Original Article

Risk factors of prelabor rupture of membranes at University of Maiduguri Teaching Hospital, Maiduguri: A cross-sectional study

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ABSTRACT

Background: Prelabor rupture of membranes (PROM) is a common obstetrics problem associated with maternal and perinatal morbidity and mortality.

Patients and Methods: This was a hospital-based cross-sectional study to determine the risk factors for PROM among women presenting to the Department of Obstetrics and Gynecology of the University of Maiduguri Teaching Hospital, Maiduguri. It was conducted between 1st May 2016 and 28th February 2017. Sociodemographic and obstetrics variables were obtained from the patients, and risk factors such as previous preterm delivery, previous PROM, miscarriages, fever, abnormal vaginal discharge, urinary tract infection, abdominal distension, trauma, and coitus were sought. For each patient, an endocervical swab, high vaginal swab, and urine samples were taken for microbacteriologic studies. The next patient without PROM is used as control. Data were analyzed using SPSS 20. A total of 258 (129 with PROM and another 129 without PROM) were analyzed.

Results: The mean age, gestational age, and parity were 27 ± 6 years, 33 ± 0.3 weeks, and 1 ± 0.92, respectively. A majority of the women (55%) had parity between 1 and 4. Term PROM recorded the highest frequency [49 (37.9%)]. Previous history of PROM [odds ratio (OR) 5.18, 95% confidence interval (CI): 2.31–11.62], history of Preterm Delivery (OR 3.26, 95% CI: 1.16–9.19), low socioeconomic status (OR 1.95 95%, CI: 1.15–3.31), and genitourinary infection are highly predictive of PROM.

Conclusion: The modifiable or treatable risk factors should be addressed during the antenatal care to reduce the risk of PROM. High-risk patients should be counseled and monitored closely to optimize pregnancy outcomes.

Key words: Maiduguri; morbidity; mortality; prelabor rupture of membranes; risk factors.

Introduction

Spontaneous membrane rupture is an integral part of normal parturition process. However, when it occurs prior to the onset of active labor, it can lead to hazards both to the mother and to the baby.[1] The condition often occurs at term or near term, and the perinatal morbidity and mortality is inversely related to the gestational age. Its management also poses an important therapeutic dilemma[2] because of the need to strike a delicate balance between delivering a preterm baby and the risk of acquiring chorioamnionitis.[2]

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Term PROM complicates 8%–10% of pregnancies.[3] When PROM occurs at term, labor typically ensues spontaneously or is induced within 12–24 h. Membrane that ruptures after the age of viability but before 37th completed week in the absence of regular painful uterine contractions is referred to preterm prelabor rupture of membranes (PROM) and this complicates 2%–4% of singleton pregnancies[4-6] and 7%–20% of twin pregnancies.[2,4] When rupture of membranes occurs before the age of viability, it is called previable PROM.

The exact cause of PROM is not known, although chorioamniotic membrane rupture may have several underlying cause. A history of prior PROM may be one of the leading risk factors for PROM in a subsequent pregnancy.[7] A history of spontaneous preterm birth in a prior pregnancy especially if due to PROM[8] and invasive procedures such as amniocentesis[9] are also risk factors for PROM. Black race is also at increased risk for PROM compared with the Caucasians.[10] Maternal age and parity may also be associated with the risk for PROM, and many studies have suggested that mothers age 30 years and above and nulliparous women[11] are at increased risk of developing PROM. Other patients at higher risk include those who have low socioeconomic status and cigarette smokers; genital tract infection leading to choriodecidual inflammation also plays an important role in PROM, particularly when membrane rupture occurs remote from term;[7] urinary tract infection (UTI), second or third trimester vaginal bleeding, uterine distension (e.g., polyhydramnios, multi fetal pregnancy), cervical conization or cerclage, exposure to air pollution,[12] and a decrease in the collagen content of the membranes have also been suggested to predispose patients to preterm PROM.[13,14] Micronutrient deficiencies that affect collagen formation have been shown to alter collagen structure and have been associated with an increased risk of preterm PROM.[15]

Sexual intercourse has also been found to predispose pregnant women to PROM because the act of sexual intercourse could precipitate an infectious process in the membranes and subsequent rupture.[13] Both high and low body mass index have been associated with preterm birth and preterm PROM.[16] PROM was more frequent in women of lower socioeconomic status with lower level of schooling because such women may not be able to access healthcare during the prenatal period either due to lack of financial support or ignorance. They may also have poor quality prenatal assistance because they may tend to undergo a smaller number of consultations and have a fewer laboratory tests, which may contribute to the occurrence of PROM.[17]

The occurrence of PROM is poorly predictable especially in developing countries where accurate investigation material is either too expensive or not available. Risk factors can be used to tease out patients at risk during antenatal period and counsel them on the consequences of PROM. This will allow institution of strategies to reduce the maternal and perinatal morbidities associated with the condition. Modifiable risk factors can be tapered to subdue the occurrence of PROM and improve maternal and perinatal outcome.

