Original Article

Maternal, Obstetric, and Foetal Risk Factors for Perinatal Asphyxia: Prevalence and Outcome at a Tertiary Hospital in Port Harcourt, Nigeria

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Abstract

Background: Perinatal asphyxia is a common global neonatal problem which significantly contributes to both morbidity and mortality of newborns, particularly in developing countries, with different risk factors predominating in different settings. **Aims:** The aims of this study were to investigate the prevalence, risk factors, and outcome of Apgar score-defined perinatal asphyxia at the Rivers State University Teaching Hospital (RSUTH). **Materials and Methods:** This was a retrospective case–control study in term newborns, with perinatal asphyxia defined as Apgar score <7 at five minutes, over a three-year period between January 2018 and December 2020. A matched control group with Apgar score ≥7 was used for comparison. Data were retrieved from hospital records of all the participants using a structured pro forma. Analysis was done using SPSS version 20 and statistical significance set at $P < 0.05$. **Results:** There were 5979 live births, of which 75 babies had perinatal asphyxia, giving a prevalence of 12.5 per 1000 live births. Foetal distress was significantly associated with perinatal asphyxia, with odds ratio (OR) = 19.9 (95% confidence interval [CI]: 6.53–60.64). The significant finding on bivariate analysis of mode of delivery ($P = 0.003$) and prolonged labour ($P = 0.001$) as risk factors lost significance on multivariate analysis. The case fatality in asphyxiated newborns was 32.1% and Sarnat Stage III was a significant risk factor for mortality, with OR = 195.0 (95% CI: 11.06–3437). **Conclusion:** The study has shown that perinatal asphyxia is a common problem at the RSUTH, with a high mortality rate. The most significant risk factor was foetal distress in labour. This can be reduced with good obstetric intervention in terms of adequate foetal monitoring in pregnancy and during labour.

Keywords: Hospital outcome, perinatal asphyxia, prevalence, risk factors

Introduction

Perinatal asphyxia is defined as the inability of the newborn to initiate and sustain enough respiration following delivery and is characterized by a marked impairment of gas exchange.[1] It can also be defined as placental or pulmonary gas exchange impairment leading to hypoxaemia and hypercarbia.[2,3] It usually follows a lack of blood flow or gas exchange in late pregnancy, during, or immediately after birth of a newborn, and if the hypoxaemia is severe enough, the tissues and vital organs (muscle, liver, heart, and ultimately the brain) will develop an oxygen deficit, in severe cases leading to an adverse outcome, with risk of death or permanent disability. It is often a result of antenatal and intrapartum factors and is a measure of the level of obstetric care in any hospital.

Hypoxic-ischemic encephalopathy (HIE) refers to the neurologic sequelae of perinatal asphyxia.[4] In perinatal asphyxia, brain damage is of most concern and the least likely to heal quickly or completely. In severe cases, the infant might survive but with damage to the brain manifesting as either mental (developmental delay or intellectual disability) or physical (spasticity) problems.[5,6]

Perinatal asphyxia is estimated to be the fifth-most common cause of under-five child deaths at 8.5%, after pneumonia, diarrhoea, neonatal infections, and preterm

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birth complications.[7] Neonates born in sub-Saharan Africa have a substantial risk of perinatal asphyxia. Approximately 280,000 neonatal mortalities occur during the first day of life because of perinatal asphyxia.[8-10] The incidence of perinatal asphyxia in developed countries is 2 per 1000 live births, but this is 10 times greater in developing countries due to inadequate access to quality maternal and neonatal care.[10]

A diagnosis of perinatal asphyxia may be made when the Apgar score of a baby is <7 at the fifth minute, or where available, umbilical cord arterial pH is <7. It is moderate when the score is 4–6 and severe when it is 0–3.[11] The Apgar score is universally used to assess newborn's health.[12] Initially, the Apgar score at one minute was used to assess the need of immediate resuscitation. Later, Apgar score at five minutes was shown to be a better predictor of neonatal survival than Apgar score at one minute.[12,13] Low Apgar score in preterm infants may reflect physiologic immaturity rather than poor condition at birth, and a low Apgar score may also be caused by maternal drugs, infections, neurological diseases, and congenital anomalies.[14,15]

There are studies that have reported risk factors for perinatal asphyxia relating to maternal, obstetric, and foetal factors. However, the diverse factors and their influence on asphyxia, and available quality of health care varies in different settings and populations, which means different risk factors will predominate in different settings. Therefore, this study sought to investigate the prevalence and risk factors for Apgar score-defined perinatal asphyxia and the management outcome among inhospital-delivered babies at the Rivers State University Teaching Hospital (RSUTH) in Port Harcourt, Nigeria. Such data are needed to identify targets for intervention and improvement in the care of these babies.

