

CLINICAL PROFILE AND SHORT-TERM OUTCOME OF ASPHYXIATED INFANTS: A PROSPECTIVE STUDY IN SOUTH-WESTERN, NIGERIA

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ABSTRACT

Background: Perinatal asphyxia is a leading cause of neonatal morbidity and mortality worldwide but with a relatively higher burden in the developing countries.

Aims: To determine the prevalence and outcome of perinatal asphyxia among the participants. Also, possible factors associated with neurodevelopmental delay in infancy were evaluated.

Method: This was a prospective observational study of all asphyxiated neonates admitted into the Neonatal Intensive Care Unit (NICU) of Mother and Child Hospital, Akure from January 2014 to December 2015. They were followed up till the age of 6 months. Data on socio-demographic characteristics, clinical features and outcomes of the participants were documented and analysed. Odd ratio (OR) and 95% confidence interval (CI) were computed for predictors of neurodevelopmental delay. P value < 0.05 was considered significant.

Results: Of the 1,749 babies admitted into the NICU, 125 had features of perinatal asphyxia giving a prevalence of 7.2%. Seventy-four of the babies were males and 51 were females giving a male: female ratio of 1.5:1. Spontaneous vertex delivery (47.2%) and emergency lower segment Caesarean section (30.4%) were the commonest routes of delivery. Prolonged labour was a major risk factor for asphyxia. Factors significantly associated with poor neonatal outcome include male gender (OR= 3.24, 95% CI = 1.02-10.35) and 5-minute APGAR < 5 (OR=4.36, 95% CI= 1.61-11.79). Also, low Apgar score (p=0.004, OR= 3.37, 95% CI = 1.45-7.82) and low birth weights (p = 0.05, OR = 2.46, 95% CI = 0.99-6.12) were associated with delayed developmental milestones in infancy.

Conclusion: The prevalence of asphyxia in the current study was 7.2%; the major risk factor was prolonged labour and mortality rate was 9.7% while 10% had delayed developmental milestone at 6 months of life.

Keywords: Clinical profile, outcome, Perinatal Asphyxia, Mother and Child Hospital.

INTRODUCTION

Perinatal asphyxia is a global problem occurring in the neonatal period.^{1,2} It is a well-recognized clinical entity that confront obstetricians and neonatologists almost daily.² It significantly contributes to the high morbidity and mortality observed in the under five children.¹ Approximately 4 million babies die before they reach the age of 1-month³ (reduced by 35 % in the year

2011)⁴ and 99% of these neonatal deaths take place in the developing countries where perinatal asphyxia contributes to almost 23% of these deaths.³

Severe perinatal asphyxia is also a known major cause of chronic neurological disability in survivors.² Asphyxia is defined as the inability of the newborn to initiate and sustain adequate respiration following complete separation from mother at delivery.⁵ It is a condition in which pulmonary or placental gas exchange is disrupted, leading to progressive hypoxemia, which is severe enough to be associated with acidosis.² The American College of Obstetricians and

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Gynecologists and the American Academy of Pediatrics assign a neonate to be asphyxiated if the following conditions are fulfilled: Umbilical cord arterial pH <7; Apgar score of 0-3 for longer than 5 minutes; neurological manifestations (e.g., seizures, coma, or hypotonia); and multisystem organ dysfunction, involving cardiovascular, gastrointestinal, hematological, pulmonary or renal system.^{1,6}

The contribution of perinatal asphyxia to neonatal mortality and other child health indices has not been previously evaluated in our free health care facility. It is desirable to evaluate the burden of asphyxia in our setting in order to aid comparison with fee-paying facilities elsewhere. Therefore, the current study aims to determine the prevalence, risk factors and short-term outcome of asphyxiated neonates in Mother and Child Hospital Akure (MCHA), south-western Nigeria.

