

MATERNAL RISK FACTORS FOR MODERATE AND LATE PRETERM LABOUR: A CASE-CONTROL STUDY FROM A TERTIARY CARE HOSPITAL IN PESHAWAR

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ABSTRACT

OBJECTIVES

The aim of the study was to determine the maternal risk factors associated with moderate and late preterm labor.

METHODOLOGY

This case-control study was conducted at the Department of Obstetrics and Gynaecology, Khyber Teaching Hospital, from March 1 2024, to August 31 2024. Patients in the age range 18 to 40 years diagnosed with moderate and late preterm labor were compared with controls for maternal risk factors, including inadequate prenatal care and maternal hypertension. Data analysis was conducted in SPSS v.26, and odds ratios were calculated using a 2x2 table.

RESULTS

The mean age of the cases was 29.14±6.239 years compared to 27.91±6.754 years in controls. The mean gestational age in cases and controls was 33.88±1.372 weeks and 38.78±1.439 weeks, respectively. Sixty-four patients (55.7%) in cases were aged more than 30 years compared to 51 patients (44.3%) among controls (p value 0.112). Among cases, 112 patients (49.1%) were multiparous, versus 116 (50.9%) among controls (p value 0.901). Overall, inadequate prenatal care was recorded in 85 participants (53; 62.4%) as cases versus 32 controls (37.6%), p value 0.006, OR 2.070 (95% CI 1.226 - 3.497). Maternal hypertension was recorded in 74 patients, more frequently among cases (n = 45, 60.8%) than among controls (n = 29, 39.2%), p value 0.029; OR 1.822 (95% CI 1.058 - 3.136).

CONCLUSION

Patients with preterm labour had a higher prevalence of poor prenatal care and maternal hypertension. Our findings highlight the significance of proper prenatal care and efficient management of hypertensive diseases throughout pregnancy.

KEYWORDS: Preterm Labor, Moderate Preterm, Late Preterm, Maternal Risk Factors, Inadequate Prenatal Care, Maternal Hypertension

INTRODUCTION

Every neonate delivered before 37 weeks of gestational age (GA) is considered preterm, according to WHO. Infants delivered within 34 and 36 weeks and six days are considered late preterm, while those born before 28 weeks are considered very premature.¹ With over one million fatalities annually globally, prematurity is the primary cause of death and disability among infants, occurring in over 10% of births. Basic medical care and inexpensive treatments can avert the majority of these fatalities.² Premature labor is the primary maternal problems that result in late preterm delivery.³ Twin pregnancies, hypertensive illness, gestational diabetes, and urinary tract infections are among the other obstetric disorders that can cause preterm birth. The unsettling fetal state and limited intrauterine growth are two of the primary fetal reasons.⁴ The relationship between GA and the risk of newborn problems is inverse. The fetus's growth advances, and the incidence

and intensity of newborn problems decrease with each passing week it stays in the uterus.⁵ The likelihood of adverse effects from late prematurity is approximately seven times greater than that of term infants (TI). These initial issues encompass breathing difficulty, failure to maintain temperature, low blood sugar, elevated bilirubin levels, eating challenges, CNS underdevelopment, and exposure to microbes.⁶ In addition, compared to term newborns, the possibility of hospital admission and morbidity is increased throughout the first year of life.⁷ In a study, intrauterine growth retardation was observed in 24.1% patients with moderate and late preterm as compared to 7.8% with term labor. Inadequate visits were reported in 76.9% patients with preterm labor as compared to 60.3% patients with term labor. Maternal hypertension was observed in 29.8% patients with moderate and late preterm as compared 11.9% with term infants.⁸ The lack of information on the risk factors for moderate and late preterm birth in our community prompted the

planning of this study. Because preterm birth has several clinical and economic ramifications, it is essential to understand the variables that contribute to moderate and late preterm birth. Our study's findings will help fill this information gap. Better counseling of expectant mothers with possible risk factors regarding the course of their pregnancy might also benefit from it.

