ASSESSMENT OF NEONATAL MORTALITY AMONGST SICK NEONATES IN THE SPECIAL CARE BABY UNIT OF A TERTIARY INSTITUTION IN ORLU, NIGERIA

Abstract:

Introduction

Neonatal mortality constitutes more than 41% of Under 5 mortality in sub-Saharan Africa, this is despite advancement in technology and concerted effort at decreasing under-five mortality. This study assesses the risk factors and underlying causes of neonatal mortality. Information obtained will to a large extent contribute to the national data necessary for development of objective polices/targeted interventions aimed at reducing neonatal and U5 mortality in line with SDG 3 target 3.2.

Method

A hospital based retrospective review of medical records of neonates who died while on admission in the Special care baby unit (SCBU) of Imo State University Teaching Hospital Orlu from 2018 to 2022. Information on sociodemographic characteristics, place of birth, mode of delivery, birth weight, gestational age at delivery, duration of stay on admission, mode of delivery and clinical diagnosis was obtained from the medical records of 948 sick neonates. Data was analyzed using SPSS version 24; summarized using frequency distributions and tables. Comparative analysis was done using Chi square. Logistic regression test at 95% level of significance was used to determine the association between independent variables and neonatal death. Values of $p < 0.05$ were considered significant.

Results

A total of 948 sick neonates were admitted into SCBU, with a neonatal mortality rate of 22.6%. Complications of prematurity 78 (36.7%), severe birth asphyxia 63(29.6%) and neonatal sepsis 31(14.6%) are the leading causes of death with majority of death occurring in the first 24 hours of life 130(60.8%). Low birth weight [OR=2.59 (95% CI 1.84-3.54)], prematurity [OR=2.79 (95% CI 2.03-3.83)] and spontaneous vaginal deliveries [OR=1.85 (95% CI 1.32-2.60)] were positively associated with increased mortality. While Caesarean section as mode of delivery

[OR=0.54 (95% CI 0.38-0.76)] and birth weight >2.5-4.0kg [OR=0.46 (95% CI 0.34-0.64)] significantly reduced neonatal mortality.

Conclusion

Neonatal mortality rate is unacceptably high, with complications of prematurity, severe birth asphyxia and neonatal sepsis contributing the highest percentage of cause of death. Measures aimed at reduction of neonatal morbidity and mortality such as improving the utilization of antenatal care services, quality of care at delivery, and at the neonatal intensive care unit needs be embraced.

Keywords

Neonates, Morbidity, Mortality, Admissions, Assessment

INTRODUCTION

Childhood mortality rates are still very high in this part of the world despite concerted efforts to lower Under 5 (U5) and Infant mortality rates (IMR) and achieve the United Nations (UN) millennium developmental goal 4.[1,2,3,4,5] Sustainable development goals Neonatal death continues to remain a significant public health issue in Nigeria, with the greatest risk of death in the first 28 days of life being 15 times greater than any other times in the first 1 year of life.[6] Despite government and several stakeholders efforts neonatal deaths remains high at 41.0% of under 5 years olds.[6] In view of these, efforts at reduction of childhood mortality rates should be focused on reducing the high neonatal rates. Unfortunately current efforts to reduce Under 5 mortality in Nigeria has been biased in favor of childhood mortality to the neglect of neonates and these have significantly contributed to higher trends in neonatal mortality rates and Under 5 mortality rates.[7] It is important to note that approximately 98% of neonatal deaths globally occur in the developing world characterized by low incomes.[8] In other to achieve the Sustainable developmental goals in Nigeria, the Federal government should embrace the global strategy for every newborn action plan launched in 2014 and adopted as a world health assembly resolution.[7]

This involves provision of quality care for the newborn, promotion of facility based delivery of newborns and strengthening of the health facility. Essentially, care for small preterm and low birth weight baby and prevention of infections forms the pivot for quality care for the newborn.

The continued reduction in neonatal deaths is critical to progress towards achieving SDG. Therefore assessing mortality and causes of death of sick newborns in the Nigerian context is important, but because we are in a poor resource setting, data is scarce. This retrospective study aims to determine the incidence, causes and risk factors of neonatal death in this environment. This, will to a large extent contribute to the national data on neonatal mortality, help lead to formulation of evidence based policies aimed at lowering Under 5 mortality rate; while helping to improve management protocol for neonates in this tertiary health facility.

