

Prevalence and Factors Associated with Early Onset Neonatal Sepsis in Babies Admitted at Hoima Regional Referral Hospital Neonatal Intensive Care Unit in Hoima District, Western Uganda.

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ABSTRACT

Globally early-onset neonatal sepsis is one of the most significant causes of morbidity and mortality among neonates. The objective of this study was to determine the prevalence of early-onset neonatal sepsis and its associated factors among neonates admitted to the Neonatal Intensive Care Unit at Hoima regional referral Hospital. A cross-sectional study where in-depth interviewing of caregivers of infants diagnosed with early-onset neonatal sepsis using IMCI was tallied and then put in frequencies and percentages. 156 neonates and their mothers were enrolled into the study. Using Microsoft Excel 2021 data was coded and encoded and presented in tables and charts. In the study, 156 neonates were enrolled into the study. 60(39.1%) had early-onset neonatal sepsis. Maternal factors contributing to neonatal sepsis were PROM (70.00%), UTIs (60.00%), ANC attendance less than three times (64.29%), parity of more than 3(46.07%), meconium staining (59.38%), more than 4 vaginal Examination during labour (54.27%) and delivery by cesarean section (52.38%). The neonatal factors contributing to neonatal sepsis were; an APGAR score of less than 7(48.75%), gestational age of less than 37 weeks (42.86%), birth weight of less than 2.50kg (42.16%), positive history of being resuscitated at birth (47.50%), and being diagnosed on their 0-4 days (47.13%). The prevalence of early-onset neonatal sepsis in Hoima Regional Referral Hospital is still high. Maternal history of PROM, UTI, attended antenatal visit less than thrice, more than 4 vaginal examinations, delivered by cesarean section, meconium staining and parity of more than 3 were associated with early onset neonatal sepsis. Neonatal factors associated with early onset neonatal sepsis are an Apgar score of less than 7, gestational age of less than 37 weeks, Birth weight of less than 2.50kg, positive history of being resuscitated at birth, and age of 0-4 days. **Keywords:** Early onset neonatal sepsis, Neonatal intensive care unit, Caregivers of infants, ANC attendance, Vaginal examination during labour.

INTRODUCTION

Early onset neonatal sepsis (EONS) cases are an occurrence in the neonatal intensive care unit of Hoima Regional Referral Hospital. According to [1], the population-level estimate for neonatal sepsis was 2202 per 100,000 live births, with mortality between 11% and 19%. Sepsis in the first 3 days of life is a leading cause of morbidity and mortality among infants [2, 3]. This will be a descriptive cross-sectional study aiming to assess the prevalence, maternal and neonatal factors associated with early onset neonatal sepsis among babies admitted at Hoima Regional Referral Hospital Neonatal Intensive Care Unit in Hoima District,

western Uganda. Hayun et al. [4] concluded that the risk factors of early-onset neonatal sepsis were: APGAR score <7, gestational age < 37 weeks and birth weight < 1500 grams. According to [5], home delivery, low birth weight, prematurity and poor hygiene/cord care were the common risk factors. [6] mentioned that among the perinatal risk factors assessed, there was a significant association of EONS with prolonged rupture of membranes, foul-smelling liquor, midwife handling and maternal urinary tract infection was observed. The prevalence of early-onset neonatal sepsis in Hoima Regional Referral

