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Prevalence and Determinants of Preterm Premature Rupture of the Membrane among Pregnant Women Admitted to Health Facilities in Ambo Town, Ethiopia: Institutional Based Cross-Sectional Study

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Abstract

Introduction: Preterm premature rupture of the membrane is a principal cause of perinatal, neonatal, and maternal morbidity and mortality both in developed and developing countries. A woman with premature rupture of membranes is at risk of complications like intra-amniotic infection, postpartum hemorrhage, and death. This study aimed to assess the prevalence and determinants of preterm premature rupture of the membrane among pregnant Women admitted to Health Facilities in Ambo town, Ethiopia.

Methods: Hospital based cross-sectional study was conducted on 391 pregnant women who were admitted to the Hospitals of Ambo town from July 05th, 2021-August 30th, 2021.

The data were collected through face-to-face interviews by a structured questionnaire. A descriptive analysis was done using frequencies, percentages and binary logistic regression after adjusting for confounding factors.

Results: All the participants gave their responses making 100% response rate. The Magnitude of preterm premature rupture of the membrane was found to be 22.6%. Preeclampsia [AOR=3.2, 95% CI (0.69-0.57)], Economic status[AOR=2.64 95% CI (1.99-6.01)], current urinary tract infection[AOR=2.42, 95% CI (1.32-5.19)], previous history of premature rupture of membrane [AOR=2.31, 95% CI (1.02-6.27)], and anemia [AOR=1.85, 95% CI (0.65-4.56)]were determinants of preterm premature rupture of the membrane.

Conclusion: The prevalence of preterm premature rupture of the membrane in the study area was slightly high. Based on the predisposing factors identified early screening and treatment as well as health promotion and disease prevention are important to reduce the risk of preterm premature rupture of membrane.

Keywords: Prevalence; Preterm; Premature Rupture of membrane; Preterm labor; Ethiopia

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Introduction

Preterm Premature Rupture of Membrane (PPROM) is defined as rupture of the membrane before the commencing of labor in pregnancies that are between 28 and 37 weeks of gestation [1]. It is distinguished by a painless liquid flow and different investigations like the ferning and pooling test. The lower limit of gestational age to describe Preterm in Ethiopia is a pregnancy that is >28 weeks of gestation and <37 weeks of gestational age [2,3]. A membrane or bag of water is the sac that keeps amniotic fluid which covers the developing baby. This fluid is important for nutrition, in defending the fetus against infection, fetal trauma, and compression of the umbilical cord [1]. The magnitude of PPROM differs across the world from country to country and the population. For instances, shred of evidence suggests that PPROM accounts for 2.2% in Manipur, India, 3.1% in Brazil, 2.3% in Canada, 19.2% in China, 3.3% in Nigeria, and 7.5% in Uganda [4-9]. In Ethiopia according to research conducted at Debre Tabor and Tikur Anbesa Hospital, the occurrence of PPROM was 13.67% and 1.4% respectively [10-12]. Even though the actual reason for PPROM is unknown; a structural defect in the membrane, maternal ethnic origin, previous preterm delivery, intrauterine infection at an early gestational age, low socioeconomic repute of the women, insufficient prenatal care, smoking, UTI at some stage in pregnancy, maternal dietary status, atypical vaginal discharge, and maternal