METHODOLOGY

This case-control study was conducted at the Department of Obstetrics and Gynecology, Khyber Teaching Hospital, Peshawar, during the period March 1, 2024, to August 31, 2024. Women aged 18 to 40 years with gestational age 32 to 36⁺⁶ weeks as per last menstrual period were contrasted, for maternal risk factors including inadequate prenatal care and maternal hypertension, with healthy controls. Patients with a prior history of cesarean delivery, patients with medical conditions such as thyroid disorder, multiple pregnancies on ultrasound, babies with congenital anomalies, and intrauterine death were excluded. Preterm labor was defined by labor onset prior to 37 weeks of gestation. Labor onset between 32 and 33⁺⁶ weeks was called moderate preterm, and 34 to 36⁺⁶ weeks were called late preterm, which were considered cases. Healthy controls included patients with an onset of labor at 37 weeks of gestation or later. Maternal risk factors evaluated included inadequate prenatal care, defined as fewer than three medical visits during pregnancy, regardless of gestational age. Maternal hypertension was defined as blood pressure more than 140/90mmHg measured using a sphygmomanometer, during pregnancy on two or more occasions at least 4 hours apart. It was hypothesized that maternal hypertension and inadequate antenatal care are associated with moderate and late preterm labor (i.e., odds ratio more than 1). Sample size was 274 (137 in each group), calculated using the WHO sample size formula, with anticipated proportions of inadequate visits in patients with preterm and term labor set at 76.9% and 60.3%, respectively, 80% power of the test, and a 95% confidence level. Participants were recruited using non-probability consecutive sampling. Patients fulfilling the inclusion criteria were enrolled from the hospital's indoor department after obtaining approval from the institute's research review board and the CPSP. Informed consent was taken from all study participants after explaining the purpose, risks, and benefits of the study. Baseline information, including age (years), gestational age (weeks), BMI (kg/m²), residence, profession, education, and socioeconomic status, was recorded. All patients were evaluated for maternal risk factors. For maternal risk factors, history was taken about previous history of hypertension.

Blood pressure was recorded in the lying position on two occasions at least 4 hours apart using a sphygmomanometer. History was taken regarding the number of visits the patients made during the entire length of pregnancy. The number of visits documented in the medical record during the period of gestation was noted. Maternal risk factors were noted as per operational definitions. Data were analyzed using IBM SPSS Statistics version 24. Frequencies and percentages were computed for qualitative variables, including residence, profession, education, socioeconomic status, parity, and maternal risk factors (hypertension and inadequate antenatal care). Means $\pm$ S.D. or median (IQR) were computed for quantitative data on age, gestational age, and BMI after checking the normality of the data using the Shapiro-Wilk test. The association between maternal risk factors and moderate/late preterm was measured using the chi-square test at the 5% level of significance, with p-values ≤ 0.05 considered statistically significant. Odds ratios for maternal risk factors (hypertension and inadequate antenatal care) were calculated using a 2x2 table to measure the strength of association. 95% CI for the odds ratio was calculated. Odds ratios with 95% CIs excluding one were considered significant. Effect modifiers such as age, gestational age, parity, BMI, residence, education, profession, and socioeconomic status were controlled for by stratification. A post-stratification chi-square test at the 5% significance level was applied. P-value ≤ 0.05 was considered statistically significant. A multivariate logistic regression model was used to identify independent predictors of preterm labour.