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Hospital is not known nor have the risk factors among the babies at the hospital been assessed. Early onset neonatal sepsis remains a common and serious problem for neonates, especially preterm infants [7]. Neonatal sepsis refers to an infection involving the bloodstream in newborn infants less than 28 days old [8]. Early onset neonatal sepsis (EOS) has been variably defined based on the age at onset, with bacteremia or bacterial meningitis occurring at ≤ 72 hours in infants hospitalized in the neonatal intensive care unit (NICU), versus < 7 days in term infants [7]. In pre-terms, it occurs within the first 3 days. EONS is an infection that occurs in the first week or 72 hours of life. Apart from the time point of onset before 72 hours of age, there is no homogenous definition of EOS in the literature [9]. A neonate is a newborn infant less than 28 days old. Neonates are at a major risk of sepsis but data on global neonatal sepsis incidence is scarce. Of newborns with early onset neonatal sepsis, 85% were present within 24 hours (median age of onset 6 hours), 5% were present at 24-48 hours, and a smaller percentage were present within 48-72 hours [10]. There is no standardized definition or diagnostic criteria for neonatal sepsis. According to [7], the diagnosis of neonatal sepsis is based on a combination of clinical presentation; the use of nonspecific markers, including C-reactive protein and procalcitonin (where available); blood cultures; and the use of molecular methods, including PCR. Cytokines, including interleukin 6 (IL-6), interleukin 8 (IL-8), gamma interferon (IFN- γ), and tumour necrosis factor-alpha (TNF- α), and cell surface antigens, including soluble intercellular adhesion molecule (sICAM) and CD64, are also being increasingly examined for use as nonspecific screening measures for neonatal sepsis. Early-onset sepsis is associated with the acquisition of microorganisms from the mother. Infection can occur via hematogenous, transplacental spread from an infected mother or, more commonly, via ascending infection from the

Study Design

Hospital-based, descriptive and analytical cross-sectional study where in-depth

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cervix. Organisms that colonize the mother's genitourinary (GU) tract may be acquired by the neonate as it passes through the colonized birth canal at delivery [11]. The microorganisms most commonly associated with early-onset infection include the following: Group B Streptococcus (GBS), Escherichia coli, Coagulase-negative Staphylococcus, Haemophilus influenzae, Listeria monocytogenes [12].

In children under the age of 5, neonatal sepsis is the third most common cause of death with an estimated 0.401 million deaths (uncertainty range [0.280-0.522], 6.8% [4.7-8.6]) in 2015, the majority of which occur in developing countries [13]. There is a large variation between incidences of early-onset neonatal sepsis between different regions. The incidence of culture-proven early-onset neonatal sepsis in the United States is approximately 0.3-2 per 1000 live births [11]. Sepsis is responsible for 28% of neonatal deaths in Africa [14]. Sepsis was attributed to causing approximately 400,000 neonatal deaths in 2015 globally, half of which occurred in sub-Saharan Africa where 34.6% to 66.0% of neonatal deaths reportedly occur within the first 24 hours of life [15]. In East Africa, neonatal sepsis is one of the most common causes of neonatal death. It causes more than one-third of neonatal deaths in Ethiopia specifically [16]. 5-46 cases of early-onset neonatal bacteremia per 1000 live births were recorded in Kilifi District Hospital, Kenya [17]. Uganda has a neonatal mortality rate of 27 per 1000 live births [18]. Data on the burden of EONS in Uganda is scarce. The prevalence of early-onset neonatal sepsis and associated factors at Hoima Regional Referral Hospital Intensive Care Unit is not known. The deficit in research data creates gaps in resource allocation and effective management of EONS cases at the hospital. The limited awareness of prevalence also hinders the implementation of preventive measures for early-onset neonatal sepsis within the NICU of Hoima regional referral hospital.

METHODOLOGY

interviewing of caregivers of infants previously or currently diagnosed with early onset neonatal sepsis based on

perinatal medical history and current medical history.

Area of Study

The study was carried out at Hoima Regional Referral Hospital in the neonatal intensive care unit, located in Hoima District Western Uganda. The hospital serves Hoima District and parts of the districts of Masindi, Kiryandongo, Kikuube, Kakumiro, Kagadi, and Kibaale.

Study Population

The source population for the study was all neonates that were admitted to the neonatal intensive care unit of Hoima Regional Referral Hospital between March and June 2022.

