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Original Research Article

Exploring epidemiological maternal risk factors associated with the cases of birth asphyxia: a study at civil hospital, Ahmedabad

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ABSTRACT

Background: Maternal health is crucial for fetal growth; certain risk factors were identified which can affect development. Birth asphyxia, a preventable condition among the newborns, which can be managed with appropriate care during pregnancy, delivery, and post-delivery. This study aimed to identify maternal risk factors for birth asphyxia in newborns. Early recognition and timely preventive measures can lower the morbidity and mortality linked to asphyxia.
Methods The cross-sectional study was conducted over a one-year period. The mothers of asphyxiated newborns were selected for the study. Data was collected using a pretested, semi-structured questionnaire and analyzed using MS Excel and SPSS 26
Results: 150 mothers were selected for the study based on the inclusion criteria. Among the maternal risk factors, late registered pregnancies and the mother who suffered prolonged labor were significantly associated with the severity of asphyxia. Newborn of pregnant women who had history of consumption of smokeless tobacco had significantly more risk of developing hypoxic ischemic encephalopathy (HIE).
Conclusions: To improve neonatal outcomes, focusing on antenatal pediatrics is essential. Early detection and referral of maternal risk factors such as lack of ANC visits, consumption of smokeless tobacco and maternal anemia can prevent adverse outcomes and ensure better care for newborns.

Keywords: Antenatal care, Anemia, Obstructed labor, Prolonged labor, Birth asphyxia

INTRODUCTION

Mother's health affects a person's health from preconception through fetal development, neonatal period, infancy, childhood, and into adulthood. If a mother is malnourished, either undernourished or suffering from a micronutrient deficiency such as anemia, the child is likely to experience intrauterine growth retardation (IUGR), low birth weight, or other complications.[1] The maternal risk factors are categorized based on their occurrence: before birth (antepartum risk factors), during birth (intrapartum risk factors), or after birth (postpartum risk factors).[2] Risk factors such as history of addiction, prolonged labor, severe vaginal bleeding during delivery, and other maternal conditions have been identified in relation to birth asphyxia (perinatal asphyxia). Perinatal asphyxia, also known as birth asphyxia, is one of the major causes of neonatal death, contributing to approximately 13% of all neonatal deaths.[3]

However, it is difficult to estimate the true burden of asphyxia due to varying definitions. According to the National neonatal perinatal database (NNPD), moderate perinatal asphyxia (PA) is characterized by slow or gasping breathing or an APGAR score of 4 to 6 at 1 minute, while severe PA is defined as no breathing or an

APGAR score of 0 to 3 at 1 minute.[4] Various maternal risk factors have been identified for perinatal asphyxia, which can aid in the early identification and timely treatment of asphyxiated newborns.

The main aim of the study was to identify the maternal risk factors responsible for birth asphyxia in newborns. Early recognition of these factors before birth and the prompt initiation of preventive measures can reduce the morbidity and mortality associated with asphyxia.

METHODS

Study design

The cross-sectional study was conducted over a one-year period, from March 2021 to March 2022, at the Special Newborn Care Unit (SNCU) of Civil Hospital, Ahmedabad. The mothers of asphyxiated newborns were selected for the study.

Inclusion criteria

The inclusion criteria for asphyxiated newborns were, the need for positive pressure ventilation for more than one minute, signs of fetal distress (heart rate of less than 100 beats per minute, late decelerations, or absence of heart rate variability), failure to initiate and sustain breathing at birth, and an APGAR score of less than 7 at 5 minutes. Data was collected using a pretested, semi-structured questionnaire and analyzed using MS excel and SPSS 26. The study protocol was reviewed and approved by the institutional ethical committee.

RESULTS

In the present study, only 3.34% of the mothers were illiterate and 56% belong to socio-economic class IV and V (Table 1). SLT (smokeless tobacco), PROM (Premature Rupture of Membrane), MSL (Meconium-stained liquor). Among the mothers of neonates, 1.33% had the history of fever at time of delivery (Table 2).

Among the maternal risk factors, late registered pregnancies and the mother who suffered prolonged labor were significantly associated with the severity of asphyxia. Newborn of pregnant women who had history of consumption of smokeless tobacco had significantly more risk of developing HIE than the other ($Z=4.94$, $p<0.001$) (Table 3). There was a statistically significant association between the history of addiction, prolonged labor and Obstructed labor with the outcome. Other factors which are mentioned above also play a key role in the early identification of high-risk pregnancies but didn't find a significant impact in this study (Table 4).

On application of regression analysis, it was found that there was statistically significant association between the risk factor such as maternal registration and history of addiction with asphyxia. AOR depicts the role of independent variable in relation to the dependent variable. There was a negative association with the time of registration which explains those who registered late (after the first trimester) had more risk [AOR-0.28, CI-0.09 to 0.81] as compared to early registered pregnancies. Other factors were not statistically significant but had some role in the occurrence of birth asphyxia.

Table 1: Detail information of mothers of the asphyxiated newborns.

