Determinate of Premature Rupture of Membrane among Women Who Gave Birth at Tefera Hailu Memorial Hospital, Northern Ethiopia: Unmatched Case-Control Study

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Abstract

Background: In both high- and low-income nations, preterm premature membrane rupture is a substantial source of perinatal, neonatal, and maternal illness and mortality. Although the prevalence and associated variables of premature membrane rupture have been extensively studied in high-income countries, there is little locally generated evidence regarding these issues in Ethiopia, particularly in the study area.

Objective: To identify determinates of premature rupture of membrane among women who gave birth at Tefera Hailu Memorial Hospital, Sekota, and Northern Ethiopia.

Method: Unmatched case-control study design was conducted in Tefera Hailu Memorial Hospital to identify determinates of premature mature of membrane. Selecting controls were done using a straightforward random sample technique, while selecting cases was done using sequential sampling. Data were collected by five diploma midwives and two-degree holder midwives as supervisors. Face-to-face interviewed with structured questionnaires were administered to collect data. Data were entered using Epi data version 3.1 and was analyzed using SPSS version 25 statistical software. Bivariable logistic regression model was fitted for each explanatory variable. Candidates for the multivariable logistic regression model were variables with a p-value in the bivariable analysis of less than 0.25. Less than 0.05 with a 95% confidence interval was regarded as a statistically significant association in a multivariable logistic regression AOR with P-value.

Result: Lack of ANC [AOR=4.78; 95% CI: 1.34, 9.67], history of pregnancy pregnancy-induced [AOR=7.32; 95% CI: 2.35, 22.80]; history of PROM [AOR=3.64; 95% CI: 1.64, 8.12] and history of multiple pregnancies [AOR=7.62; 95% CI: 2.15, 9.05] were identified as significant determinants of PROM.

Conclusion: Significant factors of PROM included the absence of ANC, a history of induced pregnancy, a history of PROM, and a history of numerous pregnancies.

Keywords: Determinates; Premature rupture of membrane; Tefera Hailu Memorial Hospital

Introduction

Preterm premature membrane rupture is characterized as occurring before 37 weeks of pregnancy and before the start of labor. Premature Rupture of Membranes (PROM) is the term for the disruption of fetal membranes prior to the onset of labor. PROM is characterized by a painless gush of fluid, oozing from the vagina (or occasionally a steady leakage of a small amount of watery fluid) and a change in the tone or diminution of the uterus' size [1,2].

The developing fetus is covered by a sac filled with fluid known as the amniotic sac or bag of water. Normally, amniotic fluid is continuously generated, but after around 16 weeks of pregnancy, fetal urine starts to take over. It protects against infection, fetal injury, and umbilical cord compression. When amniotic fluid is inadequate or nonexistent, compression of the umbilical cord and decreased

placental blood flow may result [3].

Preterm babies may experience difficulties from their prematurity, including death from both the condition itself and open membranes that allow pathogens to enter the womb [4]. Roughly 8% and 2% of pregnancies are complicated with term and preterm PROM, respectively. 40% of preterm births and 18% to 20% of perinatal mortality are linked to preterm PROM [5].

Premature membrane rupture raises hazards for mothers, babies, and newborns. In terms of maternal risk, the most frequent side effect of PROM is amniotic cavity infection. Placenta ablation and endometritis occur in roughly 2% to 29% and 15% to 25% of cases, respectively. Maternal sepsis (0.8%), retained placenta (12%), hemorrhage necessitating dilatation and curettage (12%), and maternal death (0.14%) are uncommon but serious PROM complications that are conservatively treated [1,6].

Infection and fetal discomfort brought on by umbilical cord compression or placental abruption are two prenatal problems that can occur after membrane rupture. These characteristics increase the likelihood that a woman with PROM may need a cesarean section if the fetal heart rate is unconvincing. In 1% to 2% of cases of conservatively handled PROM, fetal death occurs. After preterm PROM, respiratory distress syndrome (10% to 40%) is the most prevalent significant acute morbidity. Additionally frequent are intraventricular hemorrhage and necrotizing enterocolitis. Serious prenatal morbidity can have long-term effects, including cerebral palsy, chronic lung illness, visual or auditory impairment, intellectual disability, developmental and motor delays, and even death. Following PROM, a significant fetal condition called pulmonary hypoplasia develops [7,8].

