ratio [OR: 3.182, p-value: 0.003] of developing neonatal sepsis compared to neonates whose mothers did not have a fever. Additionally, neonates delivered vaginally had higher chances [OR: 2.253, p-value: 0.023] of experiencing neonatal sepsis. On the other hand, term neonates were less likely to develop sepsis [OR: 0.477, p-value: 0.025]. Moreover, there was a negative relationship [OR: 0.180, p-value: 0.009] between premature rupture of membranes and neonatal sepsis, indicating that the risk of sepsis in neonates whose mothers experienced premature rupture of membranes was low as seen in Table 3. The median length of hospitalization was 7 days (IQR: 2.5 days). The mortality rate was 5.45%, with 88.78% of neonates who fully recovered as shown on Table 4.

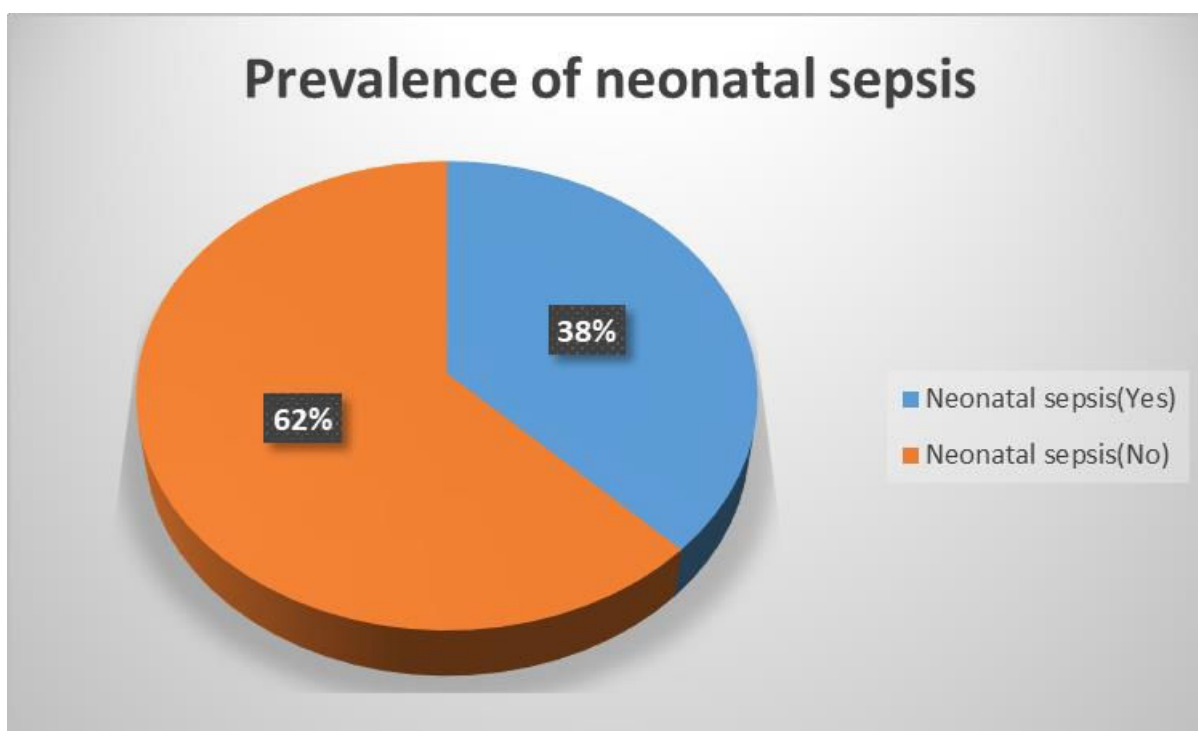


Figure 1: Prevalence of neonatal sepsis.

Variable	Categories	Frequency (n=207)	Percentage (%)
Gender	Female	88	42.51
	Male	119	57.49
Birth Weight (g)	<1500	2	1
	1500≤2500	31	14.9
	>2500	175	84.1
Age (days)	< 3	30	14.4
	> 3	178	85.6

Table 1: Demographic characteristics of the neonates.

