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The Incidence Rate and Perinatal Outcome of Delivered Women with Preterm Premature Rupture of Membrane, at a tertiary maternity hospital within a year

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Abstract

Background and objectives: Many maternal and perinatal complications can result from preterm premature rupture of membrane. This study aims to find the incidence and identify factors associated with, and factors associated with adverse perinatal outcomes among women experiencing preterm premature rupture of membrane.

Methods: A cross-sectional study was carried out at Maternity Teaching Hospital in Erbil to calculate preterm premature rupture of membrane incidence in 1 year from 2023 to 2024. Factors such as maternal age, parity, antenatal care, amniotic fluid index were studied as well as the neonate's APGAR score, birth weight and outcome.

Results: For this study; 840 patients were included. The incidence of preterm premature rupture of membrane in 2023 at the maternity teaching hospital in Erbil was 2.18%. Younger age, lower BMI, nulliparity, and history of preterm premature rupture of membrane were associated with preterm premature rupture of membrane ($p<0.05$). Antenatal care was less common among preterm premature rupture of membrane (55.2% vs. 78.1%) ($p<0.05$). Preterm premature rupture of membrane was associated with lower APGAR scores in both 1st and 5th minutes of birth ($p<0.05$). Longer duration of preterm premature rupture of membrane before admission is associated with poor fetal outcome and lower APGAR scores ($p<0.05$).

Conclusion: preterm premature rupture of membrane impacts neonatal outcomes like birth weight and APGAR score. The time between preterm premature rupture of membrane and hospital admission significantly affects outcomes.

Keywords: APGAR score**,** Fetal outcome, Preterm premature rupture of membrane

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Introduction

The key role of the amniotic membrane is to safeguard the protective amniotic fluid for the fetus to thrive in inside the uterus until labor begins.[1] When the membrane breaks prior to the onset of labor, the condition is termed PROM, which is short for pre-labor rupture of membrane.[2] If the rupture occurs after 37 weeks of gestation it's called term PROM; while if it happens before 37 weeks of gestation has been completed, it's called PPROM standing for preterm pre-labor rupture of membrane.[3,4] The incidence of PPROM varies globally, ranging from 3-10% of all deliveries.[4,5] In Iraq, in a study conducted in Baghdad by Mohammed et. al, it's reported that prevalence of PROM was significantly associated with preterm birth found in 54% of the women who gave birth prematurely.[6] Globally, 15 million babies are born prematurely every year, and about1.1 million infants die due to complications of being born prematurly.[7] Around 3% of pregnancies are complicated by PPROM and 8% of pregnancies are affected by term PROM.[8] Many maternal and perinatal complications can result from PPROM. These complications include but are not limited to abruptio placenta, chorioamnionitis, cord prolapse, hence an increased rate of Cesarean section. Moreover, fetal health is also at risk of, low APGAR score, birth asphyxia, low birth weight, respiratory distress syndrome, and hence increased rate of NICU admission and perinatal death.[9-12] PPROM causes preterm birth which is responsible for 40-75% of neonatal deaths.[13] The cause of PPROM is not clear; however, there are several factors identified to be associated with its occurrence. These factors include, socioeconomic status, trauma, smoking, history of cesarean section, history of abortion, malposition, abnormal vaginal discharge, multiple pregnancies, and maternal medical conditions.[14-16] In recent years, the pathophysiology leading to PPROM has become better understood. Some resources suggest a genetic predisposition leading to the condition. Multiple protocols have been suggested that are risk-based to identify women who are at high risk for PPROM.[17] Moreover, there are many strategies that aim to reduce adverse outcomes of PPROM such as management protocols, and prophylactic antibiotics.[18] Assessing modifiable or treatable risk factors of PPROM is crucial for designing interventions to prevent complications and optimize pregnancy outcomes. Hence, the current research aims to identify the determinants influencing adverse perinatal outcomes among women experiencing PPROM.