Materials and Methods

Study site/area

This study was conducted at the Labour Ward and Special Care Babies Unit (SCBU) of the RSUTH, a tertiary hospital owned and funded by the Government of Rivers State. The hospital provides emergency obstetric services to women referred from other centres, as well as antenatal care and delivery services for low- and high-risk pregnant women booked with the hospital. The hospital has a qualified team comprising obstetricians, pediatricians, and anesthetists. After delivery, newborns were evaluated and the Apgar (Appearance-Pulse-Grimace-Activity-Respiration) score at the fifth minute was assessed; those with scores <7 were admitted to the SCBU for further resuscitation, evaluation, and the supportive management. Three levels of resuscitation are usually administered as necessary: Level 1 – only oxygen with Ambu bag is used, Level 2 – oxygen with Ambu bag and cardiopulmonary resuscitation (CPR), and Level 3 – oxygen with Ambu bag and CPR in addition to intravenous fluids and drugs.

Study design/population

A retrospective study was conducted over a three-year period, between January 1, 2018, and December 31, 2020. The study population included women whose inhospital-born babies had Apgar score of <7 at the fifth minute. A control group (matched for age, parity, and GA) comprising women whose inhospital-born babies had Apgar score ≥7 at the fifth minute was also selected. All outborn babies and those considered to have low Apgar score for reasons other than asphyxia, such as maternal opioid injections and general anesthesia; major congenital anomalies (e.g., neural tube defects, chromosomal disorders, and congenital neuromuscular disorders) and subarachnoid hemorrhage; all preterm babies (GA <37 weeks); and those with incomplete documentation were excluded. Gestational age for unbooked patients in our centre is estimated from their LNMP and/or from scan reports they come with.

Sampling method

All women with newborns having Apgar score <7 and complete data during the study period formed the case group of the study. For each mother recruited to the case group, a control matched for age, parity, and GA was selected, who was delivered within 48 h before or after the case mother. If no suitable control was found, the time lag was moved for another 48 h until a matched control was found.

Data collection

Data were retrieved from Labour Ward records, SCBU registers, and case folders of all the mothers using a structured pro forma. Information on outcome (dependent) variables such as birth asphyxia (Apgar score <7 at the fifth minute of birth), admission to SCBU, and predischarge mortality was extracted.

- Maternal factors: Maternal age (categorized into <20 years, 20–34 years, and ≥35 years), parity (categorized into para ≤1, para 2–4, and para ≥5), booking status (booked and unbooked), birth history (previous caesarean section [CS] or spontaneous vaginal delivery [SVD]), and maternal comorbidities (diabetes mellitus [DM]/gestational DM [GDM], hypertensive disorders of pregnancy, and anemia)
- Obstetric factors: Pregnancy complication (multiple pregnancy, breech presentation, malposition, and prolonged rupture of membranes [PROM]); type of labour (spontaneous, induction, or augmented); mode of delivery (SVD, vacuum, emergency, or elective CS [ELCS]); and complication of labour–prolonged labour (>20 h for primipara and >14 h for multipara), cephalopelvic disproportion (CPD), prolapsed cord, uterine rupture, precipitate labour, meconium-stained amniotic fluid, and foetal distress (foetal heart rate <100 or >160)
- Foetal factors: Gender of baby (male or female), birth weight (categorized into <2500 g, 2500–4000 g, and >4000 g), gestational age (categorized into 37–40 weeks and >40 weeks), placenta abnormalities (abruption, previa, and vasa previa), and placental weight.

Only Apgar score was used to define asphyxia, as we do not routinely measure umbilical cord arterial blood pH in the hospital. We defined the severity of asphyxia as moderate (Apgar score 4–6) and severe (Apgar score 0–3). For the case group, the Sarnat stage within the first 24 h, type of resuscitation, hospital outcome (death or discharged), and duration of hospital stay were noted. Only the clinical elements of the Sarnat staging were used, as electroencephalogram was not routinely done in all asphyxiated cases. Mild HIE (Sarnat I) is characterized by hyper-alertness and irritability, normal muscle tone, normal or hyperactive reflexes, ankle clonus, and no seizures. Moderate HIE (Sarnat II) includes lethargy, decreased spontaneous movements, proximal muscular weakness, depressed primitive reflexes, and seizures. Severe HIE (Sarnat III) includes stupor or coma, markedly reduced muscle tone or flaccidity, and absent primitive reflexes.

