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Original Research Article

Study of Risk Factors in Children with Birth Asphyxia

Mala Kumari*, Tufail Ahmed Soomro, Rizwana Qureshi, Bela Kamran, Mahnoor Qureshi, Poonam Bai

Department of Paediatric, Ghulam Muhammad Mahar Medical College Sukkur, Pakistan
**Corresponding author`s email address:* malakumari954@gmail.com

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Abstract: *Birth asphyxia is a significant contributor to neonatal morbidity and mortality in developing countries. Identifying modifiable maternal and perinatal risk factors can enable timely interventions to reduce the incidence of asphyxia-related complications in term newborns.* ***Objective:*** *To assess the association of various maternal and perinatal risk factors with birth asphyxia in term neonates admitted to a tertiary care hospital in Pakistan.* ***Methods:*** *A case-control study was conducted at the Department of Pediatrics, Ghulam Muhammad Mahar Medical College, Sukkur, from July 1, 2024, to December 31, 2024. A total of 62 term neonates were enrolled and divided into two groups: Group A (cases, n=31) with birth asphyxia and Group B (controls, n=31) without birth asphyxia. Neonates with congenital malformations, chromosomal anomalies, or low APGAR scores due to anesthesia were excluded. Data were collected using structured proformas and included maternal factors (parity, anemia, pregnancy-induced hypertension, chorioamnionitis, mode of delivery, cardiotocography findings) and neonatal parameters (birth weight, length, head circumference, and gender). Statistical analysis was conducted using SPSS v25. Chi-square test and t-test were applied; a p-value <0.05 was considered statistically significant.* ***Results:*** *The mean birth weight was 3.64 ± 0.53 kg in cases versus 3.71 ± 0.51 kg in controls, and the mean length was 48.81 ± 3.18 cm versus 50.11 ± 2.87 cm, respectively. Head circumference was nearly identical between groups. Cesarean section (58% vs. 35%), rural residence (64% vs. 90%), and primiparity (65% vs. 39%) were more frequent among cases. Statistically significant risk factors associated with birth asphyxia included meconium aspiration syndrome (36% vs. 13%; p=0.038), fetal distress (48% vs. 13%; p=0.002), and pregnancy-induced hypertension (42% vs. 7%; p=0.001). Other factors like prolonged labor, maternal anemia, and chorioamnionitis did not show significant association.* ***Conclusion:*** *This study identifies meconium aspiration syndrome, fetal distress, and pregnancy-induced hypertension as major risk factors associated with birth asphyxia in term neonates. These findings emphasize the importance of vigilant intrapartum monitoring and early maternal risk assessment to prevent asphyxia-related complications.*

Keywords: Birth asphyxia, Risk factors, Meconium aspiration syndrome (MAS), Fetal distress, Pregnancy induced hypertension (PIH)

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Introduction

Across the world, birth asphyxia is still a major reason for neonatal mortalities and adverse health outcomes. The condition is caused by infants getting less oxygen than the brain can get at delivery, resulting in damage to the brain, developmental confusion, and finally, severe complications as a result. Most medical establishment lack enough equipment hence, birth asphyxia still remains an essential neonatal challenge (1). Clearly, good neonatal outcome requires early recognition and appropriate management of the risk factors in tertiary institutions with advanced diagnostic methods and state-of-the-art treatment approaches (2). Birth asphyxia is caused by maternal, fetal, and environmental factors that have a controlling influence on labor and delivery processes (3). In addition to fetal distress and prolonged labor, prolonged pregnancy due to pregnancy induced hypertension (PIH) is the leading factors that contribute to birth asphyxia with meconium aspiration syndrome (MAS). In the case of birth asphyxia, the cause itself is independent or simultaneous, which later results in deprivation of oxygen supply (4).

Meconium aspiration syndrome serves as a primary factor contributing to birth asphyxia. The condition develops during birth after fetal meconium reaches amniotic fluid and stays there before being inhaled by the child. Consequently, their obstructed airways, inflamed tissues, and possible infections lead to severe damage to their lung tissue and respiratory complications (5). Meconium presence in fetal distress conditions gives rise to serious respiratory problems and lack of oxygen to the fetus. MAS mostly occur during stressful delivery situations featuring prolonged and difficult birth processes that result in limited oxygen supply and asphyxia conditions. Proper treatment of MAS requires clearing airway blockages and delivery of respiratory aid to provide urgent medical care. Without MAS intervention, respiratory difficulties continue, and neurological damage occurs (6).

