

Prevalence and outcome of Preterm Premature Rupture of Membranes (PPROM) among pregnant women attending Ain Shams maternity hospital

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Abstract:

Background: Preterm premature rupture of membranes (PPROM) is one of the leading identifiable causes of premature birth and it accounts for high rates of perinatal deaths in developed and developing countries. **Objectives:** The study was conducted to measure the prevalence of PPRM among pregnant women attending Ain Shams maternity hospital, and to identify the fetal/neonatal outcome among pregnant women presented with PPRM and potential factors associated with poor fetal/neonatal outcome. **Method:** A cross sectional study was conducted on two phases using data retrieved from computerized hospital information system (HIS), Ain Shams Maternity Hospital. Data about all deliveries from 2011-2015 was revised from Hospital Information System to calculate the frequency of PPRM during these years. A sample of 300 medical files of pregnant women who were diagnosed with PPRM before 37 weeks and admitted to the hospital in the year 2015 were then extracted from the hospital archive and revised using a checklist developed by the investigators. Relevant data was obtained from these medical files. **Results:** Prevalence of PPRM ranged from 2.4% in 2011 to 4.7% in 2015 with the highest rate during 2013 (5.3%). Only 4.3% of women presented with PPRM developed chorio-amnionitis. Regarding fetal outcome, 61.3% of infants developed a poor fetal outcome including; (fetal death and ICU admission), while 38.7% of infants had good fetal outcome (alive & well). By multivariate analysis women employment (OR 1.9 CI 1.2 – 3.5), gush type of PPRM (OR 1.9 CI 1.4 – 3.6), history of chorioamnionitis (OR 14.5 CI 12.4 – 132.1), delivery by CS (OR 2.5 CI 2.01 – 4.5) and later gestational age at PPRM (OR 0.8 CI 0.2 – 0.9) were significant independent predictors of poor fetal outcome. **Conclusion & Recommendations:** Prevalence PPRM at Ain Shams maternity hospital is increasing during study duration with fetal/neonatal complications that necessitate proper antenatal care and proper management.

Key words: PPRM, fetal outcome, Ain Shams, maternity hospital.

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Introduction

Premature rupture of membranes (PROM) is the rupture of the fetal membranes before the onset of labor, if occurred before 37 weeks, it's called; the preterm premature rupture of fetal membranes (PPROM).¹ There is variation in the prevalence of PPRM and this is due to the difference in the

studied populations. Premature rupture of membranes occurs between 5 and 15% of all pregnancies.² It was 1.8% in Oman and 8% in Bangladesh. While in Pakistan a prevalence of 9.6% was reported.³ The pathophysiology is complex and multifactorial.⁴ The most common cause of PPRM is idiopathic.⁵ The primary

complication for the mother is the risk of infection which can lead to chorioamnionitis which is as high as 25–35%, metritis after delivery and increases the need for CS delivery [6]. Complications of PPRM for the fetus and newborn consist of prematurity, cord compression which leads to fetal distress, neonatal sepsis, respiratory distress syndrome (RDS), and cord prolapse during rupture of membranes, placental abruption and risk of fetal and neonatal death.⁷

The fetal and neonatal morbidity and mortality risks are significantly affected by severity of oligo-hydramniotic, duration of latency period and gestational age at PPRM.⁸

PPROM is one of the leading identifiable causes of premature birth and it accounts for approximately 18% to 20% of perinatal deaths in the United States [9], 30-40% of preterm deliveries in Oman and Iran.^{10,11}

In Egypt, approximately 30% of preterm births are related to preterm rupture of membranes.¹² PPRM is a major complication of pregnancies and an important cause of perinatal morbidity and mortality. Currently, there is no effective way of preventing spontaneous rupture of fetal membranes due to ignorance of its etiology, with consequent inability to control its incidence. However, it is important that women be well informed regarding maternal, fetal and neonatal complications regardless of controversies of its management.¹³

So PPRM is critically important to be studied and to determine its impact as a clinical and public health problem. There is paucity of information regarding prevalence of PPRM and its outcome in Ain Shams maternity hospital so the aim of current study was to determine the extent of this problem (PPROM) and its complications.

Objectives: To measure the prevalence of PPRM among pregnant women

attending Ain Shams maternity hospital during the years (2011 -2015) and to identify the outcome and the potential associated factors with poor fetal/neonatal outcome among pregnant women presented with PPRM.

