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ANTENATAL AND INTRAPARTUM RISK FACTORS FOR BIRTH ASPHYXIA AMONG EMERGENCY OBSTETRIC REFERRALS IN MULAGO HOSPITAL, KAMPALA, UGANDA

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ABSTRACT

Background: Many perinatal deaths follow birth asphyxia that occurs in newborn babies of women who are referred on developing life-threatening obstetric complications.

Objective: To determine the antenatal and intrapartum risk factors for severe birth asphyxia among babies delivered by women admitted as emergency obstetric referrals.

Design: Case-control study.

Setting: Mulago hospital, the National Referral Hospital, Kampala, Uganda.

Subjects: Cases were newborn term babies (and their mothers) with a 5-minute Apgar score 4 or less (birth asphyxia). Controls were term newborn babies with a 5-minute Apgar score more than 4.

Main outcome measures: Antepartum and intrapartum risk factors among newborn babies (and their mothers) from socio-demographic characteristics, obstetric complications or labour management. The Odds ratios (OR) for various outcomes were calculated using the Statistical Assistance Software (SAS) version 6.2 (Windows), and are presented with their 95% confidence intervals (CI) and p-values.

Results: There was no association between socio-demographic factors and birth asphyxia. Antepartum hospitalization, antepartum or intrapartum anaemia, antepartum hemorrhage and severe pre-eclampsia/eclampsia were significantly associated with birth asphyxia; the respective ORs and 95% CI were 1.73 (1.09-2.75), 5.65 (3.36-9.50), 2.12 (1.11-4.05) and 10.62 (2.92-38.47). Augmentation of labour with oxytocin, premature rupture of membranes, meconium staining of liquor amnii, vacuum extraction, caesarean section, low birth weight and mal-presentations were significantly associated with birth asphyxia with ORs of 5.76 (2.20-15.05), 2.23 (1.31-3.37), 6.40 (2.76-14.82), 2.16 (1.28-3.67), 2.36 (1.07-5.20) and 6.32 (3.57-11.20) respectively.

Conclusions: Early recognition of these complications among emergency obstetric referrals, followed by prompt and appropriate management, may reduce the perinatal deaths from birth asphyxia.

INTRODUCTION

Many perinatal deaths occur among babies of women who are referred on developing life-threatening obstetric complication(1). These deaths could be prevented if emergency obstetric care was instituted promptly(2). Many of these deaths follow intrapartum asphyxia, which predisposes these babies further to hypoglycaemia, hypothermia, electrolyte imbalance and neonatal septicaemia. There is currently an increasing interest in causal pathways to the brain and other organ pathology in infants born at term and preterm, with birth asphyxia and who are at risk of cerebral encephalopathy (3).

The factors that predispose a foetus to birth asphyxia may act on the fetus in utero, thereby affecting the intrauterine development (3), act during labour or act in the immediate postpartum period. The factors

acting in utero include maternal illness (such as malaria and urinary tract infection), obstetric complications (such as antepartum haemorrhage, preterm premature rupture of membranes, anaemia, hypertensive diseases in pregnancy), or environmental factors (such as trauma or malnutrition). Birth asphyxia may also arise from factors that act in labour (such as pyrexia in labour, premature rupture of membranes, any cause of foetal distress, whether labour is spontaneous or induced with oxytocics, and the mode of delivery). Lastly, birth asphyxia may arise during the immediate care of the baby after birth(3). Risk factors for birth asphyxia should be sought from emergency obstetric referrals in labour. Interventions in this group may reduce perinatal deaths from birth asphyxia.

In 1952, Dr. Virginia Apgar developed a scoring system to evaluate the condition of neonates at birth. Over the following 30 years, this Apgar score lost favour as

it was found to be a poor predictor of later neuro-developmental anomalies after birth asphyxia(4). Casey *et al*(5), in a retrospective analysis of 151,891 between 1988 and 1998, found that infants of Apgar score three or less had the highest risk of neonatal death. The Apgar score predicted neonatal death more accurately than umbilical artery pH, and the risk of neonatal death in term babies with a five-minute score of three or less was eight times more than in term infants with umbilical artery pH values of 7.0 or less(5). Therefore the five-minute Apgar score is still a valid method of infant assessment at birth(6).

This study analyzed the risk factors for severe birth asphyxia, using the five-minute Apgar score as an indicator of birth asphyxia (Apgar score four or less), among women admitted as emergencies in labour. The objective was to determine the antenatal and intrapartum risk factors for birth asphyxia among babies delivered by women admitted as emergency obstetric referrals in Mulago hospital, Kampala, Uganda.

MATERIALS AND METHODS

The study design was an unmatched case-control study of newborn babies (and their mothers) born to women who were admitted as obstetric emergencies in labour in Mulago hospital, Uganda. Mulago is the national referral and University teaching hospital for Makerere University, located in the capital city, Kampala. The study was approved by both the department of Obstetrics and Gynaecology and the Ethics and Research committee of Mulago hospital, and was carried out from March 1st to August 30th 2000.

