e-ISSN: 0975-1556, p-ISSN:2820-2643

Available online on www.ijpcr.com

International Journal of Pharmaceutical and Clinical Research 2024; 16(8); 1501-1505

Original Research Article

A Hospital Based Case-Control Study on Factors Relation with Adverse Neonatal Outcome in Singleton Pregnancy

Aparajita Rastogi[1], Babita Singh[2], Richa Rigveda[3], Shashibala Prasad[4]

[1]Assistant Professor, Department of Obstetrics and Gynaecology, Madhubani Medical College & Hospital, Madhubani, Bihar

[2]Associate Professor, Department of Obstetrics and Gynaecology, Madhubani Medical College & Hospital, Madhubani, Bihar

[3]Senior Resident, Department of Obstetrics and Gynaecology, Madhubani Medical College & Hospital, Madhubani, Bihar

[4]Professor and HOD, Department of Obstetrics and Gynaecology, Madhubani Medical College & Hospital, Madhubani, Bihar

Received: 05-07-2024 / Revised: 23-07-2024 / Accepted: 26-07-2024

Corresponding Author: Dr. Babita Singh

Conflict of interest: Nil

Abstract:

Background: Adverse neonatal outcomes are affected by maternal and fetal factors; it is the occurrence of Low Birth Weight (LBW), preterm delivery, low Apgar scores at first and fifth minutes after birth, early or late neonatal death, small for gestational age, and/or severe neonatal conditions.

Methods: The case-control study was conducted in obstetrics and gynaecology department of MMCH, Madhubani, Bihar from July 2023 to June 2024 over 210 singleton pregnant women following 1975 Helsinki declaration and its later amendment. Cases (n=105) were considered as having any adverse birth outcome, while controls (n=105) had none of the adverse birth events. Data were recorded in separated case-record form and analyzed by SPSS-24.

Results: Mean age of cases and controls were 28.98±5.48 (SD) years and 28.65±4.65 years, respectively (p=0.635). Preterm labour (64.8%), low birth weight (LBW, 41.9%) and neonatal intensive care unit (NICU) admission (31.4%) were the common adverse outcomes. Cases had significantly higher prevalence of obesity (24.8% vs 13.3%, p=0.035), gestational diabetes mellitus (49.5% vs 33.3%, p=0.017), pregnancy-induced hypertension (PIH, 40% vs 17.1%, p<0.001) and premature rupture of membrane (PROM, 15.2% vs 4.8%, p=0.011). Maternal age >35 years (adjusted odds ratio=3.77, 95%CI=1.12-12.65), PIH (AOR=3.602, 95%CI=1.797-7.22), and PROM (AOR=5.74, 95%CI=1.83-18.00) were the significant risk factors for adverse foetal outcome. Besides, PIH had significant odds ratio for preterm labour (AOR=2.21, 95%CI=1.13-4.33), LBW (AOR=4.19, 95%CI=1.93-9.12) and NICU (AOR=8.93, 95%CI=3.73-21.38). Maternal age >35 years (AOR=3.21, 95%CI=1.04-9.88) and PROM (OR=3.65, 95%CI=1.18-11.3) were associated with LBW, while previous caesarian section (CS) was responsible for preterm labour (AOR=2.298, 95%CI=1.09-4.87).

Conclusion: Pregnancy with advance maternal age, PIH, previous CS and PROM were the determinants of adverse birth outcomes.

Keywords: Adverse birth outcome, Preterm labour, Low birth weight, Pregnancy induced hypertension.

Introduction

Adverse birth outcomes especially LBW and preterm births are at greater risk for mortality, morbidity and several short and long-term physical, developmental and psychological problems. Adverse pregnancy outcome also leads to significant direct and indirect emotional and economic effects on the infant's family and the societies. Hence, unfavourable pregnancy outcomes are the most crucial statistics that are used to assess mother and child health programs and develop evidence-based interventions. Maternal and neonatal morbidity and mortality is still a challenging problem in developing and resource limited countries, like India. The first 28 days of life – the neonatal period – is the most vulnerable time for a child's survival. Children face the highest risk of dying in their first month of life at an average global rate of 17 deaths per 1,000 live births in 2022, down by 53 per cent from 37 deaths per 1,000 live births in 1990. In comparison, the probability of dying after the first month and before reaching age 1 was estimated at 11 deaths per 1,000

and the probability of dying after reaching age 1 and before reaching age 5 was estimated at 9 deaths per 1,000 in 2022. Globally, 2.3 million children died in the first month of life in 2022 – approximately 6,300 neonatal deaths every day.