Data analysis

Coded data were entered into an Excel spreadsheet and exported to IBM (USA) SPSS version 20.0 for Windows© Software. Categorical measurements were given as numbers and percentages, and numerical measurements were given as mean and standard deviation (SD). The Chi-square test or Fisher's exact test and analysis of variance tests were used for the statistical analysis of noncontinuous and continuous variables as appropriate. Significant factors on bivariate analysis were entered into a multivariate logistic regression analysis to determine a significant association between birth asphyxia and possible risk factors, and statistical significance was set at $P < 0.05$ and confidence interval (CI) of 95%.

Results

During the three-year study period, there were 5979 live births, of which 75 babies had perinatal asphyxia, giving a prevalence of 12.5 per 1000 live births (complete records were found in 73 of them, so further analysis was based on the 73 cases with complete data). There was no significant difference in the mean maternal age ± SD (29.81 ± 5.38 and 29.92 ± 6.26), mean GA at delivery ± SD (38.29 ± 1.69 and 38.22 ± 1.54), and median parity (1 [0–5] and 1 [0–6]) between the case group and the control group.

Table 1 refers to the maternal characteristics of the study participants. Majority of the women in both the groups were between the ages of 20 and 34 years, with 56 (76.7%) in each group. Furthermore, majority were para 1 or less, 40 (54.8%) and 38 (52.1%); majority were booked mothers, 56 (76.7%) and 64 (87.7%); and majority were nulliparous or had a birth history of previous SVD, 71 (97.3%) and 67 (91.8%), respectively, for the case and control groups.

Table 2 shows a bivariate analysis of the maternal characteristics of the women as risk factors for perinatal asphyxia. There was no significant relationship between perinatal asphyxia and maternal age, parity, booking status, birth history, and maternal comorbidities.

Table 1: Maternal characteristics of the study participants

Variables	Cases (*n*=73), *n* (%)	Controls (*n*=73), *n* (%)	Total (*n*=146), *n* (%)
Maternal age category (years)			
<20	4 (5.5)	5 (6.8)	9 (6.2)
20-34	56 (76.7)	56 (76.7)	112 (76.7)
≥35	13 (17.8)	12 (16.4)	25 (17.1)
Fisher's exact test, *P*	0.215, 1.000		
Parity			
Para 0 and 1	40 (54.8)	38 (52.1)	78 (53.4)
Para 2-4	31 (42.5)	33 (45.2)	64 (43.8)
Para 5 or more	2 (2.7)	2 (2.7)	4 (2.7)
Fisher's exact test, *P*	0.247, 0.949		
Booking status			
Booked	56 (76.7)	64 (87.7)	120 (82.2)
Unbooked	17 (23.3)	9 (12.3)	26 (17.8)
χ^2, *P*	2.995, 0.084		
Birth history			
SVD	71 (97.3)	67 (91.8)	138 (94.5)
Previous CS	2 (2.7)	6 (8.2)	8 (5.5)
Fisher's exact test *P*	0.275		

SVD: Spontaneous vaginal delivery, CS: Caesarean section

Table 2: Maternal risk factors for perinatal asphyxia among babies of the women

Variables (*n*=146)	Perinatal asphyxia (Apgar score <7)		
	Cases, *n* (%)	Controls, *n* (%)	Total, *n* (%)
Maternal age category (years)			
<20	4 (44.4)	5 (55.6)	9 (100.0)
20-34	56 (50.0)	56 (50.0)	112 (100.0)
≥35	13 (52.0)	12 (48.0)	25 (100.0)
Fisher's exact test, *P*	0.215, 1.000		
Parity			
Para 0 and 1	40 (51.3)	38 (48.7)	78 (100.0)
Para 2-4	31 (48.4)	33 (51.6)	64 (100.0)
Para 5 or more	2 (50.0)	2 (50.0)	4 (100.0)
Fisher's exact test, *P*	0.247, 0.949		
Booking status			
Booked	56 (46.7)	64 (53.37)	120 (100.0)
Unbooked	17 (65.4)	9 (34.6)	26 (100.0)
χ^2, *P*	2.995, 0.084		
Birth history			
SVD	71 (51.4)	67 (48.6)	138 (100.0)
Previous CS	2 (25.0)	6 (75.0)	8 (100.0)
Fisher's exact test *P*	0.275		
Maternal comorbidity (*n*=8)			
GDM	0	1 (100.0)	1 (100.0)
PIH	0	2 (100.0)	2 (100.0)
RVD	1 (25.0)	3 (75.0)	4 (100.0)
Epilepsy	0	1 (100.0)	1 (100.0)
Fisher's exact test, *P*	2.512, 1.000		