The aim of this study is to determine the risk factors of PROM at the University of Maiduguri Teaching Hospital (UMTH).

Patients and Methods

This is a hospital-based cross-sectional analytical study to determine the risk factors for PROM in pregnant women presenting to the Department of Obstetrics and Gynecology at UMTH, Maiduguri, Borno State, Nigeria. The study was conducted between 1st May 2016 and 28th February 2017.

The women were recruited consecutively until the desired sample sized was reached. Only women who met the inclusion criteria were recruited. For each case, the next apparently healthy patient without PROM, matched for age range, parity, and gestational age, was recruited as control.

All consenting pregnant women from gestational age of 28 weeks and above who presented to the Department of Obstetrics and Gynecology of UMTH with PROM served as cases. While women who declined consent, patients with vaginal bleeding, patients with iatrogenic rupture of fetal membranes, for example, artificial rupture of membranes, and patients who were on antibiotics or have history of having used antibiotics in the past 2 weeks were excluded.

Sociodemographic variables and clinical characteristics such as age, parity, and gestational age were noted and recorded using an investigator administered questionnaire. Sociodemographic and obstetrics variables such as age, parity, educational level of the participants, and occupation of the husband were enquired and recorded. Other information enquired included past obstetrics outcome including history of previous preterm delivery, previous PROM, and previous miscarriage. History of fever, vaginal discharge, trauma, history of abdominal distension, coitus, and urinary symptoms were also sought. Allocation into one of the three social classes was based on the participant's husband's occupation, employment and monthly income, and the participant's educational level according to a scoring system designed by Olusanya *et al*.[18] for Nigeria

and other African countries. Participant's educational level and husband's occupation were captured in the questionnaire and the social class group allocation was done on the proforma. Gestational age was determined by the last menstrual period and the results of ultrasonographic examinations before 24 weeks gestation. Membrane rupture was confirmed by visualizing amniotic fluid leaking from the cervical Oson sterile speculum examination. This procedure was explained to the participant and she was informed that she may experience slight discomfort during the procedure. A sterile speculum examination was done for all the women who took part in the study. The appearance of the cervix was assessed visually, and prolapse of the umbilical cord or fetal extremity was excluded. Evidence of fluid pooling in the vagina or leaking from the cervical os was observed. Valsalva maneuver was done when there was no active liquor drainage. The cervix was evaluated for any cervical dilation and effacement. For participants with PROM, liquor drainage was observed while no liquor drainage was observed in participants without PROM. Two endocervical swabs were taken separately by introducing a sampling swab into the cervical canal and rotated firmly for 15–20 s. Sample for high vaginal swab was obtained from the posterior fornix of the vagina; one sample obtained from the endocervical canal and high vagina was immediately inoculated into the three principal cultures: chocolate agar, blood agar, and MacConkey agar. The chocolate agar was placed in an anaerobic jar to which carbon dioxide gas packs were added. The cultures were incubated at 37°C. The other endocervical swab was used for *Chlamydia trachomatis* testing using the Chlamydia antigen detection kit (rapid detection method). The urine sample was also obtained by inserting the urethral catheter and obtaining a urine sample. This was explained to the participants, and the sample was collected with a sterile wide mouthed, plastic jar with tight fitting. The urine sample collected was immediately sent to the laboratory for processing within 2 h of collection or was kept refrigerated at 4°C, until delivery to the laboratory. The urine sample was processed no longer than 18 h after collection.

For the purpose of the study, PROM was defined as rupture of fetal membranes with no palpable uterine contractions in 10 min and no cervical changes. Data recorded on the questionnaire were transferred to a proforma developed on and then analyzed using the Statistical Package for Social Science (SPSS V 20.0 (2010) Inc., IBM, New York, NY, USA). Frequency and percentage analysis were done for the categorical variables. Data were presented in frequency charts, descriptive, and analytical tables. The association between studied variables was compared using Chi-square (χ^2) and Fisher's exact tests, while P value <0.05 was considered statistically significant. Logistic regression analysis was used to generate odds ratio to assess the contribution of the various independent variables (such as low socioeconomic status, genital infection, trauma, previous history of PROM, multifocal gestation, previous preterm birth, polyhydramnios, and cigarette smoking) to the occurrence of PROM (dependent variable).