		Number	%
Maternal age group (in years)	18 to 25	87	58
	25 to 30	44	29.33
	30 to 35	18	12
	>35	1	0.67
BMI	<18.49	12	8
	18.5 to 22.99	68	45.33
	23 to 24.99	33	22
	>25	37	24.67
Addiction to SLT	Yes	41	27.33
Comorbidity*	Hypertension	28	18.66
	GDM	1	0.67
	Hypothyroidism	28	18.66
	No comorbidity	104	69.34
Mamta card	Yes	142	94.66
Gravida	Primi-gravida	62	41.34
	Multi-gravida	88	58.66
Registration	Early	111	74
	Late	39	26
ANC visits	<4	72	48
	>=4	78	52
Birth spacing	<3 year	56	37.33

Continued.

		Number	%
	>3 year	32	21.33
	Primigravida	62	41.33
Anaemia	Yes	91	60.67
Gestational weeks	<37 weeks	26	17.34
	37 to 42 weeks	123	82
	>42 weeks	1	0.66
Duration of labor	<18 hours	90	60
	>18 hours (Prolonged Labor)	60	40
PROM	Yes	57	38
Obstructed labor	Yes	76	50.67
MSL	Yes	39	26

*****Multiple responses.

Table 2: Association between the maternal risk factors and severity of asphyxia in the newborns.

Maternal risk factors		Severity		Z test
		Mild (%)	Moderate and severe (%)	
Maternal Age	<25 years (n=87)	58 (66.67)	29 (33.33)	Z=0.25
	>25years (n=63)	43 (68.25)	20 (31.74)	p>0.05
Gestational weeks	<37 weeks (n=26)	14 (53.84)	12 (46.15)	Z=1.69
	>37 weeks (n=124)	87 (70.16)	37 (29.84)	p>0.05
Registration	Early (n=111)	80 (72.07)	31 (27.93)	Z=2.18
	Late (n=39)	21 (53.84)	18 (46.16)	p<0.05
Gravida	Primi-gravida (n=62)	41(66.12)	21 (33.88)	Z=0.25
	Multi-gravida (n=88)	60 (68.18)	28 (31.82)	p>0.05
Maternal anaemia	Yes (n=91)	60 (65.93)	31 (34.07)	Z=0.511
	No (n=59)	41 (69.5)	18 (30.5)	p>0.05
Birth spacing	<3 years (n=56)	37 (66.07)	19 (33.93)	Z=0.511
	>3 years (n=32)	24 (75)	8 (25)	p>0.05
Obstructed labor	No(n=74)	55 (74.32)	19 (25.68)	Z=1.83
	Yes (n=76)	46 (60.5)	30 (39.5)	p>0.05
Prolonged labor	No (n=90)	70 (77.78)	20 (22.22)	Z=3.34
	Yes (n=60)	31 (51.67)	29 (48.33)	p<0.0001

Table 3: Association between the maternal risk factors and Outcome of the asphyxiated newborns.

Risk factors		Total (n=150)	Mortality (n=36)	P value
Registration	Early	111	22	Z=2.05
	Late	39	14	p<0.05
Socio-economic status	III	66	14	Z=0.73
	IV	79	21	p>0.05
	V	5	1	
ANC visits	<4	72	19	Z=0.62
	>=4	78	17	p>0.05
Gravida	Primi	62	18	Z=1.27
	Multi	88	18	p>0.05
Birth spacing (N=88)	<3 years	56	10	Z=0.46
	>3 years	32	7	p>0.05
Maternal Anemia	No	59	15	Z=0.32
	Yes	91	21	p>0.05
History of Addiction	No	109	18	Z=3.52
	Yes	41	18	p<0.0001
Obstructed labor	No	74	9	Z=3.45
	Yes	76	27	p<0.0001
Prolonged labor	No	90	5	Z=6.52
	Yes	60	31	p<0.00001

Table 4: Regression analysis of the risk factors.

Risk Factors	Wald	Sig.	Adjusted odds ratio (AOR)	CI (95%)	
				LL	UL
Registration-early	5.46	0.01	0.28	0.09	0.81
Maternal age	2.15	0.14	0.90	0.79	1.03
Education					
Illiterate	0.10	0.75	0.81	0.229	2.89
Primary	0.017	0.89	1.15	0.12	10.43
Middle	0.49	0.48	1.40	0.54	3.58
High	0.90	0.82	0.81	1	1
SES					
III	5.22	0.07	0.07	0.06	0.71
IV	4.99	0.02	0.06	0.07	0.70
V	5.08	0.02	0.90	0.79	1.03
ANC visits	0.75	0.38	0.65	0.24	1.71
H/o addiction	10.10	0.001	0.21	0.08	0.55
Gravida	0.00	0.99	1.01	0.33	3.02
Maternal anaemia	0.00	0.99	0.99	0.42	2.36
Prolonged labor	1.93	0.16	0.46	0.15	1.36
Obstructed labor	0.13	0.71	0.83	0.31	2.24

DISCUSSION

The present study primarily focuses on the maternal risk factors that can lead to birth asphyxia in newborns. Birth asphyxia was found to be significantly associated with several factors during pregnancy, including non-cephalic fetal presentation, instrumental delivery, prolonged labor, meconium-stained amniotic fluid, and gestational age.