Patients and methods

In order to determine the incidence rate of PPROM a cross-sectional study was carried out. Additionally, a case-control study design was employed to assess the perinatal outcomes of PPROM. The study included all women who presented with PPROM at the Maternity Teaching Hospital in Erbil city, Kurdistan region, Iraq. Data from a control group consisted of women with term pregnancies who presented for labor were collected for comparison purposes. The study spanned one year, from January 8th, 2023, to January 8th, 2024. Inclusion criteria for the PPROM group were all women diagnosed with PPROM at the Maternity Teaching Hospital. The control group included women who agreed to participate, presented for labor with a term singleton pregnancy, and had normal placentation. Written informed consent was obtained from all participants prior to participation. The primary researcher thoroughly explained the study's aim and scope to each participant. Data were collected using a structured questionnaire, with each patient assigned a code to ensure anonymity and privacy. The first part of the questionnaire gathered sociodemographic

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data such as age, occupation, body mass index (BMI), and smoking status. The second part collected information on current and previous pregnancies, including history of PPROM, gestational age, antenatal care, parity, fetal position and presentation, genital tract infections, congenital fetal anomalies, duration of PPROM before and after admission, Amniotic Fluid Index on ultrasound, and mode of delivery. The third part focused on fetal outcomes, including APGAR scores at 1 and 5 minutes,[19] newborn weight, and overall fetal outcome. Data analysis was conducted using SPSS software (version 26). Proportions between the two groups were compared using the Chi-square test of association. Fisher's exact test was used when more than 20% of the table cells had an expected count of less than 5. The means of the two groups were compared with the student's t-test for independent samples, and correlations were assessed using the Pearson correlation coefficient. A p-value of ≤ 0.05 was considered statistically significant. Ethical approval was obtained from the Research Protocol Ethics Committee of the Kurdistan Higher Council of Medical Specialties (No.55, January 8th ,2023).

Results

A total of 840 pregnant women were included in the study. During the study period of 1 year 420 pregnant women presented with PPROM; therefore, another 420 women who presented for term labors were recruited as the control group. The incidence of PPROM in 2023 at the maternity teaching hospital in Erbil was 2.18%. Table (1) shows the baseline characteristics of the PPROM cases and the control group. The mean age of women who presented with PPROM was 26.6±6.3 years, whereas the mean age of the women in control group was 28.6±6.6. The difference between the mean ages of both groups were statistically significant ($p<0.05$). When the patients were stratified based on age categories, it was observed that the majority of PPROM cases were between 20-29 years, whereas the majority of the women in the control group were 30 years or older ($p<0.05$). The average BMI for the PPROM cases was 30.7±3.4 kg/m², while the control group had an average BMI of 31.3±3.3 kg/m², with a p-value of less than 0.05. A larger proportion of women with PPROM (48.6%) were Primigravida, compared to the those who had term pregnancies (27.1%) ($p<0.05$). History of PPROM was recorded in 43.8% of PPROM cases and in 16.2% of the control group ($p<0.05$). Mother's occupation status, and smoking status, were not statistically significant ($p>0.05$).

Table (1): Baseline characteristics

Variables		Term birth n= 420	PPROM n= 420	p-value
Mean age±SD, years		28.6±6.6	26.6±6.3	0.000
Age category	≤20	46 (11%)	78 (18.6%)	0.000
	20-29	182 (43.3%)	204 (48.6%)	
	≥30	192 (45.7%)	138 (32.8%)	
Occupation	Employee	2 (0.5%)	4 (1%)	0.686*
	Housewife	418 (99.5%)	416 (99%)	
Mean BMI, kg/m^2		31.3±3.3	30.7±3.4	0.012
Parity	Primigravida (nulliparous)	114 (27.1%)	188 (44.8%)	0.000
	Multiparous	306 (72.9%)	232 (55.2%)	
Smoking status	Smoker	8 (1.9%)	10 (2.4%)	0.634
	Non-smoker	412 (98.1%)	410 (97.6%)	
History of PPROM		68 (16.2%)	184 (43.8%)	0.000