Adverse pregnancy outcomes are influenced by a myriad of biological, social and environmental factors.Biological factors like advanced maternal age, gestational diabetes mellitus (GDM), pregnancy induced hypertension (PIH), obesity, previous caesarian section and several antenatal complications- urinary tract infection (UTI), premature rupture of membrane (PROM), oligohydramnios, etc. have been found to be associated with adverse pregnancy outcome.

Moreover, various epidemiological studies have also suggested association of adverse birth outcome with maternal education level, low socio-economic status, and environmental exposures such as environmental tobacco smoke, air pollution and chemicals. [1] However, there is still very limited data in our country context regarding factors responsible for perinatal morbidity and mortality, which hinders the policy makers and program implementers to pass evidence, based informed decisions and to achieve target neonatal outcomes.

Material and Methods

This case-control study was performed in the Obstetrics and Gynaecology department, Madhubani Medical College and Hospital, Madhubani, Bihar from June 2023 to May 2024.

A total of 210 singleton pregnant women who gave birth at/after 28 weeks of gestation were included in this study. Cases (n=105) were considered as having any adverse perinatal event, while control (n=105) mothers didn't experience none of the adverse perinatal events. At first, mother was selected using simple random sampling technique among mothers who gave birth on the first day of data collection (then, after the first mother selected, the next was continued based on their discharge from postpartum ward).Finally, systematic random sampling technique was employed to select the final study participants till the required sample size for case and controls were saturated.

Data collection tool and procedure: First the questionnaire and checklist were prepared after reviewing different related articles and documents. The questionnaire was reviewed by senior researchers and pre-tested in randomly selected 5 cases and 15 controls before actual data collection, and some minor modifications were made accordingly. The questionnaire contained a total of three major parts (mother's sociodemographic data, obstetric related data and neonatal outcomes). All pregnant women who gave birth at study center during study period were interviewed and their chart was reviewed after admitted to labor and delivery ward. All methods were performed in accordance with the relevant guidelines and regulations. The principal investigators throughout the data collection process were in close contact and under close supervision. Data from the cases and controls were obtained in a similar approach, reducing information bias.

All the data were entered into the SPSS package (version 24).

Continuous data were expressed as mean and standard deviation and categorical data were expressed as frequency and percentage and comparisons were assessed by student t-test and chi-square test for continuous and categorical variables respectively. Univariate and multiple logistic regressions were done to detect odds ratio (OR) of maternal risk factors. All explanatory variables in univariate logistic regression with p-value <0.05 were considered for multivariate logistic regression analysis to control confounding factors. Adjusted Odds Ratio (AOR) with their corresponding 95% confidence intervals (CI) was used to declare the independent predictor of adverse birth outcome. A probability (p) value of <0.05 were considered statistically significant.

Result

Mean age of cases and controls were 28.98±5.48 (SD) years and 28.65±4.65 (SD) years, respectively (p=0.635). Maternal age >35 years was more in cases than controls (14.3% vs 3.8%, p=0.008). Gestational age at delivery was significantly higher in controls compared to cases (37.49±0.80 vs 35.51±2.17 weeks, p<0.001). Cases had significantly higher prevalence of having obesity (24.8% vs 13.3%, p=0.035), gestational diabetes mellitus (49.5% vs 33.3%, p=0.017), gestational hypertension (40% vs 17.1%, p<0.001), uncontrolled hyperglycaemia (31.4% vs 14.3%, p=0.003) and premature rupture of membrane (15.2% vs 4.8%, p=0.011). However, both groups were statistically similar regarding parity, hypothyroidism, anaemia, previous history caesarian section, antenatal urinary tract infection, polyhydramnios, oligohydramnios and post-partum haemorrhage (p>0.05). [Table 1]

Table 1: Demographic profile of cases and controls (n=210)

