

Prevalence and factors associated with neonatal sepsis among neonates in Temeke and Mwananyamala Hospitals in Dar es Salaam, Tanzania

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Abstract

Background: Neonatal sepsis contributes significantly to neonatal mortality. This study was carried out to determine the prevalence and factors associated with neonatal sepsis in Dar es Salaam, Tanzania.

Methods: A hospital based cross-sectional study was conducted at Mwananyamala and Temeke hospitals in Dar es Salaam, during August-September, 2015. A standardized questionnaire was used to obtain demographic, obstetrics and clinical information. Diagnosis of neonatal sepsis was done clinically. Relationship between outcome variable and exposure variable was done using Chi square test. Multivariate logistic regression was used to measure association after controlling for confounders.

Results: A total of 220 neonates were recruited, 69 (31.4%) had sepsis. The risk factors associated with neonatal sepsis were maternal age of >35 years (AOR=6.7; 95%CI 2.1-20.1; p-value=0.001) and resuscitation at birth (AOR=1.25195%CI 1. 22-3.88; p-value=0.025).

Conclusion: Neonatal sepsis among neonates in Dar es Salaam is associated with maternal and health services related factors. The findings underscore the importance of routine assessment and close monitoring of neonates. It is therefore recommended to have more skilled health personnel and advanced equipment while providing maternal and new-born health care services.

Key words: neonatal sepsis, prevalence, risk factors, Tanzania

Introduction

Neonatal sepsis which occurs during the first 28 days of life, is estimated to cause 26% of all neonatal deaths worldwide (Lawn *et al.*, 2009). In Africa, 17% of neonatal deaths in sub Saharan Africa are attributed to neonatal sepsis (Gebremedhin *et al.*, 2016). In Sub-Saharan Africa some studies have reported neonatal sepsis to be prevalent (Vergnano *et al.*, 2005) in a number of countries. In Kenya, 5.46 cases per 1000 live births have been recorded in Kilifi (Berkley *et al.*, 2005); In Nigeria, 6.5 cases of neonatal sepsis per 1000 live births while Zimbabwe has recorded 21 cases of neonatal sepsis per 1000 live births (Airede, 1992). A recent study in Ethiopia indicates that neonatal sepsis in the major newborn killer accounting for more than one third of neonatal deaths (Gebremedhin *et al.*, 201). In Tanzania it is estimated that neonatal sepsis account 29% of the neonatal deaths (Manji, 2009) and its prevalence varies between regions. Neonatal sepsis prevalence of 38.9% (Kayange *et al.*, 2010) and 25% (Mhada *et al.*, 2012) have been reported in Mwanza and Dar es Salaam, respectively. Despite a considerable burden of neonatal sepsis, there are only a few data on the precise incidence and aetiology of maternal or early onset neonatal bacterial sepsis in sub-Saharan Africa, largely because of a lack of reliable laboratory facilities (Seale *et al.*, 2009).

Usually, early-onset neonatal sepsis is associated with prenatal background characteristics such as maternal prolonged or premature rupture of membrane. Late-onset is mainly related to the medical and surgical conditions or other procedures required by neonates such as resuscitation at birth, and intravenous access after birth (Hofer *et al.*, 2012). The chances of survival are small for new-borns with serious infection whether hospitalized or in the community. Diagnosis and treatment of new-borns with infection is inadequate in many developing countries, because sick new-born present with non-specific signs and symptoms (Lawn *et al.*, 2009). In addition, inadequate or lack of health

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personnel and laboratory facilities pose difficulties in making prompt diagnosis of neonatal sepsis (Lawn *et al.*, 2009). Culture sensitivity method is a gold standard in diagnosing neonatal sepsis, however due to lack of good laboratory facility and services, clinical diagnosis is sometimes used; which is either done by using the World Health Organization's criteria or other predator confirmed from previous studies (English *et al.*, 2004).

Implementation of essential guidelines together with timely administration of essential therapies would effectively improve management and outcome of neonatal sepsis. Despite these benefits, guidelines cannot be implemented in most middle- or low-income countries due to lack of resources. Early identification of the risk factors for neonatal sepsis would enable early clinical diagnosis and treatment aiming to reduce morbidity and mortality. A few studies on factors contributing to neonatal sepsis have been reported in Tanzania. This study was therefore, carried out to determine the prevalence and factors contributing to neonatal sepsis among neonates in two hospitals of Dar es Salaam, Tanzania.

