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Original Research Article

Identification of risk factors of premature rupture of membrane at a tertiary care centre: a case-control study

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ABSTRACT

Background: Premature rupture of membranes (PROM) is a critical issue in obstetrics, occurring in 3-4% of pregnancies and accounting for 40-50% of preterm births. This study aims to identify risk factors associated with premature rupture of membranes in women who deliver at tertiary care centre.
Methods: This research is a case-control study conducted with 240 women at the Department of Obstetrics and Gynaecology, People's College of Medical Sciences and Research Institute, Bhopal. The study comprised 80 cases and 160 controls in a 1:2 ratio.
Results: There were no significant demographic differences between cases and controls. However, significant differences were found in past obstetric and gynecological histories. PROM was strongly associated with previous PROM (Adjusted OR: 4.62, 95% CI: 2.06-10.52), previous lower segment cesarean section (LSCS) (Adjusted OR: 2.08, 95% CI: 1.14-6.74), abnormal vaginal discharge (AOR: 2.35, 95% CI: 2.53-22.46) and urinary tract infections (UTI) (AOR: 3.40, 95% CI: 6.56-13.04).
Conclusions: Key risk factors for premature rupture of membranes include previous PROM, LSCS, abnormal vaginal discharge and UTIs. Addressing these factors is crucial for preventing PROM and enhancing maternal and fetal health outcomes.

Keywords: Obstetric complications, Preterm birth, Premature rupture of membranes

INTRODUCTION

Fetal membranes are essential in pregnancy, serving mechanical, immune, endocrine, transport and antimicrobial functions.[1] The thick basement layer of the amniotic membrane is particularly important in protecting the fetus throughout pregnancy.[2] As pregnancy progresses, these membranes undergo ageing, which is associated with fetal growth and development.

By term, the membranes show aging pathology, characterized by inflammation, which prompts the release of mediators that initiate labor. This dual role highlights their importance in both maintaining pregnancy and promoting delivery.[1] Disruption of the cellular and matrix structure of the membranes can lead to complications such as preterm premature rupture of membranes (pPROM) and spontaneous preterm birth (PTB).[1] Notably, pPROM constitutes about 40% of all PTB cases. It is defined as the rupture of membranes before 37 weeks of gestation and before the onset of labor.[3]

PROM affects 3-4% of pregnancies, significantly contributing to preterm births (40-50%) and having a substantial impact on neonatal mortality and morbidity. Despite advancements in prenatal care, the incidence of PROM and related preterm births has increased over the past three decades. This study seeks to identify the risk factors for PROM in women delivering at tertiary care centers.[4]

METHODS

The current case-control study was carried out over an 8-months period, from February 1, 2023, to September 30, 2023. The study was done at the Department of Obstetrics and Gynecology, People's College of Medical Sciences and Research Institute, Bhopal.

This study encompassed 240 women, categorized into 80 cases (women diagnosed with PROM) and 160 controls (women without PROM).

The control group included women presenting for delivery without PROM, encompassing both term and preterm pregnancies. To minimize confounding factors, controls were meticulously matched with cases in terms of age and parity.

Data was gathered through an interviewer-administered structured questionnaire. The sample size was calculated to ensure sufficient statistical power for detecting meaningful differences between the cases and controls.

Inclusion criteria

The inclusion criteria comprised women presenting for delivery, including both term and preterm pregnancies, with age and parity matching between cases and controls.

Exclusion criteria

Exclusion criteria included pregnant women with serious fetal or maternal conditions necessitating immediate delivery. A binary logistic regression model was utilized to analyze the association between dependent and independent variables. Additionally, multivariable logistic regression was employed to identify independent predictors of premature rupture of membranes (PROM). Statistical significance was determined at a p value of less than 0.05.

RESULTS

Table 1 Demographic comparison Age: 1.2% of cases were aged 18-19 years, compared to 6.2% of controls; 91.2% of cases and 82.5% of controls were aged 20-34; 7.5% of cases and 11.2% of controls were aged 35-45. Regarding occupation, 80.0% (cases) and 82.6% (controls) were housewives; 9.6% (cases) and 7.0% (controls) were employed, 6.1% (cases) and 6.5% (controls) were merchants and 4.3% (cases) and 3.9% (controls) fell into “Other. Monthly income data (including partner) indicated that 54.1% (cases) and 53.4% (controls) earned less than 25,000, while 45.9% of cases and 46.6% of controls earned 25,000-49,000. In terms of residence, 57.4% (cases) and 55.2% (controls) were urban, while 42.6% (cases) and 44.8% (controls) were rural.