Inclusion criteria

Neonates that were admitted to the neonatal intensive care unit of Hoima Regional Referral Hospital between March and June 2022. Neonates whose caretakers consented to the study.

Exclusion criteria

Neonates in critical conditions were not included in the study. Neonates whose caretakers did not consent to the study. Neonates with incomplete medical records were not legible to participate in the study. Neonates with a diagnosis other than early-onset neonatal sepsis.

Sample Size Determination

The sample size was determined using Kish and Leslie's (1965) formula.

$$N = \frac{Z^2 PQ}{D^2}$$

Where N= Desired sample size

Z= Standard normal deviation was taken as 1.96 at a confidence level of 95%

P= Proportion of target proportion estimated to have similar characteristics was got.

If there is no estimated percentage, 50% or 0.5 (constant) was considered.

Therefore, P=0.5

Therefore, Q= is standardized 1.0- P= 0.5 D= Acceptable error was 0.05 or 5%

In this case, the 95% confidence level had 5% errors. Therefore 0.05 was the level of significance

$$N = (1.96^2 \times 0.5 \times 0.5) \div 0.05^2$$

$$N = 384$$

The target population was less than 10,000. The adjusted Kish and Leslie (1965) Formula was applied.

Sampling Techniques

Consecutive recruitment till when the desired sample size was attained. All neonates admitted during the study period were interviewed in order to get prevalence out of all admitted. The first participant was chosen at random and then interviewed by the researcher and the two research assistants using detailed interview questionnaires.

Data collection

A structured questionnaire was used to gather information on socio demographic variables (gender, age, etc.), APGAR score, gestational age at birth, birth weight, resuscitation at birth, antenatal care attendance, parity, premature rupture of membranes, evidence of urinary tract infection during pregnancy, meconium stained/ foul smelling meconium, mode of delivery, number of vaginal exams during labour and place of delivery. The patients were examined for congenital anomalies and the need for assisted ventilation was noted. Maternal nutrition was also assessed. The patient was diagnosed with early onset neonatal sepsis if their blood tests are positive for bacteremia occurring at ≤ 72 hours in infants hospitalized in the neonatal intensive care unit (NICU) and < 7 days in term infants.

Data management

Data collected were checked for completeness, entered to Excel and imported to the SPSS version 27.0 or Stata version 14 for analysis.

Data Analysis

The data collected were analyzed using SPSS version 27.0 or Stata version 14 and the results presented in tables and pie charts/graph.

Quality Control

The research assistants were trained. The checklists and questionnaires were first given to a few caregivers of patients in KIUTH to assess the acceptability of data collection to the participants and necessary adjustments were made to ensure adequate data quality.

Prevalence of Early Onset Neonatal Sepsis.

The study found out that of the 156 neonates who were admitted to the

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neonatal Intensive care unit in Hoima
Regional Referral Hospital, 60(39.1%) had

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early onset neonatal sepsis as shown in the
figure below.

