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Antenatal and Intrapartum Risk Factors Associated with Birth Asphyxia in Term Babies

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Author`s Contribution

[1] designed the study[2] drafted the manuscript,[3] literature review and data analyses, reviewed the manuscript, for important intellectual content, [4]final approval of the version to be published

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ABSTRACT

Objective: To determine antenatal and intrapartum risk factors associated with birth asphyxia in term babies.

Methodology: This cross-sectional study was conducted in Department of Obstetrics and Gynecology, Unit II, Foundation University Islamabad from Feb 2024 to July 2024. According to the estimated frequency of birth asphyxia, which ranged from 30.5% to 40% or higher case fatality rates with a 5% margin of error and a 95% confidence range, the WHO calculation yielded a sample size of 326 individuals.[9] SPSS version II was used for data analysis. Chi square tests were used to determine the frequency and percentages.

Results: The study comprised 326 mothers who were pregnant at term. Maternal ages ranged from 18 to 35 years old, with an average age of 29.4 ± 5.1. 23.9% (n = 78) of the mothers were older than 35, whereas the majority (76.1%, n = 248) were between the ages of 18 and 35. Over half were primigravida (54.0%, n = 176), while 46.0% (n = 150) were multigravida, according to parity analysis. In terms of fetal characteristics, 47.2% (n = 154) of the newborns were female, while 52.8% (n = 172) were male. Therefore, efforts should be made to raise the standard of services related to prenatal and postpartum risk factors.

Conclusion: The present study identifies several important risk factors for birth asphyxia, many of which can be changed by optimizing prenatal and postpartum care. Lowering asphyxia rates and improving newborn outcomes need interventions that focus on maternal anemia, glycemic management, and attentive intrapartum surveillance (particularly for meconium, fetal distress, and placental problems).

Keywords: Birth asphyxia Hypoxic-ischemic encephalopathy Caesarean section, Apgar score, Normal vaginal delivery.

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Introduction

The inability of newborns to start and maintain breathing at birth is known as birth asphyxia (BA), which is followed by poor gas exchange that causes progressive hypoxemia, hypercapnia, and, if left untreated, severe metabolic acidosis.[1,2] In addition to threatening infant survival, severe BA can result in numerous organ damage, such as brain damage, cardiac injury, respiratory distress, renal injury, hepatic incompetence, and necrotizing enterocolitis.[3] The most concerning of these is brain damage, also known as hypoxic-ischemic encephalopathy (HIE), because of its high mortality rate and long-term neurological aftereffects, which include cerebral palsy, epilepsy, intellectual incompetence, cognitive deficits, and motor disability, leaving the family and society with a lifetime burden.[4]

The majority of newborn mortality occur in low-resource nations with subpar healthcare infrastructure. Sub-Saharan Africa and areas of Southeast Asia, including Pakistan, are home to the majority of these nations. For this reason, developing countries have a higher prevalence of newborn fatalities (around 4 million per year) than developed countries (2.3 million per year).[5,6]

Risk factors for neonatal deaths differ between developed and developing nations. For example, in developing nations, the most common risk factors include premature birth, low birth weight, congenital defects, and use of tobacco and alcohol during pregnancy, while in developed nations, the most common risk factors include lack of perinatal checkups, maternal malnutrition during pregnancy, and delivery at unsanitary healthcare facilities that can result in infection [7]

The burden of birth asphyxia (BA) is incurred by the government and parents in low-resource nations like Pakistan, Nigeria, and portions of Sub-Saharan Africa when healthcare services are inadequate.[8] Birth asphyxia is far more common in developing nations, where case fatality rates range from 5.1 to 30.5% and 40% or higher.[9]

Antepartum risk factors include severe hypotension or hypertension in the pregnant woman, diabetes, antepartum hemorrhage during pregnancy, a history of premature birth, fewer than four prenatal care visits, oligohydramnios, maternal fever, maternal anemia, parity, young or old age, residence area, and low educational status (primary education and illiteracy). Malpresentation, prolonged second stage of labor, home birth, obstructed labor, oxytocin use, and meconium-stained amniotic fluid are among the risk factors for intrapartum complications. The following prenatal risk factors are linked to birth asphyxia: resuscitation, tight nuchal cord, multiple gestation, low or high birth weight, and fetal distress.[10,11] The absence of scientific data in Pakistan compels us to carry out this investigation in order to close the evidence gap. Finding the different causes of hypoxia in premature infants was the aim of this investigation. Early detection of these risk factors and the implementation of preventive measures can lower the risk of birth asphyxia-induced brain damage and infant mortality.