Variables	Control (n=105)	Case (n=105)	p-value
Maternal age at delivery (years)			
≤35	101(96.2)	90(85.7)	0.008á
>35	4(3.8)	15(14.3)	
Mean±SD	28.65±4.65	28.98±5.48	0.635â
Gestational age at delivery (in weeks)	37.49±0.798	35.51±2.17	<0.001â
Maternal height (cm)	153.01±5.64	152.79±5.72	0.78â
Pre-pregnancy maternal height (cm)	63.66±9.24	65.04±9.74	0.296â
Pre-pregnancy maternal BMI (kg/m²)	27.19±3.69	27.84±3.76	0.205â
Para			0.245á
Primiparous	73(69.5)	65(61.9)	
Multiparous	32(30.5)	40(38.1)	
Clinical factors			
Obesity	14(13.3)	26(24.8)	0.035á
Gestational diabetes mellitus	35(33.3)	52(49.5)	0.017á
HbA1C(%)			
≤6.5	90(85.7%)	72(68.6%)	0.003á
>6.5	15(14.3%)	33(31.4%)	
Pregnancy induced hypertension	18(17.1)	42(40.0)	<0.001á
Hypothyroidism	3(2.9)	4(3.8)	1.00ã
Anaemia	54(51.4)	64(61.0)	0.164á
Previous CS	18(17.1)	24(22.9)	0.301á
Ante-natal UTI	9(8.6)	14(13.3)	0.269á
PROM	5(4.8)	16(15.2)	0.011á
Polyhydramnios	5(4.8)	3(2.9)	0.337á
Oligohydramnios	7(6.7)	6(5.7)	0.775á
PPH	6(5.7)	10(9.5)	0.298á

SD=standard deviation, BMI= Body mass index, CS= caesarian section, UTI= Urinary tract infection, PROM= Premature rupture of the uterus, PPH= post-partum haemorrhage, Values are expressed mean±SD and within parenthesis percentage (%) over column in total, p-value was determined by áChi-squared Test (c2), âIndependent sample T test and ãFisher's exact test

Among cases, preterm labour (64.8%) was the most common adverse outcome. Other unfavourable events were low birth weight (41.9%), macrosomia (5.7%), neonatal jaundice (8.6%), intra-uterine growth retardation (9.5%), foetal distress (4.8%), microcephaly (7.6%), anencephaly (1%), and other congenital anomalies (1.9%). Overall, thirty-three neonates (31.4%) of cases needed intensive care.Multivariate logistic regression analysis found that maternal age >35 years (OR=3.77, 95% CI= 1.12-12.65), PIH (OR=3.602, 95%CI= 1.797-7.22), and PROM (OR=5.74, 95%CI= 1.83-18.00) were the significant risk factors for adverse foetal outcome. [Table-2]

Table 2: Maternal risk factors for adverse foetal outcomes (n=210)

Predictor	Univariate				Multivariate			
	COR	95%CI		p-value	AOR	95%CI		p-value
		Lower	Upper			Lower	Upper	
Age >35	4.21	1.35	13.15	0.013	3.769	1.123	12.651	0.032
Obesity	2.14	1.05	4.38	0.037	2.068	0.934	4.582	0.073
GDM	1.96	1.12	3.43	<0.001	1.613	0.728	3.573	0.239
Gestational hypertension	3.22	1.70	6.11	<0.001	3.602	1.797	7.221	<0.001
HbA1C>6.5%	2.75	1.39	5.45	0.035	1.782	0.681	4.663	0.239
PROM	3.6	1.27	10.21	0.016	5.732	1.825	18.002	0.003
Previous CS	1.43	0.72	2.83	0.302	1.495	0.695	3.212	0.303

AOR=Adjusted odds ratio, COR= Crude odds ratio, CI=confidence interval CS=Caesarian section, GDM=Gestational diabetes mellitus, PIH=Pregnancy induced hypertension, PROM= Premature rupture of the uterus

Table-3 showed that PIH had significant odds ratio for preterm labour (OR=2.21, 95%CI= 1.13-4.33), LBW (OR=4.19, 95%CI= 1.93-9.12) and NICU admission (OR=8.93, 95%CI=3.73-21.38) after

adjusting other risk factors- age, obesity, GDM, HbA1C, PROM and previous CS. Besides, maternal age > 35 years (AOR=3.21, 95%CI= 1.04-9.88) and PROM (OR=3.65, 95%CI= 1.18-11.3) were associated with delivering LBW babies. Moreover, previous history of CS was the significant risk factor for preterm labour (AOR= 2.298, 95%CI= 1.09-4.87). [Table-3]

Table 3: Risk factors for preterm delivery, low birth weight baby and NICU admission (n=210)