*Fisher's exact test

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Table (2) shows the prenatal characteristics of the study population. The mean gestational age of PPROM cases was 33.5±2.7 weeks, and of the control group was 38.2±1.1 ($p<0.05$). The most common fetal position was cephalic in both the PPROM cases and the control group (92.4% and 93.3%, respectively). Breech position was more common among the PPROM cases (7.6% vs. 5.2%). Moreover, Transverse position was only found in 1.4% of the PPROM group and none of the patients in the control group. Antenatal care was present in 55.2% of the PPROM cases and 79.5% of the control group (<0.05%); the median antenatal care visits was 2 for the PPROM group and 3 for the control group ($p<0.05$). Frank genital tract infection was more common among the PPROM group (78.1%) compared to the control group (71.4%) ($p<0.05$). Fetal congenital anomaly was more common among the PPROM group (3.3%) than the control group (1%) ($p<0.05$). Ultrasound findings showed that a larger proportion of PPROM cases (31%) had AFI<5 compared to the control group (1%) ($p<0.05$). As for mode of delivery, it's evident that spontaneous vaginal delivery and induction of labor were more common among the PPROM group (61.4% vs. 39%, and 4.8% vs. 1.4%, respectively), whereas elective C/S and Emergency C/S were more common among the control group (13.8% vs. 0.5%, and 45.7% vs. 33.3%, respectively) ($p<0.05$).

Table (2): Prenatal characteristics of the groups

Variables		Term birth n= 420	PPROM n= 420	p-value
Mean Gestational age±SD, weeks		38.2±1.1	33.5±2.7	0.000
Fetal position	Cephalic	398 (94.7%)	382 (~91%)	0.015*
	Breech	22 (5.2%)	32 (7.6%)	
	Transverse	0 (0%)	6 (1.4%)	
Antenatal care		334 (79.5%)	232 (55.2%)	0.000
No. of antenatal care visits, median		3	2	0.000
Frank genital tract infection		300 (71.4%)	328 (78.1%)	0.026
Fetal congenital anomaly		4 (1%)	14 (3.3%)	0.017
US finding	AFI >5	416 (99%)	290 (69%)	0.000
	AFI<5	4 (1%)	130 (31%)	
Mode of delivery	Spontaneous vaginal delivery	164 (39%)	258 (61.4%)	0.000*
	Induction of labor	6 (1.4%)	20 (4.8%)	
	Elective C/S	58 (13.8%)	2 (0.5%)	
	Emergency C/S	192 (45.7%)	140 (33.3%)	

*Fisher's exact test

Table (3) demonstrates the difference between neonatal outcomes of the PPROM cases and the control group. Among the PPROM cases the majority of the newborns (53.8%) had an APGAR score between 0-7 at the first minute of birth, whereas among the control group the majority (66.7%) had an APGAR score between 8-10 at the first minute of birth ($p<0.05$). At the fifth minute an APGAR score between 7-10 was more prevalent among the PPROM group, and an APGAR score between 8-10 was more common among the control group ($p<0.05$). The mean weight of the newborn was 2244.3±544.4 grams in the PPROM cases, and 3373.1±429.6 grams in the control group ($p<0.05$). The majority of the newborns of both groups were alive and well, however, a higher percentage was recorded among control group than the PPROM cases (95.7%

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vs. 71.4%, respectively). NICU admission was more common among the PPROM cases (19%) compared to the control group (3.8%). Neonatal death was recorded in 10.5% of the PPROM cases, whereas only 0.5% of the newborns of the controls ended in early neonatal death. Table (4) shows the association between the duration of PPROM before and after admission with neonatal outcome. The mean duration before admission was for newborns with good outcome was 14.2±19.4 hours and for newborns with poor outcome the mean duration was 22.7±26.5 hours, and this finding was statistically significant ($p<0.05$). The mean duration of the PPROM after admission between newborns of good and poor outcome was not statistically significant ($p>0.05$). Table (5) shows the correlation relationship between the duration of PPROM prior to admission and the APGAR score at 1st and 5th minutes. There was a negative correlation between duration of PPROM before admission and the APGAR score at both1st ($r = -0.217$) and 5th ($r = -0.22$) minutes, and this correlation was statistically significant ($p<0.05$).