Methods

Type, place & population of the study:

This study was conducted as a cross sectional study on two phases using data retrieved from the computerized hospital information system (HIS), in Ain Shams Maternity Hospital. **Time of data collection:** This Study lasted one year from January 2016 to December 2016. First phase included data collection about all deliveries from 2011-2015 obtained from the HIS. The second phase included retrieving a sample of files of pregnant women in 2015 who were diagnosed with PPRM before 37 weeks and admitted to Ain Shams maternity hospital. **Diagnostic criteria of cases:** Diagnosis of cases with PPRM was confirmed by obstetrics and gynecology physicians by presence of history of fluid drainage through the vagina, direct visualization of fluid from cervical os and ultrasound was done for fluid index.¹⁴ **Sample size:** To achieve the first study objective (prevalence of PPRM) total number of deliveries and total number of pregnant women who suffered from PPRM in each year from (2011-2015) were identified and included in calculating the prevalence in each year using the following equation:

Prevalence of PPRM= Total number of women presenting with PPRM/ Total number of deliveries in the same year and place.¹⁵

To achieve the second objective, sample size was calculated based on: frequency of expected poor neonatal outcome of PPRM from a previous study ; Mohamad 2013¹⁶, α error = 0.05, Power=0.8 and accordingly, the sample size was calculated to be (300) patient

Table (1): Prevalence of PPRM among women delivered at Ain Shams maternity hospital from 2011 to 2015.

| Year | Number of deliveries | Number of pregnant women presenting with PPRM | Prevalence of PPRM | 95% CI | |
|--------------|----------------------|---|--------------------|--------|-------|
| | | | | Lower | Upper |
| 2011 | 13501 | 327 | 2.4% | 2.1 | 2.7 |
| 2012 | 13966 | 446 | 3.1% | 2.8 | 3.4 |
| 2013 | 13498 | 723 | 5.3% | 4.9 | 5.7 |
| 2014 | 12868 | 634 | 5% | 4.6 | 5.4 |
| 2015 | 12743 | 605 | 4.7% | 4.3 | 5.1 |
| Total | 66576 | 2735 | 4.1% | 3.9 | 4.3 |

files presented with PPRM using Power & Sample size program.

In paper based archives, files were sorted in monthly piles. Files of females with PPRM were selected from year 2015 files until predetermined sample size (300 files) was satisfied. Patients' files of 2015 were the ones chosen because files of that year were the most recent and data is expected to be more or less complete.

Study tool: A checklist was developed by the investigators that included relevant variables from literature search [15,17,18] and modified based on available data recorded in archived patient files. It contained the following items: Socio-demographic data (maternal age, occupation and smoking status). Obstetric data: (gravidity, gestational age at PPRM in weeks, previous history of PPRM, gestational age at delivery in weeks, type of pregnancy (single, twins, triple...), type of PPRM, latency period and history of chronic diseases of pregnant women. Maternal outcomes: Mode of delivery (spontaneous vaginal or CS delivery), presence of clinical chorioamnionitis which is characterized by maternal fever ($>39^{\circ}\text{C}$) accompanied by at least two of the following signs: maternal or fetal tachycardia, maternal leukocytosis, uterine tenderness, or foul-smelling amniotic fluid [19]. Fetal/Neonatal outcome: Birth weight (in Kgs), alive and well, alive but needed Neonatal intensive care unit (NICU)

admission, neonatal death or others (eg., neonatal infection-jaundice).

Pilot study: The checklist was tested for clarity and suitability for the aims of the study and to check for completeness and availability of patient files. Twenty patient files were extracted and completed in checklists. These files were paper based files from the archives of Ain Shams maternity hospital yet were not included in study sample.