RESULTS

The mean age of the cases was 29.14 $\pm$ 6.239 years compared to 27.91 $\pm$ 6.754 years in controls. The mean gestational age in cases and controls was 33.88 $\pm$ 1.372 weeks and 38.78 $\pm$ 1.439 weeks, respectively. Sixty-four patients (55.7%) in the cases were aged more than 30 years, compared to 51 patients (44.3%) among controls (p value 0.112). Among cases, 112 patients (49.1%) were multiparous, versus 116 (50.9%) among controls (p value 0.901). No statistically significant difference was observed between cases and controls regarding socioeconomic status (p-value 0.468); however, a significant difference in profession distribution was observed (p-value 0.034). Overall, inadequate prenatal care was recorded in 85 participants, of whom 53 (62.4%) were cases and 32 (37.6%) were controls (p value 0.006; OR 2.070 [95% CI 1.226-3.497]). Maternal hypertension was recorded in 74 patients, more frequently among cases (n = 45, 60.8%) than among controls (n = 29, 39.2%), with an OR of 1.822

(95% CI 1.058 - 3.136). Stratification of inadequate prenatal care by age showed no statistically significant difference (p-value = 0.726). 49 patients (29.3%) with BMI 25.0 kg/m² or below received inadequate care, compared to 36 patients (33.6%) with BMI > 25.0 kg/m², p value 0.452. Inadequate care was observed in 16 (34.8%) primiparous patients, compared with 69 (30.3%) multiparous patients (p value 0.546). No statistically significant association was observed with other parameters (p value > 0.05). Forty-one patients (25.8%) aged 30 years or below had maternal hypertension versus 33 (28.7%) aged more than 30 years. The p-value was 0.592. The p-value for the difference in distribution by BMI was 0.419. Sixteen patients (34.8%) with maternal hypertension were primiparous versus 58 (25.4%) multiparous patients (p value 0.193). A binary logistic regression model was constructed to assess the effect of baseline variables on outcome parameters. However, no statistically significant effect was observed (p value > 0.05, OR $\approx$ 1 and 95% CI for odds ratio included 1).

Table 1: Distribution of Patients According to Baseline Parameters (n = 274)

		Group		P-Value
		Cases (n=137)	Controls (n=137)	
Age (years)	30 or below	73	86	0.112
		45.9%	54.1%	
	More than 30	64	51	
		55.7%	44.3%	
BMI (kg/m ²)	25.0 or below	83	84	0.901
		49.7%	50.3%	
	More than 25.0	54	53	
		50.5%	49.5%	
Parity	Primiparous	25	21	0.901
		54.3%	45.7%	
	Multiparous	112	116	
		49.1%	50.9%	
SES	Fair	61	67	0.468
		47.7%	52.3%	
	Poor	76	70	
		52.1%	47.9%	
Profession	House wife	105	89	0.034
		54.1%	45.9%	
	Professional	32	48	
		40.0%	60.0%	
Residence	Rural	73	79	0.466
		48.0%	52.0%	
	Urban	64	58	
		52.5%	47.5%	
Education	No formal schooling	34	18	0.037
		65.4%	34.6%	
	Matric or below	61	76	
		44.5%	55.5%	
	Above matric	42	43	
		49.4%	50.6%	

Table 2: 2x2 Table Analysis and Odds Ratio for Outcome Variables (n = 274)

Outcome variables		Group		P-Value	Odds ratio
		Cases	Controls		
Inadequate Prenatal Care	Yes	53	32	0.006	2.070 (1.226 - 3.497)
		62.4%	37.6%		
	No	84	105		
		44.4%	55.6%		
Maternal Hypertension	Yes	45	29	0.029	1.822 (1.058 - 3.136)
		60.8%	39.2%		
	No	92	108		
		46.0%	54.0%		

Table 3: Stratification of Inadequate Prenatal Care with Baseline Parameters (n = 274)