METHODS

Study Setting and Participants: The study was carried out at the Mother and Child Hospital, Akure (MCHA). It is a busy 100-bedded (60 obstetrics and 40 Paediatric beds), ultra-modern public facility with level II Neonatal Intensive Care Units (NICU). It provides specialized free and effective health care services for children aged 0-5 years and pregnant mothers in Ondo state, ally communities and neighbouring states in the South-Western Nigeria and sometimes as far as the Northern and Southern parts of the nation in area of maternal and child health. Akure is the state capital of Ondo State, located in the South-West geo-political zone of Nigeria with land area of 15,000 square kilometre and has a long coastal line. All asphyxiated neonates with Apgar score of ≤ 3 at one minute, ≤ 5 at five minutes and those with neurological depression using the Sanart and Sanart criteria for Asphyxia were recruited.⁷

This was a prospective observational survey. Ethical clearance was obtained from the Research and Ethics committee of the MCHA and verbal consent was obtained from parents of the participants. Each baby was followed up till discharge and 6 months

of life; poor outcome defined by mortality and delayed developmental milestone.

Data Collection: Baseline data of the participants such as gestational age, sex, birth weight, parity of mother, booking status, source of referral, duration of labour and mode of delivery were documented in a microsoft excel sheet. They were followed up till the age of 6 months in the Consultant Out-Patient Clinic of the centre. Also, follow up data of the infants including developmental milestones were recorded. Neck control was sought at 3 to 4 months of life. It was not there even at 6 months. Sitting with support at least at 5 to 6 months was absent even at 6 months. The total number of deliveries and live births during the study period were obtained from the hospital delivery register.

Data Analysis: The data were analyzed using SPSS version 20.0 statistical software for Windows (IBM, Armonk, N.Y., United States). The place of delivery, asphyxia risk factors and clinical-laboratory features of the infants were presented frequency tables. Proportions were computed. The mean (\pm standard deviation) of their birth weights were calculated. Using multiple logistic regression analysis, odd ratio (OR) and 95% confidence Interval (CI) were calculated for variables that may be associated with poor outcome including developmental delay. The level of significance was considered as $p < 0.05$.

RESULTS

General characteristics of the study subjects

The total delivery during the study period was 11,677 with 11,546 live births and there were 563 cases of intrauterine fetal deaths (IUFDs) from various causes. Of the 1,749 babies admitted into the SCBU, 125 had features of perinatal asphyxia giving a prevalence of 7.2% (10.8/1000 live birth). Seventy-four of the babies were males and 51 were females giving a male: female ratio of 1.5:1.

All the babies were recruited within 30 minutes of delivery. The mean birth weight of the babies was 2944.8 ± 652.6 g, with a range of 1500 to 5200g. Fifty one (40.8%) of the

mothers of these babies had antenatal care in places other than the mother and child hospital, while 2 (1.6%) did not receive any form of antenatal care and 48 (38.4%) had prolonged rupture of membrane. Majority of the mothers (56.8%) were multiparous while 51 (40.8%) and 3 (2.4%) were primiparous and grandmultiparous respectively.

Table 1 shows there is no significant association between perinatal asphyxia and place of antenatal care. Of the 125 babies, 59 (47.2%) were delivered by spontaneous vertex delivery (SVD), 38 (30.4%) by emergency lower segment Caesarean section (EMLSCS), 6 (4.8%) by elective Caesarean section, 4 (3.2%) by breech extraction and the remaining had instrumental delivery. Moderate Perinatal Asphyxia (APGAR score of 4-5 at one minute of life) was documented in 12 (9.6%) while Severe Perinatal Asphyxia (SPA; APGAR score of ≤ 3 at one minute of life or ≤ 5 at 5 minutes) was noted in 113 (90.4%) of the babies. Of the 12 babies who had Moderate Perinatal Asphyxia (MPA), Nine (75%) were delivered by SVD while the remaining were delivered by EMLSCS. Although a higher proportion of babies delivered by SVD compared with those delivered by EMLSCS had moderate perinatal asphyxia, this difference was not statistically significant ($p=0.102$).

Risk factors for perinatal Asphyxia

The Risk factors for perinatal Asphyxia among neonates with MPA and SPA are as shown in Table 2. Prolonged labour was the most common maternal risk factor for both MPA and SPA while fetal distress was the most common fetal risk factor among babies with SPA. No documented fetal risk factor among babies with MPA.

The clinical features seen in neonates with Perinatal Asphyxia

The clinical features seen in the babies are as shown in Table 3. Seizure is the commonest clinical feature documented in babies with SPA. Thirty seven (29.6%) of the 125 babies who presented with features of asphyxia had features of Hypoxic ischemic encephalopathy (HIE). Thirty (81.1%) had HIE stage 2 and the remaining had HIE stage 3.