Predictor	Preterm labour		LBW		NICU admission	
	AOR (95%CI)	p-value	AOR (95%CI)	p-value	AOR (95%CI)	p-value
Age>35years	1.038(.36-3.98)	0.945	3.206(1.04-9.88)	0.043	0.235(0.05-1.24)	0.088
Obesity	1.835(0.86-3.93)	0.119	1.607(0.62-4.19)	0.332	1.071(0.37-3.09)	0.899
GDM	0.803(0.34-1.92)	0.623	1.391(0.50-3.84)	0.524	1.169(.39-3.53)	0.783
PIH	2.213(1.13-4.33)	0.020	4.189(1.93-9.12)	<0.001	8.934(3.73-21.38)	<0.001
HbA1C>6.5%	2.274(0.84-6.13)	0.104	1.777(.55-5.7)	0.333	1.048(0.28-3.94)	0.945
PROM	2.622(0.98-6.99)	0.054	3.650(1.18-11.3)	0.025	2.166(.62-7.54)	0.225
Previous CS	2.298(1.09-4.87)	0.030	1.43(0.3-6.7)	0.14	0.221(0.05-1.05)	0.057

AOR=Adjusted odds ratio, CI=confidence interval CS=Caesarian section, GDM=Gestational diabetes mellitus, LBW= low birth weight, NICU= neonatal intensive care unit, PIH=Pregnancy induced hypertension, PROM= Premature rupture of the uterus

Discussion

This study found that maternal age >35 years had significant odds ratio for adverse birth outcome, especially to deliver LBW babies (AOR=3.21, 95% CI=1.04-9.88). A multi-country evaluation encompassing 29 middle- and low-income nations came to the same conclusion that advanced maternal age was a risk factor for LBW (OR= 1.1, 1.4 and 1.2 for women aged 35–39, 40–45 and e" 45 years old, respectively) [2]. The high prevalence of obstetric complications and associated iatrogenic preterm difficulties in older pregnancies may be the cause of this similarity. Changes in social and economic conditions, as well as improvements in assisted reproductive technologies, have all contributed to delays in childbearing. These factors add to the risk of developing disorders during gestation that are unrelated to pregnancy. Adverse perinatal outcomes are therefore more frequent in older patients. Hence, raising public knowledge of the adverse impacts of late childbearing is necessary.

In current study, cases had significantly higher prevalence of obesity (24.8% vs 13.3%, p=0.035) than controls. Several previous studies also found the similar adverse birth outcome in obese mothers. [3,4] Although the precise mechanism underlying this relation is yet unknown, the most likely cause may be the close association between maternal obesity and the frequent co-occurrence of diabetes and hypertension in the same patient. This study also noticed that cases had significantly higher prevalence gestational diabetes mellitus (49.5% vs 33.3%, p=0.017), and pregnancy induced hypertension (40% vs 17.1%, p<0.001). These findings are also in conformance with the work of previous researchers [5–7]

In present study, pregnancy induced hypertension had significant odds ratio for adverse birth outcome, especially for preterm delivery (AOR=2.21, 95% CI=1.13-4.33), LBW (AOR=4.19, 95% CI= 1.93-9.12) and admission to neonatal intensive care unit (AOR=8.93, 95%CI=3.73-21.38). Similarly, an Ethiopian study also noticed that women with pregnancy-induced hypertension were born babies with a higher risk of low birth weight (AOR=5.1, 95% CI=3.4-7.8), preterm labour (AOR=5.2, 95% CI=3.4-7.9), and NICU admission (AOR=5.1, 95% CI=3.1-8.4) compared to normotensive pregnant women after adjusted for confounders. [8] A study from Malaysia found pregnancy-induced hypertension as an independent risk factor (AOR = 5.06; 95%CI= 2.63-9.71) for low birth weight after controlling for important confounders such as maternal age, ethnicity, education, parity, gestational age at delivery, and previous history of abortion. [9] Additionally, biological explanations for the connection between pregnancy-induced hypertension and low birth weight have been put forth due to placental insufficiency. Thus, low birth weight and foetal growth retardation are caused by the reduced utero-placental blood perfusion. Besides, different interventional delivery methods used on eclamptic women regardless of gestational age also may contribute to the high rate of preterm delivery in pregnancy induced hypertension. [8] Alarmingly, complications from preterm birth and low birth weight are the leading cause of child deaths every year.Current study also found that preterm labour and low birth weight were the most common adverse birth outcomes.

