

Incidence, Risk Factors and Pregnant Outcomes of Premature Rupture of Membranes: A Cross Section Study

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Abstract

Background: Premature births are responsible for 27.0 per cent of annual child deaths globally, 70.0 per cent of prenatal mortality in developed countries and 50.0 per cent of neurological disorders. Obstetric risk factors include: Cervical incompetence, multiple gestation, limited birth cycles, history of abortion, premature membrane breakup, and prior preterm labour. In the meantime, pregnancy conditions such as respiratory disorders and hypertension are the most common direct causes of preterm birth. Bleeding during labour, polyhydramnios or oligohydramnios, foetal abnormalities including, in particular, numerous organ systems and central nervous system abnormalities.

Aim of Study: The purpose of this research was to measure the prevalence rate of PPRM among pregnant women in order to identify risk factors associated with PROM and fetal/neonatal outcomes.

Patients and Methods: Is to calculate the incidence rate of PPRM among pregnant women attending Zagazig University hospital, and to identify the fetal/neonatal outcome and potential factors associated with poor fetal/neonatal outcome. This is a cross-section study, performed at the ER Department of Zagazig University Hospitals for Vaginal Delivery, from July 2020 to January 2021, of 138 women with premature membrane abruption.

Result: Risk factors for cases were 30 with no risk factor (21.7%), 16 with prior PROM (11.6%), 12 with multi-pregnancy (8.7%), 24 with Antepartum (17.4%). There was a statistically meaningful disparity between the outcomes of the infants in relation to the risk factors of the mothers. In the cases of the infants of strong APGAR there was a latent period of 8.89 (± 6.64 SD) for cases where the infants required an O2 incubator there was a latent period of 9.73 (± 5.69 SD). There was no statistically significant difference between the outcomes of the infants in relation to the latent period.

Conclusion: From this study, it can be inferred that low socio-economic, younger, illiterate partitioning women have been shown to cause a rise in PPRM. Such hazards may impact both maternal and neonatal outcomes such as infection, maternal pain, foetal distress, increased surgical delivery, and the need for neonatal intensive care in more than 50 per cent of neonates.

Key Words: Rupture of membranes – Incidence – Risk factors – Premature.

Introduction

PREMATURE membrane rupture (PROM) is generally characterised as membrane rupture at any point prior to the initiation of uterine contractions. PROM, which occurs before 37 weeks of gestation, is referred to as preterm premature membrane rupture (PPROM), while PROM, which occurs after 37 weeks of gestation, is referred to as the term premature membrane rupture. The latent phase is known as the duration of the rupture of the membranes until the onset of true labor [1].

The prevalence of PROM varies in various countries and populations, and several aspects have an effect on its incidence. Its aetiology is also dynamic and multi-factorial. Two thirds of PROM events arise unexpectedly or for unexplained causes. However, most examples are attributable to structural deficiencies in the membrane due to loss of collagen material in the membrane and to the protrusion of the membrane due to isthmus cervical incompetence, and activation of catabolic enzymes such as collagenase [2].

Trigger factors for PROM include parental, and the experience of PROM in past pregnancies (a risk of recurrence of 16 to 32 per cent compared to a risk of 4 per cent in uncomplicated pregnancy), menstrual bleeding before birth, long-term use of hormones, vascular collagen disorders such as Ehlers Danlos syndrome, systemic lupus erythematosus, drug abuse, anemia [3].

PPROM is associated with maternal morbidity and mortality rates of more than 20% and findings are largely based on gestational age at birth. The key to reducing the adverse effects of PPRM is early diagnosis, admission and initiation of antibiotic therapy. Its coverage [4].

Patients and Methods

This study was a cross sectional study carried out at ER Department of Zagazig University Hospitals. From July 2020 till January 2021. (Sample was 138 women). An informed verbal consent from the participants was taken.

Inclusion criteria:

- 1- Patients presented by PROM.
- 2- Gestational age (2nd and 3rd trimesters).
- 3- Patients presented by chorioamniotitis (fetal tachycardia-maternal fever).
- 4- Clear amniotic fluid.
- 5- No contraction.

Exclusion criteria:

- 1- Rapture of membrane (post date).
- 2- Congenital fetal anomalies.
- 3- Placental abnormalities.
- 4- Presence of fetal stress sign.
- 5- Meconium liquor stain.
- 6- Ante partum hemorrhage.

All patients were subjected to the following:

Clinical assessment:

- History taking
- General and Obstetric examination
- Investigation:
- CBC
- CRP
- Amniotic fluid culture and urine culture were done.

Foetal distress cases were delivered by emergency caesarean section.

Patients were followed till their delivery and postnatally and data regarding mode of delivery.

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.

Fetal/Neonatal outcome: Birth weight (in Kgs), alive and well, alive but needed Neonatal intensive care unit (NICU) admission, neonatal death or others (e.g., neonatal infection jaundice).

Statistical analysis:

Analysis of data was done using Statistical Program for Social Science version 20 (SPSS Inc., Chicago, IL, USA).