SVD: Spontaneous vaginal delivery, CS: Caesarean section, GDM: Gestational diabetes mellitus, PIH: Pregnancy-induced hypertension, RVD: Retroviral disease

Figure 1 relates to the pregnancy complications among the study participants. The most common complication was postdate pregnancy found in 10 (constituting 41.7% of complications) and 5 (constituting 33.3% of complications) in the case group and control group, respectively. Other common findings were preeclampsia/eclampsia 5 (20.8%) and 1 (6.7%), foetal macrosomia 2 (8.3%) and 3 (20.0%), breech presentation 2 (8.3%) and 2 (13.3%), and twin gestation 0 and 2 (13.3%), in the case group and control group, respectively. Other pregnancy complications (APH, fibroid, GDM, oblique lie, transverse lie, placenta previa, and PROM) constituted 5 (20.8%) and 2 (3.3%) in cases and controls, respectively. Overall, complications were seen in 24 (32.9%) in the case group and 15 (20.6%) in the control group.

Table 3 shows the relationship of the pregnancy complications and the occurrence of perinatal asphyxia among the women. There was no significant association of perinatal asphyxia with postdate pregnancy, preeclampsia/eclampsia, foetal macrosomia, breech presentation, and twin gestation.

Figure 2 relates to the obstetric factors in the study participants. Majority of the women had spontaneous labour, 67 (97.1%) and 60 (100%) in the case and control groups, respectively. Those delivered by emergency CS (EMCS) were 45 (61.6%) and 28 (38.4%), respectively, and by ELCS were 2 (2.7%) and 12 (16.4%), in the case and control groups, respectively. Figure 3 relates to the common labour complications seen in the women. Foetal distress was found in 44(89.8% of complications) and 7(25.9%) among the case and control groups respectively. CPD was seen in 3 (6.1%) and 8 (29.6%) and prolonged labour 0 and 11 (40.8%), respectively. Other complications (failed induction, malpresentation, and uterine rupture) were seen in 2 (4.0%) and 1 (3.7%) in cases and controls, respectively. Overall, labour complications were seen in 49 (67%) of the case group and 27 (37%) of the control group.

The relationship between these obstetric factors and perinatal asphyxia is shown in Table 4. There was a significant finding of perinatal asphyxia and mode of delivery ($P = 0.003$), foetal distress ($P = 0.0001$), and prolonged labour ($P = 0.001$). However, following multiple logistic regression [Table 5], only foetal distress remained significantly associated with perinatal asphyxia (odds ratio [OR] = 19.9, 95% confidence interval [6.53–60.64], $P = 0.0001$).

Table 6 refers to the foetal characteristics of the babies. Majority were males, 47 (64.4%) and 37 (50.7%) in both the groups, and had a birth weight range of 2500 g–4000 g, 58 (79.5%) and 64 (87.7%) in both the groups. The GA at delivery was 37–40 weeks in 65 (89.0%) and 66 (90.4%) in both the groups, respectively, while the placenta weight was ≥600 g, 49 (67.1%) each in both the groups. Placenta was normal in 70 (95.9%) and 72 (98.6%), respectively, for the case and control groups. The differences between the case and control groups were not statistically significant, as shown by the bivariate analysis of these factors as risk factors for perinatal asphyxia.