Methodology

This cross sectional study was conducted in Department of Obstetrics and Gynecology, Unit II, Foundation University Islamabad from Feb 2024 to July 2024. The sample size, as determined by the WHO analysis, was 326 individuals. The anticipated frequency of birth asphyxia ranged from 30.5% to 40% or higher case fatality rates, with a 95% confidence range and a 5% margin of error. [9]

All pregnant women who were admitted to the labor room between the ages of 18 and 35 or older, with gestational ages between or greater than 37 to 39 + 6 weeks and 40 to 40 + 6 weeks, and who gave their consent were chosen. This study excluded mothers whose gestational age was less than 37 weeks and who gave birth to children with serious congenital problems, including hydrops, chromosomal disorders, or cyanotic congenital heart disease, as well as those who did not provide their consent to participate.

Although this study included both spontaneous vaginal delivery and cesarean section as delivery methods, the prevalence of birth asphyxia was more closely linked to underlying maternal and intrapartum risk factors than to the actual delivery method.

In order to identify the maternal risk factors linked to delivery asphyxia, a structured questionnaire was used to gather data in two portions (1). Demographic and baseline information on the mother, including her age, residency area, level of education, parity, fetus gender, booked or unbooked labor, birth weight, gestational age, and any other related pregnancy-related morbidities. (2). Current maternal and fetal clinical parameters, such as the presence or absence of birth asphyxia, history of anemia, diabetes, preeclampsia, eclampsia, mode of fetal delivery, APGAR score, fetal distress, IUGR, oligohydramnios, prolonged labor, and placental complications, were included in the second section of the questionnaire, which asked about the history of the current pregnancy. At minute one, minute five, and minute twenty, the APGAR score was noted. Certain factors, including physical signs, skin color, fetal heart rate, fetal respiratory rate, reflex irritability, and muscle tone, were used to calculate the APGAR score. Data on the five chosen risk factors for birth asphyxia parity, fetal distress, APGAR score, meconium-stained liquor, and diabetes mellitus were gathered from the NICU admission registration, birth record register, and the gynecologist who attended the delivery in the labor room. The APGAR score, meconium-stained liquor, fetal distress, and primigravida were the study factors.

SPSS version 26.0 (IBM SPSS Inc., Chicago, IL, USA) was used to analyze all of the data. The mother's age, the baby's weight, the APGAR score in minutes, and the fetal heart rate were all included in the calculation of the mean and standard deviation. For both the baby's gender and the delivery method, frequency and percentages were assessed. Stratification was used to control confounding variables such as the mother's age, the baby's weight, and the baby's gestational age.

The frequency of the research variables (premigravida, fetal distress, extended labor, and meconium-stained liquor) in cases and controls was compared using a chi-square test. A P-value of 0.05 or less was considered significant.

Results

The study comprised 326 mothers with term pregnancies in total. The mean age of the mothers was 29.4 ± 5.1 years, with a range of 18 to 35 years. Of the moms, 23.9% (n = 78) were older than 35, while the majority (76.1%, n = 248) were between the ages of 18 and 35. In terms of where they lived, 43.6% (n = 142) of the mothers were

from rural areas, whereas more than half (56.4%, n = 184) were from urban areas. In terms of educational achievement, 41.1% (n = 134) were illiterate, whereas the majority (58.9%, n = 192) were literate. Just 42.3% (n = 138) of the mother's had scheduled pregnancies, whilst 57.7% (n = 188) of the mothers had not scheduled prenatal care.

In terms of parity, 46.0% (n= 150) were multigravida and more than half (54.0%) were primigravida. Male newborns made up 52.8% (n= 172) of the fetal features, while female babies made up 47.2% (n = 154). The majority of newborns (63.8%, n = 208) weighed between 2.5 and 3.5 kg, with the mean birth weight being 3.05 ± 0.42 kg. 19.0% (n = 62) had low birth weights (<2.5 kg), whereas 17.2% (n = 56) had birth weights >3.5 kg.