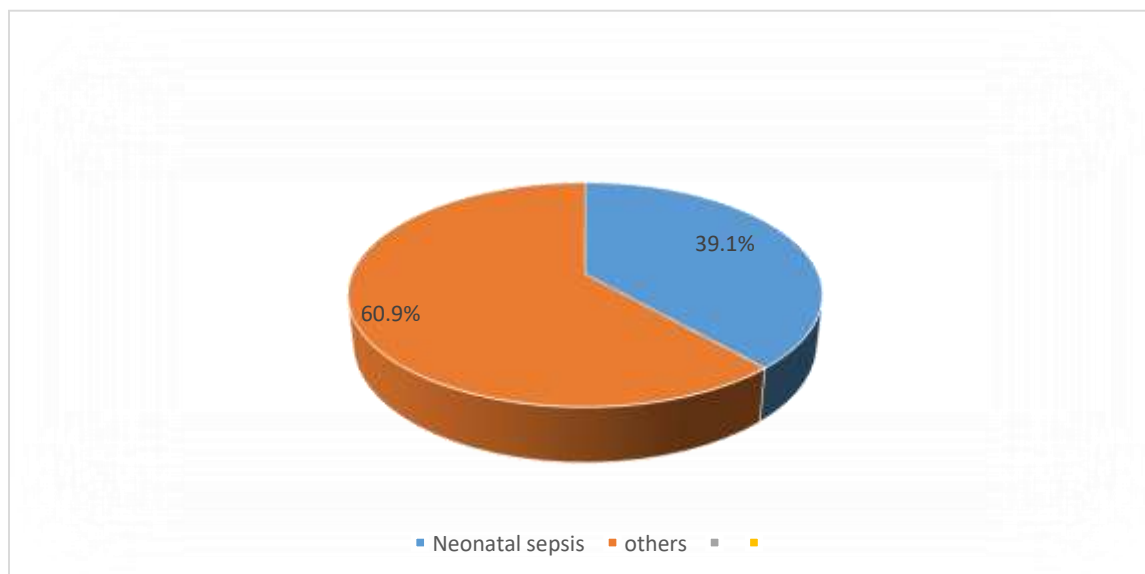


Figure 1: Prevalence of early onset neonatal sepsis in Hoima Regional referral hospital.

RESULTS

Factors Associated with Early Onset Neonatal Sepsis

Maternal Factors

In the study, among the mothers who participated 32.05% had a history of PROM, 19.23% had a history of UTI, 89.74% attended ANC more than three times during pregnancy, 42.95% had parity less than three while 57.05 had parity more than

three. 20.51% had a history of meconium staining, 44.87% had more than 4 vaginal examinations done on them while 55.13% had less than 4 vaginal examinations, 59.62% delivered vaginally while 40.38% delivered by cesarean section as shown in Table 1 below.

Table 1: Maternal Factors

Variable	Frequency		Percentage (%)
History of Prom	Yes	50	32.05
	No	106	67.95
History of UTI	Yes	30	19.23
	NO	126	80.77
Anc (At Least Thrice During Pregnancy)	Yes	140	89.74
	No	16	10.26
Parity	Less Than 3	67	42.95
	More Than 3	89	57.05
	Yes	32	20.51
Meconium Staining	No	124	79.49
	More Than 4	70	44.87
Frequency Of Vaginal Examination	Less Than 4	86	55.13
	Vaginal	93	59.62
Mode of Delivery	C/S	63	40.38

Neonatal Factors

In the study among the neonates who were recruited, 51.28% had an Apgar score of less than 7 in the first minute while 48.72% had an Apgar score of more than 7 in the first minute. 67.31% were born at less than 37 weeks of gestation while 32.69% were born

at more than 37 weeks of gestation. 65.38% had a birth weight of less than 2.5kg while 34.2% had a birth weight of more than 2.5kg. 51.28% were resuscitated at birth, 55.77% were 0 to 4 days old and 44.23% were 5 to 7 days old as shown in table 2 below.

Table 2: Neonatal factors

Variable		Frequency	Percentage (%)
Apgar Score	Less Than 7 In the First Minute	80	51.28
	More Than 7 In the First Minute	76	48.72
Gestational Age	Less Than 37 Weeks	105	67.31
	More Than 37 Weeks	51	32.69
Birth Weight	Less Than 2.5kg	102	65.38
	More Than 2.5kg	54	34.62
Resuscitation At Birth	Yes	80	51.28
	No	76	48.72
Neonatal At Diagnosis Age	0-4 days	87	55.77
	5-7 days	69	44.23