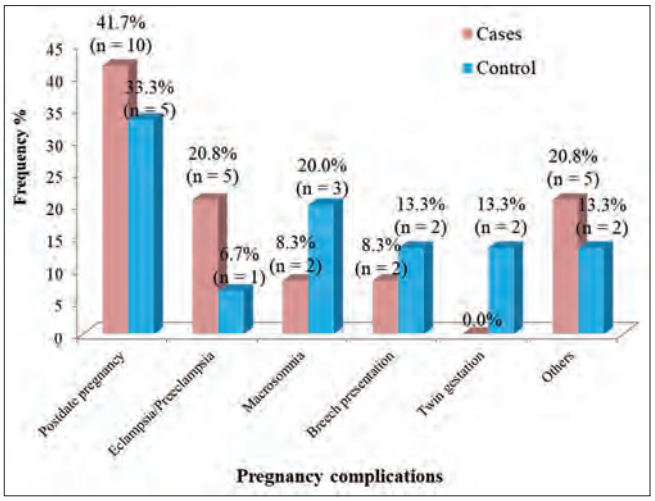

Figure 1: Pregnancy complications among the study participants

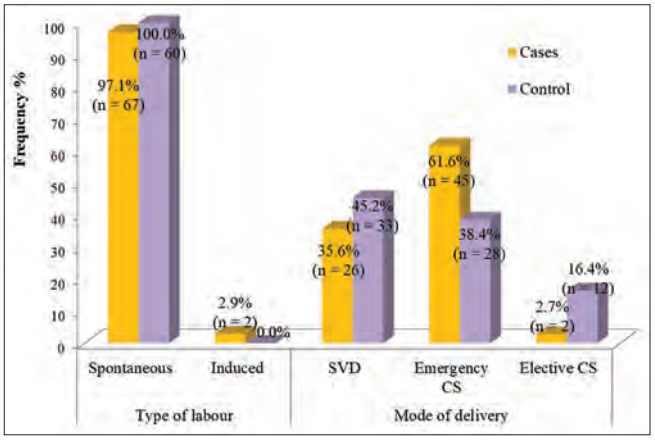

Figure 2: Obstetric factors among the study participants. SVD: Spontaneous vaginal delivery, CS: Caesarean section

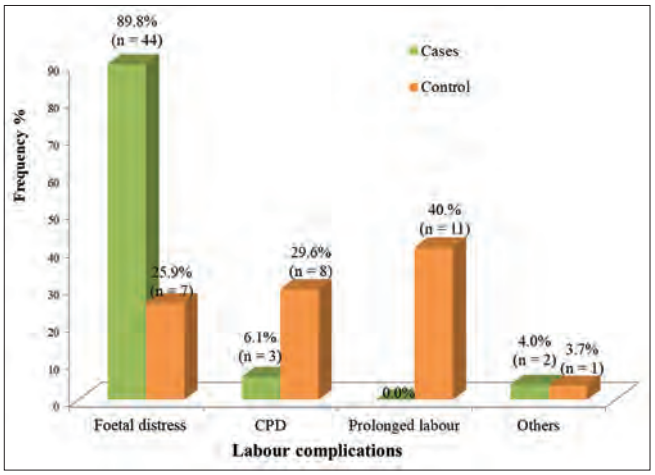

Figure 3: Labour complications among women delivering at RSUTH. RSUTH: Rivers State University Teaching Hospital

Table 7 refers to the management outcomes in the asphyxiated babies of the women. Of the 73 babies, 12 were discharged against medical advice and 8 were referred out to another

Table 3: Pregnancy complication and perinatal asphyxia among babies of the women

Variables (n=146)	Perinatal asphyxia (Apgar score<7)		
	Cases, *n* (%)	Controls, *n* (%)	Total, *n* (%)
Postdate pregnancy			
Yes	10 (66.7)	5 (33.3)	15 (100.0)
No	63 (48.1)	68 (51.9)	131 (100.0)
χ^2, *P*	1.858, 0.173		
Eclampsia			
Yes	5 (83.3)	1 (16.7)	6 (100.0)
No	68 (48.6)	72 (51.4)	140 (100.0)
Fisher's exact test *P*	0.209		
Macrosomia			
Yes	2 (40.0)	3 (60.0)	5 (100.0)
No	71 (50.4)	70 (49.6)	141 (100.0)
Fisher's exact test *P*	1.000		
Breech presentation			
Yes	2 (50.0)	2 (50.0)	4 (100.0)
No	71 (50.0)	71 (50.0)	142 (100.0)
Fisher's exact test *P*	1.000		
Twin gestation			
Yes	0	2 (100.0)	2 (100.0)
No	73 (50.7)	71 (49.3)	144 (100.0)
Fisher's exact test *P*	0.497		