Factors associated with poor neonatal

outcome and developmental delay

Eleven (9.7%) of the severely asphyxiated infants died but no death was recorded among the babies with moderate asphyxia ($p < 0.001$). All neonates (100%) who recovered from asphyxia within 24 hours as well as 85.5% of those who recovered in the early neonatal period attained normal developmental milestones at 6 months of life. Table 4a&b show that factors significantly associated with poor neonatal outcome in asphyxiated infants include male gender (OR= 3.24, 95% CI = 1.02-10.35) and 5-minute APGAR < 5 (OR=4.36, 95% CI = 1.61-11.79). Also, the latter variable was associated with a triple fold increase in the occurrence of developmental delay in infancy ($p=0.004$, OR= 3.37, 95% CI = 1.45-7.82); likewise, birth weight < 2.5 kg was associated delayed milestones ($p = 0.05$, OR = 2.46, 95% CI = 0.99-6.12). Only gender, mode of delivery and Apgar score were still significantly associated with poor outcome on multiple logistic regression analysis. Gestational age (GA) and prolonged rupture of membrane (PROM) did not have a significant relationship with neonatal outcome and neurodevelopment of the participants ($p > 0.05$). Strabismus occurred in 3.5% of the severely asphyxiated infants.

TABLE 1: RELATIONSHIP BETWEEN TYPE OF PERINATAL ASPHYXIA AND PLACE OF ANTENATAL CARE

Place of antenatal clinic visit	No of babies	MPA (Total=12)		SPA (Total=113)		p value
		No	%	No	%	
MCH	72	6	50.0	66	58.4	0.575
PHC	28	4	33.4	24	21.2	0.554
CHC	15	1	8.3	14	12.4	1.000
Others (BHC, GH, self)	10	1	0.8	9	7.2	0.700

NB: MCH; Mother and Child Hospital, PHC; Primary Health Centre, CHC; Comprehensive Health centre, BHC; Basic Health Centre, GH; General Hospital

TABLE 2: RISK FACTORS FOR PERINATAL ASPHYXIA AMONG THE ASPHYXIATED NEONATES

Risk factors	Perinatal asphyxia (N=125)	
	n	%
Maternal		
Prolonged labour	51	40.8
Delayed second stage	8	6.4
Previous scar	7	5.6
Co-existing fibroid	2	1.6
PIH/Eclampsia	4	3.2
APH	13	10.4
Fetal		
Fetal distress	11	8.8
Malpresentation	5	4.0
Multiple gestation	4	3.2
Cord prolapsed	1	0.8
Cephalopelvic disproportion	4	3.2

NB: MPA = Moderate Perinatal Asphyxia, SPA= Severe Perinatal Asphyxia, APH= Antepartum Haemorrhage, PIH= Pregnancy Induced Hypertension.

TABLE 3: CLINICAL-LABORATORY FEATURES OF THE NEONATES

Clinical Features	Perinatal asphyxia (N=125)	
	n	%
Seizures	24	19.2
Bleeding disorders	12	9.6
Metabolic derangement	3	2.4
Respiratory distress	5	4.0
Recurrent Apnoea	3	2.4
Temperature instability	3	2.4

TABLE 4a: FACTORS ASSOCIATED WITH POOR OUTCOME AMONG THE PARTICIPANTS

Factors	Frequency (%)	χ^2	OR	95% CI	P
Gestational age					
Preterm	4(25)	1.106	1.94	0.56-6.76	0.286
Term/post-term	16(14.7)				
Gender					
Male	16(21.6)	4.265	3.24	1.02-10.35	0.048
Female	4(7.8)				
Mode of delivery					
Others	17(19.5)	2.669	2.45	0.84-5.95	0.102
EMLSCS	3(7.9)				
Booked in MCHA					
Book	11(15.3)	0.066	1.13	0.43-2.97	0.810
Unbook	9(17.0)				
PROM					
Positive	11(22.9)	2.774	2.25	0.85-5.91	0.132
Negative	9(11.7)				
Parity					
Primiparous	9(17.6)	0.174	1.23	0.47-3.22	0.677
Multiparous	11(14.9)				
Apgar score @ 5mins					
<5	11(32.4)	9.293	4.36	1.61-11.79	0.002
5 and above	9(9.9)				

