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Neonatal Sepsis among Neonates at Public Hospitals in Jimma, Ethiopia

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Abstract

Background

Neonatal sepsis is one of the major causes of neonatal morbidity and mortality globally. Its incidence varies from 1 to 4 cases per 1,000 live births in developed countries. The burden of the problem occurs in the developing world while most confirmation is derived from developed countries. This study is aimed to assess the prevalence of neonatal sepsis and associated factors among newborns admitted in neonatal intensive care units.

Materials and Methods

An institutional based cross-sectional study was conducted in two hospitals in Jimma town, Ethiopia, 2019. Sampling was taken consecutively to select the study participants. Face to face interview with the mothers and document review was used to collect data by using a structured questionnaire. The data was checked for completeness, coded, cleaned and entered into Epi-data version 3.1 and exported to SPSS version 23 for analysis. Binary and multivariable logistic regression was used to understand association between dependent and independent variables. P-value <0.05 at 95% CI, or (for interpretation of results) was declared a statistically significant association.

Results

This study found that 52.6% of the neonates had neonatal sepsis during admission. Among these, 39.8% were early onset of neonatal sepsis and 12.8% were late onset of neonatal sepsis. Factors such as maternal Urinary tract infection, maternal fever, chorioamnionitis, and age of neonates (0-7 days), male sex and resuscitation at birth were significantly associated to neonatal sepsis.

Conclusion

This study identified that rate of neonatal sepsis was high and maternal related factors were significant predictors of neonatal sepsis. Therefore, health professionals should work on risk factors associated with sepsis to decrease its prevalence and other complications.

Key Words: Ethiopia, Neonatal sepsis, Neonatal intensive care unit; Neonates.

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1- INTRODUCTION

Neonatal sepsis is characterized by systemic result from bacterial invasion and multiplication in the blood stream (1). Its clinical presentation is non-specific and includes: fever, respiratory distress, lethargy, impaired or refusal of feeding, jaundice, decreased Moro reflex, hypothermia, convulsions and bleeding disorder (2). Based on the onset of clinical sign and symptom, it is classified as early-onset sepsis (EOS) if the onset of clinical feature present from birth to 7 days (usually <72 hour), and late-onset sepsis (LOS) if it presents from 8 to 28days after birth (3). Out of the three-leading causes of neonatal mortality, sepsis is the third leading cause of neonatal mortality worldwide (5). Epidemiological estimates suggest that there were 1.7 million cases of neonatal sepsis globally, 0.6 million cases and 0.14 million were neonatal deaths in sub-Saharan Africa and neonatal sepsis accounts for an estimated 26% of under-five deaths (6, 7).

Every year 2.6 million neonates die and 75% of these deaths occur in the first week of life, and almost all (99%) in low- and middle-income countries (8). The incidence of neonatal sepsis is around 40 times higher and its mortality rate is two times higher in middle-income countries compared to high-income countries (9). Even though the 2014 child mortality report indicated decreased neonatal mortality from 5.1 million to 2.8 million neonatal deaths, still 15% of the death are due to neonatal sepsis and the case fatality rate had decreased only by 28% from 2000 to 2013 (10). In Ethiopia bacterial sepsis accounts for 32.5% of neonatal death and it's the second cause of hospital admission preceded only by prematurity and its complications (11). Similarly, study conducted in Gondar university hospital in Intensive care unit indicated that 67.4% were EOS and 32.6% LOS based on clinical parameters (12). The risk for neonatal sepsis such as chorioamnitis, UTI (Urinary tract infections), PROM (Prolonged rupture of membrane), prematurity and maternal fever has become six times higher in developing countries compared to that of developed countries (13). Despite improvements in diagnosis and management of neonatal sepsis in recent years, it has become a leading cause of admission and death in neonatal units especially in developing countries due to different conditions (14, 15). As indicated in different studies conducted in developed and developing countries, there is variation of prevalence of neonatal sepsis from place to place. Due to this reason, assessment of prevalence and associated factors of neonatal sepsis among neonates admitted in neonatal intensive care unit is needed.

2- MATERIALS AND METHODS

2-1. Study setting and design

The study was conducted at two public hospitals: Jimma Medical Center (JMC), and Shenen gibe hospital which is located 352 km from Addis Ababa, Southwest Ethiopia. JMC is one of the referral hospitals and it serves as a teaching hospital. Being a referral hospital, JMC handles many high-risk pregnancies. Shenen gibe hospital is one of the district hospitals located in Jimma town, Oromia Region, Southwest Ethiopia (16). The study was conducted from to March 12 to May12, 2019 at two governmental hospitals in Jimma town. Institutional based cross-sectional study was conducted.