METHODOLOGY

Study Setting and Area

The study setting is the Special Care Baby Unit (SCBU) of the department of Paediatrics Imo State University Teaching Hospital situated in Orlu Imo State. The unit provides services to patients from the state and adjoining states. The SCBU provides a level II care for sick neonates both in-born and out-born babies. Inborn babies were admitted through the department of Obstertrics and Gynaecology of the institution, while out-born babies were referred from peripheral hospitals in and out of the state. The SCBU has two sections, for inborn and out-born babies. The unit is supervised by Consultant paediatricians with Residents doctors(senior/junior registrars) available all day. Orlu is a cosmopolitan town, however majority of the inhabitants are mainly of the Igbo ethnic stock. Majority of the inhabitants have primary and secondary levels of education and are engaged in traditional occupations and petty trading. It is a semi

urban town approximately 30 km from Owerri the capital of Imo state. Orlu is located in the tropical rain forest of the south eastern part of Nigeria. It lies within latitude 5^0 43’45’’N to $5^0$53’00’’N and longitude $7^0$7’30’’E. It lies within the Awka-Orlu uplands. It is the third largest city in Imo state with a population of 420,000 covering a surface area of 12935.6km^2. Annual rainfall varies between1990mm and 2200mm. The mean annual temperature is about 27^0C with relative humidity of 75%.[9]

Study design/ Study Population

This was a hospital based retrospective study. Medical records of sick neonates who died while on admission in Special care baby unit of a tertiary health facility were reviewed over a five year period (2018-2022).

Source of Data

Medical records of the subjects obtained from the medical records department and SCBU over the study period were reviewed. Information obtained included diagnosis, gender, place of birth, birth weight, gestational age at delivery, duration of stay in the hospital, mode of delivery and outcome were recorded on a proforma designed for this study. The disease conditions for which they were admitted, were categorized based on the international classification of diseases-Perinatal period- XVI (ICD-10) World health organization.

The criteria for the various categories of admission diagnosis are:

1. Prematurity- babies delivered to mothers before 37 weeks from the first day of the last menstrual period.

2. Birth asphyxia- low Apgar score of 5 at 10 minutes with respiratory distress requiring continuous resuscitation.

3. Neonatal sepsis- evidence of systemic inflammatory response and clinical evidence of systemic infection.

4. Meconium aspiration syndrome- Respiratory distress in the setting of meconium containing amniotic fluid with x-radiograph showing hyperinflation, atelectasis and flattening of the dome of the diaphragm.

Information from the proforma designed for this study was transferred to SPSS version 24 and analyzed. Data was summarized with frequencies, ratios and percentages were calculated for descriptive statistics. A bivariate logistic regression analysis was carried out to observe the association between the independent and the outcome variable. Where appropriate with Odds ratio and corresponding 95% confidence interval were computed and presented as a measure of association. Values of $p < 0.05$ were considered significant.

RESULTS

Yearly trend in admission and neonatal mortality rate: In table I, a total of 948 sick neonates were admitted into the Special care baby unit over the 5 years period of review. Two hundred and fourteen of these babies died while 734 survived under the period of review. This corresponds to an overall neonatal mortality rate of 22.6% and survival rate of 77.4%. Yearly

trend in mortality distribution showed neonatal mortality rate ranging from 17.5% in 2018 to 25.3% in 2022.

Demographic characteristics of Neonatal mortality

In table II, Of the 214 babies that died 132(61.7%) were males, while 82(38.3%) were females, resulting in a male/ female mortality ratio of 1.6:1.0.

In table II, majority (54.6%) of the children admitted into SCBU were delivered in the hospital and referred to the Special baby care unit, while 45.4% were referred from outside the hospital (out born). Of the 214 neonates that died, 126(58.9%) were inborn while 88(41.1%) were out born.

Of the 214 neonates that died, majority 115 (53.7%) were neonates weighing less than 2.5kg (low birth weight), while majority of the neonates (56.1%) who survived were neonates whose birth weight were within the normal range, this is depicted in table II.