In the same way, fetal distress is one of those crucial factors that give rise to birth asphyxia. At birth, the fetus shows symptoms of oxygen deprivation by means of medical staff detecting abnormal fetal heart rate patterns, both bradycardias and decelerations. Fetal distress is triggered by three main causes: poor function of fetal blood flow in the uterus, medical conditions in the mother, and dislocation of the umbilical cord from the placenta (7). Lacking oxygen for a long period before being given access to medical intervention, the brain injuries are severe and are accompanied by multiple serious illnesses. It is an essential thing in that the detection of fetal distress and the specific management should be carried out from the time of momentous warning (8). Among instrumental delivery and caesarean section, prompt delivery execution does, in fact, decrease the risk of birth asphyxia by increasing the delivery of respiratory oxygen. Because asphyxia is a serious condition, it is important to identify fetal distress conditions before asphyxia occurs (9).

Also contributing to birth asphyxia is Labor dystocia, referred to as an extended delivery process. Whenever the uterine contractions are weak, along with some abnormal maternal pelvic structure and also the fetus malpositions delay the process of normal labor, such a situation is termed as birth asphyxia. When labor is prolonged, which is the result of umbilical cord compression and uteroplacental insufficiency combined, the fetal oxygen supply becomes interrupted (10). When physicians determine that a fetus is faced with a risk for birth asphyxia, medical procedures, including cesarean section, are required because doctors need to act to prevent the progress of fetal distress and to stop the fetal asphyxia

from developing. Monitoring labor development while providing adequate medical treatment remains a vital mechanism to reduce birth asphyxia risks during extended labor (11).

Pregnancy-induced hypertension is the main cause of the risk of birth asphyxia; other key elements leading to this complication during childbirth. Pregnancy-induced hypertension can be associated with preeclampsia, which elevates maternal blood pressure in a way that restricts placental circulation and reduces fetal oxygen supply. This is because placental insufficiency is caused when the blood circulation in the placenta is not good enough, and therefore, the fetus does not get the necessary oxygen and nutrients from this vital organthat nourishes the fetus (12). If this condition develops, it is the combination of a restrictive fetal growth and low birth weight with a birth that is asphyxiated which causes distress. Patients affected with PIH should be observed completely medically along with optimum regulation of blood pressure; often, the pregnancy is concluded early to avoid complications. The reason why timely detection of PIH requires implementation with intervention strategies is that the treatment of PIH in pregnant women reduces birth asphyxia occurrences (13).

The prevention of birth asphyxia is determined in most cases with identification and managing risk factors; thus, newborns should be listed in terms of important health problems. The birth asphyxia risks for full-term newborns from maternal medical conditions and fetal medical conditions, as well as prolonged labor time. Risk factor evaluation in tertiary care hospitals provides substantial help in identifying preventive strategies and management solutions. Understanding the relationship with each other allows the medical staff to predict complications and then start up preventive actions in relation to newborns at risk (14).

Methodology

This case-control study was conducted at Ghulam Muhammad Mahar Medical College Sukkur from 1st July 2024 to 31st December 2024. A total of 62 neonates were included and they were divided equally into two groups: Group A (cases) consisted of term neonates (gestational age ≥37 weeks) with a history of birth asphyxia, and Group B (controls) consisted of term neonates (gestational age ≥ 37 weeks) with no history of birth asphyxia. Neonates born with congenital malformations, cyanotic congenital heart defects, chromosomal anomalies, or congenital infections were excluded, along with those with opium or anesthesia-related low APGAR scores. Written informed consent was obtained from the parents of all participants. Data collection involved a comprehensive assessment, including detailed patient history and physical examination, which covered gender, age (in days), birth weight, fronto-occipital circumference (FOC), gestational age, and mode of delivery. APGAR scores were documented at birth. Maternal risk factors including parity, maternal chorioamnionitis, pregnancy-induced hypertension, anemia, prolonged labor, and poor cardiotocography before delivery were also checked. Recorded risk factors for both groups included meconium aspiration syndrome (MAS), fetal distress, length of labor, premature rupture of membranes and PIH. The data was entered and analyzed through SPSS-24.