PROM = prolonged rupture of membrane

TABLE 4b: MULTIVARIATE LOGISTIC REGRESSION ANALYSIS FOR POOR OUTCOME BY SELECTED CLINICAL FEATURES

Variables	Regression coefficient	p-value	Odds ratio (OR)	95% CI for OR
Gestational age	0.519	0.59	1.68	0.25 11.31
Birth weight	0.873	0.29	2.39	0.47 12.18
Gender	1.697	0.02	5.46	1.33 22.46
Mode of delivery	1.631	0.04	5.11	1.08 24.21
Apgar score	1.661	0.01	5.27	1.53 18.12

DISCUSSION

The prevalence of perinatal asphyxia in the current study is 7.2% (10.8 per 1000 live births). This prevalence is higher than values from resource-rich countries; Europe (1 per 1000 live birth),⁸ America (1-8 per 1000 live birth)⁹ and Asia (2.8%).¹⁰ Babies delivered in our setting compared with those from resource rich setting are not exposed to advanced resuscitation facilities and were likely to have had some pregnancies managed by poorly skilled birth attendant coupled with out of pocket payment for health care sourcing which may result in delay in referral for high risk pregnancy. This may be corroborated by the documentation of a lower prevalence of 4.7% in South Africa, the same continent as ours, where Padayachee and Ballot had majority of their recruited babies with mothers who had antenatal care in the facility of study.¹¹ The prevalence in the current study was comparable to that reported by Babu et al¹² in India where term babies were also recruited but lower than the prevalence documented in other developing country like ours as well as different regions within Nigeria. Aluvaala et al¹³ in Kenya in 2015 reported a prevalence of 30% in five Kenyan hospitals, so also other studies in Nigeria; Port-Harcourt (24.9 % or 63 per 1000 live birth),¹⁴ Enugu (30%),¹⁵ Jos (11.5%),¹⁶ Gusau (21.1%),¹ Ife (14.2%)¹⁷ and Warri (32%).¹⁸ Majority of these studies unlike the present study recruited babies delivered outside the health facilities as well as low birth weight babies.

Prolonged obstructed labour, delayed second stage of labour, antepartum hemorrhage (APH), pregnancy-induced hypertension (PIH), pre-eclampsia, eclampsia and prolonged rupture of membranes have been associated with increased risk of birth asphyxia in multiple hospital-based studies.^{1, 2, 12, 14} In our study, prolonged labour was noted among 25% of the moderately and 42.5 % of the severely asphyxiated babies. This calls for introduction of the partograph in all facilities where labour is being monitored as well as training of birth attendants on the use of this instrument as this will guarantee a more judicious use of the instrument thereby making an allowance for earlier interventions and reduction of asphyxia rates.

The overall Caesarean section rate of 35.2% in the current study is well above the World Health Organization (WHO)¹⁹ recommended rate of 15%. This finding is explained by the fact that the centre is a referral hospital for all complicated cases from neighbouring hospitals. Forty-two percent of the mothers registered their pregnancy in places other than MCHA (p-value = 0.6). Similar higher Caesarean rates have been documented in other Nigerian studies for similar reasons.²⁰⁻²²

The most common foetal risk factor among babies with SPA was foetal distress and this could also have contributed to the high rate of surgical intervention in the present study.

The major consequence of perinatal asphyxia is hypoxic ischaemic encephalopathy (HIE), neurological sequel or death. In the current study, mortality rate was 9.7% among the SPA while none died among MPA. This rate is lower than other earlier studies in the country probably due to the fact that our study was mainly on the in-born babies.^{14, 16, 17, 23}

Seven babies (6.2%) left the hospital against medical advice perhaps to seek alternative medical and spiritual help following slow recovery and the outcome of such babies could not be ascertained. Apart from the four babies (3.5%) lost to follow up, about 9% of the babies followed up till 6 months post discharge had neurologic sequel of delayed developmental mile stone when monitored. While the number of babies followed up in the present study may be too small to draw adequate conclusion on neurological sequelae following asphyxia, rates of cerebral palsy following neonatal encephalopathy has been reported to be about 10%-13% among survivors of moderate to severe encephalopathy in developed settings.^{24, 25}

Conclusion: The prevalence of perinatal asphyxia in the current study is lower than the range previously reported in Nigeria but higher than figures from the developed world. Prolonged labour was the major risk factor while major sequel of asphyxia occurred in babies whose recovery was after one week.

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