Variable	Categories	Frequency	Percentage
Fever	Yes	106	96.36
	No	4	3.64
Intercostal indrawing	No	83	76.85
	Yes	25	23.15
Nasal flaring	No	84	76.36
	Yes	26	23.64
Expiratory grunting	No	94	85.45
	Yes	16	14.55
Skin Coloration baby	Cyanosed	17	15.6
	Jaundiced	23	21.1
	Other	2	1.83
	Pink	67	61.47
Level of Consciousness	Conscious	98	89.09
	Unconscious	12	10.91

Table 2: Clinical features of neonates hospitalized for neonatal sepsis.

Variables	p-value	Odds ratio	95% C.I.
Premature rupture of membranes (Yes)	0.009	0.18	0.080-0.380
Fever during labour (Yes)	0.003	3.182	1.519-7.045
Gestational age (Term)	0.025	0.477	0.248-0.904
Mode of delivery (Vaginal)	0.023	2.253	1.127-4.589

Table 3: Multivariate analysis of maternal and neonatal risk factors associated with neonatal sepsis.

Variable	Categories	Frequency(n=110)	Percentage (%)
Died during hospitalization	No	104	94.54
	Yes	6	5.45
Full Recovery	No	13	11.82
	Yes	97	88.18
Discharged against medical advice	No	99	90.00
	Yes	11	10.00

Table 4: Immediate outcome of neonates with neonatal sepsis.

Discussion

In this study, we provide evidence that neonatal sepsis is an important public health problem in Cameroon, which results in substantial morbidity and mortality. The prevalence of neonatal sepsis reported in this study was 37.54%, which is high. This high prevalence of neonatal sepsis found in our study is expected because our study areas are referral hospitals, which receive neonates with severe complications as well as complicated pregnancies from all over the region. Our findings were similar to that reported by Mah, et al., in Cameroon (37.9%), Olorukooba, et al., in Nigeria (37.6%) and Jabiri, et al., in Tanzania (34.1%) [12-15].

However, it was higher than that reported by Okube, et al., in Kenya (29.7%) and lower than that reported by Assemie, et al., in Ethiopia (45%) [16,17]. These disparities in prevalence of neonatal sepsis could be explained by the fact that they used different clinical definitions and or diagnostic criteria of sepsis at different settings. In Kenya, the study was carried out at a referral hospital with probably better infection control measures. They also had a smaller sample size of 196 participants. Meanwhile, in Ethiopia, the study was a meta-analysis with a sample of 10495 neonates.

The most common clinical presentations of neonatal sepsis identified in our study were fever (96.36%), signs of respiratory distress (nasal flaring: 23.64%, intercostal indrawing: 23.15%, expiratory grunting: 14.55%) and absent primitive reflexes (30.28%). Our findings were similar to studies conducted by Magzoub, et al., in Sudan, where, fever (63.3%), respiratory distress (44.2%), jaundice (31%) and absent Moro reflex (20.8%) were common clinical presentations seen in neonates with sepsis [18]. These are different from studies conducted by Adediwura, et al., in Nigeria, where respiratory distress (46%), refusal to feed (27%), convulsion (25%), fever (25%) were the most common clinical presentation seen [19]. Also, studies by Chiabi, et al., in Cameroon and Ogundare, et al., in Nigeria reported fever (44.95%, 23.6%), refusal to feed (32.11%, 43.1%) and respiratory distress (28.90%, 48.6%), respectively [20,21]. The variation in clinical presentations of neonatal sepsis further reiterate the nonspecific nature of its manifestations and the need for a high index of suspicion.

Our study found that neonates born to mothers with fever during labour and delivery had a higher odd [OR:3.182, p:0.003] of developing sepsis than those whose mothers were afebrile. This is in concordance with studies carried out by Shifera, et al., in Ethiopia, where intrapartum fever was a risk factor [OR = 3.481; 95% CI (1.18-10.21)] [22]. However, our findings were different from studies carried out by Towers, et al., in the United States of America who reported that, the risk of neonatal sepsis in new-borns delivered to mothers with intrapartum fever was low (0.24%, <1 in 400) [23].