Table (3): Comparison of the neonatal outcomes of PPROM and controls

Variables		Term birth n= 420	PPROM n= 420	p-value
APGAR Score Category, 1st minute	0-7	140 (33.3%)	226 (53.8%)	0.000
	8-10	280 (66.7%)	194 (46.2%)	
APGAR Score Category, 5th minute	0-7	24 (5.7%)	120 (28.6%)	0.000
	8-10	396 (94.3%)	300 (71.4%)	
Mean newborn weight±SD, grams		3373.1±429.6	2244.3±544.4	0.000
Fetal outcome	Alive and well	402 (95.7%)	296 (70.5%)	0.000
	NICU admission	16 (3.8%)	80 (19%)	
	Early neonatal death	2 (0.5%)	44 (10.5%)	

Table (4): Association between duration of PPROM and neonatal outcome

Time	Neonatal outcome		p-value
	Good neonatal outcome	Poor neonatal outcome	
Duration of PPROM before admission, Mean±SD	14.2±19.4	22.7±26.5	0.001
Duration of PPROM after admission, Mean±SD	6.4±6.1	6.4±4.8	0.896

Table (5): Correlation between Duration of PPROM before admission and APGAR score

Pearson Correlation	r-value	p-value
Correlation between Duration of PPROM before admission and APGAR score at 1st minute	-0.217	0.000
Correlation between Duration of PPROM before admission and APGAR score at 5th minute	-0.220	0.000

Discussion

The incidence of PPROM in the current study was 2.18% that is 21.8 cases per 1000 deliveries. This rate is similar to a study conducted by Jena et al., in which they reported an incidence of 2%. [20] A slightly

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higher incidence of PPROM was recorded in a study conducted by Zhou et al. in 2014.[21] In retrospective study covering a period of 10 years from 1999 to 2009, by TC et al., an incidence rate of 3.3% was recorded. [22] In a study by Abouseif et al. an incidence of 4.7% was recorded in 2015.[23] In the current study we found that age of patients presented with PPROM was significantly less than the age of patients presented for labor with term pregnancies (26.6±6.3 years vs. 28.6±6.6, respectively). Moreover, the prevalence of age groups of 29 years and below was significantly higher among the PPROM cases compared to those with term pregnancies, in which age groups of 30 and above were most prevalent. This finding is in accordance with Wolde et al.'s study, in which they reported a prevalence of 76.7% in the age groups of 29 years and below and a prevalence of 23.3% in age groups of 30 and above among PPROM cases.[24] Our finding is similar to Abouseif at al.'s study in which they reported a mean age of 27±6 years, with the majority of cases falling under the age category of 30 years and below.[23] In this study, we found that a significantly higher percentage of PPROM patients were primigravida (44.8%) compared to those presented for labor with term pregnancies (27.1%). In accordance with our findings Wolde et al., reported a percentage of 44.6% of primigravida in PPROM patients. Abouseif et al., reported a lower percentage of primigravida (31.3%) among PPROM patients compared to ours. [23] TC et al. also reported a lower percentage of nulliparity (29.1%) compared to ours.[22] Moreover, Bouvier et al. identified nulliparity as a highly significant risk factor for PPROM. [25] Furthermore, we found that percentage of women with history of PPROM was significantly higher in patients presented with PPROM compared to the control group (43.8% vs. 16.2%, respectively). This finding goes hand in hand with Bouvier et al.'s study in which they reported that history of PPROM was a significant risk factor of recurrent PPROM.[25] However, Abouseif et al. reported a significantly lower percentage of previous PPROM (4%) among their patients.[23] As expected, in the current research, the average gestational age in the PPROM cases was lower (33.5±2.7 weeks) than the control group (38.2±1.1weeks). Abouseif et al. reported a similar mean gestational age in their PPROM cases (32.2±3.1).[23] In this research, we found a substantial difference between the fetal positions of PPROM cases and the control group. Despite the fact that cephalic presentation was the most frequent presentation in both groups, it was less common among the PPROM group (91%) compared to the control group (94.7%). Additionally, Breech presentation was more common among the PPROM group (7.6% vs. 5.2%), whereas transverse presentation was only found in 1.4% of the PPROM cases, but none of the control group. Joy et al., reported a higher percentage of breech presentation among their PPROM cases (20.7%) and a lower percentage of cephalic presentation (79.3%) compared to our study. [26] Goodman et al. reported that 19.1% non-cephalic presentations in their PPROM cases which were also significantly more prone to maternal and fetal complications such as abruptio placenta, oligohydramnios, and intrauterine death.[27] Antenatal care was a major focal point in our study. We found that the percentage of PPROM patients who had received antenatal care was significantly lower compared to the control group (55.2% vs. 79.5%, respectively). Moreover, the median number of visits was lower in PPROM cases compared to the control group. In congruent with Singh et al and Tiruye et al's studies in which they concluded women without antenatal care have increased odds of developing PPROM.[28,29] In the current study, we found that frank genital tract infection was significantly more common among the