Data management: Data were coded, entered and analyzed using SPSS program version 20. Operational definitions of variables: *Gravidity was categorized into 3 groups:* either primigravida (pregnant for the first time), multi gravida (pregnant \geq twice) or grand multi gravida (pregnant \geq 5 times).³ *Birth weight was classified into 2 groups:* either low birth weight $\leq 2.5\text{Kg}$ or Normal birth weight $> 2.5\text{Kg}$.²⁰ *Infant viability was classified into 3 groups:* alive and well, alive but ill (including NICU admission, preterm birth, respiratory distress or infection) and neonatal death. *Neonatal outcome was classified into 2 groups according to prognosis;* either Poor neonatal outcome (occurrence of one or more of the following (NICU admission, preterm birth, respiratory distress or neonatal death) or Good neonatal outcome (born alive and well).¹⁸

Data Analysis: Quantitative variables were described as range and mean \pm SD. Qualitative variables were described as number and percentage with 95% CI of

Table (2): Socio - demographic characteristics & Obstetric history of women with PPROM.

| Socio-demographic Characteristics | N N=300 | % |
|--|--------------|------------------|
| Maternal age: | | |
| • < 20 years | 47 | 15.7 |
| • 20-30 years | 175 | 58.3 |
| • > 30 years | 78 | 26.0 |
| Employment status | | |
| • Employed | 89 | 29.7 |
| • Unemployed | 211 | 70.3 |
| Smoking (tobacco): | | |
| • Smoker | 13 | 4.3 |
| • Nonsmoker | 287 | 95.7 |
| Type of PPROM: | | |
| • Drain | 76 | 25.3 |
| • Gush | 224 | 74.7 |
| Latency period (days)*: | | |
| • ≤ 1 | 157 | 52.3 |
| • 2-3 | 76 | 25.3 |
| • ≥ 4 | 67 | 22.4 |
| Gravidity: | | |
| • Primi gravida (Nulli-para) | 94 | 31.3 |
| • Multi gravida (1-4) | 174 | 58.0 |
| • Grand multi gravida ≥5 | 32 | 10.7 |
| Multiple pregnancy: | | |
| • Single | 255 | 85.0 |
| • Twins | 45 | 15.0 |
| Previous history of PPROM: | | |
| • Present | 12 | 4.0 |
| • Absent | 288 | 96.0 |
| Chronic diseases: | | |
| • Present | 59 | 23.0 |
| • Absent | 198 | 77.0 |
| | Range | Mean ± SD |
| Maternal age (years) | 15 - 45 | 27 ± 6 |
| Gestational age at PPROM (weeks) | 28 - 36 | 32 ± 3 |
| Latency period (days) | 0 - 3 | 3 ± 4.5 |
| Gestational age at delivery (weeks) | 28-37 | 32.2 ± 3.1 |

*Latency Period: Time interval from PPROM to onset of labor.

frequency of PPROM was calculated.²¹ ANOVA and Post Hoc test were used to compare between more than two groups as regards quantitative variables. Multivariate logistic regression model was built to identify the factors which finally predict poor neonatal outcome in PPROM cases, poor outcome was coded as (0) and good was coded as (1).

Results:

Prevalence of PPROM ranged from 2.4% in 2011 to 4.7% in 2015 with the highest rate during 2013 (5.3%) table (1). Women presented with PPROM aged between 15 to 45 years with mean age ± SD (27 ± 6 years). Gestational age at PPROM ranged from 28-36 weeks, mean ± SD (32 ± 3 weeks). The majority of women were non-smokers (95.7%), housewives (70.3%) and presented with gush type of rupture membrane (74.7%). Most of them were multigravida (58%) with singleton pregnancy & 52.3% went into spontaneous labor within 24 hours. The majority of women didn't have a past history of PPROM (96%) and most of them were free from chronic diseases (77%) (table 2). Low percentage of women developed chorioamnionitis (4.3%) and 46.7% delivered by CS. Fetal outcome is presented in Table (3). As regards fetal/neonatal outcome; 61.3% of infants developed poor fetal outcome including; (fetal death, ICU admission), while 38.7% of infants had good fetal outcome (alive & well). Univariate analysis showed that among socio-demographic characteristics only maternal age was significantly related to poor fetal outcome ($p < 0.05$). Regarding obstetric history of pregnant women; mean gestational age at PPROM & at delivery, type of rupture of membranes, history of chorioamnionitis, mode of delivery and infant birth weight were significantly related to poor fetal outcome ($p < 0.05$). However, other studied factors were not statistically significant.