2-2. Eligibility criteria

All neonates admitted to NICU were included in this study, neonates who were early discharged before data collection was completed but only their card was available, incomplete patient chart information, and those neonates who died on arrival were excluded from this study. NICU is selected for the study because

knowing the disease patterns and causes in the Neonatal Intensive Care Unit (NICU) as well as disease-wise mortality rate can inform the requisite efforts to reduce morbidity and mortality. The study included neonates with clinical diagnosis of sepsis based on the following two risk factors and/or clinical features of bacterial infections (1, 3). Risk factors include: Low birth weight (<2500 grams) or prematurity (<37 weeks of gestation age), febrile illness in the mother within 2 weeks prior to delivery, foul smelling discharge and/or meconium stained amniotic liquid. Suspected chorioamnionitis, prolonged rupture of membranes >18 hours. Clinical feature of sepsis include: poor reflexes, lethargy, respiratory distress, bradycardia, apnea, fever, convulsions, abdominal distension, and bleeding (3).

2-3. Sample size determination and Sampling technique

The sample size was determined by using single population proportion formula and the proportion was taken from the previous literature in Ethiopia. According to a study conducted at Wolaita Sodo hospital, the prevalence of neonatal sepsis was 33.8% (15). By considering 95% confidence interval (CI) and 5% marginal error, the sample size was calculated as follows:

Where $n = (Z_{\alpha/2})^2 \ P\ (1\text{-}P)/d^2$

$n = (Z_{\alpha/2})^2 \ P\ (1\text{-}P)/d^2 = (1.96)^2 \ \ 0.338(1\text{-}0.338) / 0.0025 = 344$

Since the patient flow by default is random, data was collected consecutively during study period. Sample was proportionally allocated to each hospital.

2-4. Statistical Analysis

The data was checked for completeness, coded, cleaned, compiled, and entered into Epi-data version 3.1 and exported to SPSS version 23 for analysis. Crude and adjusted odds ratio (AOR) was analyzed at 95% confidence interval (CI). Binary logistic regression was performed and variables having P-value <0.25 were screened for multivariable logistic regression. The reason we used multivariable rather than multivariate is that we have only one dependent variable. Finally, variables having P- value <0.05 on multivariable model at 95% CI were considered as statistically significant.

2-5. Ethical Approval

This study was approved by the ethics committees of Institutional Review Board of Jimma University and was submitted to both JMC and Shenen gibe general hospital after explaining the aim of study. Permission to gather data was obtained from the medical directors of two hospitals and heads of the neonatal intensive care unit. The respondent's privacy and confidentiality of the information were assured throughout the study.

3- RESULT

3-1. Socio-demographic characteristics of the mothers

A total of 344 neonates were involved in this study and concerning maternal residence majority, 148 (54.8%) of them were living in rural areas. Regarding educational status, 111 (32.3%) of them were illiterate. Of the total samples, 107 (31.1%) of them were in the age group of 25-29 years. Almost half, 170 (49.9%) of the mothers were house wife (**Table. 1).**

3-2. Maternal related factors

Of the total mothers involved in the study, 152 (44.2%) had UTI (diagnosed clinically and supported with lab finding not proven with culture), 192 (55.8%) were multiparous and 228 (66.3%) had membrane rupture less than 18 hours **(Table. 2).**

Table-1: Socio-demographic characteristics of the mothers at public hospital in Jimma, Ethiopia, 2019.

Variables		Frequency	Percent
Maternal Residence	Urban	160	46.5
	Rural	184	53.5
	Total	344	100
Maternal Educational	Illiterate	111	32.3
Status	1st cycle (grade 1-4)	92	26.7
	2nd cycle (grade 5-8)	60	17.4
	High school (Grade 9-12)	43	12.5
	Higher education (>12)	38	11.1
	Total	344	100
Occupational Status	House Wife	170	49.9
	Governmental-Employee	85	24.0
	Self- Employee	89	26.1
	Total	344	100
Monthly Income	<1000	161	46.8
	1000-1500	36	10.5
	1501-2000	11	3.2
	2001-2500	27	7.8
	>2500	109	31.7
	Total	344	100
Maternal Age in	<19	34	9.9
years	20-24	88	25.6
	25-29	107	31.1
	30-34	60	17.4
	35-39	53	15.4
	40^{+}	2	0.6
	Total	344	100

Table-2: Maternal risk factors for neonatal sepsis among neonates at public hospital in Jimma, Ethiopia, 2019.