		Inadequate Prenatal Care		P-Value
		Yes (n=85)	No (n=189)	
Age (years)	30 or below	48	111	0.726
		30.2%	69.8%	
	More than 30	37	78	
		32.2%	67.8%	
BMI (kg/m ²)	25.0 or below	49	118	0.452
		29.3%	70.7%	
	More than 25.0	36	71	
		33.6%	66.4%	
Parity	Primiparous	16	30	0.546
		34.8%	65.2%	
	Multiparous	69	159	
		30.3%	69.7%	
SES	Fair	42	86	0.549
		32.8%	67.2%	
	Poor	43	103	
		29.5%	70.5%	
Profession	House wife	64	130	0.273
		33.0%	67.0%	
	Professional	21	59	
		26.3%	73.8%	
Residence	Rural	47	105	0.968
		30.9%	69.1%	
	Urban	38	84	
		31.1%	68.9%	
Education	No formal schooling	18	34	0.355
		34.6%	65.4%	
	Matric or below	37	100	
		27.0%	73.0%	
	Above matric	30	55	
		35.3%	64.7%	

Table 4: Stratification of Maternal Hypertension with Various Parameters (n = 274)

		Maternal Hypertension		P-Value
		Yes (n=74)	No (n=200)	
Age (years)	30 or below	41	118	0.592
		25.8%	74.2%	
	More than 30	33	82	
		28.7%	71.3%	
BMI (kg/m ²)	25.0 or below	48	119	0.419
		28.7%	71.3%	
	More than 25.0	26	81	
		24.3%	75.7%	
Parity	Primiparous	16	30	0.193
		34.8%	65.2%	
	Multiparous	58	170	
		25.4%	74.6%	
SES	Fair	35	93	0.907
		27.3%	72.7%	
	Poor	39	107	
		26.7%	73.3%	
Profession	House wife	50	144	0.474
		25.8%	74.2%	
	Professional	24	56	
		30.0%	70.0%	
Residence	Rural	44	108	0.419
		28.9%	71.1%	
	Urban	30	92	
		24.6%	75.4%	
Education	No formal schooling	09	43	0.204
		17.3%	82.7%	
	Matric or below	39	98	
		28.5%	71.5%	
	Above matric	26	59	
		30.6%	69.4%	

Table 5: Logistic regression analysis predicting inadequate prenatal care and maternal hypertension (n = 274)

Dependent Variable	Predictors	B	S.E.	Wald	df	Sig.	OR	95% CI for OR	
								Lower	Upper
Inadequate prenatal care	Age	-.114	.268	.182	1	.670	.892	.528	1.508
	BMI	-.163	.273	.359	1	.549	.849	.497	1.450
	Parity	.178	.348	.262	1	.609	1.195	.604	2.364
	SES	.168	.268	.393	1	.531	1.183	.700	1.998
	Profession	.308	.301	1.053	1	.305	1.361	.755	2.454
	Residence	-.013	.268	.002	1	.962	.987	.583	1.671
	Education	-.055	.191	.082	1	.775	.947	.651	1.377
Maternal HTN	Age	-.124	.281	.195	1	.659	.883	.510	1.532
	BMI	.254	.292	.761	1	.383	1.290	.728	2.285
	Parity	.398	.353	1.266	1	.260	1.489	.745	2.976
	SES	.098	.281	.121	1	.728	1.103	.635	1.914
	Profession	-.201	.300	.447	1	.504	.818	.454	1.473
	Residence	.130	.283	.211	1	.646	1.139	.654	1.982
	Education	-.305	.203	2.249	1	.134	.737	.495	1.098