Material and Methods

Study site, design and subjects

A cross sectional study was conducted in two municipal referral hospitals, Mwananyamala and Temeke in, Dar es Salaam, Tanzania between 27th August and 28th September 2015. All new-borns \leq 28 days of life were involved in the study. Neonatal sepsis was defined as infection that had occurred during the neonatal period (from birth to 28 days) (Mhada *et al.*, 2012). Clinical features were used for diagnosing neonatal sepsis. Using predator confirmed from previous study a child who showed the following symptoms: bradycardia, seizures/convulsion, fever, apnoea, reduced sucking, reduced movements, vomiting and infected umbilical cord was classified as a child with sepsis (English *et al.*, 2004). Blood /Microbial tests could not be done as a confirmation of neonatal sepsis because they are not routinely done at the hospitals due to lack of laboratory facilities.

Data collection

Convenience sampling was used to select neonates who met the inclusion criteria. A standardized questionnaire was used to obtain information about neonatal characteristics (age, sex, birthweight, Apgar score, resuscitation after birth, history of bradycardia, seizures/convulsions, fever, apnoea, reduced sucking, reduced movement, vomiting and infected umbilical cord). In addition, obstetrics information including parity, gestational age at delivery, premature rupture of membrane was collected. The antenatal cards were used to validate some of the obtained information, where applicable.

Data analysis

Data from the questionnaire were entered into a computer using SPSS Version 20 followed by data cleaning and generation of frequency distribution tables. Association of the risk factors under study were assessed by applying χ^2 test at a significant level $P \leq 0.05$. Logistic regression analysis was done to assess the strength of association between dependent (neonatal sepsis) and independent variables (age, sex, birth weight, Apgar score, resuscitation after birth, parity, gestational age at delivery, and premature rupture of membrane). Odds Ratios (OR) and 95% Confidence Intervals (CI) for the OR was obtained and a P-value of ≤ 0.05 was considered significant.

Ethical considerations

Ethical clearance was obtained from the Institutional Research Board of the Hubert Kairuki Memorial University. Permission to carry out the study was obtained from the respective Municipal Hospital Authorities. Informed consent was obtained from neonates' mothers before data collection.

Results

Characteristics of the neonates

A total of 220 neonates were involved in the study, 110 from each hospital. Nearly half (49.1%) of the cases, aged below 7 days. Majority of the neonates were females (54.1%). The body weights ranged between 2.5 and 3kg for most neonates (46.5%). More than half (53.6%) had the Apgar score below 7. Slightly over a third (37.7%) of the mothers used warm water for cleaning neonate's cord (Table1).

Table 1: Characteristics of the neonates (N=220)

Variable	Response/value	Number	Percent
Age(days)	From birth to 7 days	108	49.1
	8days to 14days	69	31.4
	15days to 21 days	38	7.3
	22days to 28 days	5	2.3
Sex	Male	101	45.9
	Female	119	54.1
Birth weight (Kg)	1.9-2.4	26	11.8
	2.5-3.0	102	46.4
	3.1-3.6	80	36.4
	3.7-4.2	10	4.5
Cried immediately after birth	Yes	104	47.3
	No	116	52.7
Apgar Score (5min)	<7	118	53.6
	7 and above	102	46.4
Gestation age	Preterm	17	7.7
	Term	203	92.3
Resuscitation at birth	Yes	83	37.7
	No	137	62.3
Cord care	Applying antiseptic	73	33.2
	Leaving it to dry	44	20
	Cleaning with warm water	83	37.7
	Applying powder	20	9.1

Characteristics of the mothers

Slightly over half (51.9%) of the mothers were 21-30 years old, and 130 (59.1%) were primigravida. Half of the mothers 109 (50.5%) had premature rupture of membrane and nearly two thirds 135(61.4%) had spontaneous vaginal delivery (SVD). The majority 209 (95%) gave birth in the hospitals (Table 2).

Table 2: Socio-demographic characteristics of the mothers (N= 220)

Variable	Response	Number	Percent
Maternal age(years)	Less than 20 years	39	17.7
	21-30 years	114	51.9
	31-40years	61	27.7
	Above 40 years	6	2.7
Education	Never gone to school	18	8.2
	Primary school	179	81.3
	Secondary university	23	11.5
Marital status	Married/living with partner	141	64.1
	Not married /not living with partner	79	35.9

Occupation	Employed	70	31.8
	unemployed	180	68.2
Parity	Primigravida	130	59.1
	Multiparous	90	40.9
Premature rupture of membrane	Present	109	49.5
	Absent	111	50.5
Mode of deliver	Spontaneous vaginal delivery	135	61.4
	Caesarean section	68	30.9
	Vacuum extraction	17	7.7
Place of delivery	Hospital	209	95.0
	Home/on the way to hospital	11	5.0