Table 4: Obstetric risk factors for perinatal asphyxia among babies of the women

Variables (n=146)	Perinatal asphyxia (Apgar score<7)		
	Cases, *n* (%)	Controls, *n* (%)	Total, *n* (%)
Type of labour (n=129)			
Spontaneous	67 (52.8)	60 (47.2)	127 (100.0)
Induced	2 (100.0)	0	2 (100.0)
Fisher's exact test *P*	0.499		
Mode of delivery (n=146)			
SVD	26 (44.1)	33 (55.9)	59 (100.0)
Emergency CS	45 (61.6)	28 (38.4)	73 (100.0)
Elective CS	2 (14.3)	12 (85.7)	14 (100.0)
χ^2, *P*	11.932, 0.003*		
Labour complications (n=146)			
Foetal distress			
Yes	44 (86.3)	7 (13.7)	51 (100.0)
No	29 (30.5)	66 (69.5)	95 (100.0)
χ^2, *P*	41.254, 0.0001*		
CPD			
Yes	3 (27.3)	8 (72.7)	11 (100.0)
No	70 (51.9)	65 (48.1)	135 (100.0)
χ^2, *P*	2.458, 0.117		
Prolonged labour			
Yes	0	11 (100.0)	11 (100.0)
No	73 (54.1)	62 (45.9)	135 (100.0)
χ^2, *P*	11.896, 0.001*		

*Statistically significant (*P*<0.05). SVD: Spontaneous vaginal delivery, CS: Caesarean section, CPD: Cephalopelvic disproportion

hospital for lack of bed space, which led to their exclusion. The remaining 53 cases either died or were discharged after hospitalization. Of these, 17 babies died, giving a case fatality of 32.1%, while 36 (67.9%) recovered and were discharged. Majority of the babies, 30 (41.1%), were classed as HIE ≤1 by Sarnat staging within 24 h and majority, 35 (47.9%), received maximum resuscitation, with oxygen/Ambu bag, CPR, and IV fluids and drugs. Majority had duration of hospital stay of 7–14 days 27 (75.0%). The mean duration of hospital stay ± SD was 7.00 ± 5.24 days, with a median of six days and a range of 1–23 days.

Table 8 shows the risk factors for predischarge mortality of the asphyxiated babies. There was a statistically significant association, on bivariate analysis, between mortality and severity of Apgar score (P = 0.032), Sarnat stage in 24 h (P = 0.0001), and level of resuscitation received (P = 0.0001), however, following multiple logistic regression, only Sarnat staging remained a significant risk factor for mortality (OR = 195.00, 95% CI [11.06–3437], P = 0.0001).

Discussion

This study describes the prevalence and outcome of perinatal asphyxia among term babies delivered at the RSUTH. A matched case–control study using multivariate logistic regression was done to address possible confounders for risk estimates. There were, therefore, no significant differences when both the groups were compared in terms of the mean maternal age, mean GA at delivery, and median parity.

The prevalence of perinatal asphyxia in this study was 12.5 per 1000 live births. While this is higher than the reported 2 per 1000 in the developed world,[10] and 6 per 1000 term births reported from Nepal,[16] it is lower than figures reported in many studies in Nigeria and beyond. The only previous study in our centre by West and Opara[17] reported 63 per 1000 live births. That study included outborn babies and preterm births, and reports data that is a decade old, and cannot represent the current level of obstetrics care in our hospital. Much higher figures of 28 per 1000 in Warri[18] and 100 per 1000 in Ilesha,[19] both in Nigeria, and 80.5 per 1000 in Cameroon[20] have been reported. The variations in the reported prevalence may be attributed to differences in the definitions of perinatal asphyxia and methodology used or differences in the resources and availability of skilled workforce in the study facilities.

Some other studies have reported the prevalence of perinatal asphyxia as a proportion of total admissions to their neonatal intensive care units and not as proportion of live births. Examples are the report of 18% from northern Ethiopia[21] and 21.1% reported from Gusau, Nigeria.[22] The lack of uniformity in the reportage of prevalence of perinatal asphyxia makes comparison with findings of some studies rather difficult. However styled, these rates are high, compared to developed countries, and reveal a slow change in the prevailing suboptimal circumstances in the developing world.