Cases were term babies (and their mothers) delivered at term, with Apgar score at five minutes of four or less, who required resuscitation with oxygen for at least 30 minutes, were eventually admitted to the intensive neonatal care unit for the same reason, and whose mothers consented to join the study. The controls were term babies (and their mothers) admitted on the same day as the cases, who had a five minute Apgar score of five or more, whose mothers consented to join the study. All the women who had multiple pregnancy, and babies with gross congenital abnormalities, were excluded from the analysis. Data from all mother-baby couples who fulfilled the inclusion criteria were obtained from the data base and used in the analysis.

Study variables included socio-demographic characteristics (such as maternal age, parity, education level, religion, body mass index, age and education level of spouse and urban or rural domicile), antenatal care attendance and antenatal risk factors (such as febrile illness in pregnancy and any other antenatal complications). About antenatal care attendance, attendance was defined as attending at least four times with the first visit before 20 weeks. The intrapartum variables included labour augmentation, mode of delivery, fetal distress in labour, birth weight, indication for admission to the neonatal care unit, neonatal complications while in neonatal care unit and cause of neonatal death.

Foetal distress was defined as heart rate less than 120 or more than 160 per minute, or any abnormality in foetal heart rhythm such as early or late decelerations at any time in labour (using a Pinnard foetal stethoscope). Birth weight was classified as normal (2,500 g or more) or low birth weight (less than 2,500g). Anaemia in antenatal period was defined

as documented evidence of haemoglobin measurement of less than 11.0 grams per 100 milliliters of blood, at any time prior to or after admission as emergency referrals. Premature rupture of membranes was defined as rupture of the foetal membranes at term at least 24 hours before onset of labour. Mal-presentations were defined as any presentation in labour other than vertex presentation.

For the babies, the cases and controls were followed up to the time of death or discharge in order to validate the risk factors. The data were collected with the assistance of pre-trained nurse-midwives, using pre-coded questionnaires, and was analyzed using the Statistical Assistance Software (SAS) version 6.2 (Windows). The Odds ratios for various outcomes were calculated with the 95% confidence intervals at a level of significance of less than 0.05.

RESULTS

During the study period, 983 women were admitted as emergency obstetric referrals in labour or immediate puerperium (excluding those who had multiple pregnancy or whose babies had major congenital abnormalities). Of these, 645 (65.6%) were at term (as calculated from the first day of the last normal menstrual period) and in labour, 95 (9.7%) had preterm labour, 126 (12.8%) were in the puerperium and 117(11.9%) delivered still births. Of the 645 term live births, 85(13.1%) had severe birth asphyxia (Apgar score four or less) while 560 (86.8%) had Apgar score five or more. All the 85 babies were admitted to neonatal special care unit from where 21 (24.7%) died. The commonest indications for admission were lethargy(35), grunting respiration(27), need for endotracheal incubation(15). (some babies had more than one indication). The immediate recorded cause of death was hypoglycaemia(7), septicaemia(6), respiratory distress(4), intracerebral haemorrhage(3) and anaemia(1).

From the study, there was no difference in the socio-demographic characteristics such maternal age, body mass index, parity, education level, age of spouse, education level of spouse or ethnicity ($p>0.05$). There was no significant difference in the distance from referring clinic, whether subject lived in a rural or peri-urban area, prior use of family planning, or whether conception was intended or not ($p>0.05$). Those who did not attend antenatal care or attended less than four times were more likely to deliver babies with birth asphyxia (low Apgar score) ($p=0.036$). However, there was no significant difference for the number of antenatal clinic visits ($p=0.054$) between cases and controls.

The study evaluated several risk factors. Table 1 shows the antenatal risk factors. Febrile illness in pregnancy, which included cases of confirmed and unconfirmed malaria in pregnancy, was a significant risk factor for Apgar score four or less (birth asphyxia) (Odds ratio 1.99, 95% confidence interval 1.02-3.86, p -value 0.039). Likewise, antepartum hospitalization, antepartum or intrapartum anaemia, antepartum haemorrhage and severe pre-eclampsia/eclampsia were significantly associated with birth asphyxia; the respective odds ratios were 1.73 (1.09-2.75), 5.65 (3.36-9.50), 2.12 (1.11-4.05) and 10.62 (2.92-38.47).

Table 1*Antenatal factors associated with low Apgar score*

Risk factor	Cases n=85	Controls n=560	Odds ratio and the 95% confidence intervals	p-value
* Febrile illness	13 (15.7)	47 (8.6)	1.99 (1.02-3.86)	0.039
# Admission in pregnancy	46 (55.4)	230 (41.8)	1.73 (1.09-2.75)	0.020
& Anaemia	11 (13.4)	181 (32.9)	5.65 (3.36-9.50)	0.001
& Severe PET	14 (16.9)	48 (8.7)	2.12 (1.11-4.05)	0.020
\$ Antepartum haemorrhage	6 (7.2)	4 (0.73)	10.62 (2.92-38.47)	0.018

*. These cases included both confirmed and unconfirmed malaria cases, and all had been managed as cases of malaria.