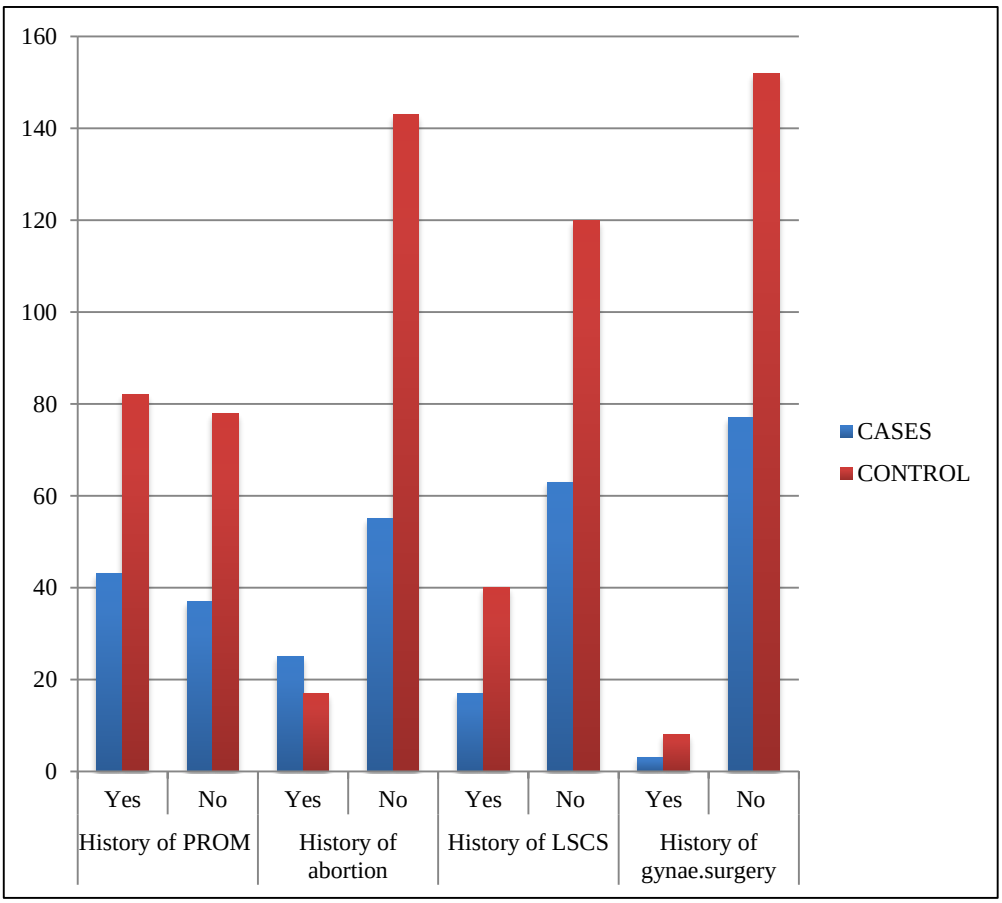

Figure 1: Past obstetric and gynaecological history.