Results

The case group exhibited a lower mean weight value of 3.64±0.53 kg and in control group's 3.71±0.51 kg weight. The mean length was 48.81±3.18 cm in case group whereas the control group averaged 50.11±2.87 cm in their measurements. Both groups received a similar measurement for head circumference where the case group averaged 35.68±1.49 cm while the control group maintained a mean of 35.74±1.42 cm. The case group included 14 (45%) males and 17 (55%) females while in control group 16 (52%) males and 15 (48%) females. Neonates in the case group resided primarily in rural areas at 20 (64%) while urban areas accounted for 11 (36%) of the population. The control group comprised 31 subjects where 3 (10%) were born in urban locations and 28 (90%) belonged to rural areas. Spontaneous vaginal delivery occurred in 42% of case group neonates while cesarean section deliveries comprised 58% of births and the control group experienced 65% vaginal deliveries and 35% cases of cesarean section delivery. Among the case group mothers, primiparous births made up 65% while multiparous births made up 35%. Meanwhile, the control group had primiparous births comprising 39% with the rest being multiparous births at 61% (Table 1). The meconium aspiration syndrome developed in 11 out of 30 newborns (36%) from the case group but affected only 4 out of 31 newborns (13%) from the control group (p=0.038). This result indicates birth asphyxia shows a significant connection with meconium aspiration. Moreover, birth asphyxia showed a strong association with fetal distress because the case group containing 15 neonates (48%) and the control group with 4 (13%) documented fetal distress conditions (p=0.002). However, the analysis of prolonged labor revealed no significant connection because seven neonates from the case group (23%) experienced it yet two neonates from the control group (7%) did with p-value of 0.071. A substantial connection existed between pregnancy-induced hypertension (PIH) and birth asphyxia based on data analysis because 13 neonates (42%) from the case group presented with PIH versus only 2 (7%) from the control group at a statistical significance level of p = 0.001. The study reveals meconium aspiration syndrome together with fetus distress and pregnancy-induced hypertension as important factors which increase birth asphyxia risk yet data does not establish prolonged labor as a causal factor. No relationship between birth asphyxia and maternal anemia since 6 cases (19%) from the treatment and 4 cases (13%) from the control demonstrated this condition (p=0.490). Additionally, no association existed between maternal chorioamnionitis and birth asphyxia events since 4 cases (13%) experienced it in the case group while 3 cases (10%) had it in the control group (p-value = 0.688) (Table-2).

Table-1: Demographic information of the patients (n=62)

Characteristics	Case Group (n=31)	Control Group (n=31)
Weight (kg)	3.64±0.53	3.71±0.51
Length (cm)	48.81±3.18	50.11±2.87
Fronto-occipital circumference (FOC)	35.68±1.49	35.74±1.42
Gender		
Male	14 (45%)	16 (52%)
Female	17 (55%)	15 (48%)
Place of Residence		
Urban	11 (36%)	3 (10%)
Rural	20 (64%)	28 (90%)
Mode of Delivery		
Vaginal	13 (42%)	20 (65%)
Cesarean	18 (58%)	11 (35%)
Parity		
Primiparous	20 (65%)	12 (39%)
Multiparous	11 (35%)	19 (61%)

Table 2: Comparison of risk factors in both groups (n=62)

Risk Factors	Case Group (n=31)	Control Group (n=31)	P-value
Meconium aspiration syndrome	11 (36%)	4 (13%)	0.038**
Fetal distress	15 (48%)	4 (13%)	0.002*
Prolonged labor	7 (23%)	2 (7%)	0.051*

Pregnancy-induced hypertension (PIH)	13 (42%)	2 (7%)	0.001*
Maternal anemia	6 (19%)	4 (13%)	0.490*
Maternal chorioamnionitis	4 (13%)	3 (10%)	0.688*

**P<0.05 (Significant) **P>0.05 (Not significant*

Discussion

There is no noteworthy difference between groups regarding the neonate's weight, length, and head circumference measurements in the present. Both groups had similar anthropometric measurements where the case group weighed slightly less at 3.64±0.53 kg and measured slightly shorter at 48.81±3.18 cm than the control group. In another study, Kune et al (14). Also demonstrate that birth asphyxia fails to produce detectable changes in anthropometric results for full term newborns. The average head circumference measurement (FOC) between groups remained similar with 35.68±1.49 cm in the case group and 35.74±1.42 cm in the control group, thus confirming previous findings that state brain injury is needed for head circumference to indicate birth asphyxia (15). The minimal yet insignificant differences in anthropometric measurements suggest term-affected newborns normally demonstrate unremarkable physical abnormalities caused by birth asphyxia. Among the study participants, birth asphyxia occurred similarly among male and female neonates because 45% of male subjects had the condition alongside 55% of female subjects. The study outcome matches findings from Lal et al (16). Detected no gender variations regarding birth asphyxia rates. Other investigators report findings that show male neonates might experience higher rates of asphyxia compared to female neonates based on gender differences (17).