For preparing health workers in Ethiopia for the management of a woman experiencing obstetric emergencies, including preterm PROM, training manuals and guidelines have been created. Other strategies were also developed to deal with the issue, such as referring pregnant women with preterm extended PROM (>12 h) to a referral-level hospital for examination and preventive antibiotic and steroid therapy following preterm PROM [9].

Although the prevalence and associated variables of premature membrane rupture have been extensively studied in high-income countries, there is little locally generated evidence regarding these issues in Ethiopia, particularly in the study area. The purpose of this study is to determine what factors lead to premature membrane rupture in Northern Ethiopia and at Tefera Hailu Memorial Hospital in Sekota.

Methods and Materials

Study design

A hospital-based unmatched case-control study design was employed.

Study setting and study period: An institutional-based unmatched case-control study design was conducted from April 15th to May 30th, 2022 in Tefera Hailu Memorial Hospital, Ethiopia. Tefera Hailu Memorial Hospital is located in the Amhara regional state of Ethiopia, in the Wag Hemra zone of Sekota town, 560 kilometers from Bahir Dar, the Amhara region's headquarters, with a catchment population of 12345 people according to the 1999 Ethiopian calendar. In the southern direction, North Wello, South Gonder, and in the eastern direction, North Gondar, the hospital is surrounded by

Tigray regional state. The hospital was built with government funds in 1990ec at a cost of 17 billion Ethiopian Birr.

Source and study population

Source population: All women who were admitted to the labor ward at Tefera Hailu Memorial Hospital in Sekota town throughout the data collecting period and had a gestational age of more than 28 weeks.

Study population

For cases: Women who, during the data collecting period, were admitted to the labor, maternity, and high-risk wards at Tefera Hailu Memorial Hospital in Sekota town with a painless gush of fluid that flows out of the vagina and a change in color or a reduction in the size of the uterus.

For controls: Pregnant women who, throughout the study period, were admitted to the same ward of Tefera Hailu Memorial Hospital in Sekota town but lacked any of the aforementioned symptoms. Women who were initially enrolled in the control group but later switched to the case group were excluded from the study.

Eligibility criteria

Exclusion: Participants who were less than 28 weeks along with those who experienced a significant illness during the time of data collection were eliminated.

Study Variables

Dependent variable

Premature rupture of membrane.

Independent variables

Sociodemographic variables: Age, educational status, income, residence, marital status, religion, and occupational status.

ANC utilization and obstetrics: Utilization of ANC services, gestational diabetes mellitus, gestational hypertension, a history of early membrane's rupturing, antepartum hemorrhage, parity, gravidity, desire for the last pregnancy, history of multiple pregnancies, history of abortion.

Maternal medical conditions: Diabetic mellitus, Chronic Hypertension, and UTI.

Sample size determinations

Using EPI INFO 7.2.2. software and taking into account the double population proportion calculation, the sample size was determined. The variable that produces the largest sample size was chosen from among the several variables that were connected to premature membrane rupture. According to the study on the factors that influence premature membrane rupture among pregnant women admitted to public hospitals in Southern Ethiopia in 2020, a total sample size of 245 was determined. This sample size was calculated using r=3 (ratio of cases to controls), 80% power, and 95% confidence level. Nonresponse rate was 10%. (This included for Case 62 and for control 183) (Table 1).

Sampling method and procedures

Until the necessary sample size was reached, eligible cases were chosen using consecutive sampling and the control group, which consisted of expectant mothers who were admitted to the same ward of Tefera Hailu Memorial Hospital in Sekota town during the study period but did not exhibit any of the aforementioned symptoms.

Table 1: Sample size determination to identify determinates of premature rupture of membrane in Tefera Hailu Memorial Hospital, Sekota, and Northern Ethiopia, 2022.

Variables	Percent of exposure		Case to control ratio	Sample size (with 10% non- response)
	Case	Control		
History of abortion(yes) [10]	29.1	11.3	1:3	245
Previous history of PROM (yes) [11]	38.7	61.3	1:3	220
MUAC(<23 Cm) [10]	31.2	9.1	1:3	171

Data collection tools and procedures

A structured questionnaire and checklist were used to gather data from in-person interviews and chart reviews, respectively. After analyzing a number of pertinent literatures, a questionnaire and checklists were created [2,9-14]. It consists of sociodemographic variables: Age, educational status, residence, marital status, religion, occupational status, ANC utilization, and obstetrics: Utilization of ANC services, gestational diabetes mellitus, gestational hypertension, history of premature rupture of the membrane, antepartum hemorrhage, parity, gravidity, desire for the last pregnancy, history of multiple pregnancies, history of abortion, Maternal medical condition: Anemia, Diabetic mellitus, Chronic Hypertension and UTI.