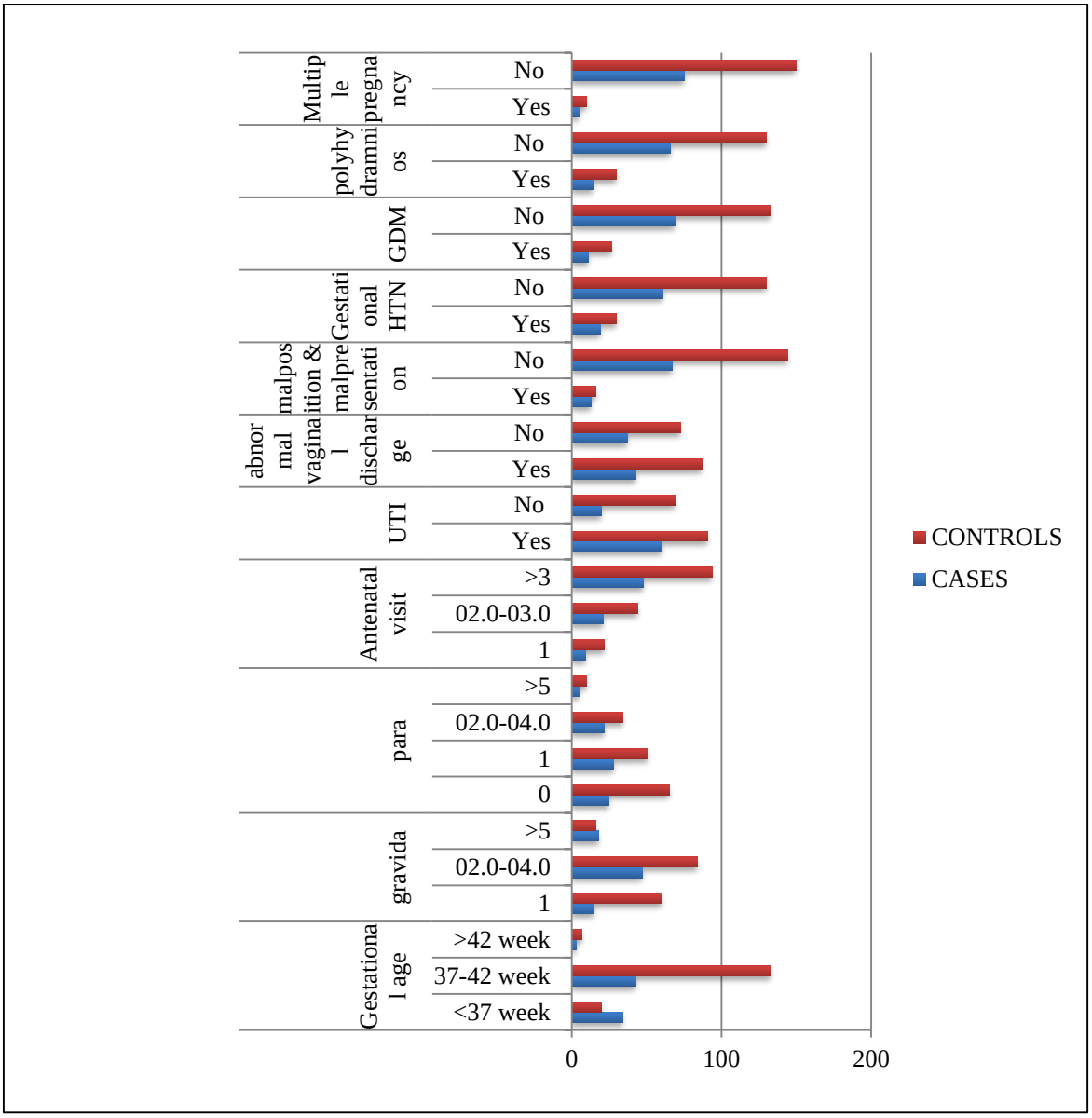

Figure 2: Risk in index pregnancy.

Table 2 past obstetric and gynecological History, History of premature rupture of membranes (PROM) was reported in 52.8% (cases) and 51.2% (controls), while 47.2% (cases) and 48.8% (controls) had no history of PROM. History of abortion was present in 31.2% (cases) and 10.5% (controls), while 68.8% of cases and 89.5% of controls had no history of abortion. History of lower segment cesarean section (LSCS) was reported by 21.4% (cases) and 25.2% (controls), while 78.6% (cases) and 74.8% (controls) had no history of LSCS. Gynecological surgery was reported by 3.5% (cases) and 4.6% (controls), while 96.5% (cases) and 95.4% (controls) had no history of surgery.

Table 3 risk assessment in index pregnancy, Gestational age of <37 weeks was seen in 42.3% (cases) and 11.8% (controls), while 53.8% (cases) and 84.2% (controls) fell between 37-42 weeks and 3.8% of cases and 3.9% of controls exceeded 42 weeks. Gravida showed that 23.8% (cases) and 37.5% (controls) were first pregnancies, 62.5% (cases) and 52.5% (controls) had 2-4 pregnancies and 13.8% of cases and 10% of controls had over five pregnancies. Parity showed 31.2% of cases and 40.6% of controls had no births, 35% of cases and 31.9% of controls had one, 27.5% of cases and 21.2% of controls had 2-4 and 6.2% of cases and 6.2% of controls had over five births.