#. There was no analyses of the different indications for admission.

&. These included 11 and 4 cases of eclampsia among the cases and controls respectively, the rest were cases of severe pre-eclampsia.

\$. All these were cases of confirmed abruptio placentae

Table 2*Intrapartum factors associated with low Apgar score*

Risk factor	Cases (n=85)	Controls (n 560)	Odds ratio and the 95% confidence intervals	p-value
Augmentation of labour with oxytocin	8 (9.6)	10 (1.8)	5.76 (2.20-15.05)	0.001
Premature rupture of membranes	24 (28.9)	85 (15.5)	2.23 (1.31-3.37)	0.002
Caesarean section	24 (28.9)	87 (15.7)	2.16 (1.28-3.67)	0.003
Meconium stain in liquor	4 (4.8)	1 (0.18)	27.8 (3.07-25.8)	0.049
Vacuum extraction	11 (13.4)	13 (2.4)	6.40 (2.76-14.82)	0.001
Low birth weight	9 (10.8)	27 (4.9)	2.36 (1.07-5.20)	0.030
1 minute Apgar score less than 4	58 (71.6)	15 (2.7)	96.6 (47.11-197.8)	0.001
Mal-presentation	26 (31.3)	37 (6.7)	6.32 (3.57-11.20)	0.030

Table 2 shows the intrapartum risk factors for birth asphyxia. The indications for labour augmentation with oxytocin were mainly premature rupture of membranes and dysfunctional labour leading to slow rate of cervical dilatation for patients in the active phase of labour. Breech presentation was the commonest mal-presentation occurring among 16 (18.8%) and 31 (5.5%) of the cases and controls respectively. Other mal-presentations were face presentation (six and four among cases and controls respectively) and brow presentation (four and one among cases and controls respectively). Augmentation of labour with oxytocin, premature rupture of membranes, meconium staining of liquor amnii, vacuum extraction, caesarean section, low

birth weight (all small for-gestation-age births) and mal-presentations were significantly associated with birth asphyxia with ORS of 5.76 (2.20-15.05), 2.23 (1.31-3.37), 6.40 (2.76-14.82), 2.16 (1.28-3.67), 2.36 (1.07-5.20) and 6.32 (3.57-11.20) respectively.

DISCUSSION

This study evaluated the antepartum and labour risk factors for low Apgar score as an indicator of birth asphyxia, resulting from adverse factors in the antepartum and intrapartum period. Adverse factors in the intrauterine environment may lead to poor growth in utero, from factors in the foetus, placenta or mother.

These factors act as a continuum in some cases, and may interact in such a way that so many causal pathways are initiated(3), eventually leading to pathological changes that culminate into birth asphyxia. The finding that socio-demographic characteristics and other markers of social adversity are rarely significantly associated with birth asphyxia or perinatal mortality has been observed in other previous studies(7,8).

The strength and validity of this study is affected by failure to adjust for confounding of the different socio-demographic factors and how they interact with the antepartum and intrapartum factors. Secondly, foetal umbilical artery pH levels (the most valid assessment of birth asphyxia) were not assessed. However, the risk factors were validated with further follow up of the babies admitted in neonatal care unit up to discharge or death. Thirdly, for evidence of anaemia, antepartum hospitalization and antepartum pyrexia, the study relied much on the maternal history without consideration of when the events occurred, how long they were or how they were managed. The study however identified some of the factors that may be involved in the causal pathways of birth asphyxia.

Pyrexia antepartum and premature rupture of membranes (PROM) were significantly associated with birth asphyxia. The cause of this was probably malaria, urinary tract infection or chorioamnionitis (in patients with premature rupture of membranes). Unfortunately, no histological examination of the placenta was made to confirm chorioamnionitis. Pyrexia may indicate intrauterine infection of the membranes or placenta(9,10). Malaria and urinary tract infection may cause intrauterine foetal growth retardation leading to a foetus to be born with little energy reserves to sustain it during labour or the immediate postpartum period. The pathological end result may be birth asphyxia.

Antenatal fetal distress and meconium staining of liquor have been associated significantly with perinatal morbidity and intensive care admission(7,8). Most of the factors identified (Table 1 and 2) operate by causing foetal distress antepartum or in labour, eventually leading to birth asphyxia, which may manifest as low Apgar score deliveries.

In conclusion, anaemia, febrile illness in pregnancy, severe pre-eclampsia and eclampsia and antepartum haemorrhage were antepartum risk factors for birth

asphyxia. Vacuum extraction, mal-presentations, premature rupture of membranes and pyrexia in labour were risk factors for birth asphyxia.

The findings of this study imply that prevention strategies for birth asphyxia among newborns need to look at factors operating both during labour and before labour onset.

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