Patient medical records and charts were used to gather obstetric and medical information that could not be obtained through interviews, such as gestational age, PROM diagnosis, urinary tract infection, and hypertensive disorders of pregnancy.

The data collection process involved a total of seven health professionals. Five health professionals with diplomas in midwifery work as data collectors, and two professionals with BSc degrees in midwifery work as supervisors. In the labor wards of hospitals, the same interviewer spoke with the two cases and the corresponding three controls.

Data analysis and management

Epi data version 3.1 was used to enter the data, which was then exported to SPSS version 25 for analysis. When describing categorical variables, frequency and percentage were employed. Calculated were the median and interquartile ranges. The strength of the link was determined using an odds ratio with a 95% confidence interval.

To ascertain the basic relationship between the independent factors and the dependent variable, a bivariable logistic regression model was used. In order to control confounding variables and identify the independent predictors of PROM, variables having a P-value of less than 0.25 in the bivariable logistic regression were exported to a multivariable logistic regression model. At P<0.05, statistical significance was declared. There were attempts to verify that the main premise of logistic regression was true. Hosmer and Lemeshow test and omnibus test of model coefficients were used to evaluate the quality of fit.

Data quality assurance

Data collectors and supervisors received two days of training on the purpose of the study, the questionnaire's content, how to fill it out, respondent rights, informed consent, interviewing techniques, and how to maintain the subjects' confidentiality and privacy in order to maintain the quality of the data. Afterward, pretest was done on 5% (12 participants, 3 cases, and 9 controls) mothers who gave birth at Ziquala Primary Hospital which is found in North Ethiopia. After pre-test some adjustment was done accordingly. The questionnaire was developed in English and then translated to a local language (Amharic) for simplicity and then retranslated to English language for consistency.

Ethical considerations

Zemen Postgraduate College of Research Ethics Committee was provided its approval to the study. The Tefera Hailu Memorial Hospital was consulted for permission. Permission was also sought from each of the individuals. After each study participant had been told about the value of participating in the study, an individual permission was acquired from them. Each responder was made aware of the objectives of the study, the methods used to choose participants, the guarantee of anonymity, and their right to cancel the interview at any time. Because of this, neither the participants' names nor the data we collected from them were disclosed.

Result

Social and demographic information about the respondents

Fifty PROM cases and 195 non-cases of PROM were included in this study during the two-month period. One hundred ninth eight (80.8%) were rural residents. Majority of the participants, 146 (59.6%) were in the age group of (20-24). Of the respondents, 222 (90.6%) were orthodox in religion. One hundred sixty-one (65.7%) participates were married (Table 2).

Respondents' obstetric characteristics

There was no discernible variation in the proportions of gravidity and parity among responders between cases and controls. Forty-one (16.7%) of the cases and 161 (65.7%) of the controls were multiparas with 2 to 4 live children. Thirty-one cases (20.4%) and 119 controls (48.6%) had 2 to 4 pregnancies on average. A history of abortion was present in 15 (6.1%) cases and 44 (18%) controls. In 20 (8.2%) of the patients and 40 (16.3%) of the controls, there was a history of PROM (Table 3).

Medical and maternal health service characteristics

Majority of cases, 44 (18%) and controls, 118 (48.2%) had ANC checkup at the health facility. Regarding to mode of delivery and desire for the last pregnancy, the majority of cases, 30 (12.2%) and controls, 111 (45.3%) had C/S and SVD mode of delivery respectively. On the other hand, 40 (16.3%) cases and 159 (63.7%) had unplanned pregnancy (Table 4).

Determinants of Premature Rupture of Membranes (PROM)

Four characteristics were found to be significant predictors of PROM out of the six that were eligible for multivariable logistic regression: History of PROM, history of pregnancies, history of pregnancy-induced hypertension, and lack of ANC checkup at a health facility. As a result, the presence of PROM in the past was discovered to be a powerful predictor of PROM. Respondents with a history of PROM were 3.64 times more likely than those without to develop into cases of PROM [AOR=3.64; 95% CI: 1.64, 8.12].

Table 2: Social and demographic information about mother who gave birth at THMH, 2022.