The gestational age was 38.3 ± 1.6 weeks on average. The majority of neonates (80%, n = 258) were born between 37 and 39+6 weeks of pregnancy, whereas 20% (n = 68) were born between 40 and 40 + 6 weeks of pregnancy. Of the prenatal risk variables, mother age over 35 years was found to be present in 34 instances (30.9%) of birth asphyxia and in 28 cases (12.6%) of asphyxia-free births. Only 22 women (10.2%) in the non-asphyxia group had diabetes mellitus, compared to 26 (23.6%) mothers of afflicted newborns. Similarly, among mothers with birth asphyxia, anemia was detected in 20 (18.2%) and preeclampsia in 18 (16.4%). Fetal distress was much more common in asphyxiated neonates (40 instances, 36.4%), compared to only 20 cases (13.9%) in the non-asphyxia group, when considering intrapartum variables.

Meconium-stained liquid was found in 18 (11.1%) of the non-asphyxia group and 42 (38.2%) of the birth asphyxia patients. Additionally, 48 (43.6%) of the asphyxiated babies had a low APGAR score (<7 at 5 minutes), compared to only 16 (7.4%) of the non-asphyxia group.

These results show that the most common intrapartum risk variables linked to delivery asphyxia were low APGAR score, meconium-stained liquor, and fetal distress. The most common risk variables linked to birth asphyxia in this study were anemia (18.2%), diabetes mellitus (23.6%), preeclampsia (16.4%), and maternal age >35 years (30.9%). Asphyxiated neonates had significantly greater levels of meconium-stained liquid (38.2%), fetal distress (36.4%), and low APGAR score at 5 minutes (43.6%) among intrapartum variables than the non-asphyxia group. These results demonstrate that the incidence of birth asphyxia is significantly influenced by both maternal problems and intrapartum events.

Table I: Demographic and Baseline Data of Mothers and Neonates. (n = 326)

Variable	Category	(n)	(%)	Mean ± SD
Maternal Age (years)	18–35	248	76.1	29.4 ± 5.1
	>35	78	23.9	
Area of Residence	Urban	184	56.4	0.56 ± 0.50
	Rural	142	43.6	
Education Status	Literate	192	58.9	0.59 ± 0.49
	Illiterate	134	41.1	
Booked Status	Booked	138	42.3	0.42 ± 0.49
	Unbooked	188	57.7	
Parity	Primigravida	176	54.0	0.54 ± 0.50
	Multigravida	150	46.0	
Fetal Gender	Male	172	52.8	0.53 ± 0.50
	Female	154	47.2	
Birth Weight (kg)	<2.5 kg	62	19.0	3.05 ± 0.42
	2.5–3.5 kg	208	63.8	
	>3.5 kg	56	17.2	
Gestational Age (weeks)	37 to 39+6 weeks	258	80.0	38.3 ± 1.6
	40 to 40 + 6 weeks	68	20.0	

Table II: Antenatal and Intrapartum Risk Factors Associated with Birth Asphyxia. (n = 326)

Risk Factor	Birth Asphyxia Present (n=110)	Birth Asphyxia Absent (n=216)	p-value
Antenatal Factors			
Maternal age >35 years	34 (30.9%)	28 (12.6%)	0.032*
Diabetes mellitus	26 (23.6%)	22 (10.2%)	0.001*
Hypertension / Preeclampsia	18 (16.4%)	22 (10.2%)	0.142
Anemia	20 (18.2%)	10 (4.6%)	<0.001*
Intrapartum Factors			
Meconium-stained liquor	42 (38.2%)	18 (11.1%)	<0.001*
Fetal distress	40 (36.4%)	20 (13.9%)	<0.001*
Prolonged labor	28 (25.5%)	36 (16.7%)	0.065
Placenta previa	12 (10.9%)	10 (4.6%)	0.037*
Placental abruption	14 (12.7%)	10 (4.6%)	0.008*
IUGR	22 (20.0%)	20 (9.3%)	0.012*
Oligohydramnios	18 (16.4%)	14 (6.5%)	0.006*
Low APGAR (<7 at 5 min)	48 (43.6%)	16 (7.4%)	<0.001*