In table II, With regards to distribution of mortalities amongst the gestational age of neonates admitted into the SCBU, 99(36.4%) preterm out of a total of 272 died while on admission within the period of review. Of the 635 term neonates admitted, 105(16.5%) died while on admission.

With respect to the relationship between mortality and the duration of admission in SBCU as shown in table II, majority of deaths 60.8% occurred in the first 24 hours of admission irrespective of the cause of death.

In table II, majority of babies that died during the period of review were products of spontaneous vaginal delivery 73.8%), while only 26.2% of mortalities were delivered through Caesarean sections.

Associations between Demographic Characteristics of Neonates and Neonatal mortality

Table III shows the Odds ratios for factors associated with neonatal mortality. Demographic factors such as gender and place of birth were not significantly associated with neonatal mortality. However, birth weight, gestational age at birth, how long the baby stayed in the hospital and mode of delivery were significantly associated with neonatal mortality.

Major causes of Neonatal death

In table IV, complications of prematurity are the leading cause of death (36.7%) during the period of review. This is followed by severe birth Asphyxia, severe neonatal Sepsis and multiple congenital malformations. Together they make up 88.4% of the causes of death. The case fatality rate was highest amongst sick neonates admitted for severe neonatal respiratory distress (57.1%), followed by complications of prematurity (33.2%).

Discussion

Neonatal mortality is still high and available evidence advocates for constant appraisal. In resource poor settings, the bulk of neonatal mortality occurs as a result of poor quality of care during the antenatal, intrapartum, and postpartum periods. This study showed that the extent of neonatal mortality was a high 22.6%, which maybe a reflection of the current neonatal mortality rate in Nigeria of 32.9%. This finding is consistent with findings by other workers in other parts of the Nigeria; Okposio and Igbosewe[1] in Niger delta, 20.3%, Toma et al[2] 19.4% in North Central, Obi and Onyire[3] 19.5% South East, Yola and Iliyasu [4] 16.9% North West and Imodu IA et al[5] 19.3% North East. The slight difference in neonatal mortality rate might be due to sociocultural and socioeconomic diversity across different geographic regions in Nigeria. Comparatively these neonatal mortality rates are much higher than figures obtained from other

parts of the developed world in places such as United States of America 3.88%, France 2.6%, Germany 2.7%, Norway 2.1% and Italy 2.8%.[11] The high neonatal mortality rate in Nigeria may be due to poor service utilization including, poor obstetrics management, giving birth at health institutions without skilled care providers. Poor health seeking behavior for sick neonates and neonatal care with deficient equipment still prevalent in this part of the world all contribute to the dismal picture portrayed. Neonatal mortality is a reliable index for evaluating the overall progress of neonatal and perinatal care in a community and in a wider context it is a valuable indicator of the standard of countries educational, community and national health system.[12] Available data from this study seems to show increasing neonatal mortality rates from 2014 to 2018. This may be a reflection of worsening socioeconomic situation of the average Nigerian/ child, decaying infrastructure in the health sector and health worker migration to saner climes "japa syndrome".

Male preponderance was observed in the gender distribution of neonatal mortality with male/female ratio of 1.6:1. Other studies have consistently reported similar findings as documented by Toma et al [2] in Jos who obtained a male female neonatal mortality ratio of 1.4:1, Akpan in Uyo[12] Okposio[1] in Ughelli both in Southern Nigeria obtained a neonatal mortality ratio of 1.3:1, 1.7:1 respectively. In this study, sex differentials does exist however the differences were not statistically significant. Sex differentials in childhood mortality have been a topical issue amongst researchers and epidemiologists. Newborn girls have a biological advantage in survival over newborn boys; they have less vulnerability to perinatal conditions such as intra uterine hypoxia and birth asphyxia, prematurity and respiratory distress syndrome[13] This biological advantage is compromised by discrimination against girls in certain population

especially in the West African region with the female child less likely to being brought to hospital when sick than the male child.[14]

From this study majority of the sick neonates admitted during the period of study were delivered in the hospital (58.9%), while 41.1% were sick neonates delivered outside the hospital and referred to the hospital. The mortality rate of the inborn neonates of 24.3% was higher than the mortality rate of 20.5% amongst neonates delivered outside the hospital. This is in contrast to findings by other workers in different centers in this area.[15,16] Probably this may be due to the fact that most of these deliveries within the hospital were complicated cases of labour referred from outside the hospital for delivery within the hospital, a result of poor health seeking behavior of the economically challenged population. This may also be so because of the higher proportion of inborn babies admitted into the SCBU since this difference was not statistically significant.

