ORIGINIAL ARTICLE

Prevalence and presentation of neonatal sepsis at a paediatric emergency department in Johannesburg, South Africa

Tchouambou SN Clotilde, Feroza Motara, Abdullah E Laher*

Department of Emergency Medicine, Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, South Africa

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ABSTRACT

Background: Despite a significant reduction in the prevalence of neonatal sepsis over the past three decades, the prevalence still remains high, especially in low- and middle-income countries. The aim of this study was to determine the prevalence and presenting features of neonatal sepsis at a paediatric emergency centre (PEC).

Methods: Medical records of all neonates presenting to an academic hospital PEC over a six-month period were analysed. Data was compared between neonates with and without sepsis. The odds ratio was calculated to determine factors associated with neonatal sepsis.

Results: Of the 210 neonates who were included, 43 (20.5%) were diagnosed with neonatal sepsis. Of these, 19 (44.2%) presented within the first 72 hours of life (early-onset neonatal sepsis) and 4 (9.3%) died prior to hospital discharge. A history of maternal employment (odds ratio (OR) 2.38, p=0.021), preterm birth (OR 3.24, p=0.019), low birth weight (<2.5kg) (OR 2.67, p=0.026), perinatal human immunodeficiency virus exposure (OR 3.35, p=0.002), not being breast fed (OR 4.36, p=0.001), and signs of lethargy (OR 14.01, p<0.001), dehydration (or 11.14, p<0.001), poor feeding (OR 7.20, p<0.001), irritability (OR 6.93, p<0.001), fever (OR 5.50, p<0.001), vomiting (OR 4.14, p=0.001) and respiratory distress (OR 4.12, p<0.001) were significantly associated with neonatal sepsis.

Conclusion: Among neonates presenting to the PEC, various clinical features on history and examination may be useful in predicting the diagnosis of neonatal sepsis. Clinicians working in the PEC must adopt a high index of suspicion when attending to neonates presenting with these features.

African relevance

- The incidence of neonatal sepsis in low- and middle-income countries is estimated at 3930 cases per 100 000 live births.
- Neonatal sepsis accounts for a third of neonatal deaths in low-income countries.
- A history of preterm birth, low birth weight, perinatal HIV exposure, not being breast fed and presentation with lethargy, dehydration, poor feeding, irritability, fever, vomiting, and respiratory distress are associated with a significantly higher likelihood of neonatal sepsis.
- EC clinicians must adopt a high index of suspicion when attending to neonates presenting with these features.

Introduction

Neonatal sepsis can be defined as a clinical syndrome that manifests with non-specific signs and symptoms that are secondary to an underlying bacterial bloodstream infection that presents within the first 28 days of life [1]. Despite a significant reduction in global neonatal mortality over the past three decades, the burden remains high, with there being 18 recorded neonatal deaths per 1000 live births reported in 2017. It is projected that between 2018 and 2030, 27.8 million children will die in their first month of life [2]. In low-income countries, neonatal sepsis has been shown to be responsible for approximately a third of neonatal deaths [3].

Between 2009 and 2018, the incidence of neonatal sepsis in low- and middle-income countries was estimated as 3930 cases per 100 000 live births [4]. In sub-Saharan Africa, it is estimated that neonatal sepsis is associated with a loss of 5.29 to 8.73 million disability-adjusted life years (DALYs), which translates to an annual economic burden of 10 to 469 billion US dollars [5]. Every year, a million neonates die from neonatal sepsis, with approximately 42% of these deaths occurring within the first seven days of life [6]. The overall mortality associated with neonatal sepsis has been estimated at 17.6% [4].

The clinical presentation of neonatal sepsis is predominantly non-specific and includes a myriad of signs and symptoms that include lethargy, dehydration, poor feeding, irritability, fever, vomiting, diarrhoea, respiratory distress, jaundice, seizures, hypothermia, and haemodynamic shock. This coupled with the low yield of true positive labora-

* Corresponding author at:
E-mail address: abdullahlaher@msn.com (A.E. Laher).