depression are regarded as risk factors [13]. The effect of PPROM ranges from maternal and neonatal morbidity and mortality [14]. It complicates 3% to 4.5% of pregnancies worldwide [4,15]. Among women with preterm PROM, the clinically evident intra-amniotic infection takes place in about 15% to 25%, and postpartum infection occurs in approximately 15% to 20% of the cases [16]. The incidence of infection is higher at earlier gestational ages, and life-threatening maternal infections complicate expectant management of prevailed PROM [13,17]. The fundamental complication for the mother is an infection which can lead to chorioamnionitis, placental abruption, psychological effect, lactation problem, disseminated intravascular coagulopathy, metritis after delivery, increase the need for operative delivery, and economic and resource wastage [18]. PPROM raises perinatal mortality by four times and neonatal morbidity by three times [19,20]. The longer the time between rupture of the membrane and delivery, the higher the risk of maternal and fetal morbidity and mortality [21]. Prematurity is responsible for 80% to 90% of perinatal mortality due to problems like Respiratory distress syndrome, Birth injury, Intraventricular hemorrhage, Hypocalcemia, hypoglycemia, Hypothermia, Hyperbilirubinemia, and Infection [11,22,23]. It also increases neonatal resuscitation, and cord compression which leads to fetal distress and neonatal sepsis [24,25]. In low-income countries, more than 90% of extremely preterm newborns (less than 28 weeks of gestation) die during the first few days of life; in high-income countries, less than 10% of extremely preterm babies die within the first few days of existence [26,27]. PPROM is far away from time solely be cared for in facilities where a Neonatal Intensive Care Unit (NICU) is accessible and successful in caring for the premature neonate. This is a challenge, especially in developing countries like Ethiopia where most of the health facilities are not properly equipped. This study aims to identify the related factors and helps to establish a comprehensive plan to assist the country in reducing the prevalence of PPROM. It also presents the community with the severity of the problem and informs them about how they may prevent the problem and act carefully to make it much less challenging than predicted. In addition, the study might also be beneficial to different researchers as reference material for future studies on similar issues. Even if few studies with fewer variables have been conducted in some parts of Ethiopia, there is no similar research carried out in the study area. So, this study plans to examine the occurrence of preterm premature rupture of membrane and its determinants among admitted pregnant woman in Ambo Health institutions.

Material and Methods

Study area and design

An institution-based cross-sectional study was conducted in Ambo town, Oromia Regional state, from July 05th, 2021-August 30th, 2021. The town is located 114 km from Addis Ababa the capital city of Ethiopia. The total population of this town is estimated to be 83,053 of whom 41,692 are men and 41,361 women according to the 2007 census. The town has four governmental health institutions. These consist of Ambo University Referral Hospital, Ambo General Hospital, Awaro Health Center, and Ambo Health Center. Ambo University Referral Hospital and Ambo General Hospital are included in the study. Since its establishment in July 1999 Ambo General Hospital is providing obstetrics and gynecologic care in addition to other services. The department has 19 beds with 3 delivery Kochs. Ambo University Referral Hospital was established in 2006 and currently provides Gynecology, labor, and delivery in addition to other services with 38 beds (14 labor and delivery ward, 24 gynecology wards) and 4 deliveries Koch's. The selected pregnant women who were admitted in obstetrics wards of AGH and AURH at their gestation between 28 and 37 weeks of gestation were the study population.

Sample size and sampling technique

The Sample size was calculated by using a single population proportion formula by considering P=0.137; taken from previous research done at Debre Tabor [11], 95% confidence level, 5% desired degree of accuracy. By adding a 10% non-response rate and using a design effect of 2, the final calculated sample size was found to be 391. Systematic random sampling was used to select study participants. The average number of pregnant women who were admitted to Ambo General Hospital and Ambo University Referral Hospital during the data collection period was estimated based on the previous admission, which was obtained by referring to a six-month registration book/record before data collection. Around 755 pregnant women were admitted to labor, maternity, and high-risk wards in six months. The sampling interval (kth unit) was obtained by dividing the entire total pregnant women admitted in six months (755) by the desired sample size (391) and it was approximately [2]. The first woman was randomly chosen for the survey by the lottery method, and then every second woman who was admitted to the ward was selected for the study.

Study variables

Dependent variable

- Preterm Premature rupture of membrane

Independent variable

- Sociodemographic status, past, and current obstetric characteristics, and medical and behavioral characteristics.