In this study, premature rupture of membrane (15.2% vs 4.8%, p=0.011) was occurred more in cases than controls. Besides, PROM had significant odds ratio for adverse birth outcome (AOR=5.73, 95%CI= 1.82-18). Similarly, Degno et al., also observed that mothers who had PROM during the current pregnancy were approximately two times

more likely to have adverse birth outcome than mothers who had no PROM (AOR = 2.31, 95%CI= 1.26–4.21; P = 0.006). [10]This study also found that previous history of CS was the significant risk factor for preterm labour (AOR=2.298, 95%CI= 1.09-4.87). In a secondary analysis of World Health Organization multi-country survey on maternal and newborn health also reported that previous CS was associated with increased risk of preterm birth (AOR=1.07; 95% CI=1.01-1.14). [11]Besides, according to a prior study conducted in a sizable cohort of pregnant women in the United States, pregnant women with prior CS were 14% more likely to have a preterm birth in their subsequent pregnancy (95% CI= 1.12 to 1.16). [12] These findings highlight that efforts to limit unnecessary CS may lead to lowering the preterm birth rate. Our study has some potential limitations. It was a single centered and small sized study. Besides, we did not investigate the effect of socio-economic, genetic and environmental factors. Moreover, diet history, family violence and psychological status of pregnant mothers were also not evaluated.

Conclusion

Pregnancy with advance maternal age, gestational diabetes mellitus, pregnancy induced hypertension; previous caesarian section and premature rupture of membrane were found to be associated with adverse birth outcome. Therefore, it is better for health care providers to counsel couples, who seek to have a child in their later ages, about the risks of advanced maternal age, especially in those who had previous history of caesarian section. Necessary steps should be taken to control blood glucose and pressure during pregnancy. Besides, mothers should be encouraged for regular antenatal visit for prevention, early diagnosis and prompt management of premature rupture of membrane.

References

1. Díaz J, Arroyo V, Ortiz C, Carmona R, Linares C. Effect of Environmental Factors on Low Weight in Non-Premature Births: A Time Series Analysis. PLoS One. 2016 Oct 27;11(10):e0164741.
2. Laopaiboon M, Lumbiganon P, Intarut N, Mori R, Ganchimeg T, Vogel JP, et al. Advanced maternal age and pregnancy outcomes: a multicountry assessment. BJOG. 2014;121 Suppl:49–56.
3. Aubry EM, Oelhafen S, Fankhauser N, Raio L, Cignacco EL. Adverse perinatal outcomes for obese women are influenced by the presence of comorbid diabetes and hypertensive disorders. Sci Rep. 2019;9(1):9793.
4. Liu L, Ma Y, Wang N, Lin W, Liu Y, Wen D. Maternal body mass index and risk of neonatal adverse outcomes in China: a systematic review and meta-analysis. BMC Pregnancy Childbirth. 2019;19(1):105.
5. Patel R, Baria H, Patel HR, Nayak S. A study on pregnancy induced hypertension and foetal outcome among patient with PIH at tertiary care hospital, Valsad. Int J Community Med Public Heal. 2017;4(11):4277.
6. Mistry SK, Das Gupta R, Alam S, Kaur K, Shamim AA, Puthussery S. Gestational diabetes mellitus (GDM) and adverse pregnancy outcome in South Asia: A systematic review. Endocrinol Diabetes Metab. 2021;4(4):e00285.
7. Zhuang W, Lv J, Liang Q, Chen W, Zhang S, Sun X. Adverse effects of gestational diabetesrelated risk factors on pregnancy outcomes and intervention measures. Exp Ther Med. 2020 Oct;20(4):3361–7.
8. Berhe AK, Ilesanmi AO, Aimakhu CO, Mulugeta A. Effect of pregnancy induced hypertension on adverse perinatal outcomes in Tigray regional state, Ethiopia: a prospective cohort study. BMC Pregnancy Childbirth. 2019;20(1):7.
9. Rahman LA, Hairi NN, Salleh N. Association between pregnancy induced hypertension and low birth weight; a population-based case-control study. Asia-Pacific J public Heal. 2008;20(2):152–8.
10. Degno S, Lencha B, Aman R, Atlaw D, Mekonnen A, Woldeyohannes D, et al. Adverse birth outcomes and associated factors among mothers who delivered in Bale zone hospitals, Oromia Region, Southeast Ethiopia. J Int Med Res. 2021;49(5).
11. Kietpeerakool C, Lumbiganon P, Laopaiboon M, Rattanakanokchai S, Vogel JP, Gülmezoglu AM. Pregnancy outcomes of women with previous caesarean sections: Secondary analysis of World Health Organization Multicountry Survey on Maternal and Newborn Health. Sci Rep. 2019;9(1):1–9.
12. Williams CM, Asaolu I, Chavan NR, Williamson LH, Lewis AM, Beaven L, et al. Previous cesarean delivery associated with subsequent preterm birth in the United States. Eur J Obstet Gynecol Reprod Biol. 2018; 229:88–93.