Relationship Between Maternal Factors and Early Onset Neonatal Sepsis

In the study, 70.00% of the neonates whose mothers had a history of PROM, developed EONS, while 23.58% with no history of PROM had early onset neonatal sepsis (EONS). 60.00% of the neonates born to mothers with a history of UTI in pregnancy had EONS while 25.40% of those who had no history of UTI developed EONS. 62.50% of those whose mothers did not attend ANC more than thrice during pregnancy developed EONS while 35.71% of those whose mothers attended ANC more than thrice during pregnancy had EONS. 46.07% of the neonates whose mothers were para 3 and

above had EONS while 28.36% of those whose mothers' parity was less than 3 developed Early onset neonatal sepsis. 59.38% of neonates born to mothers with meconium staining had EONS. 54.29% of neonates born to mothers who had more than 4 vaginal examinations during labour developed EONS while 25.58% of those whose mothers had less than 4 vaginal examinations during labour developed EONS. 52.38% born by cesarean section developed EONS while 29.03% of the neonates who were delivered vaginally had developed EONS as depicted in table 3 below.

Table 3: Relationship between maternal factors and early onset neonatal sepsis.

Variable	Frequency	Early Onset Neonatal Sepsis			
		Frequency	Percentage (%)		
History Of Prom	Yes	50	Yes	35	70.00
			No	15	30.00
	NO	106	Yes	25	23.58
			No	81	76.42
History Of UTI	Yes	30	Yes	18	60.00
			No	12	40.00
	No	126	Yes	32	25.40
			No	94	74.60
Anc (At Least Thrice During Pregnancy)	Yes	140	Yes	50	35.71
			No	90	64.29
	No	16	Yes	10	62.50
			No	6	37.50
Parity	Less Than 3	67	Yes	19	28.36
			No	48	71.64
	More Than 3	89	Yes	41	46.07
			No	48	53.93
Meconium Staining	Yes	32	Yes	19	59.38
			No	13	40.63
	No	124	Yes	41	33.06
			No	83	66.94
Vaginal Examination	More Than 4	70	Yes	38	54.29
			No	32	45.71
	Less Than 4	86	Yes	22	25.58
			No	64	74.42
Mode Of Delivery	Vaginal	93	Yes	27	29.03
			No	66	70.97
	C/S	63	Yes	33	52.38
			No	30	47.62

Relationship Between Neonatal Factors and Early Onset Neonatal Sepsis

In the study, 48.75% of neonates with an Apgar score of less than 7 in the first minute after birth developed early onset neonatal sepsis (EONS) while 25.63% with an Apgar score of more than 7 in the first minute developed EONS. 42.86% born below 37 weeks of gestation developed EONS while 29.41% born above 37 weeks had EONS.

Among those with birth weight below 2.5kg, 42.16% had EONS while 31.48% with birth weight more than 2.5kg developed early onset neonatal sepsis (EONS). 47.50% of neonates who were resuscitated at birth and 28.95% who were not resuscitated at birth developed EONS. 47.13% who were between 0-4 days and 27.54% of those between 5-7 Days old had early onset neonatal sepsis as depicted in Table 4 below.

Table 4: Relationship between neonatal factors and early onset neonatal sepsis.

Variable		Frequency	Early Neonatal Sepsis		
			Frequency	Percentage	
Apgar Score	Less Than 7 In the First Minute	80	Yes	39	48.75
			No	41	51.25
	More Than 7 In the First Minute	76	Yes	21	27.63
			No	55	72.37
Gestational Age	Less Than 37 Weeks	105	Yes	45	42.86
			No	60	57.14
	More Than 37 Weeks	51	Yes	15	29.41
			No	36	70.59
Birth Weight	Less Than 2.5kg	102	Yes	43	42.16
			No	59	57.84
	More Than 2.5kg	54	Yes	17	31.48
			No	37	68.52
Resuscitation At Birth	Yes	80	Yes	38	47.50
			No	42	52.50
	No	76	Yes	22	28.95
			No	54	71.05
Neonatal Age at Diagnosis	0-4 days	87	Yes	41	47.13
			No	46	52.87
	5-7 Days	69	Yes	19	27.54
			No	50	72.46

DISCUSSION

The Prevalence of Early Onset Neonatal Sepsis

According to the study, the prevalence of early-onset neonatal sepsis was at 39.1% in Hoima Regional Referral Hospital. This was higher than the prevalence of 21.8% reported in eastern Uganda. This may have been due to underreporting and variation in surveillance methods used for the identification of neonates with early-onset neonatal sepsis.