By multivariate analysis women employment (OR 1.9 CI 1.2 – 3.5), gush type of PPROM (OR 1.9 CI 1.4 – 3.6), history of chorioamnionitis (OR 14.5 CI 12.4 – 132.1), delivery by CS (OR 2.5 CI 2.01 – 4.5) and later gestational age at PPROM (OR 0.8 CI 0.2 – 0.9) were significant independent predictors of poor fetal outcome. (Table 4)

Discussion:

In the current study the prevalence of PPRM was 4.1% which agrees with a study conducted in India²², but it was lower than that reported in Bangladesh²³ and high if compared to rates in Nigeria²⁴, Oman²⁵ and in USA²⁶. Higher rates of PPRM in the current study could be explained by the fact that Ain Shams Maternity hospital is a tertiary care level referral hospital to which complicated cases are usually referred. Also, cultural

Table (3): Fetal outcome of PPRM among neonates of studied women

| Fetal outcome of PPRM | N N=300 | % |
|--|------------|------|
| Neonatal viability: | | |
| • Alive | 257 | 85.7 |
| • Dead | 43 | 14.3 |
| Fetal outcome: | | |
| 1-Alive and well | 116 | 38.7 |
| 2-Alive but ill (n= 141) | 141 | 47.0 |
| • NICU admission | 21 | 7.0 |
| • PT & RDS ^① | 114 | 38.0 |
| • Others ^② | 6 | 2.0 |
| 3-Died | 43 | 14.3 |
| Fetal outcome*: | | |
| • Good fetal outcome ^③ | 116 | 38.7 |
| • Poor fetal outcome ^④ | 184 | 61.3 |
| Infant Birth weight | | |
| • Normal birth weight>2.5kg | 62 | 20.7 |
| • Low birth weight≤2.5kg | 238 | 79.3 |
| Birth weight of infant at birth(kg) | | |
| Range (Min–Max) | 1-3.7 | |
| Mean ±SD | 2 ± 6 | |

^①PT= preterm & RDS: respiratory distress syndrome, ^②fetal infection-jaundice, ^③Good outcome: born alive and well, ^④ Poor outcome: as neonatal NICU admission, preterm birth, respiratory distress or neonatal death

influences of early marriage, poverty resulting in low maternal weight gain and lack of birth spacing which are significantly associated with PPRM and this explanation was supported by Tahir et al.²⁷ Moreover, inadequate antenatal care had a higher risk of poor maternal outcome according to a study

done in Ismailia General Hospital [28]. Although there is a high utilization rate of antenatal care in Egypt (82%) according to²⁹ EDHS, 2016, the visits may be ineffective or inadequate.

In the present study the prevalence rate of PPRM among registered deliveries showed some fluctuations and rising frequency between 2011 till 2015. PPRM is considered to be increasing despite the minimal decline in 2014. A definite cause for this condition is still not clear however some factors which are already increasing in our society may have a role e.g. active and passive smoking.

Rate of chorioamnionitis in the current study was much lower than that reported in other countries ranged between 13% and 60% in Victoria, Ireland and in Bangladesh.^{30,15, 31} This difference could be explained by the fact that most deliveries in the current study occurred within 24 hours after PPRM that could decrease the incidence of chorioamnionitis. However, lower rates of chorioamnionitis were reported in Iran and Zambia.^{32, 18}

Poor fetal outcome in the current study (61.3%) was high compared to other studies 26.8% & 34% in Zambia & Ethiopia.^{18,20} One of the expected reasons may be the admission of late or complicated cases of PPRM that are probably referred to a tertiary care level as Ain Shams maternity hospital for better management so the chance of complications may be higher.

Fetal death occurred in 14.3%, which is high if compared to 3.1 to 10% in other countries.^{18, 22, 32} The higher percentage of fetal death in the current study may be attributed to high rate of low birth weight (LBW) (79.3%) and consequently high incidence of Respiratory Distress Syndrome (RDS). However, this rate is low if compared to 19.2%, 17.8% and 29%^{27,33,34} in other countries. This difference may be due to different patient

characteristics like history of chorioamnionitis, late gestational age at

Table (4): Multivariate logistic regression analysis to identify predictors of poor fetal/neonatal outcome of PPRM.