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tory culture findings renders the diagnosis of neonatal sepsis challenging [7].

Although there are multitudes of publications relating to the subject of neonatal sepsis, there is a paucity of data on the prevalence and presenting features of neonatal sepsis in the paediatric emergency centre (PEC) setting. Hence, the aim of this study was to determine the prevalence and presenting features of neonatal sepsis at a PEC in Johannesburg, South Africa.

Methods

This prospective cross-sectional study was conducted at the Charlotte Maxeke Johannesburg Academic Hospital Paediatric Emergency Department (CMJAH PED) between 01 January and 30 June 2018. The facility has approximately a thousand beds that includes 15 neonatal intensive care unit (ICU) beds and another 80 neonatal ward beds. Since the hospital is a designated tertiary care facility, it has the capability to cater for comprehensive obstetric and neonatal care.

Annually, approximately 400-500 neonates attend the PEC, all of whom are triaged into the unit for formal assessment by the on-shift EC doctor. As per the PEC unit protocol, laboratory investigations including sepsis biomarkers, blood culture, urine culture and cerebrospinal fluid analysis are conducted on all patients presenting with suspected neonatal sepsis. Furthermore, empiric antibiotics are also commenced in these patients. Neonates requiring possible admission are referred to the on-call neonatology registrar. Since there are no specific criteria dictating referral to the neonatology department, the decision is left to the discretion of the attending EC doctor.

Permission to conduct the study was granted by the hospital manager, while ethics clearance was obtained from the Human Research Ethics Committee of the University of the Witwatersrand (certificate no M160608). The study enrolled all neonates who presented during the data collection period and in whom consent for study participation was obtained.

For the purpose of this study, neonatal sepsis was defined as presentation within the first 28 days of life with either laboratory culture confirmed infection or with clinical and/or other laboratory findings that the attending specialist neonatologist attributed to the presence of neonatal sepsis and treated as such [7]. Early-onset neonatal sepsis was defined as presentation within the first 72 hours of birth, while late-onset neonatal sepsis was defined as presentation after 72 hours of birth [8]. Preterm birth was defined as birth prior to 37 completed weeks of pregnancy [9], while low birth weight was defined as a weight at birth of less than 2.5kg [10]. Neonates who initially received empiric antibiotic therapy for possible neonatal sepsis, but in whom the diagnosis was later reviewed to a non-sepsis diagnosis, were categorised as not presenting with sepsis.

Doctors and nurses employed at the PEC were briefed regarding the study protocol and were thereafter requested to inform the primary investigator of all neonates (≤28 days of age) who presented over the data collection period. The primary investigator also reviewed the PEC patient register to identify potential study subjects who were missed by the unit staff. Informed consent for study participation was obtained from the primary caregiver of the neonate. Data from hospital records were collected daily by the primary investigator over the entire duration of hospital stay and entered into a standardised data collection sheet. Where necessary, additional information relevant to the study but not found in the patient’s hospital records was directly obtained from the participant, the participants laboratory records, or the primary caregiver. Collected data included demographic details (sex, maternal employment), patient referral, preterm birth status, birth weight, perinatal HIV exposure, method of delivery, method of feeding, in-hospital mortality and presenting clinical features. Subjects were followed-up until data collection was completed.

The data was thereafter entered into Microsoft® Excel® (Microsoft 365, Version 16.0.13029.20232) and exported to Stata version 16 (Stat-
reason for the higher reported prevalence in these two studies is that both studies defined early-onset neonatal sepsis as onset of sepsis within the first seven days of life, whereas we defined it as onset within the first three days of life. In stark contrast to our study findings, an earlier study conducted between 2001 and 2003 at the neonatal unit of the same hospital as this study, reported that only five of 96 (5.2%) neonates presented with early-onset sepsis. The study however only enrolled neonates with laboratory culture positive sepsis [15].