Results

A total of 153 women with PROM who presented to the Department of Obstetrics and Gynecology were approached for the study and 129 consented to take part. The age distribution and parity are similar in the cases and control as shown in Table 1. The study population consisted mainly of the parity group 1–4 (55%) of the participants. Term PROM (37–42 weeks) recorded the highest frequency (37.9%). Sixteen (12%) of the participants with PROM were of low socioeconomic status when compared with seven (5%) of participants without PROM as shown in Table 1.

Previous PROM, previous PTD, abnormal vaginal discharge, UTI, previous history of miscarriage, and low social class were associated with PROM. These associations were statistically significant as shown in Table 2.

Table 3 shows the risk of PROM after multiple logistic regression analysis. Previous PROM, history of PTD, UTI, genital tract infection, and low socioeconomic status maintained their significance and were highly predictive of PROM.

Table 1: Sociodemographic and obstetrics characteristics of the participant

Sociodemographic characteristic	Cases (%)	Control (%)
Age (years)		
<19	6 (4.6)	5 (3.9)
20-24	38 (29.5)	39 (29.9)
25-29	34 (26.3)	35 (27.3)
30-34	31 (24.0)	30 (23.3)
35 or more	13 (15.6)	13 (15.6)
Total	129 (100)	129 (100)
$\chi^2=0.17$, $P=0.99$		
Parity		
0	38 (29.4)	34 (26.4)
1-4	68 (52.7)	71 (55.0)
5 or more	23 (17.8)	24 (18.6)
Total	129 (100)	129 (100)
$\chi^2=0.31$, $P=0.86$		
Social class		
Low class	16 (12)	7 (5)
Middle class	54 (42)	39 (30)
High class	59 (46)	83 (65)
Total	129 (100)	129 (100)
$\chi^2=9.99$, $P=0.007$		

Table 2: Risk factors for PROM among the cases and control

Risk factors	Cases (%)	Control (%)	Total (%)	OR (95% CI)
Abnormal vaginal discharge	89 (61.3)	56 (38.7)	145 (100)	2.90 (1.74-4.83)
Urinary tract infection	78 (65)	42 (35)	120 (100)	3.16 (1.90-5.27)
Genital infection	102 (79.1)	7 (5.5)	109 (100)	1.67 (1.28-1.89)
History of fever	60 (63.2)	11 (14.5)	76 (100)	2.37 (1.43-15.83)
History of coitus	46 (51.1)	44 (48.9)	90 (100)	1.07 (0.64-1.78)
Previous miscarriage	65 (85.5)	11 (14.5)	76 (100)	10.89 (5.36-22.11)
Previous PROM	42 (78.8)	11 (21.2)	52 (100)	10.24 (5.04-20.78)
Previous Preterm delivery	36 (83.7)	7 (16.3)	43 (100)	6.74 (2.87-15.83)
Low social class	16 (69.5)	7 (30.4)	23 (100)	3.12 (1.24-8.30)
Twin gestation	10 (6.66)	5 (33.4)	15 (100)	0.48 (0.15-1.44)
Air pollution	5 (83.3)	1 (16.7)	6 (100)	5.16 (0.59-44.81)
Polyhydramnios	2 (66.6)	1 (33.4)	3 (100)	2.01 (0.18-22.51)
Abdominal trauma	2 (66.6)	1 (33.4)	3 (100)	2.01 (0.18-22.51)

PROM: prelabor rupture of membranes; OR: odds ratio; CI: confidence interval

Table 3: Multinomial logistic regression analysis model of risk factors for PROM

Risk factors	OR	95% CI	*P*
Urinary tract infection	3.16	1.90-5.27	0.012
Previous PROM	10.24	5.04-20.78	0.0001
Previous preterm delivery	6.74	2.87-15.83	0.025
Low social class	3.12	1.24-8.30	0.0001
Genital tract infection	3.11	1.67-4.33	0.001

PROM: prelabor rupture of membranes; OR: odds ratio; CI: confidence interval

Discussion

PROM is one of the causes of increased maternal and perinatal morbidity and mortality. The cause may not be known, but multiple risk factors abound. Past obstetric performance is an important risk factor for PROM, and in keeping with other studies, we found previous history of PROM to be highly predictive of subsequent PROM. This finding was consistent with studies by Emechebe *et al*.[15] and Caughey *et al*.[16] Caughey *et al.* found that the risk of recurrence of PROM ranges from 16% to 32% when compared with 4% in women with previously uncomplicated pregnancy.[16] Similarly, Kilpatrick *et al*.[17] and Lee *et al*.[19] found a 20-fold increased risk of recurrence in a patient with previous PROM. The recurrence of PROM may be associated with an underlying pathology or unforeseen genetic factor that has persisted in the subsequent pregnancies. A proper evaluation in to the possible cause of PROM and its subsequent elimination may change the course of future pregnancies.