| Covariates | Odds ratio | 95% CI | | P value |
|-------------------------------|------------|--------|-------|--------------|
| | | Lower | Upper | |
| Employment | 1.9 | 1.2 | 3.5 | 0.02* |
| Type of PPRM | 1.9 | 1.4 | 3.6 | 0.03* |
| Chorioamnionitis | 14.5 | 12.4 | 132.1 | 0.01* |
| Mode of delivery | 2.5 | 2.01 | 4.5 | 0.00* |
| Later gestational age at PPRM | 0.8 | 0.21 | 0.90 | 0.00* |
| Gravidity | | 0.67 | | 0.67 |
| Multi gravidity | 0.7 | 0.38 | 1.4 | 0.38 |
| Grand gravidity | 0.8 | 0.77 | 2.1 | 0.77 |
| Multiple pregnancy | 0.7 | 0.38 | 1.5 | 0.38 |
| Chronic diseases | 1.1 | 0.60 | 2.2 | 0.60 |
| Smoking | 1.5 | 0.67 | 12.3 | 0.67 |
| Maternal age | | 0.144 | | 0.14 |
| • 21-30years | 1.3 | 0.46 | 2.8 | 0.46 |
| • >30years | 2.4 | 0.06 | 6.2 | 0.06 |
| Previous history of PPRM | 0.4 | 0.24 | 1.7 | 0.24 |

* Statistically significant difference

PPROM & rate of preterm delivery in previous studies.

In the current study, 47% of infants were admitted to NICU which is low as compared to 65.3% and 75.8% in other studies.^{32,35} The higher rate of admission compared to the current study was described as their studies were performed on preterm babies; therefore more problems and higher rate of NICU admission compared to present study that included infants born at a wider range of gestational ages.

However, lower rates of NICU admission in the current study may be attributed to high rate of referral to other hospitals. Ain Shams University suffers from relative shortage of places in NICU in relation to the high number of deliveries received daily by the hospital. Admission of the needed cases may pose a problem.

In the current study 2% of infants had neonatal sepsis, similarly, Nabhan et al., 2014 reported that 3.5% of infants of mothers having PPRM at Ain Shams maternity hospital developed sepsis.³⁶ But this rate is low if compared to rates of 18% in a study in Assuit and 6.7% in

Bangladesh [16 & 31]. The higher rate of sepsis reported in these studies may be due to difference in diagnostic criteria as diagnosis of sepsis was based on histopathological findings rather than clinical diagnosis as performed in the current study.

Working mothers had more risk for having poor fetal outcome with Odds ratio 1.9 (95% CI: 1.2 - 3.5). This may be caused by work related stress; exerting effort in work and difficult transportation in Egypt may induce PPRM with all its consequences. This result goes in agreement with Sathenahalli et al., 2016 who reported that maternal manual labor during pregnancy was associated with higher incidence of prematurity and low birth weight.³⁷ The lack of significant association in the present study between smoking & poor fetal outcome was similarly reported in Zambia.¹⁸

There was no significant association between previous history of PPRM & poor fetal outcome. Lack of association is probably due to that past history of PPRM is mostly related to subsequent occurrence of PPRM rather than its poor or good outcome.

CS delivery was associated with risk of poor fetal outcome (Odds=2.5). Similarly in Jordan, delivery by CS was identified as a risk factor for NICU admission which is considered as one of the poor fetal outcomes [38]. This association is explained as CS, usually, reflects worse condition either maternal; as oligo-hydramnios due to gush of liquor, or fetal causes; like fetal distress -that necessitates ICU admission- or even fetal death. Also, chorioamnionitis was a significant predictor of poor fetal outcome similar to a study conducted in China.³⁹

The earlier gestational age at PPRM in the present study was significantly associated with poor fetal outcome which agrees with other studies.^{8, 22, 40} This is explained by the fact that incidence of respiratory distress syndrome and the length of hospital stay are related to gestational age.

More efforts should be done to decrease the occurrence of PPRM through adequate antenatal care and health education of pregnant women about risk factors of PPRM. To improve neonatal outcome; efforts should be done to improve Ain Shams neonatal intensive care units (NICUs), supplying them with better equipment and increase their number so that they become suitable to deal with such kind of complications.

Study Limitations:

Secondary data collection has its known limitations such as lack of completeness or sometimes doubted accuracy. Incompleteness was avoided by conducting a pilot study that revealed the available data in patient files before conducting the study. However there were some important missing data due to lack in the medical files as maternal factors which-in previous studies- were found to be significantly associated with LBW, included mother's knowledge (eg., importance of antenatal care visits), her health status and family's income, antenatal care follow up, some maternal

complications like (endometritis, wound infection and puerperal sepsis) & fetal complication (cord prolapse, inter ventricular hemorrhage). These factors could not be studied in the current study and may have a relationship with LBW in Egyptian mothers if studied effectively.

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