Prevalence and factors associated with neonatal sepsis

Out of 220 Neonates 69 (34.1%) had sepsis. Various socio demographic characteristics were associated with neonatal sepsis including. These included the maternal age of less than 20 years [25/39(64.1%), ($\chi^2=26.06$ P-value=0.000)], and low educational level [11/18 (61%) ($\chi^2 = 11.55$ P-value=0.009)] (Table 3). Obstetrics factors associated with neonatal sepsis were premature rupture of membrane [42/109(35.5%) ($\chi^2=10.43$, P-value=0.029)] and delivered out of the health facility [8/16(75%) ($\chi^2= 9.22$, P-value=0.01)] (Table 3). Neonatal characteristics which were associated with neonatal sepsis included Apgar score of less than seven [43/118(36.4%) ($\chi^2=4.71$, P-value=0.03)], prematurity [9/17(52.9%), ($\chi^2=3.98$ P-value=0.046)] resuscitation at birth [39/83(51.3%)($\chi^2=21.47=$ P-value=0.000)] and male sex [43/101 (42.6%) ($\chi^2=10.90$, P-value=0.001)] (Table 4).

Table 3: Mother's socio-demographic characteristics associated with neonatal sepsis

Variable	Response/value	Sepsis N (%)	Total N(%)	χ^2	P-value
Maternal age (years)	Less than 20 years	25(64.1)	39(100.0)	26.06	0.000
	21-30 years	23(20.2)	114(100.0)		
	31-40years	19(31.1)	61(100.0)		
	Above 40 years	2(33.0)	6(100.0)		
Education status	Never gone to school	11(61.0)	18(100.0)	11.55	0.009
	Primary school	48(26.8)	179(100.0)		
	Secondary university	10(48.1)	23(100.0)		
Marital status	Married/living with partner	51(36.2)	141(100.0)	4.34	0.04
	Not married /not living with partner	18(22.8)	79(100.0)		
Occupation	Employed	21(30.0)	70(100.0)	0.089	0.766
	unemployed	48(32.0)	180(100.0)		
Parity	Primigravida	45(34.6)	130(100.0)	2.69	0.101
	multiparous	24(26.7)	90(100.0)		
Premature rupture of membranes	Present	42(38.5)	109(100.0)	10.43	0.029
	Absent	27(24.3)	111(100.0)		
Mode of delivery	Spontaneous vaginal delivery	46(34.1)	135(100.0)	1.32	0.518
	Caesarean section	19(27.9)	68(100.0)		
	Vacuum extraction	4(23.5)	17(100.0)		
Place of delivery	Hospital	61(29.2)	209(100.0)	9.22	0,01
	Home/on the way to hospital	8(72.7)	11(100.0)		

Table 4: Neonatal characteristics associated with neonatal sepsis

Variable	Response/Value	Sepsis N(%)	Total	χ^2	P value
Age (years)	From birth to 7 days	31(28.7)	108	1.22	0.27
	8days to 14days	26(37.7)	69		
	15days to 21 days	12(31.6)	38		
	22days to 28 days		5		
Sex	Male	43(42.6)	10	10.90	0.001
	Female	26(21.8)	119		
Birth weight (kg)	1.9-2.4	12(46.2)	26	0.02	0.90
	2.5-3.0	31(30.4)	102		
	3.1-3.6	21(26.2)	80		
	3.7-4.2	3(30)	10		
	4.3-4.8	0(0)	2		
Apgar score (5min)	<7	43(36.4)	118	4.71	0.03
	7 and above	26(25.5)	102		
Gestation age	Preterm	9(52.9)	17		
	Term	60(29.6)	203		
Resuscitation at birth	Yes	39(51.3)	83	21.47	0.000
	No	30(20.8)	137		
Cord care	Applying antiseptic	23(31.5)	73	6.61	0.082
	Leaving it to dry	14(31.8)	44		
	Cleaning with warm water	21(25.3)	83		
	Applying powder	11(55.0)	20		

After controlling for potential confounders, factors that were associated with neonatal sepsis were mothers of less than 20 years (AOR=6.7;95%CI2.1-20.1; P-value=0.001) and resuscitation at birth (AOR=1.25195%CI. 22-3.88; P-value=0.025) (Table 5).