Variables		Frequency (n=344)	Percent
Maternal UTI	Yes	152	44.2
	No	192	55.8
Post-Partum	Yes	42	12.2
Hemorrhage	No	302	87.8
Anti-Partum	Yes	75	21.8
Hemorrhage	No	269	78.2
Hx of abortion	Yes	103	29.9

	No	241	70.1
Duration of labour	<6hrs	86	25.0
	6-12hrs	166	48.3
	12-24hrs	68	19.8
	24hrs	24	7.0
History of	Yes	91	26.5
Chorioamnitis	No	253	73.5
Parity	Primipara	152	44.2
	Multipara	192	55.8
Meconium stained	Yes	144	41.9
amniotic fluid	No	200	58.1
Foul smelling liquor	Yes	105	30.5
	No	239	69.5
Maternal Fever	Yes	116	33.7
	No	228	66.3
Duration of rupture of	<18hrs	228	66.3
membrane	>=18hrs	116	33.7
Mode of delivery	Spontaneous Vaginal Delivery	201	58.4
	Cesarean Section	114	33.1
	Instrumental	29	8.4

UTI: Urinary tract infection.

3-3. Neonatal related factors

Among neonates who were included in this study, 195(56.7%) were aged between 0-7 days. Out of the study samples more than half, 197 (57.3%) of them were male.

Regarding gestational age, half, 172 (50%) of them were term (37-42 weeks). Majority of the neonates, 189(60.9%) had fifth minute Apgar score of ≥7 **(Table. 3)**.

Table-3: Neonatal factors predisposing a neonate for neonatal sepsis among neonates at public hospital in Jimma, Ethiopia, 2019.

Variables		Frequency	Percent
Age of Neonate	0-7 days	195	56.7
	8-28days	149	43.3
	Total	344	100
Sex of Neonate	Male	197	57.3
	Female	147	42.7
	Total	344	100
Gestational age,	Term 37-42	172	50.0
week	Preterm <37	116	33.7
	Post term >42	56	16.3

	Total	344	100
Birth weight	NBW (2500-4000gm)	212	61.6
	LBW(<2500gm)	96	27.9
	Microsomia	36	10.5
	Total	344	100
APGAR score at 1st	0-3	59	18.7
minute	4-6	122	39.7
	7-10	129	41.6
	Total	310	100
APGAR score at 5th	0-3	3	0.9
minute	4-6	118	38.1
	7-10	189	60.9
	Total	310	100

APGAR: Appearance, Pulse, Grimace, Activity and Respiration, NBW: Normal Birth weight, LBW: Low Birth weight.

3-4. Medical related factors

Among the total study participants, for more than half, 198 (57.6%) of the neonates, intranasal oxygen was administered by nasal catheter and 122 (35. %) were managed with mechanical ventilation **(Table. 4)**. Among neonates who participated in this study, 181(52.6%) were diagnosed with neonatal sepsis and followed by Meningitis 113 (26%) **(Figure. 1).** Among 344 sampled neonates, more than (57.6%) of them were delivered in hospital and (28.5%) were at health center (**Figure. 2).**

Table-4: Medical risk factor for neonatal sepsis among neonates at public hospital in Jimma, Ethiopia, 2019.

Variables		Frequency (n=344)	Percent
Any medical problem	Yes	58	16.9
	No	286	83.1
Mechanical ventilation	Yes	122	35.5
	No	222	64.5
Oxygen via nasal catheter	Yes	198	57.6
	No	146	42.4
Oxygen via mask	Yes	56	16.3
	No	288	83.7
Resuscitated	Yes	143	41.6
	No	201	58.4