DISCUSSION

Pakistan has 21.6% preterm birth rate, which is comparable to other developing nations and far higher than that of industrialized nations.⁹ This case-control study assessed the maternal risk factors associated with moderate and late preterm birth in a tertiary care setting in Pakistan. The findings demonstrated that inadequate prenatal care and maternal hypertension were significantly associated with preterm labor, which aligns with previously reported literature. While most baseline demographic characteristics, such as maternal age, BMI, parity, socioeconomic status, and residence, did not differ significantly between groups, our study found a statistically significant difference in education level ($p = 0.037$). A greater proportion of women in the preterm group had no formal schooling compared to controls. These findings suggest that lower educational attainment may contribute to an increased risk of preterm birth, possibly due to limited health literacy or reduced access to healthcare resources. These associations merit further exploration in future studies.^{11,12} Maternal hypertension was another significant risk factor identified in our study. Among preterm cases, 60.8% had hypertension compared to 39.2% of controls ($p = 0.029$; OR 1.82, 95% CI: 1.06-3.14). This finding corroborates earlier research by Brown et al. and Araújo et al., which demonstrated that hypertensive disorders in pregnancy, primarily preeclampsia, are strongly associated with placental insufficiency and increased rates of medically indicated preterm birth.^{4,13} Hypertension compromises uteroplacental blood flow, potentially leading to fetal growth restriction and premature labor induction. Numerous studies link insufficient prenatal care to preterm birth.^{14,15} Our results showed that inadequate prenatal care, defined as fewer than three visits during pregnancy, was significantly more common among women who delivered preterm than among those with term deliveries (62.4% vs. 37.6%, $p = 0.006$; OR 2.07, 95% CI: 1.23-3.50). This observation is consistent with studies by Razeq et al. and Machado et al., which found that reduced antenatal visits are associated with an increased risk of preterm delivery.^{12,16} Poor attendance at prenatal clinics may lead to missed opportunities for early detection and management of pregnancy complications, thereby increasing the risk of adverse outcomes such as preterm birth. Approximately two-thirds of the late preterm babies in previous research were spontaneous preterm deliveries. Recognizable risk variables, including diabetes, hypertension, and fetal distress, accounted for the remaining third.^{17,18} A minor fraction lacked a discernible risk factor, which may

have been caused by surgical decision-making or inadequate reporting of maternal or fetal diseases.^{19,20} The clinical implications of our findings are considerable. Emphasizing the importance of regular, high-quality antenatal care can enable earlier identification and management of maternal conditions, such as hypertension. Public health strategies should therefore include strengthening community-level awareness and improving access to antenatal services, particularly in underserved populations. Moreover, targeting educational interventions to less educated women and homemakers may further reduce the burden of preterm birth. The strengths of this study include its prospective design, standardized data collection methods, and operational definitions, which enhance methodological rigor. Moreover, the study population was adequately matched, and confounding variables were addressed using logistic regression, thereby strengthening the internal validity of this study.

LIMITATIONS

First, it was conducted at a single tertiary care hospital, which may limit the generalizability of the findings to other settings, particularly rural areas. Second, the use of non-probability consecutive sampling could introduce selection bias. Third, the reliance on self-reported data in the absence of medical records for antenatal care visits introduces the potential for recall bias. Fourth, although key maternal risk factors were considered, unmeasured confounders such as nutritional status, psychosocial stress, and environmental exposures were not accounted for. Lastly, maternal hypertension was analyzed as a single entity, as it was not always possible to differentiate reliably between chronic hypertension, gestational hypertension, and preeclampsia, due to the late booking of some patients.

CONCLUSIONS

Inadequate prenatal care and maternal hypertension are significant contributors to moderate and late preterm labor in our population, almost doubling the risk. Focused antenatal interventions, educational support, and improved maternal health surveillance, including regular blood pressure monitoring, can mitigate these modifiable risk factors for preterm labor. Future multicenter studies with larger sample sizes and broader risk-factor assessment are recommended to elucidate the determinants of preterm birth in Pakistan.

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AUTHORS CONTRIBUTION

Sara Jamil - Concept & Design; Data Acquisition; Data Analysis/interpretation; Drafting Manuscript; Final Approval
Fauzia Afridi - Concept & Design; Data Acquisition; Drafting Manuscript; Critical Revision; Supervision; Final Approval
Wajeaha Javid - Concept & Design; Data Acquisition; Drafting Manuscript; Final Approval

The authors accept responsibility for all aspects of the work and will ensure that any concerns regarding the accuracy or integrity of any part are properly investigated and resolved.



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