Data collection tools, procedures, and quality control

The questionnaire was initially prepared in English version by reviewing different related literature [5,10-13]. Then the questionnaire was translated to Afan Oromo an area language and then translated back to English by language experts by maintaining consistency. The questionnaire includes sociodemographic characteristics, historical and current obstetrical gynecological history, medical history, and behavioral factors. Medical and obstetric data that could not be accessed by interviews, such as gestational age, diagnosis of PPROM, urinary tract infections, STIs, and anemia were collected from patient medical records and charts. In addition, each woman's MUAC was measured using non-elastic and non-stretchable MUAC tapes at the midpoint between the tips of her shoulder and elbow on her left arm. Data were collected through face-to-face interviews by using structured pretested questionnaires from women. The data collection was carried out by five trained degree holders' health care providers and supervised by 1 Master holder. Two-days training were given for the data collectors. The collected data were reviewed and checked for consistency, clarity; completeness, and accuracy throughout the data collection process.

Data processing and analysis

The collected data had been entered into Epi data version 3.3.1 software after coding and checking the completeness and exported to the statistical package for social science SPSS model version 20 for analysis. Descriptive analysis using frequencies, means, percentage, and popular deviations have been completed and presented in

Table 1: Sociodemographic characteristics of pregnant women attending health facilities in Ambo town, Ethiopia, 2020. (n=391).

Variables		Frequency	(%)
Respondent's Age (years)	<20	33	8.4
	20-30	331	84.8
	>31	27	6.8
Marital Status	Single	8	1.9
	Married	372	95.2
	Divorced	9	2.3
	Widowed	2	0.6
Ethnicity	Oromo	383	98.1
	Amhara	2	0.6
	Others*	6	1.3
Religion	Orthodox	187	47.7
	Muslim	79	20.3
	Protestant	110	28.1
	Others**	15	3.9
Educational Status	No formal education	135	34.5
	Primary education	92	23.5
	Secondary and above	164	41.9
Occupational status	governmental employer	102	26
	self-employment	82	20.9
	Daily labor	98	25
	housewife	86	22
	Students	23	5.8
Monthly income	<= 1000.00	150	38.3
	1001.00 - 3000.00	161	41.2
	3001.00+	80	20.5
MUAC	<23	92	31
	≥ 23	299	69
Residence	Urban	246	62.9
	Rural	145	37.1

Others*: Tigre, SNNP
Others**: (Wakefata and Adventist).

text and tables. Logistic regression analyses adjusting for potential confounding elements were done to see the association between the preterm untimely rupture of membrane and the explanatory variables which had a P-value less than 0.25. Finally, the strength of association was weighed using an odds ratio at a 95% confidence interval and P-value <0.05.

Operational definitions

- **Preterm Premature rupture of membrane (PPROM)** - Preterm Premature Rupture of Membrane (PPROM) is defined as membrane rupture before the beginning of labor in pregnancies that are less than 37 weeks of gestation.
- **Preterm:** Babies born alive before 37 weeks of pregnancy are completed but after 28 weeks of gestation.
- **Premature rupture of the membrane:** Is rupture of fetal membranes at least an hour before the onset of labor.
- **Preterm labor:** Labor occurring after 28 weeks of gestation but before 37 completed weeks of gestation.

Table 2: Past and current obstetric characteristics of respondents attending health facilities in Ambo town, Ethiopia, 2020. (n=391).

Variables		Frequency	(%)
Gravidity	Primigravida	145	37.1
	Multigravida	179	45.8
	Grand multigravida	67	17.1
Gestational age (in weeks)	29-33	72	18.4
	34-36	319	81.6
ANC follow-up	Yes	381	97.4
	No	10	2.6
History of previous PROM	Yes	91	23.2
	No	300	76.8
History of preterm birth	Yes	135	21.9
	No	92	78.1
Presentation	Cephalic	251	64.2
	Breech	129	32.9
	Shoulder	11	2.9
UTI current pregnancy	Yes	63	16.11
	No	328	83.88
Abnormal Vaginal discharge	Yes	53	13.5
	No	338	86.5
GDM	Yes	42	10.6
	No	349	89.4
PPROM	Yes	89	22.7
	No	302	77.3
Lifting heavy objects	Yes	8	2.6
	No	383	97.4
Falling in accident	Yes	5	1
	No	386	99
Anemia	Yes	19	4.8
	No	372	95.1

- **Anemia:** A pregnant woman whose Hemoglobin level is <11 gm/dl.