In the present study, rural residents made up 65% of the case group neonates but urban residents accounted for 90% of the control group. Existing research confirms that restricted perinatal care access in rural regions leads to higher birth asphyxia rates (18). The detection and management of fetal distress along with meconium aspiration and other complications faces delays in rural areas due to limited skilled healthcare access thus raising the birth asphyxia risk. The data demonstrates that better healthcare infrastructure in rural populations would help decrease birth asphyxia rates.

This study showed that case group comprised of patients who received a cesarean birth at a rate of 58% as compared to the control group patients who had a cesarean rate of 36%. Primarily, cesarean-section interventions for distressed newborns could explain why birth asphyxia tends to affect those from this population more (19). The case group population results showed that 65% of mothers delivered their first child, which correlates to previous research of risk during first-time pregnancy (asphyxia) (1). The research findings are in line with several studies documenting the association between the maternal delivery experiences that decreases the delivery complications (20).

Moreover, we have also studied three major types of birth complications, which were meconium aspiration syndrome, fetal distress, and pregnancy-induced hypertension. The statistics also showed that developing meconium aspiration syndrome could be related because the case group experienced this syndrome 36% of the time while the control group did so only 13% of the time. The findings of previous research also justify that meconium aspiration is the leading factor in developing perinatal deaths and diseases (21). The strong link between meconium aspiration and birth asphyxia requires health professionals to provide enhanced monitoring and early preventative measures throughout labor so that the risk of this condition can be decreased. The study determined fetal distress as a notable risk factor because it affected 48% of patients in the case group but only 13% in the control group at a statistically significant level. The research by Aslam et al (22). Confirms that fetal distress represents a primary factor causing birth asphyxia. The risk for asphyxia reduces when healthcare professionals provide timely fetal heart rate monitoring and prompt deliveries to patients showing signs of fetal distress.

This study did not demonstrate a meaningful relationship between birth asphyxia and prolonged labor durations, but the incidence was higher among the case group (23%) than the control group (7%). The lack of statistical significance for prolonged labor affecting birth asphyxia risk in this research might result from either a small sample size or unseen confounding elements. The study also revealed that hypertension during pregnancy produced a substantial relationship to birth asphyxia since 42% of neonates in the case group delivered from mothers experiencing PIH, while the control group contained 7%. Previous studies confirm that PIH functions as a primary risk element for placental insufficiency as well as fetal oxygen deficit leading to birth asphyxia (23).

Likewise, the researcher uncovered no substantial relationships linking anemia and chorioamnionitis in pregnant mothers to their childbirth results. The findings from Randis et al (24). Support that minimal cases of these conditions do not trigger birth asphyxia directly unless they are severe. This study showed maternal anemia and chorioamnionitis did not reach statistical significance in adverse neonatal outcomes because fetal distress and PIH seemed more important factors for term babies experiencing birth asphyxia. This study also supports past studies and confirms the requirement for prompt detection and healthcare accessibility, including rural service for effective birth asphyxia prevention.

Conclusion

The multiple perspectives about birth asphyxia, which have been failed to demonstrate the correlations between prolonged labor and maternal anemia and chorioamnionitis and to enhance birth asphyxia risk evaluations and develop better preventative strategies. In contrast, prolonged labor, maternal anemia, and chorioamnionitis showed no strong association. Strengthening prenatal care and fetal monitoring can help mitigate these risks and improve neonatal outcomes.

Declarations

Data Availability statement

All data generated or analysed during the study are included in the manuscript.

Ethics approval and consent to participate

Approved by the department concerned. (IRBEC-24)

Consent for publication

Approved

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Conflict of interest

The authors declared the absence of a conflict of interest.

Author Contribution

MK (Postgraduate Residents)
Manuscript drafting, Study Design,
TAS (Associate Professor)
Review of Literature, Data entry, Data analysis, and drafting article.
RQ
Conception of Study, Development of Research Methodology Design,
BK (Associate Professor)
Study Design, manuscript review, critical input.
MQ (Postgraduate Residents)
Manuscript drafting, Study Design,

PB (Postgraduate Residents)
Review of Literature, Data entry, Data analysis, and drafting article.

All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the integrity of the study.

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