Table 5: Multiple logistic regression showing obstetric factors associated with perinatal asphyxia among babies of the women

Factors	Coefficient (B)	OR	95% CI	*P*
Foetal distress				
Yes	2.991	19.901	6.53-60.64	0.0001*
No^R		1		
Mode of delivery				
SVD/elective CS	0.525	1.691	0.65-4.41	0.283
Emergency CS^R		1		

*Statistically significant (P<0.05). OR: Odds ratio, CI: Confidence interval, SVD: Spontaneous vaginal delivery, CS: Caesarean section

Table 6: Foetal risk factors for perinatal asphyxia among babies of the women

Variables (n=146)	Perinatal asphyxia (Apgar score<7)		
	Cases, *n* (%)	Controls, *n* (%)	Total, *n* (%)
Sex of neonate			
Male	47 (56.0)	37 (44.0)	84 (100.0)
Female	26 (41.9)	36 (58.1)	62 (100.0)
χ^2, *P*	2.803, 0.094		
Birth weight (g)			
<2500	6 (60.0)	4 (40.0)	10 (100.0)
2500-4000	58 (47.5)	64 (52.5)	122 (100.0)
>4000	9 (64.3)	5 (35.7)	14 (100.0)
χ^2, *P*	1.838, 0.399		
Gestational age at delivery (weeks)			
≤40	65 (49.6)	66 (50.4)	131 (100.0)
>40	8 (53.3)	7 (46.7)	15 (100.0)
χ^2, *P*	0.074, 0.785		
Placenta weight (g)			
<600	24 (50.0)	24 (50.0)	48 (100.0)
≥600	49 (50.0)	49 (50.0)	98 (100.0)
χ^2, *P*	0.000, 1.000		
Abnormal placentation			
None	70 (49.3)	72 (50.7)	142 (100.0)
Placenta previa	3 (75.0)	1 (25.0)	4 (100.0)
Fisher's exact test *P*	0.620		

Table 7: Findings on admission and management outcome in asphyxiated babies

Variables (n=73)	Frequency (%)
Predischarge mortality (n=53)	
Yes (died)	17 (32.1)
No (discharged)	36 (67.9)
Sarnat staging on admission evaluation (n=73)	
HIE I	30 (41.1)
HIE II	23 (31.5)
HIE III	20 (27.4)
Type of resuscitation received	
Oxygen/Ambu bag	3 (4.1)
Oxygen/Ambu bag+CPR	35 (47.9)
Oxygen/Ambu bag+CPR+IVF/D	35 (47.9)
Duration of hospital stay for discharged babies (days) (n=36)	
<7	4 (11.1)
7-14	27 (75.0)
>14	5 (13.9)

CPR: Cardiopulmonary resuscitation, IVF/D: Intravenous fluids/drugs, HIE: Hypoxic-ischemic encephalopathy

Table 8: Risk factors for predischarge mortality of asphyxiated babies of the women

Variables (n=53)	Predischarge mortality		
	Yes (died), *n* (%)	No (discharged), *n* (%)	Total, *n* (%)
Apgar score			
0-3 (severe birth asphyxia)	4 (80.0)	1 (20.0)	5 (100.0)
4-6 (moderate birth asphyxia)	13 (27.1)	35 (72.)	48 (100.0)
Fisher's exact test *P*	0.032*		
Sarnat staging			
HIE I	0	21 (100.0)	21 (100.0)
HIE II	2 (12.5)	14 (87.5)	16 (100.0)
HIE III	15 (93.8)	1 (6.2)	16 (100.)
χ^2, *P*	40.665, 0.0001*		
Type of resuscitation received			
Oxygen/Ambu bag	0	3 (100.0)	3 (100.0)
Oxygen/Ambu bag+CPR	1 (5.0)	19 (95.0)	20 (100.0)
Oxygen/Ambu bag + CPR + IVF/D	16 (53.3)	14 (46.7)	30 (100.0)
Fisher's exact test, *P*	14.478, 0.0001*		

*Statistically significant. CPR: Cardiopulmonary resuscitation, IVF/D: Intravenous fluids/drugs, HIE: Hypoxic-ischemic encephalopathy

The most significant risk factor for perinatal asphyxia in this study was foetal distress in labour. Babies who had foetal distress during labour were about 20 times more likely to develop perinatal asphyxia at birth. Foetal distress has also been reported as a significant risk factor in other studies.[16,23] In addition, on bivariate analysis, we found prolonged labour and mode of delivery (EMCS) to be associated with perinatal asphyxia, as was the finding by others studies,[20,23,24] but these risk factors were not statistical significance on further multivariate analysis. The risk of prolonged labour resulting in perinatal asphyxia was also not significant in some other studies.[22,25] The difference lies in the study methodology used, the study participants, and how possible confounders were eliminated. Likewise, some studies have reported a strong relationship between EMCS and birth asphyxia.[20,23,24,26] In this study, foetal distress was responsible for most of the EMCS in the asphyxiated group.