Table 5: Multivariate logistic regression on factors associated with neonatal sepsis

Variable	Response	Sepsis N (%)	Total N (%)	AOR	95%CI	P-value
Maternal age (years)	21-30	23(20.2)	114(100.0)	1		
	31-40	19(31.1)	61(100.0)	1.18	0.97-2.07	0.08
	Above 40	2(33.0)	6(100.0)	1.42	1.51-4.47	0.0001
Education status	Less than 20 years	25(64.1)	39(100.0)	6.7	2.2-3.88	0.001
	Secondary university	10(48.1)	23(100.0)	1		
	Primary school	48(26.8)	179(100.0)	0.08	0.11-4.33	0.55
Marital status	Never gone to school	11(61.0)	18(100.0)	1.15	1.18-4.48	0.09
	Married/living with partner	51(36.2)	141(100.0)	1		
	Not married /not living with partner	18(22.8)	79(100.0)	0.9	0.01-1.44	0.55
Premature rupture of membranes	Present	42(38.5)	109(100.0)	1.99	0.2-4.4	0.11
	Absent	27(24.3)	111(100.0)	1		
Place of delivery	Hospital	61(29.2)	209(100.0)	1		
	Home/on the way to hospital	8(72.7)	11(100.0)	3.4	0.45-5.56	0.09
Sex of neonate	Male	43(42.6)	101(100.0)	1		
	Female	26(21.8)	119(100.0)	0.9	0.1-4.5	0.52
Apgar score (5min)	7 and above	26(25.5)	102(100.0)	1		
	<7	43(36.4)	118(100.0)	2.15	1.15-5.58	0.07
Gestation age	Term	60(29.6)	203(100.0)	1		
	Preterm	9(52.9)	17(100.0)	1.99	0.2-4.4	0.11
Resuscitation at birth	No	30(20.8)	137(100.0)	1		
	Yes	39(51.3)	83(100.0)	1.25	1.22-3.38	0.025

Discussion

The prevalence of neonatal sepsis in this study was 31.4%; slightly higher than 29% which was previously reported in Tanzania by Manji (2009). This higher prevalence is likely to be due to the fact that the study sites are referral hospitals, most frequently receiving neonates with complications as well as complicated pregnancies. A study done in South-eastern Mexico (Leal *et al.*, 2012) reported a lower prevalence of neonatal sepsis (24%). This difference may have been contributed by the presence of more skilled personnel in Mexico and advanced or modernized equipment compared to Tanzania.

Various risk factors were associated with neonatal sepsis. The findings in this study are consistent with those reported by Santhosh (2005) and Leal *et al.* (2012). These similarities may be due lack of knowledge among some of the health care providers on aseptic precautions while resuscitating neonates in all settings. The study demonstrated that low Apgar score (less than 7 after 5 minutes) was significantly associated with neonatal sepsis. One previous study has also reported similar result (Sundaram *et al.*, 2008). Neonates with low Apgar score tend to have poor adaptation to extra uterine life due to the stress experienced during labour and therefore are more prone to infection (Benitz *et al.*, 1999; Simonsen *et al.*, 2014). Also the results showed preterm delivery as a significant factor for neonatal sepsis. This is in agreement with the finding from an earlier study done by Haque (2005). This could be explained by the fact that premature new-borns have poor host defences and thus are more likely to suffer from neonatal sepsis.

Another risk factor for neonatal sepsis was premature rupture of membrane. Similar observations have been reported elsewhere (Wilson & Lowdermilk, 2006; Fraser *et al.*, 2006). Early membrane rupture exposes a newborn to ascending microorganisms from the vagina into the amniotic sac and if not managed well, neonate can develop sepsis after delivery. In a recent study in Ethiopia, the possible risk factors of neonatal sepsis were history of maternal urinary tract infection or sexually transmitted infection, prolonged rupture of membrane, place of delivery; health facility delivery, intrapartum fever, Apgar score <7 at 5th minute and not crying immediately at birth (Gebremedhin *et al.*, 2016). Contrary to our findings, a study by Siakwa *et al.* (2014) did not find premature rupture of membrane as a significant risk factor; probably due to appropriate interventions put in place to manage such cases.

In conclusion, the prevalence of neonatal sepsis in Temeke and Mwananyamala hospitals is high. The study identified resuscitation at birth, low Apgar score, prematurity, maternal age and premature rupture of membrane as significant factors associated with neonatal sepsis. These findings suggest a possibility for routine assessment of neonates in order to identify risk factors for neonatal sepsis. It is therefore recommended to have more skilled health personnel and advanced equipment while providing maternal and neonatal health care services. Health care providers should adhere to aseptic precautions while performing invasive procedures. Provision of community health education would encourage pregnant women to abide to the recommended antenatal schedule and take prompt action in seeking medical help during obstetric emergencies.

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