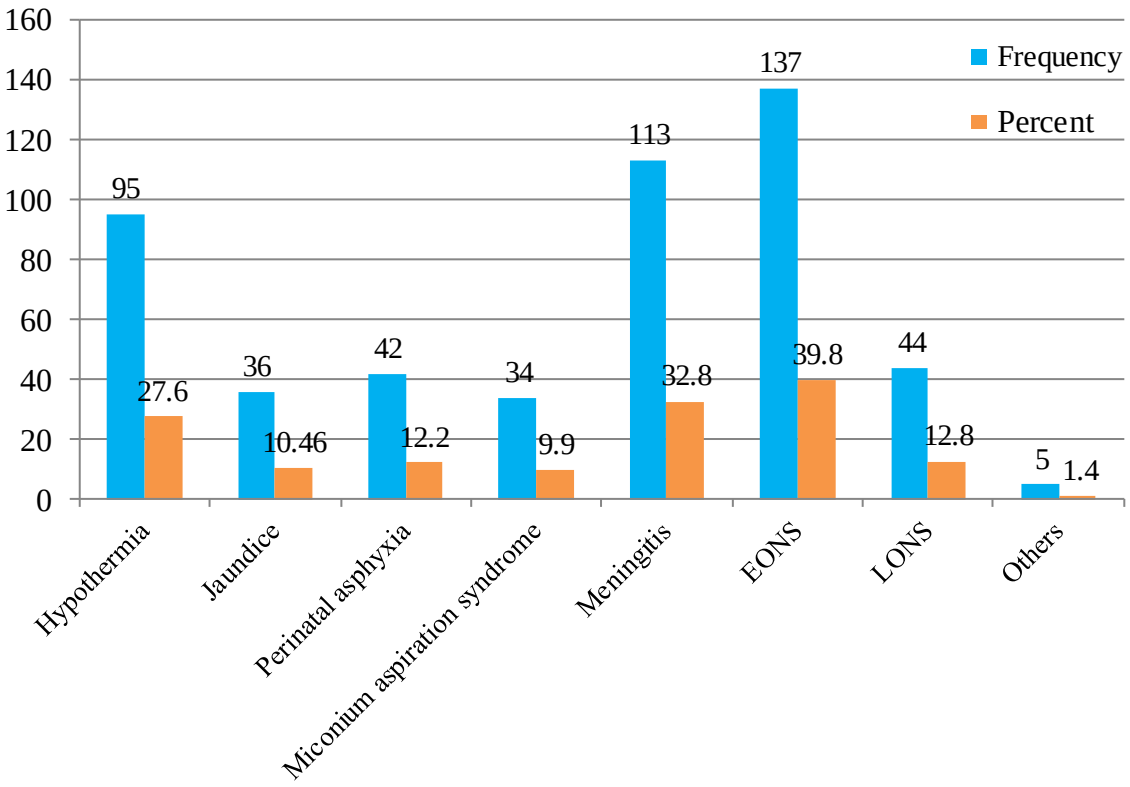

Fig.1: Neonatal sepsis and other comorbidities at public hospital in Jimma, Ethiopia, 2019.

EONS: Early Onset of Neonatal Sepsis, LONS: Late Onset of Neonatal Sepsis.

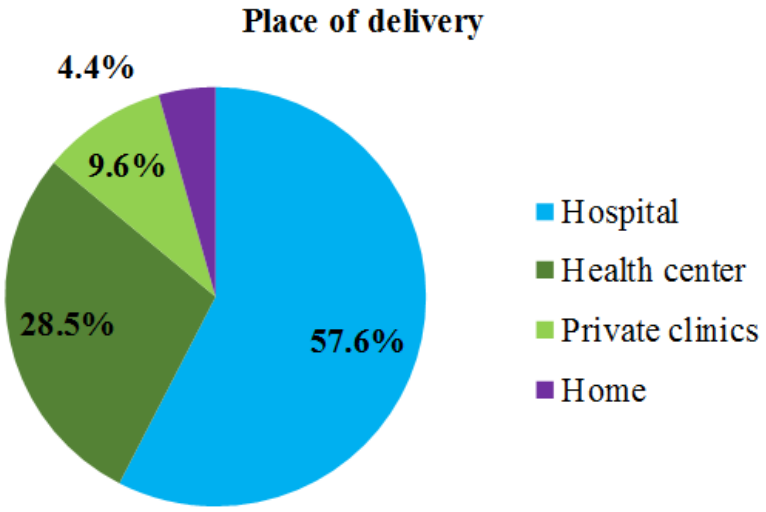

Fig.2: Place of delivery among neonates at public hospital in Jimma, Ethiopia, 2019.

3-5. Factors associated with Neonatal Sepsis

The study revealed that those neonates who were born from mothers having UTI were 2 times more likely to develop sepsis compared to those born from mothers with no UTI; neonates whose mothers had foul smelling vaginal discharge developed sepsis 2 times more often, and 8-28 days old neonates, were 60% less likely to develop it than 0-7 days old. Those who were born from mothers having chorioamnionitis and maternal fever were also 3 times likely to develop sepsis **(Table. 5).**

Table-5: Multiple variable analysis of factors associated to neonatal sepsis in neonates at public hospital in Jimma, Ethiopia, 2019.