We also found that neonates delivered vaginally had a higher susceptibility to sepsis in comparison to those delivered via caesarean sections [OR: 2.253, p-value: 0.023]. These findings align with previous research conducted by Roble, et al., in Eastern Ethiopia, which also observed a correlation between vaginal delivery and an increased risk of neonatal sepsis [OR: 1.78, 95% CI: 1.08-2.96] [24]. However, contrasting results were found in studies conducted by Salama, et al., in Egypt, Rafi, et al., in Bangladesh

[25,26]. Salama's study revealed that neonates born via caesarean section were 2.5 times more likely to develop sepsis (p -value < 0.001), so did Rafi's study also reported elevated rates of sepsis in those born via caesarean section [OR: 1.5, p -value: 0.011]. This discrepancy can be attributed to the fact that the latter studies were conducted in regions with advanced perinatal care and stringent hygiene and sanitation practices. These factors potentially provided a protective environment against sepsis, thereby influencing the observed outcomes and most caesarean sections were performed as emergencies with probable prolonged rupture of membranes.

Our research unveiled that, mothers who experienced premature rupture of membranes had neonates with lower chances of developing neonatal sepsis, [0.180, $p=0.009$]. Contrasting findings have been reported elsewhere by Jabiri, et al., in Tanzania $p=0.029$ and Alemu, et al., in Ethiopia [2.81; 95% CI (1.01, 7.79)] [28], where resuscitation at birth, premature rupture of membranes and neonatal age were revealed to be risk factors [27,28]. When membranes rupture early, it exposes a new-born to ascending microorganisms from the birth canal into the amniotic sac, thereby potentially predisposing them to neonatal sepsis within the initial days following delivery, but in our setting once membranes rupture, mother is systematically administered antibiotics to prevent sepsis.

The investigation conducted by our study revealed a notable disparity in the occurrence of sepsis between infants delivered at full term and those born prematurely. This finding aligns with the research conducted by Tewabe, et al., in the region of Northwest Ethiopia [OR:2.46, $p<0.001$], where a positive correlation was established between prematurity and an elevated susceptibility to neonatal sepsis [29]. The observation that babies born at term have a lower risk of developing sepsis compared to those born preterm highlights the importance of gestational age in determining neonatal health outcomes.

The mortality rate of neonatal sepsis reported in our study was 5.45% ($n = 6$). This was different from the study by Endazanaw, et al., in Ethiopia who reported a mortality rate of 24.4% [30]. This difference could be explained by the fact that their study was conducted in a neonatal intensive care hospital which probably manages more critically ill neonates compared to our setting. However, our findings are similar to 4% obtained by Tewabe, et al., in North West Ethiopia [29].

A good number of the neonates fully recovered (88.39%) by the end of our study. However, 11.61% of these neonates had not recovered fully. These findings are similar to 84% full recovery reported by Tewabe, et al., in North West Ethiopia [29]. On the other hand, studies by Ambaye, et al., in North East Ethiopia recorded a 78.63% recovery rate and a median time to recovery of 6 days [31]. This is like the median 7 recovery days recorded in our study. This finding corresponds to the 7-day findings of Diresse, et al., in East Ethiopia [32]. This is higher than findings of other studies conducted by Tumuhamy, et al., in Uganda and Singh, et al., in India which reported median times to recovery for septic neonates of 4.5 and 5.5 days, respectively [33,34]. These differences could be because of the difference in protocols used by different countries. These settings receive patients from their immediate local environments, whereas our setting is a referral hospital which manages complicated cases referred from distant health facilities.

Also, compared to a study conducted by Meshram, et al., in Central India, the median time of recovery of neonates was 9.67 days [35], which is higher than that reported by our study. This difference could be explained by the fact that all neonates included in the Central India study were referred cases or high-risk patients who had a higher likelihood of delayed recovery due to factors such as delay in seeking health care or delay in referral. Additionally, nearly 50% of neonates had Low Birth Weight (LBW) which is a known risk factor of neonatal sepsis. Prematurity predisposes them to a lengthy recovery period as seen in our study.

Strengths

The prospective nature of our study ensured completeness and accurate collection of data.

Limitation

The generalizability of the findings may be limited to the specific population served by the Buea and Limbe Regional Hospitals.

Conclusion

The prevalence of neonatal sepsis remains high and keeps resulting to significant morbidity and mortality in our setting. The most common clinical presentations of neonatal sepsis identified were fever and signs of respiratory distress. Maternal fever

during labour and vaginal mode of delivery were significant risk factors to neonatal sepsis and the mortality rate in our cohort was 5.45%.

Conflict of Interests

The authors have no conflict of interest to declare.

Author Contributions

NM conceived the study and drafted the initial manuscript, NM and NW participated in data extraction and analysis and EM reviewed and corrected.

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