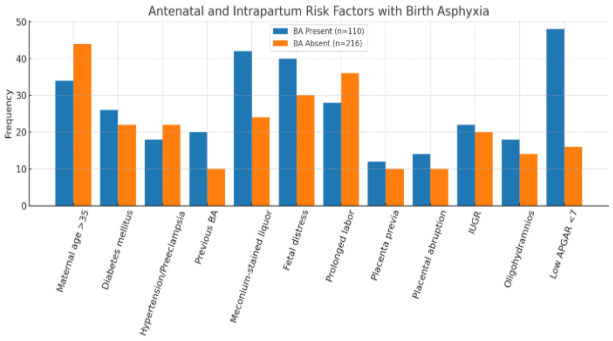

Figure 1. Shows Antenatal and Intrapartum risk factors with Birth Asphyxia.

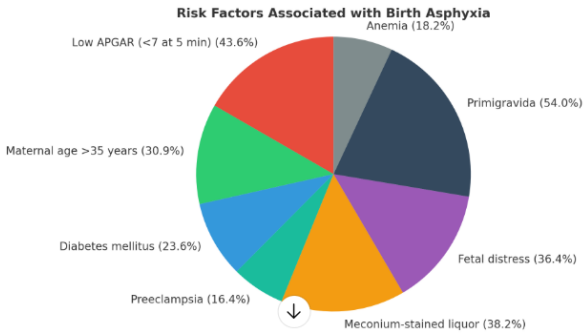

Figure 2. Shows Significant risk factors associated with Birth Asphyxia

Discussion

According to larger-scale epidemiological studies, approximately 4 million of the 130 million newborns born die within the first month of their lives. Furthermore, over 98% of these newborn deaths take place in low- and middle-income nations, such as Nigeria, India, Pakistan, and Africa. The rate of mortality among children of less than five years of age has substantially improved during the previous couple of decades and on the other hands, there is no or little change in terms of mortality of neonates. It is also predicted that one third of death among children occur in before reaching the age of 5 years. The fourth Millennium Development Goal (MDG) states that efforts should be directed at lowering the number of children who die from avoidable causes, such as complex infections and birth asphyxia. The frequency of birth asphyxia is less than 0.1% in the majority of affluent nations that adhere to the MDG 4 recommendations.

Nigeria has the greatest rate of birth asphyxia at 40%, whereas the frequency in underdeveloped nations can reach up to 23%. Implementing MDG 4 recommendations in their healthcare institutions is the primary cause of this significant disparity.

The overall prevalence of birth asphyxia (BA) in our study was 28.8%, which is marginally higher than previous findings from other countries. For example, a research conducted in Ethiopia found that 26% of NICU admissions were related to[12] and 4.8% prevalence in community-based data was reported by a sizable Chinese meta-analysis.[13] Due to the fact that our hospital is a tertiary referral center and receives high-risk pregnancies with problems like preeclampsia, anemia, and diabetes, the proportion in our sample is comparatively greater.

Furthermore, a noteworthy percentage of our mothers (57.7%) were not scheduled, which is a recognized indicator of unfavorable perinatal outcomes because of lost chances for early intervention and risk assessment. The greater incidence of intrapartum problems compared to data from areas with superior primary maternal healthcare coverage is probably caused by the combination of unplanned pregnancies and late referrals.

According to a hospital-based study, children born to mothers over 35 had greater rates of BA than infants delivered to women under 35.[13] Intrapartum hypoxia is more likely to occur in patients with these comorbidities. Asphyxia-related newborn deaths are represented by the percentage of neonatal deaths in Pakistan (Karachi 14%, Lahore 35%, and Khyber Pakhtunkhwa 11%), not the prevalence among live births.[14]

According to UNICEF's estimation, intrapartum-related incidents account for 20.9% of newborn fatalities in Pakistan.[15] This may be because BA cases were recruited from populations with earlier reproductive ages, even if some Pakistani data showed a younger maternal age in BA cases (24.2±3.4 years).[16] Our study's greater maternal age may be the result of urban populations' delayed childbearing, where women put off getting pregnant for social or professional reasons.

In our study, 52.8% of BA cases were in male neonates, which was more common than in female neonates (47.2%). This male disadvantage is frequently mentioned[17] this is explained by sex-dimorphic brain responses to hypoxia, where females trigger more protective apoptotic mechanisms while males incline to excitotoxic and necrotic cell death pathways. Furthermore, the higher male-to-female ratio (2:1) observed in our data in comparison to international reports may be explained by biological and cultural factors (bigger birthweights, more challenging births) that raise intrapartum stress.