For antenatal visits, 10.4% of cases and 13.0% of controls had one visit, 26.7% of cases and 28.0% of controls had 2-3 and 62.8% of cases and 59.0% of controls had more than three. Urinary tract infections (UTI) were reported in 74.2% of cases and 56.8% of controls, while abnormal vaginal discharge was reported in 42.3% (cases) and 54.6% (controls). Lifting heavy objects was noted by 16.5% of cases and 8.3% of controls. Gestational hypertension (HTN) was reported in 23.8% (cases) and

18.8% (controls), gestational diabetes mellitus (GDM) in 13.3% of cases and 16.8% of controls, polyhydramnios in 17.5% of cases and 18.8% of controls and multiple pregnancies in 6.2% of both cases and controls. Table 4 bivariate and multivariate logistic regression analysis for the history of PROM, the crude odds ratio (COR) was 4.85 (95% CI: 2.98–10.86) and the adjusted odds ratio (AOR) was 4.62 (95% CI: 2.06–10.52). History of LSCS had a COR of 2.15 (95% CI: 1.08–4.20) and an Adjusted OR of 2.08 (95% CI: 1.14–6.74). Abnormal vaginal discharge showed a corrected OR of 2.24 (95% CI: 3.86–19.74) and an Adjusted OR of 2.35 (95% CI: 2.53–22.46). For UTI, the COR was 3.06 (95% CI: 5.04–11.26) and the Adjusted OR was 3.40 (95% CI: 6.56–13.04). These values highlight the association and strength of specific risk factors in cases compared to controls.

These analyses underscore the significant associations and strengths of specific risk factors in cases versus controls.

Table 1: Demographic details.

Variables	Category	Cases N %	Control N %
Age (in years)	18-19	1 (1.2)	10 (6.2)
	20-34	73 (91.2)	132 (82.5)
	35-45	6 (7.5)	18 (11.2)
Educational status	Yes	43 (53.8)	87(54.0)
	No	37 (46.9)	73 (47.0)
Occupation	Housewife	64 (80.0)	134 (82.6)
	Employee	8 (9.60)	12 (7.0)
	Merchant	5 (6.1)	10 (6.5)
	Other	3 (4.3)	5 (3.9)
Income monthly Including partner	<25000K	43 (54.1)	86 (53.4)
	25K-49K	37 (45.9)	74 (46.6)
Residence	Urban	46 (57.4)	88 (55.2)
	Rural	34 (42.6)	72 (44.8)

Table 2: Past obstetric and gynaecological history–n 240 (cases 80, control 160).

Variables	Category	Cases N %	Control N %
History of PROM in previous pregnancy	Yes	43 (52.8)	82 (51.2)
	No	37 (61.9)	78 (48.8)
History of abortion	Yes	25 (31.2)	17 (10.5)
	No	55 (68.8)	143 (89.5)
History of LSCS	Yes	17 (21.4)	40 (25.2)
	No	63 (78.6)	120 (74.8)
History of gynae surgery	Yes	3 (3.5)	8 (4.6)
	No	77 (96.5)	152 (95.4)

Table 3: Risk in index pregnancy: N 240 (80 cases, 160 controls).

Variables	Category	Cases N %	Control N %
Gestational age	<37 week	34 (42.3)	20 (11.8)
	37-42 week	43 (53.8)	133 (84.2)
	>42 week	3 (3.8)	7 (3.9)
Gravida	1	15 (23.8)	60 (37.5)
	2-4	47 (62.5)	84 (52.5)
	>5	18 (13.8)	16 (10)
Para	0	25 (31.2)	65 (40.6)
	1	28 (35)	51 (31.9)
	2-4	22 (27.5)	34 (21.2)
	>5	5 (6.2)	10 (6.2)
Antenatal visit	1	9 (10.4)	22 (13.0)
	2-3	21 (26.7)	44 (28.0)
	>3	48 62.8)	94 (59.0)

Continued

Variables	Category	Cases N %	Control N %
UTI	Yes	60 (74.2)	91 (56.8)
	No	20 (25.8)	69 (40.8)
Abnormal vaginal discharge	Yes	43 (42.3)	87 (54.6)
	No	37 (76.5)	73 (45.4)
Malposition and malpresentation	Yes	13 (16.5)	16 (8.3)
	No	67 (83.5)	144 (91.7)
Gestational HTN	Yes	19 (23.8)	30 (18.8)
	No	61 (76.2)	130 (81.2)
GDM	Yes	11 (13.3)	27 (16.8)
	No	69 (86.7)	133 (83.2)
Polyhydramnios	Yes	14 (17.5)	30 (18.80
	No	66 (82.5)	130 81.2)
Multiple pregnancy	Yes	5 (6.2)	10 (6.2)
	No	75 (95.8)	150 (95.8)

Table 4: Bivariate and multivariate logistic regression.