A study conducted in Southern Ethiopia reported that the likelihood of neonatal sepsis was 2.76 times higher in neonates who were born to mothers with lower income compared to those who were born to mothers with higher income [16]. Another study reported that every year approximately one millions neonates die from infections in low income households in Pakistan [17]. In contrast, in our study, the likelihood of developing neonatal sepsis was 2.38 times higher in neonates whose mothers were employed in comparison to neonates whose mothers were unemployed. Although we did not determine total household income and reasons for this rather surprising finding, a probable explanation may be that total household income may have been low, so these mothers were forced to seek employment and hence may not have been able to take adequate care of their baby. This finding should be further investigated in future studies.

A systematic review and meta-analysis which comprised of eight studies that were all conducted in Ethiopia, reported that compared to normal birthweight neonates, those with a low birth weight (<2.5kg) were 1.42 times more likely to develop sepsis [18]. Comparatively, in our study, a low birth weight (<2.5kg) was associated with a 2.67 times higher likelihood of developing neonatal sepsis.

In our study, the prevalence of neonatal sepsis was significantly higher among neonates with a history of perinatal HIV exposure. Similarly, other studies also reported a higher incidence of sepsis among HIV exposed but uninfected infants who were <3 months old [19–22]. Group B streptococcus was the causative organism in most of these studies. In comparison to breastfed neonates, the likelihood of presentation with neonatal sepsis was 4.36 times higher among formula fed neonates in our study. A study conducted in Bangladesh reported that compared to neonates in whom breastfeeding was initiated within an hour of birth, those in whom there was a >48-hour delay in initiating breastfeeding and those who were not breastfed, had a 4.13- and 4.7-times higher likelihood of developing severe illness in the first seven days of life, respectively [23]. Another study showed that even among partially breastfed neonates, the likelihood of neonatal sepsis was 18 times lower [24].

In our study, presentation with lethargy (OR 14.01), dehydration (OR 11.14), poor feeding (OR 7.20), irritability (OR 6.93), fever (OR 5.50), vomiting (OR 4.24) and respiratory distress (OR 4.12) were associated with a significantly higher likelihood of neonatal sepsis. Comparatively, a study that investigated the predictors of neonatal sepsis in four developing countries reported that a bulging fontanel (OR 10.0), poor feeding (OR 5.1), a history of convulsions (OR 4.2), hypothermia (OR 3.7), fever (OR 3.6) and a decrease in the level of consciousness (OR 3.0) were significantly associated with a higher likelihood of neonatal sepsis [25].

There are some limitations to this study. Firstly, this was a single centre study, hence, our findings may differ to that of other facilities where triage criteria and management protocols may vary. Secondly, due to the low yield associated with obtaining a positive laboratory cultures in neonates with sepsis, it is possible that the true prevalence of neonatal sepsis may have been under- or over-reported, thereby influencing our study findings. However, this limitation is applicable to all studies that relate to neonatal sepsis. Thirdly, due to the relatively small sample size, our data was not amenable to multivariate analysis. Hence, we were unable to determine which of the studied variables were independent predictors of neonatal sepsis. Nevertheless, it is hoped that findings of this study will encourage others to conduct similar but larger scale studies that will aim to determine the independent predictors of neonatal sepsis in lower-income settings.

Conclusion

The prevalence of neonatal sepsis among neonates presenting to the CMJAH PED over the study period was 20.5%. A history of maternal
employment, preterm birth, low birth weight, perinatal HIV exposure, not being breast fed, poor feeding and signs of lethargy, dehydration, irritability, fever, vomiting, and respiratory distress were significantly associated with a diagnosis of neonatal sepsis. Due to the non-specific presentation of neonatal sepsis and the consequences associated with missing the diagnosis, clinicians working in the PEC must adopt a high index of suspicion when attending to neonates presenting with these features.

Dissemination of results

Results from this study were shared with emergency centre staff at the study site.

Author contributions

Authors contributed as follow to the conception or design of the work; the acquisition, analysis, or interpretation of data for the work; and drafting the work or revising it critically for important intellectual content: TC contributed 40%; AL 35%; and FM contributed 25%. All authors approved the version to be published and agreed to be accountable for all aspects of the work.

Declaration of Competing Interest

The authors declared no conflict of interest.

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