Interestingly, term babies had greater rates of delivery hypoxia and mortality (80.0%). This result is in contrast

to the majority of research, which shows that low birth weight and prematurity are known risk factors for BA and negative consequences.[18]

Additionally, our study found that anemia (18.2%) is a maternal risk factor for BA. Due to a decrease in oxygen-carrying capacity, maternal anemia puts the fetus at risk for hypoxia during labor. Similar results, where anemia leads to prolonged fetal hypoxia, have been documented in cohorts from rural Africa.[19]

We observed a significant incidence of preeclampsia (16.4%), low Apgar score at 5 minutes (43.6%), diabetes mellitus (23.6%), fetal distress (36.4%), primigravida (54.0%), and meconium-stained liquid (38.2%). Many studies shows that these elements are highly predictive of BA. Adjusted risk ratios >6 in previous research have established preeclampsia's strong connection with BA, which contributes to uteroplacental insufficiency and fetal hypoxia.

Despite being less common in local research, diabetes mellitus played a significant role in our investigation. Fetal hyperinsulinemia and hyperglycemia raise oxygen consumption and put infants at risk for perinatal hypoxia.[20] There is clear evidence in the literature linking meconium-stained amniotic fluid (38.2% vs. 11.1%, $p < 0.001$) to birth asphyxia.

Meconium can be an indication of fetal hypoxia and a risk factor for meconium aspiration syndrome (MAS), which mostly increases asphyxia and other morbidities. Similar results were seen in studies conducted in Ethiopia and Nepal, highlighting the importance of careful intrapartum surveillance.[21] Asphyxia was significantly correlated with fetal distress (36.4% versus 13.9%, $p < 0.001$). Perinatal asphyxia has long been known to be predisposed by unsettling fetal heart rate rhythms, which are traditional markers of fetal compromise.

Similar findings from a multicenter research in Nepal revealed that a non-reassuring fetal condition quadrupled the risk of hypoxia (aOR = 1.9).[21.] Asphyxia was strongly predicted by an APGAR score of less than 7 at five minutes (43.6% vs. 7.4%, $p < 0.001$). Although low APGAR is frequently a result rather than a cause, its strong correlation highlights how urgent neonatal resuscitation is in order to reduce hypoxic harm.

According to a Nepalese study, low APGAR was associated with higher HIE stages and greater mortality rates.[21] Among the deliveries in our study, 54% were primigravida. First-time mothers are more likely to experience birth asphyxia, which is consistent with global data. For instance, a Pakistani study found that primigravida accounted for 62% of asphyxia cases, whereas controls accounted for 51.6% ($p = 0.0314$)[22]

These results are indicative of systemic problems, including insufficient prenatal involvement and inexperience among new mothers. Inadequate fetal monitoring, delayed hospital arrival, and limited intrapartum interventions (e.g., timely cesarean sections) may account for the greater percentage of these factors in our study. Intermittent monitoring, as opposed to continuous monitoring, is carried out in many low-resource facilities, which raises the possibility of undetected fetal distress and delayed care.

Birth asphyxia was mainly correlated with placenta previa (10.9% vs 4.6%, $p = 0.037$) and placental abruption (12.7% vs 4.6%, $p = 0.008$). Ethiopian and South Asian research have found that placental abruption in particular is a powerful predictor.[23] We discovered substantial relationships with IUGR (20.0% versus 9.3%) and oligohydramnios (16.4% vs 6.5%). Consistent with earlier assessments, these symptoms reflect persistent placental insufficiency.[24]

Conclusion

Major risk factors for birth asphyxia that are highlighted in this study can be changed by optimizing prenatal and postpartum care. Asphyxia rates can be decreased and neonatal outcomes improved by interventions that focus on maternal anemia, glycemic management, and careful intrapartum surveillance (particularly for meconium, fetal distress, and placental problems). Interventions that lower the risk of newborn asphyxia include regular monitoring for primigravida and early prenatal education. The findings of this study demonstrate the need for improved maternal care, educating maternity health professionals about the factors that contribute to birth asphyxia, closely monitoring labor, and identifying and implementing appropriate interventions that may help lower the incidence of birth asphyxia.

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