In this study low birth weight was positively associated with neonatal mortality in the SCBU (CI=1.84 to 3.54) p value = <0.0001, OR = 2.29) with majority of neonates who died (53.7%) during the course of study been low birth weight babies. These findings are in keeping with a majority of studies [17, 18] on the outcome of low birth weight neonates in these parts of the world and maybe a reflection of the poor facilities available in these health institutions for the management of these low birth weight babies. Generally low birth weight babies are associated with higher fatal outcomes, prolonged hospital stay and more comorbidity. It becomes imperative that identifying and eliminating the predisposing factors to delivering babies with low birth weight should be the main thrust in the management of these children rather than treating them.

This study also revealed that prematurity is positively associated with mortality in SCBU where 36.4% of preterm admitted into SCBU died. Complications of prematurity were noted to be the leading cause of death 36.7% followed by severe birth asphyxia. This finding is in keeping with findings obtained by other workers in this part of the country.[1, 12, 19] The case fatality rate for complications of prematurity is 33.2%, the second highest following severe neonatal respiratory distress. Essentially majority of these neonates may have died as a result of failure of adaptation to extra uterine life that required urgent resuscitation. Resuscitation of the small immature neonates required sophisticated and costly equipments, well trained efficient personnel and the right infrastructure such as electricity, clean potable water etc. Unfortunately, these requirements for successful resuscitation of the newborn babies are lacking in most tertiary health institutions, compounded by the paucity of well trained health workers (no thanks to the "Japa" migration syndrome). Thus, it is not surprising that 60.8% of neonatal death over the study period occurred within 24 hours of admission. These were mainly small premature babies and neonates with birth asphyxia who needed urgent resuscitation within the first few hours of admission to stay alive. Behnaz et al[20] in Iran noted that 25% of premature neonate had earlier mortality, Yismaw and Terekgn [21] in their study noted the high proportion of preterm neonatal death and concluded that improved infrastructure and presence of skilled manpower is important in providing special care for preterm to avoid complications due to prematurity.

With regards to the mode of delivery, the differences in the outcome of these babies were remarkably significant. Neonates delivered through caesarean section and admitted into the SCBU experienced lower mortality than those who were admitted following delivery through spontaneous vaginal delivery. Similar findings were noted by other workers in this part of Nigeria, [22,23] Delivering of the fetus through an abdominal and uterine incision represents the

most significant operative intervention in obstetrics practice. It has immensely improved maternal and fetal outcomes of pregnancy in Nigeria.[24]

Conclusion

The prevalence of neonatal mortality rate was high comparable to the National values and a reflection of the poor national health index. Poor facilities for resuscitation/management of neonates within the first 24hours of life are a major contributor to the high neonatal mortality rate. Complication of prematurity, severe birth asphyxia, severe neonatal sepsis and multiple congenital anomalies are the leading causes of death with severe complications of prematurity and severe neonatal respiratory distress having the highest case fatality rate. Cultivating utilization of ANC, promotion of hospital delivery, quality care for the newborn, strengthening the health facilities infrastructure, training and retraining of newborn staff could prevent newborn deaths.

What is already know on this topic

Neonatal mortality rate is high in Nigeria

Male neonates are at a higher risk of death than females

Low birth weight is a significant predisposing factor to maternal death.