This study did not find maternal age, parity, booking status, previous birth history, and medical comorbidities as significant maternal risk factors for perinatal asphyxia. Like this study,

primiparity was observed to be common but not a significant risk factor by other studies.[22,24,25] Unbooked status have also been observed as common with perinatal asphyxia in some studies.[18,22,24,25] Our study, like that of West and Opara,[17] had majority of the mothers as booked. It may also be explained by the fact that most of these unbooked women would have received informal antenatal care at one point during their pregnancy. Likewise, we did not find any statistically significant association between pregnancy complications and risk of perinatal asphyxia. Preeclampsia and eclampsia have, however, been reported as significant risk factors in some studies.[20,27]

The gender, birth weight, placenta weight, and abnormal placentation were all not significant risk factors for perinatal asphyxia in this study. Like this study, other studies have found perinatal asphyxia to occur mostly in males than females, although no statistically significant relationship was established.[17,26,27] Badawi *et al*. had earlier reported that the male sex increased the risk of occurrence of birth asphyxia by 50%, with no known cause-to-effect relationship given.[28] Johnston and Hagberg had reasoned that the female sex hormones (estrogen) enhance their protection against anoxic-ischemic damage.[29]

Our case fatality rate from perinatal asphyxia of 32% (17/53) was unacceptably higher than reports from other similar low-resource settings. This was notably higher than the 16.6% reported a decade ago at our centre by West and Opara.[17] It is also higher than reports of 14.7% from Nasarawa,[30] 15.7% from Benin,[31] 20.8% from Ilesha,[19] 25.5% from Gusau,[22] and 27.3% from Warri,[18] all in Nigeria. Our case fatality was, however, lower than figures of 37.5% reported from northern Ethiopia,[21] 40.6% from Sri Lanka,[32] and 62.5% from Tanzania.[33] This finding has serious implications and signifies challenges with acute care of asphyxiated newborns in our centre. The patient-to-health-care staff ratios are high in our setting, there is dearth of continuous monitoring devices and mechanical ventilators, and local health expenditure is primarily out of pocket, with most parents unable to provide needed medications and oxygen. Improvement in the case fatality ratio in our centre can only result from increase in health-care workforce, appropriate training and retraining, and provision of more continuous monitoring devices and mechanical ventilators.

This study also found a statistically significant association between the Sarnat staging in the first 24 h and the risk of predischarge mortality, with those with score of Sarnat III having odds of 195 times of dying. The severity of asphyxia by Apgar score as risk of mortality was significant on bivariate analysis but lost its significance on multivariate analysis. Other studies have also reported that most deaths occurred in babies with Sarnat Stage III asphyxia.[21,34]

Limitations

This study was retrospective, so data on long term outcomes were unavailable, notably post discharge morbidity and mortality. Further studies with long term follow up will be required to validate these findings. Another limitation was the fact that a good proportion of cases were referred out for lack of bedspace or were discharged against medical advice and were excluded in the analysis of outcome. These factors are unlikely to abate except the health budgets are improved. Furthermore, the data were from a single institution and cannot be generalized. Measurement of foetal arterial blood gases, a stricter and more precise way to define perinatal asphyxia, was not available in our centre, and we had to rely on Apgar score alone for diagnosis, which has been found to be unreliable in predicting outcomes.[35] However, because Apgar score is used globally, is easy to learn by all cadres of birth attendants, and does not require sophisticated equipment, it will continue to be relied upon in resource-poor settings.

Conclusion

This study has shown that perinatal asphyxia is a common clinical problem in the RSUTH, with a high mortality rate. The most significant risk factor was foetal distress in labour, and the Sarnat stage at 24 h was a significant determinant of mortality. The risk can largely be reduced with good obstetric intervention in terms of adequate foetal monitoring during pregnancy and labour, identifying cases likely to develop foetal distress in labour and delivering them by ELCS. There is also the need to expand our neonatal intensive care unit and invest in electronic monitoring devices and mechanical ventilators toward reducing the mortality from perinatal asphyxia and achieving the target of the millennium development goals (MDG) 4.

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Conflicts of interest

There are no conflicts of interest.

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