Variables		COR (95% C.I)	AOR (95% C.I)	P- value
Maternal UTI	Yes	4.00(2.53,6.31)	2.40 (1.16,4.95)	0.018
	No			1
Duration of	<6hrs			1
labour	6-12hr	7.33(2.03,26.41)	10.22(1.73,60.27)	0.012
	12-24hrs	6.51(1.87,22)	7.80(1.41,42.96)	0.018
	$24hrs^{+}$	7.87(2.14,28.89)	15.86(2.51,100.29)	0.003
Foul smelling	Yes	6.33(3.64,10.98)	2.39(0.99,5.76)	0.051
vaginal discharge	No			1
Duration of	<18hrs			1
Rupture of membrane	>=18hrs	0.47(0.30,0.75)	3.28(1.41,7.65)	0.003
Age of neonates	0-7 days			1
	8-28 days	0.41(0.26,0.63)	0.40(0.22,0.72)	0.002
Sex of neonate	Male	9.77(5.92,16.10)	9.30(4.54,19.04)	0.000
	Female			1
APGAR score at	0-3			
first minute	4-6	0.38(0.19,0.72)	0.30(0.10,0.86)	0.025
	7-10	0.33(0.17,0.63)	0.07(0.02,0.22)	0.000
Chorioamnionitis	Yes	2.309(1.295,4.116)	2.65(1.31,5.37)	0.007
	No			
Maternal Fever	Yes	4.61(2.71,7.83)	3.17(1.52,6.58)	0.002
	No			
Resuscitation		7.86(4.75,12.99)	13.87(5.72, 33.60)	0.000

NB; UTI: Urinary tract infection, COR: Crude Odds Ratio, AOR: Adjusted Odds Ratio.

4- DISCUSSION

This study assessed predictor's neonatal sepsis in order to tackle the disease burden and its specific associated problems. In this study the overall prevalence of neonatal sepsis was 52.6%. Study done at Shashamane town showed that the overall prevalence of neonatal sepsis was 77.9% (7). Study conducted in Black Lion specialized hospital in 2010 also reported that the prevalence of neonatal sepsis was 44.7% (18). This difference could be because the culture was not utilized for diagnosing neonatal sepsis in this study, and clinical parameters alone were used in both hospitals. Another study done in Iran showed that prevalence of neonatal sepsis was 51.8% (19). This might be because of difference in sample size and in socio-demographic status of population as well as accessibility to health facility. Finding in Egypt reported that prevalence of neonatal sepsis was 40.7% (20). This difference might be justified as confirmed laboratory results based on blood culture can be used for effective diagnosis of neonatal sepsis.

The current study finding revealed that the probability that a neonate develops sepsis increased at an early age. It was also identified that (39.8%) had early onset neonatal sepsis (<7 days). This finding is similar to the study conducted at Mekele city public hospitals in which the majority of them had early onset neonatal sepsis (17). This might be due to ascending infections or due to direct contact with microorganisms during the delivery process. This study revealed that mothers who had a history of UTI during the current pregnancy have a significant association with neonatal sepsis. Neonates born to mothers who had a UTI were nearly 2 times more likely to develop sepsis than those neonates born to mothers who did not have a UTI during the pregnancy. This finding is similar to the studies conducted in Mekele, Bishoftu and Ghana (17, 21, 22). This might be due to late diagnosis and treatment of maternal UTI that could result in development of neonatal sepsis because of ascending infection via vagina. This study also revealed that neonates whose APGAR scores were less than 7 in the first minute were significantly associated with the risk of developing sepsis. This finding is consistent with the results of a study conducted in Ghana were they found the APGAR score in the first minute to be strongly associated with the occurrence of neonatal sepsis (22). Similar findings were also observed in other previous studies in Ethiopia (21). This might be due to contamination of materials used during resuscitation. This study also showed that neonates who were resuscitated at birth were statistically associated with the risk of developing neonatal sepsis.

Evidence shows that resuscitation of neonates is a risk factor of sepsis among patients with weak immunity, including hospitalized patients and newborns (23). This might be due to poor practices and non-adherence to guidelines by health professionals during resuscitation may predispose the neonate with a greater risk of developing sepsis and this might not be different from the current study. This study revealed that duration of rupture of membrane was significantly associated with the risk of neonatal sepsis. This study is also similar to the study conducted in India (24). This implies that, we have to give attention to maternal infection to save the life of the newborn. Similarly, this study showed that sex has significant association with neonatal sepsis. From the finding, male neonate developed the sepsis 9 times more often than female neonates.

5- CONCLUSION

The study showed that the prevalence of neonatal sepsis was too high. Maternal related factors were significant predictors of neonatal sepsis. Therefore, health

professionals should work on risk factors associated with sepsis to decrease its prevalence and other complications.

6- ABBREVIATIONS

AOR: Adjusted Odds Ratio; APGAR: Appearance, Pulse, Grimace, Activity, and Respiration); CI: Confidence interval; EOS: Early Onset Sepsis, JMC: Jimma Medical center; LOS: Late Onset Sepsis; NICU: Neonatal Intensive Care Unit; UTI: Urinary Tract Infection.

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8- CONFLICT OF INTEREST: None.

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