Variables	Category	Cases	Control	COR (95%CI)	AOR (95%CI)
H/O PROM	Yes	43	82	4.85 (2.98, 10.86)	4.62 (2.06, 10.52)
	No	37	78	1	1
H/O LSCS	Yes	17	40	2.15 (1.08, 4.20)	2.08 (1.14, 6.74)
	No	63	120	1	1
Abnormal vaginal discharge	Yes	43	87	2.24 (3.86,19.74)	2.35 (2.53, 22.46)
	No	37	73	1	1
UTI	Yes	60	91	3.06 (5.04, 11.26)	3.40 (6.56, 13.04
	No	20	69	1	

DISCUSSION

This study sought to determine the risk factors associated with premature rupture of membranes (PROM) in women delivering at a tertiary care center and to examine their relationship with PROM. Demographic analysis revealed that cases and controls were similar regarding age, occupation, monthly income and residence. However, significant differences emerged in past obstetric and gynecological histories. Specifically, a history of PROM was reported by 52.8% of cases compared to 51.2% of controls and 31.2% of cases had a history of abortion versus 10.5% of controls.

Risk assessment during the index pregnancy showed significant differences between cases and controls, with gestational age less than 37 weeks being more common among cases (42.3%) than controls (11.8%). Additionally, urinary tract infections (UTI) were reported in 74.2% of cases versus 56.8% of controls.

The prevalence of abnormal vaginal discharge and lifting heavy objects was higher in cases as well. Our findings are consistent with other studies, such as Dange et al, who reported common clinical features like leaking fluid per vagina, fever, decreased fetal movement and foul-smelling discharge.[5] Similarly, Assefa et al, (2018) found that history of abortion, PROM, caesarean section and abnormal vaginal discharge were positively associated with PROM.[6] Other notable studies include Zhou et al, which identified increased risk factors for PPROM among migrant women and those with recurrent induced abortions and preterm births.[7] Bivariate and multivariate logistic regression analyses in our study highlighted significant risk factors for PROM, such as history of PROM, lower segment cesarean section (LSCS), abnormal vaginal discharge and UTI.

These results are supported by Enjamo M et al, who reported similar associations with PROM, including history of abortion, caesarean section and hypertension during pregnancy.[8] Frequent traveling, pregnancy-induced hypertension, history of abortion, carrying heavy weights, gestational diabetes mellitus (GDM) and cervical incompetence were also identified as risk factors by Dange et al.

Harger et al in 1990 further found that antepartum vaginal bleeding (odds ratio 7.4; 95% confidence interval, 1.4, 3.1), cigarette smoking (odds ratio 2.1; 95% confidence interval, 1.4, 3.1) and previous preterm delivery (odds ratio 2.5; 95% confidence interval, 1.4, 2.5) were independent risk factors for preterm PROM.[5,9] Another corresponding study conducted by Kaye et al, reported history of hypertension, abortion, prior PROM, caesarean section, cervical cerclage or abnormal vaginal discharge as

significant risk factors of preterm PROM ($p<0.05$).[10] Noor et al reported that risk of pPROM were seen to be the highest among patients giving birth to their first child (42.2%), with gestational age between 30-35 weeks (43.5% cases) and 35-37 weeks (35.2%).[11]

Another study by Wondosen et al reported that PROM was associated with history of vaginal discharge, previous history of membrane rupture and gestational age.[12] The common underlying factor among these diverse risk factors is the weakening of the chori amniotic membrane, often due to reduced collagen content, decreased membrane size or enzymatic degradation. This vulnerability highlights the need for targeted interventions to mitigate the risks and consequences associated with PROM.[14]

The history of PROM in previous pregnancies may result from abnormal anatomical formations of the uterus and cervix and cesarean section scars on the uterine wall, which increase the risk of premature rupture. Despite the study's limitations, including its sample size and single-center design, it contributes valuable insights into PROM and informs healthcare providers and policymakers aiming to improve maternal and fetal outcomes.[8,9,15,16]

CONCLUSION

In conclusion, identifying and managing risk factors for PROM is crucial to reducing preterm births and improving pregnancy outcomes. Future research should focus on developing effective strategies for preventing PROM and enhancing maternal and fetal health.

In summary, this case-control study identified several significant risk factors for premature rupture of membranes (PROM) among women delivering at a tertiary care center. The results indicate that women with a history of PROM, abortion or cesarean section in previous pregnancies face an elevated risk of experiencing PROM in their current pregnancy.

Additionally, abnormal vaginal discharge and urinary tract infections during the index pregnancy were found to be substantial risk factors. These findings underscore the importance of vigilant monitoring and prompt intervention in pregnancies deemed high-risk to improve maternal and fetal health outcomes.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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