Ethical Consideration

Ethical clearance has been obtained from the department of midwifery Ambo University research and community service coordinator. The letter of permission was soughed from the West Shoa Zonal health department and each health institution. Verbal consent was taken from the participants after the data collectors clarified the objectives of the study, processes, and their right to refuse no longer to participate at any time. Furthermore, the confidentiality of the study participants was assured.

Results

A total of 391selected pregnant women participated in the study. The mean age of respondents was 25.23 (SD +4.05). The majority of the participants (95.2) were married and nearly all of them (98.1%) were Oromo in ethnicity and 331 (84.8%) respondents had been in the age range of 20 to 30 years. Concerning education (41.9%), of the participants, had attended secondary school and above. Regarding the occupational status 102 (26.0%) women were governmental employers and 299 (69.0%) participants' mid-upper

Table 3: Bivariate and multivariable analysis of pregnant women attending health facilities in Ambo town, Ethiopia, 2020. (n=391).

Variables		Preterm PROM				p-value
		Yes	No	COR	AOR	
Gravidity	Primigravida	30 (20.7 %)	115 (79.3%)	6.05(3.01-14.02)	5.3(2.07-13.52)*	0.001
	Multigravida	41 (23%)	138 (77%)	1.41 (0.59-2.87)	1.78 (1.64-5.92)	
	Grand multigravida	18 (26.8 %)	49 (73.1%)	1	1	
Economic status	<= 1000.00	28 (18.7 %)	122 (81.3%)	1	1	
	1001-3000	38 (23.6%)	123 (76.3%)	1.02 (0.48-3.36)	1.27 (0.62-3.74)	
	3001.00+	24 (30 %)	56 (70%)	1.87 (0.60-3.90	2.14(0.89-5.41)*	0.008
Gestational DM	Yes	21 (50%)	21 (50%)	0.26(0.10-0.69)	0.2 (0.69-0.57)	
	No	77 (22.5%)	272 (77.5%)	1	1	
Preeclampsia	Yes	13 (12%)	95 (87.9%)	2.83(1.41-5.69)	3.2 (1.47-7.04)	
	No	59 (27.3%)	157 (72.7%)	1	1	
Previous PROM	Yes	34 (37.5%)	57 (62.5)	2.53 (1.25-5.78)	2.31 (1.02-6.27)*	0.003
	No	54 (18.0%)	246 (82%)	1	1	
Current UTI	Yes	24 (38%)	39 (62%)	3.04 (1.43-5.23)	2.62 (1.32-5.19)*	0
	No	64 (19.6%)	264 (80.4%)	1	1	
Lifting heavy objects	Yes	25 (58.8%)	18 (41.2%)	0.15 (0.73-0.32)	0.76 (0.03-0.18)	
	No	63 (18.1%)	285 (81.9%)	1	1	
Anemia	Yes	10 (52.6 %)	9 (47.4)	2.08 (0.65-5.65)	1.85 (0.65-4.56)*	0.002
	No	79 (25.1)	293 (74.9 %)	1	1	

arm circumference measurements were greater than or equal to 23 cm (Table 1).

Past and current obstetric characteristics

The majority of the members (45.8%) were multigravida. Concerning gestational age, 319 (81.6%) of the respondents were found between 34 to 36 weeks and almost all of the participants (97.4%) have had ANC follow-up, 72 (23.2%) respondents have had the previous history of PROM, and 68 (21.9%) had a past history of preterm delivery. Of the selected individuals 251 (64.2%) of the current pregnancy's presentation was cephalic, 63 (16.1%) have had urinary tract infection currently while 53 (13.5%) have vaginal discharge (Table 2).