Variables	Category	Frequency	Percent
Age	15-19 yrs.	2	0.8
	20-24 yrs.	146	59.6
	25-29 yrs.	91	37.1
	30-34 yrs.	2	0.8
	≥ 35 yrs.	4	1.6
Residence	Urban	47	19.2
	Rural	196	80.8
Religion	Orthodox	226	92.2
	Muslim	17	6.9
	Protestant	2	0.8
Marital status	Married	160	65.3
	Single	64	26.1
	Windowed	10	4.1
	Divorced	11	4.5
Educational status of mothers	No formal education	85	34.7
	Primary education	118	82.9
	Secondary education	21	0.8
	More than secondary education	21	0.8
Occupational status of mothers	Housewife	141	57.6
	Private employee	97	39.6
	Merchant	7	2.9
Educational status of husband	No formal education	82	35.5
	Primary education	124	50.6
	Secondary education	23	9.4
	More than secondary education	16	6.5

Table 3: Obstetric features of the mother who gave birth at THMH, 2022.

Variable	Category	Cases (50)	Controls (195)	X²	P-value
Family size	<5	21 (8.6%)	80 (32.7%)	0.016	0.51
	≥ 5	29 (11.8%)	115(46.9%)		
Gravidity	2-4	31(12.7%)	119 (48.6%)	0.16	0.57
	≥ 5	19 (20.4%)	76 (79.6%)		
Parity	2-4	41 (16.7%)	161 (65.7%)	0.009	0.53
	≥ 5	9 (3.7%)	34 (13.9%)		
History of multiple pregnancy	Yes	17 (6.9%)	5 (2%)	48.1	<0.01
	No	33(13.5%)	190 (77.6%)		
History of abortion	Yes	15 (6.1%)	44 (18%)	1.2	0.18
	No	35 (14.3%)	151 (61.6%)		
History of PROM	Yes	20 (8.2%)	40 (16.3%)	8.17	0.005
	No	30 (12.2%)	155 (63.3%)		
History of preterm birth	Yes	16 (6.5%)	39 (15.9%)	3.29	0.05
	No	34 (13.9%)	156 (63.7%)		
History of pregnancy induced HTN	Yes	14 (5.7%)	8 (3.3%)	27.8	≤ 0.001
	No	36 (14.7%)	187 (76.3%)		
History of vaginal bleeding	Yes	15 (6.1)	37 (15.1)	2.89	0.069
	No	35 (14.3)	158 (64.5)		

Table 4: Maternal health service and medical characteristics of mother who gave birth at THMH, 2022.

Variables	Category	Case (50)	Controls (195)	X²	P-value
UTI	Yes	10 (4.1%)	35 (15.1%)	0.27	0.57
	No	40 (16.3%)	158 (64.5%)		
Chronic DM	Yes	10 (4.1%)	37 (15.2%)	0.28	0.505
	No	40 (16.3%)	158 (64.5%)		
Desire for the last pregnancy	Planned	10 (4.1%)	39 (15.9%)	0.001	0.57
	Unplanned	40 (16.3%)	159 (63.7%)		
ANC check-up at health facility	Yes	44 (18%)	118 (48.2%)	13.42	<0.001
	No	6 (2.4%)	77 (31.4%)		
Mode of delivery	SVD	11 (4.5%)	111 (45.3%)	24.3	<0.001
	Instrumental	9 (3.7%)	34 (13.9%)		
	C/S	30 (12.2%)	50 (13.9%)		

The finding showed that respondents who had previously experienced pregnancy-induced hypertension had a 7 times higher likelihood of developing PROM than their counterparts, AOR=7.32; 95% CI: 2.35, 22.80]. The recent investigation also showed the absence of ANC as a risk factor for PROM. In comparison to respondents who did not have ANC visits, mothers who did not receive ANC were 4.78 times more likely to develop PROM [AOR=4.78; 95% CI: 1.34, 9.67]. Additionally, compared with their counterparts, women with a history of multiple pregnancies had a 7.62-fold increased chance of getting PROM [AOR=7.62; 95% CI: 2.15, 9.05] (Table 5).

Discussion

The purpose of this study was to identify the factors that lead to Premature Membrane Rupture (PROM). As a result, it was determined that the absence of ANC, a history of pregnancy-induced hypertension, a history of PROM, and a history of many pregnancies were significant predictors of PROM.