What this study adds

Complications of prematurity is the leading cause of death in our SCBU at IMSUTH Orlu

Case fatality rate is highest with neonatal respiratory distress in our SCBU at IMSUTH Orlu

Most deaths occurred in the first 24 hours of admission into the SCBU at IMSUTH Orlu

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Table I. Yearly Trend in admission and mortality			
Year	Total Admission %	Total Mortality(n)	Mortality rate %
2018	212	37	17.5%
2019	213	39	18.3%
2020	163	40	24.5%
2021	194	56	28.8%
2022	166	42	25.3%
	948	214	22.5%

Table II. Demographic characteristics of Neonatal mortality

Demographic characteristics	n_o (%)	Mortality (%)	Survival (%)
Gender			
Male	570(60.1)	132(61.7)	438(59.7)
Female	378(39.9)	82(38.3)	296(40.3)
Place of birth			
Inborn	518(54.6)	126(58.9)	392(53.4)
Out born	430(45.4)	88(44.1)	342(46.6)
Birth weight			
<-2.50kg	363(38.3)	115(53.7)	218(33.8)
2.50-4.0kg	467(49.3)	85(39.7)	412(56.1)
->4.0kg	88(9.3)	14(6.6)	74(10.1)
Gestation			
Preterm	272(28.7)	99(46.3)	173(23.6)

Term	635(67.0)	105(49.1)	530(72.2)
Post term	41(4.3)	10(4.6)	31(4.2)
Duration			
<-24hrs	154(16.2)	130 (60.8)	24(3.3)
7-days	442(46.7)	62(29.0)	380(51.8)
8-30days	321(33.9)	21(9.8)	30.0(40.8)
>30	31(3.27)	1(0.4)	30(4.1)
Mode of delivery			
Ceasarean	347(36.6)	56(26.2)	291(39.6)
SVD	601(63.4)	158(73.8)	443(60.4)

TABLE III: ASSOCIATION BETWEEN THE DEMOGRAPHIC CHARACTERISTICS OF NEONATES AND NEONATAL MORTALITY

Demographic characteristics	n_o	Mortality (%)	Survival (%)	95% CI	Pvalue	OR
Gender						
Male	570	132(61.7)	438(59.7)	(.7958, 1.4871)	0.5974	1.0879
Female	378	82(38.3)	296(40.3)	(.6725, 1.2565)	0.5974	0.9192
Place of birth						
Inborn	518	126(58.9)	392(53.4)	(0.9170, 1.7006)	0.1575	1.2492
Out born	430	88(44.1)	342(46.6)	(0.5880, 1.0898)	0.1575	0.8005
Birth weight						
<-2.50kg	363	115(53.7)	218(33.8)	(1.844, 3.5401)	<0.0001	2.5897

2.50-4.0kg	467	85(39.7)	412(56.1)	(0.3418, 0.6381)	<0.00001	0.4570
->4.0kg	88	14(6.6)	74(10.1)	(0.2208, 0.7150)	0.0021	0.3973
Gestation						
-preterm	272	99(46.3)	173	(2.0307, 3.8376)	<0.0001	2.7916
-Term	635	105(49.1)	530	(0.2712, 0.5070)	<0.0001	0.3708
-Post term	41	10(4.6)	31	(0.5359, 2.3059)	<0.0000	1.1116
Duration						
<-24hrs	154	130 (60.8)	24(3.3)	(28.0294, 74.7846)	<0.0001	45.7830
-7-days	442	62(29.0)	380(51.8)	(0.2735, 0.5280)	<0.0001	0.3820
-8-30days	321	21(9.8)	30.0(40.8)	(0.0980, 0.2528)	<0.0001	0.1574
>30	31	1(0.4)	30(4.1)	(0.0149. 0.8127)	0.0305	0.1102
Mode of delivery						
-Ceasarean	347	56(26.2)	291(39.6)	(0.3845, 0.7571)	0.0004	0.5396
-SVD	601	158(73.8)	443(60.4)	(1.3207, 2.6007)	0.0004	1.8534

Table IV. Major causes of Neonatal death

Diagnosis	n_o	Mortality (%)	CFR
Complication of Prematurity	235	78(36.7)	33.2

Severe Birth Asphyxia	257	63(29.6)	24.5
Severe Neonatal Sepsis	163	31(14.6)	19.0
Multiple congenital malformations	67	16(4.2)	23.9
Severe Neonatal Jaundice	133	9(4.2)	6.8
Severe Neonatal Respiratory disease	14	8(3.8)	57.1
Meconium Aspiration Syndrome	14	4(1.9)	28.6
Small for Gestational Age	20	3(1.4)	15.0
Severe hypoglycemia	5	1(0.5)	20.0
Severe Neonatal anaemia	7	1(0.5)	14.3
		214(100)	