Determinants of preterm premature rupture of the membrane

Gravidity, preeclampsia, current urinary tract infection, records of previous preterm premature rupture of membrane, monetary status, and being anemic are considerably related to preterm premature rupture of the membrane. Grand multigravida women were almost five times more likely predisposed to PPROM than primigravida [AOR=5.30, 95% CI: (2.07, 13.52)]. Furthermore, women who had Preeclampsia had been three times and those who have a history of Previous PROM two times more likely to develop PPROM than those who do not have respectively [AOR=3.2, 95% CI: (1.47 to 7.04)], [AOR=2.31, 95% CI: (1.02 to 6.27)]. A woman whose economic status was less than one thousand Ethiopian birr was two times more likely to develop PPROM than those who earn more than three thousand Ethiopian birr [AOR=2.14, 95% CI: (0.89 to 5.41)]. Women who had anemia were nearly two times more likely to develop PPROM in contrast to those who are not [AOR=1.85, 95% CI: (0.65 to 4.56)] (Table 3).

Discussion

The prevalence of Preterm Premature Rupture of Membrane (PPROM) in this study was found to be 22.6%. This finding was higher than the studies conducted in, tertiary care centers in India (2.01%), the Rio Grande in Brazil (3.1%), in China (19.2%), Kampala International University teaching hospital in Uganda (7.5%), and Debre Tabor (13.67%) [4,5,7,9,11]. The distinction may be due to reduced popular quality of health care, low financial status, and social life in developing countries. Since the sample of this study used to be from high-risk populations/admitted pregnant women rather than those who are in the community this might also extend the magnitude of PPROM. Women with preeclampsia have been three times more likely to increase PPROM than those who did not have preeclampsia. This finding is additionally supported by some studies conducted in Uganda, Lithuania, and China [9,28,29]. In preeclampsia, reactive oxygen species which are generated with the aid of oxidative stress, and some pathological conditions that develop throughout pregnancy and are related to hypoxic stress can affect the elevation of S100B (Anti-S100 beta antibody) concentration in the amnion and alter production and/or clearance of prolactin from the maternal compartment that can bring premature rupture of membrane [30-32]. Urinary tract infection was another factor related to the development of PPROM. Pregnant women with a history of UTI in pregnancy had been two times more probably to get PPROM than those who did not have UTI. This finding was consistent with the study performed by Singh et al and Dagne et al. [2,11]. This might be because Elevations of inflammatory mediators such as prostaglandins, cytokines, and proteinase in the local tissue play a causative role in the disruption of fetal membrane integrity and in triggering uterine contractility. They are produced as a part of the physiologic maternal defense mechanism in response to pathogens' invasion. The inflammatory mediators and production of matrix-degrading enzymes and TNFs are involved in the mechanisms of PPROM [33]. In the current study, those women whose monthly income was less than one thousand Ethiopian Birr/or fewer than twenty dollars had been two times more at risk of developing PROM

than those who earn more than three thousand Ethiopian Birr/sixty dollars. A study conducted in Northern Ethiopia supplemented this finding [11]. This might be due to fewer income results nutritional deficiency and the mother becoming undernourished. Nutritional deficiencies, particularly micronutrient deficiencies such as vitamin C or ascorbic acid, affect collagen formation and can weaken the body's ability to defend itself from degenerative processes caused by oxidative stress, which could lead to easy breakage of the membrane [30]. In our study, having anemia was also found to be a major risk factor. Pregnant women with anemia would be at risk of PROM nearly two times greater than non-anemic mothers. This is supported by the study done in Indonesia [34,35]. This may be justified by the fact that women with anemia are more likely to develop intra-amniotic and intrapartum infections, which may lead to PPROM.

Some limitations of this study were: The respondents might be prone to social desirability bias because some of the variables were based on self-reports. Finally, there might be a possibility of recall bias because women were asked about events that happened before the study.

Conclusion and Recommendation

The prevalence of preterm premature rupture of the membrane is high in the study area. To prevent PPROM, it is essential to check for modifiable factors during antenatal care and early screening, diagnosis, and treatments of preeclampsia and UTI are indicated to reduce PPROM.

Since this study was carried out in hospital-admitted pregnant women, we recommend large low-risk population-based studies in the study area as well as in the country as a whole to interpret differences between countries. To prevent PPROM, it is essential to check for modifiable factors during antenatal care and early screening, diagnosis, and treatments of preeclampsia and UTI are indicated to reduce PPROM.

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