According to the findings of our study, respondents with a history of PROM had a 3.64 times greater chance of becoming a PROM case than respondents without a history. Studies done in Northern Ethiopia support this conclusion [9,12]. This might be because the earlier PROM incident and the current PROM incidence might have shared obstetric reasons, like an untreated genitourinary infection and a low cervical length (Cervical incompetence). Additionally,

obstetric diseases are recurring by their very nature. In order to effectively assess past obstetric issues, health care practitioners at maternal health service delivery locations must prioritize doing so. Once these moms have been identified, careful evaluation, health promotion, and follow-up measures must then be given.

The PROM case was 7 times more likely to occur in respondents who had previously experienced pregnancy-induced hypertension than in their peers.

Additionally, compared with other women, those with a history of many pregnancies had a 7.62-fold higher risk of getting PROM. It is consistent with the research done in Bangladesh [15]. This may be due to excessive uterine distention brought on by multiple pregnancies or polyhydramnios, which in this study had rates of 6.7% and 6%, respectively, respectively.

The findings of this study demonstrated that Antenatal Care (ANC) follow-up had a substantial impact on preterm membrane

Table 5: Determinates of PROM among mother who gave birth at THMH, 2022.

Variables	Category	PROM		COR (95% CI)	AOR (95% CI)	P-value
		Case (%)	Control (%)			
Residence	Urban	4 (1.6%)	43 (17.6%)	1	1	
	Rural	46 (18.8%)	152 (62.0%)	3.2 (1.1, 9.54)	3.95 (0.82, 18.98)	0.085
History of abortion	Yes	15 (6.1%)	44 (18%)	1.47 (0.74, 2.94)		
	No	35 (14.3%)	151 (61.6%)	1		
History of PROM	Yes	20 (8.2%)	40 (16.3%)	2.58 (1.33, 5.02)	3.64 (1.64, 8.12)*	<0.001
	No	30 (12.2%)	155 (63.3%)	1	1	
History of multiple pregnancy	Yes	17 (6.9%)	5 (2%)	19.52 (6.75, 56.70)	7.62 (2.15, 9.05)*	0.002
	No	33(13.5%)	190 (77.6%)	1	1	
History of PIH	Yes	14 (5.7%)	8 (3.3%)	9.01 (3.55, 23.25)	7.32 (2.35, 22.80)*	0.001
	No	36 (14.7%)	187 (76.3%)	1	1	
Vaginal bleeding	Yes	15 (6.1)	37 (15.1)	1.83 (0.91, 3.69)	1.07 (0.43,2.68)	0.877
	No	35 (14.3)	158 (64.5)	1	1	
Desire on the last pregnancy	Planned	10 (4.1%)	39 (15.9%)	1		
	Unplanned	40 (16.3%)	159 (63.7%)	1 (0.46, 2.17)		
ANC checkup at health facility	Yes	44 (18%)	118 (48.2%)	1	1	0.011
	No	6 (2.4%)	77 (31.4%)	4.78 (1.95, 11.77)	3.60 (1.34, 9.67)*	

rupture. Premature membrane rupture was 4.78 times more likely to occur in pregnant women who did not get Antenatal Care (ANC) follow-up compared to those who did. This result is consistent with research from India and Uganda [16].

This demonstrated that women who had prenatal care follow-up were less likely to experience an early membrane rupture. This may be explained by the fact that ANC is a type of general medical care provided to expectant mothers that helps to maintain and enhance the mother's optimum health throughout her pregnancy. This may be explained by the fact that ANC enables the promotion and maintenance of the mother's health throughout her pregnancy, making it an important touch point for pregnant women's general wellbeing. On the other hand, moms who do not receive ANC might be less knowledgeable of possible PROM risk factors and might be subjected to dangerous behaviors and practices. In order to lessen the impact of PROM, healthcare professionals should track all moms who do not receive ANC.

Conclusion and Recommendations

In the current study, important factors of PROM included the absence of ANC, a history of pregnancy-induced hypertension, a history of PROM, and a history of multiple pregnancies. In order to deliver appropriate ANC, healthcare professionals should track down mothers who have not got it. Additionally, in order to lessen the likelihood of PROM, healthcare professionals should pay special attention to women who have a history of pregnancy-induced hypertension, repeated pregnancies, or PROM.

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Author Contributions

All authors participated in the writing of the article or its critical revision for important intellectual content, gave final approval to the version to be published, and agreed to be accountable for all aspects of the work. They also all made substantial contributions to its conception and design, the collection of data, the analysis of data, and its interpretation.

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