Educating a female in a family is a driving force for better health. Higher literacy among women is associated with low infant mortality and low maternal mortality 3.34% of mothers was illiterate in the present study, and there was no significant association between the outcome of the newborns and the literacy status of mothers. Contrary to the findings by Lee et al in which they found a decrease in the number of cases with an increase in literacy level.[5] Educating a woman can have a direct or indirect impact on the outcome of the newborn. In present study, 95% of pregnant women had mamta card while 74% had registered the pregnancy in their first trimester. There was a negative association with the time of registration which explains those who registered late (after the first trimester) had more risk (AOR-0.28, CI-0.09 to 0.81) as compared to early registered pregnancies. Futrakul S et al found a significant association between the lack of scheduled ANC visits and incidence of HIE cases.[6]

Socio-economic status is an important factor affecting the health condition of an individual or a family. We found that the 56% of the mothers belong to SE class IV and V. On regression analysis, class VI and V had significant role as risk factors with AOR-0.06;95% CI=0.07 to 0.7. A study by Solayman M et al and Butt et al also reported a significant association between SE class and mortality of asphyxiated newborns.[7,8] Approximately 6% of the migrant mothers were registered; originally, they were from Rajasthan, Uttar Pradesh and Madhya Pradesh. Tracking of the migrant patients becomes difficult and also, they didn't get the advantages of the government (state) yojana's. Body mass Index (BMI) can help in screening the health problems at an early stage, in the present study, 55% of mothers had abnormal BMI at the time of registration of pregnancy.[9]

We found that 60% of the mothers were anaemic which was similar to findings by Yadav N et al.[10] The reason could be due to the lack of ANC visits and the side effects of IFA tablets. In the current study, there was no significant association between anaemia its role as a risk factor for severity of asphyxia and also with outcome of asphyxiated newborn, contrary to the observation in the study by Gane et al Mohan K et al and Meshram et al.[11,12]

Smokeless tobacco (SLT) use in pregnant women reduces birth weight and shortens gestational period which leads increase in a number of low birth weight and preterm babies.[13] And these were considerable foetal risk factors for birth asphyxia. In the present study 27% of mothers had a history of consumption of smokeless tobacco that involves chewing tobacco and supari. It had a significant effect on the severity [AOR-0.21 95% CI=0.08 to 0.55] and also on the outcome ($p<0.0001$) of the asphyxiated newborn. As per study findings by Zhou S et al.[14] Smokeless tobacco during the pregnancy, increases the rate of fetal morbidity and mortality. Due to the prolonged labor there is diminished uteroplacental circulation which increases the chances of hypoxia. In the present study, 40% of mothers had prolonged labor (>18 hours) and its role as a risk factor for severity of asphyxia

and mortality in newborn was statistically significant (p<0.0001). The study by Nadeem et al and Chiabi et al also had similar findings.[15,16]

In mothers with obstructed labor, asphyxia results from tonic uterine contraction which interferes with uteroplacental circulation. In the current study 50% of the asphyxiated newborns had history of obstructed labor and it was found to be the significant risk factor for mortality in the asphyxiated newborns (p<0.0001); similar to findings by Solayman M et al.[7] Among the maternal risk factors, late pregnancy registration and prolonged labor were significantly associated with the severity of asphyxia.

A history of smokeless tobacco consumption and maternal factors such as obstructed labor and prolonged labor were significantly linked to increased mortality risk among asphyxiated newborns. Early identification of these risk factors would be beneficial in reducing neonatal mortality from preventable causes. Emphasizing early pregnancy registration, ensuring the completion of scheduled ANC visits, and vigilant monitoring during labor can decrease mortality rates among asphyxiated newborns.

Limitation was to study the variability of maternal risk factors, it is essential to expand the sample size and consider geographical differences. Future research should also include critical factors such as women's nutritional diets during the antenatal period to ensure more precise and comprehensive findings.

CONCLUSION

To improve the neonatal outcome, we need to start focusing on the antenatal paediatrics. In our study, maternal factors like lack of ANC visits, consumption of smokeless tobacco, maternal anaemia, literacy status of mother was highlighted. Consumption of smokeless tobacco and late registration of pregnancy was found to be significantly associated with severity and mortality among asphyxiated newborns. Although the other maternal factors did not find to have a significant effect in our study, but these factors should be taken into consideration.

Several intrapartum risk factors were also emphasized for a more accurate assessment of the situation, including obstructed labour, prolonged labour, PROM, and MSAF. It's indeed better to detect these factors early and refer patients in accordance with procedure because some centre lacks the specialised doctors or equipment or both to address those risk factors. Consequently, this can aid in preventing the adverse neonatal outcome and will give the newborn the better service and care that is needed. Identifying the maternal risk factors will play a crucial role in decreasing the morbidity and mortality among the newborns.

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