The Maternal Factors

In this study, the prevalence of early neonatal sepsis was higher in neonates whose mothers had premature rupture of membrane and this is in agreement with a study done by [19, 20]. Premature rupture of membranes increases the risk of infection regardless of the geographical location of an individual. According to this study, early neonatal sepsis was higher in children whose mothers had a history of UTIs. The same findings were reported in a study by [19]. The study also showed that the prevalence of early-onset neonatal sepsis was higher in children whose mothers attended less than three Antenatal care visits. This concurs with a study [21] which found that lack of antenatal care later results in more sick children. Antenatal care offers an opportunity to identify and address risk factors early in order to minimize the risk of infections. Early onset neonatal sepsis was higher among neonates whose mothers had a parity of more than 3, and this was in agreement with a study by [22]. Genital tract colonization among mothers whose parity is 3 or higher may be increased compared to those whose parity is less than 3 hence predisposing to infection. The prevalence of early-onset neonatal sepsis was higher in neonates whose mothers had meconium-stained liquor and this is similar to the study done by [22]. Meconium staining spreads microorganisms. The study found that neonates whose mothers had more than 4 vaginal examinations during labour were more likely to develop early-onset neonatal

sepsis than those who had less than 4. Multiple vaginal were reported to be associated with early onset neonatal sepsis in a study [23]. Regular vaginal examinations introduce microorganisms into the genital tract increasing the inoculum size hence a higher risk for infection. Neonates born by cesarean section (52.38%) were more likely to develop early-onset neonatal sepsis compared to those delivered vaginally (29.03%). Similar findings were reported in a study [24] which showed that cesarean section was associated with culture-positive blood samples in neonates with early-onset neonatal sepsis. This is because of improper preparation of patients before surgery and exposure to unsterile conditions.

The Neonatal Factors

In this study, the prevalence of early-onset neonatal sepsis was higher in the neonates who had APGAR scores of less than 7 and this was similar to the study done by [19, 7]. The resuscitative activities are done to ensure a smooth transition to extrauterine life and increase microbial flora introduced into the baby. Early, onset neonatal sepsis was more prevalent among neonates who had gestational age of less than 37 weeks. Similar findings were reported in a study done by [25] in Brazil. Effective elimination mechanisms are poorly developed in preterm compared to term infants. Birth weight of less than 2.50kg was associated with early onset neonatal sepsis, this concurs with a study by [7, 26] in South Africa.

In this study, the prevalence of early-onset neonatal sepsis was higher in neonates who were resuscitated at birth and this is similar to the finding of a study done by [26]. Exposure to microorganisms occurs during resuscitation which increases the risk of early-onset neonatal sepsis. The Prevalence of early-onset neonatal sepsis was higher in the neonates who were 0 to 4 days old and this was similar to the study done by [20] in Jinja.

CONCLUSION

The prevalence of early-onset neonatal sepsis was 39.1% in Hoima Regional Referral Hospital. Maternal history of PROM, UTI, less than three antenatal care visits, more than 4 of vaginal examinations, cesarean section, meconium staining and parity of less than 3 were associated with early onset neonatal sepsis. Neonatal factors associated with early onset neonatal sepsis were; an APGAR score of less than 7, gestational age of less than 37 weeks, Birth

weight less than 2.50kg, positive history of resuscitation at birth and age of 0 to 4 days.

Recommendation

Early diagnosis and prompt treatment of urinary tract infections. Encourage Antenatal care with screening for infections and prompt treatment and hospital delivery. Improved a surveillance system for the neonates so that correct data is obtained.

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