Women of low socioeconomic status are more likely to develop PROM and this is in consonance with the findings by Choudry *et al*.[20] and Spinello *et al*.[21] where they quoted that maternal low socioeconomic status is a strong independent predictor of PROM. The reason could be that women with low socioeconomic status and those with low level of schooling may not be able to access healthcare during the prenatal period either due to lack of financial support or ignorance. In addition, Ganjoei[22] analyzing for risk factor for bacterial vaginosis found that low socioeconomic status is significantly associated with 20-fold increased risk PROM. Genital tract infection is also an independent risk factor for development of PROM.

Previous preterm delivery and miscarriage as risk factors for PROM in this study is in keeping with the findings of Hackenhaar *et al.*[14] but contrasts with the study of Choudry *et al*.[20] Similarly, Silverman and Wojtowycz[23] also found a positive association between PROM and previous PTD. This could possibly be due to the presence of cervical incompetence that will heighten the pressure on the most dependent part of the membranes overlying the cervix thereby increasing the chance of spontaneous tear and leakage of liquor. PROM being one of the major causes of PTD also shares similar risk factors with it.

History of fever, abnormal vaginal discharge, and urinary symptoms were other risk factors found in this study, and these findings conflicts with the study by Hackenhaar *et al.*[14] who found no association with maternal UTI or presence of vaginal discharge with PROM. However, Nakubulwa *et al.*[24] and Choudry *et al.*[20] reported an association between abnormal vaginal discharge and genitourinary infection with PROM. The possible explanation in abnormal vaginal discharge leading to PROM could be that bacterial over growth is associated with an increase in vaginal PH which may weaken the protective cervical mucus operculum and permit dissolution of the membrane.[16] In addition, bacterially stimulated phospholipase may mediate premature cervical effacement through prostaglandin intermediates.[25] Microorganisms such as group B *Streptococcus* are implicated in about 5% of UTI in pregnant women and this organism is known to cause spontaneous rupture of membranes. The presence of genital tract infection is an independent risk factor for PROM as shown in this study. Abnormal vaginal discharge may not necessarily translate to genital infection as many patients with abnormal discharge were found not to harbor any genital infection.

Polyhydramnios, twin pregnancy, abdominal or genital trauma, history of air pollution, and history of coitus could not maintain significance after controlling for compounding variables.

Not consistent with this study, a significant association between coitus and PROM was found in a study by Karat

et al.[26] The role of coitus during pregnancy in causing PROM is not clear, but it is believed that the act of intercourse precipitates an infectious process in the membranes which is caused by bacteria from the lower genital tract being forced against the cervix by the actions of the intercourse. However, Naieye[13] and Omar[27] reported that although recent coitus and PROM are correlated, a causal relationship could not be demonstrated, and their findings were found to be consistent to this study. Similarly, history of abdominal distension (polyhydramnios) and multiple pregnancy were found to be significant risk factors for PROM in previous studies by Silverman and Wojtowycz.[23] Choudry *et al*.[20] also found a significant association between abdominal trauma/fall, coitus, abdominal distension (polyhydramnios), and multiple pregnancy with PROM.

Evidence for bacteriological, fungal, viral, and protozoa cause for PROM has been established.[13,20] This study showed a significant association between bacterial colonization of the genital tract infection and UTI with PROM. This finding agrees with the studies of Aboyeji *et al*.,[28] Salou and Dossim,[29] Kennedy,[30] and Eleje *et al*.[31] Genitourinary infection is a risk for PROM and *Escherichia coli* is the most implicated pathogen as the etiological agent of UTI.[32,33] *E. coli* was isolated from the urine sample of 15.5% of participants with PROM compared with only 3.1% of participants without PROM. This underscores the need to treat all genitourinary infection during the antenatal period to forestall the occurrence of PROM.

The major limitations of the study are the small sample size and being a single-center study, thereby making generalization of the finding difficult. A large multicenter study can be done to elucidate the above findings.

Conclusion

Our finding suggests that presence of previous PROM, PTD, low socioeconomic status, and genitourinary infection in patients identifies a group of pregnant women at increased risk of PROM. Risk factors that are modifiable or treatable should be addressed during the antenatal care to reduce the risk of PROM. High-risk patients should be counseled and monitored closely to optimize pregnancy outcomes.

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Conflicts of interest

There are no conflicts of interest.

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