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PPROM cases compared to the control group (78.1% vs. 71.4%). This finding is in accordance to Tiruye et al., Byonanuwe et al. and Hackenhaar et al.'s studies, where they also reported a higher prevalence of genital tract infection among PPROM cases.[29,30,31] Fetal congenital anomaly was another significant finding in our study. We found that a significantly higher percentage of fetal congenital anomaly was detected among the PPROM cases (3.3%) compared to the control group (1%). This finding is in agreement with Laignier et al.'s study.[32] We also found that oligohydramnios was significantly more common among patients presented with PPROM (31%) compared to the control group (1%). This finding is congruent with Bouvier et al.'s study, in which they reported oligohydramnios as a significantly prevalent complication associated with PPROM.[25] Kim et al. reported similar findings in their study, in which they found that the prevalence of oligohydramnios higher among PPROM patients compared to non-PPROM patients.[33] In our study, the most common mode of delivery in the PPROM was spontaneous vaginal delivery (61.4%); whereas the common mode of delivery in in the control group was emergency C/S (45.7%). In contrast to our finding, Bouvier et al. reported a higher percentage and an increased odd of cesarean section among their PPROM group. This discrepancy to differences in hospital management protocols. Moreover, Abouseif et al. reported delivery by CS as a significant predictor of poor fetal outcome.[23] Assessment of the fetal outcome was also a major focus in our study. We found that among the newborns of PPROM cases, a significantly higher percentage had low APGAR scores at 1st (53.8%) and 5th (28.6%) minutes compared to the control group. Wolde et al., reported a higher percentage of low APGAR score in the 5th minute of birth among newborns of PPROM cases (34.7%) compared to our study. [24] In the current study, the majority of PPROM newborns were alive and well (70.5%), however the rate of NICU admission (19%) and early neonatal death (10.5%) was more common among the PPROM newborns compared to the control group (3.8% and 0.5%, respectively). Abouseif et al., reported a significantly lower percentage of alive and well newborns of PPROM (38.7%), and a higher percentage of NICU admission (47%) and fetal death (14.3%) compared to our study. [23] Wolde et al., reported a higher percentage of alive newborns (89.85%) compared to us, however, their percentage also included those admitted to NICU. [24] Meanwhile they reported a lower percentage of early neonatal death (4.3%) compared to our finding. Bouvier et al. reported a significantly higher rate of NICU admissions in newborns of PPROM cases, compared to ours.[25] One explanation for this difference could be higher rate of low birth weights in the current study. Another important finding in the current study is that longer duration of PPROM prior to hospital admission is significantly associated with poor neonatal outcome. We found that duration of PPROM prior to admission is negatively correlated with the APGAR score at 1st and 5th minutes of birth. This means that as the duration of PPROM before admission increases the APGAR score decreases. This finding is supported by Ocviyanti et al.'s study, in which they reported that duration of PPROM ≥ 18 hours increases the risk of neonatal sepsis by 3 folds.[34]

Conclusion

Preterm premature rupture of membranes significantly affects neonatal outcomes such as the birth weight, the APGAR score, and fetal outcome. Duration of PPROM before admission has an important role in predicting neonatal outcome.

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Conflict of interest

The authors declare no conflict of interest

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