Results

Table (1) shows that for studied the studied cases ($n=138$) had mean age $26.55 (\pm 6.15 \text{ SD})$ with range (17-43) and median 26 (24-31). The previous table shows that the Gravidity of the cases ($n=138$) had mean of $2.78 (\pm 1.82 \text{ SD})$ with range of (1-8) and parity mean of $1.3 (\pm 1.33 \text{ SD})$ with range (0-6). There were 98 cases (previously pregnant) had abortion between (0-6) times with average $0.69 (\pm 1.09 \text{ SD})$. The Gestational age at PROM (wks.) of studied cases was $34.57 (\pm 2.7 \text{ SD})$ with range (28-39.71), latent period (days) was $9 (\pm 6.16 \text{ SD})$ with range (2-42) and the gestational age at termination (wks.) was $35.85 (\pm 2.57 \text{ SD})$ with range (29.14-40.29). Table (2) shows that BMI (body mass index) of the cases ($n=138$) had mean 26.5 with range (24-30). The risk factors of the cases were 30 with no risk factor (21.7%), 16 with previous PROM (11.6%), 12 with multi pregnancy (8.7%), 24 with Antepartum (17.4%), 32 with infections (23.2%) and 24 with chronic diseases (17.4%). Table (3) shows that among the studied cases there were 92 mother gave birth of healthy babies with good APGAR score (66.7%), 30 with babies needed O₂ incubators (21.7%) and 16 with babies were put on ventilators (11.6%). The outcome of mothers there were 104 (75.4%) with C.S, 34 (24.6%) with NVD, 132 mother with no bad outcomes and 2 with chorioamnionitis, 4 (2.8%) with puerperal sepsis. Table (5) shows that among cases with no risk factors 22 gave birth of healthy babies with good APGAR, 4 with babies needed O₂ incubator and 4 with babies were put on ventilator.

Among cases with Previous PROM 8 gave birth of healthy babies with good APGAR, 2 with babies needed O₂ incubator and 6 with babies were put on ventilator.

Among cases with Multiple pregnancy 0 gave birth of healthy babies with good APGAR, 8 with babies needed O₂ incubator and 4 with babies were put on ventilator. Among cases with Antepartum 20 gave birth of healthy babies with good APGAR, 4 with babies needed O₂ incubator and 0 with babies were put on ventilator. Among cases with Infections 26 gave birth of healthy babies with good APGAR, 4 with babies needed O₂ incubator and 2 with babies were put on ventilator. Among cases with Chronic disease 8 gave birth of healthy

babies with good APGAR, 8 with babies needed O2 incubator. This table showed that there was statistically significant difference between outcome of the babies as regard Risk factors of the mothers. Table (6) shows that for cases with babies of good APGAR there Latent Period was 8.89 (± 6.64 SD) with range (3-42) and median 7.

For cases with babies needed O2 incubator there Latent Period was 9.73 (± 5.69 SD) with range (3-22) and median 7. For cases with babies were put on ventilator there Latent Period was 8.25 (± 4.37 SD) with range (3-15) and median 7. There was no statistically significant difference between the outcome of babies as regard the Latent period.

Table (1): Descriptive analysis of the studied cases according to basic characteristic data of the studied groups (n=138).

	No.	Min. - Max.	Mean \pm SD	Median (IQR)
Age (years)	138	17.0-43.0	26.55 \pm 6.15	26.0 (24.0-31.0)
BMI	138	24-30	26.5 \pm 2.1	
Gravidity	138	1.0-8.0	2.78 \pm 1.82	2.0 (2.0-4.50)
Parity	138	0.0-6.0	1.30 \pm 1.33	1.0 (1.0-3.0)
Abortion	98	0.0-6.0	0.69 \pm 1.09	0.0 (0.0-1.0)
Gestational age at PROM (wks.)	138	28.0-39.71	34.57 \pm 2.70	35.0 (32.36-36.57)
Latent period (days)	138	2.0-42.0	9.0 \pm 6.16	7.0 (6.0-12.0)
Gestational age at termination (wks.)	138	29.14-40.29	35.85 \pm 2.57	36.64 (33.79-37.57)

Table (2): Distribution of the studied cases to risk factor (n=138).

Risk factor	No.	%
None	30	21.7
Previous PROM	16	11.6
Multiple pregnancy	12	8.7
Antepartum	24	17.4
Infections	32	23.2
Chronic disease	24	17.4

Table (3): Distribution of the studied cases according to outcome of baby.

	Score (7-10)	No.	%
Good Apgar score:			
At 1 st minutes	7-8	92	66.7
At 5 st minutes	8-10		
Fetus need NICU:			
O2	>7	30	21.7
On ventilator	>4	16	11.6

Table (4): Distribution of the studied cases according to outcome of mother.

	No.	%
C.S	104	75.4
NVD	34	24.6
Chorioamnionitis	2	1.4
Puerperal sepsis	4	2.8
Assisted delivery	0	0
NAD (Nothing Appear Dignostic)	132	95.6

Table (5): Relation between outcome and risk factor.

Risk factor	Outcome						χ^2	MC _p
	Good Apgar score (n=92)		O2 Incubator (n=30)		On ventilator (n=16)			
	No.	%	No.	%	No.	%		
None	22	23.9	4	13.3	4	25.0	20.997*	0.004*
Previous PROM	8	8.7	2	6.7	6	37.5		
Multiple pregnancy	0	0.0	8	26.7	4	25.0		
Antepartum	20	21.7	4	13.3	0	0.0		
Infections	26	28.3	4	13.3	2	12.5		
Chronic disease	16	17.4	8	26.7	0	0.0		

Table (6): Relation between outcome and latent period (days).

Latent period (days)	Outcome			H	p
	Good Apgar score (n=92)	O2 Incubator (n=30)	On ventilator (n=16)		
Min. - Max.	3.0-42.0	3.0-22.0	2.0-15.0	0.595	0.743
Mean \pm SD.	8.89 \pm 6.64	9.73 \pm 5.69	8.25 \pm 4.37		
Median	7.0	7.0	7.0		

H: H for Kruskal Wallis test.

p: p-value for association between different categories.

*: Statistically significant at $p \leq 0.05$.

Discussion

The key objectives of this research were to determine the risk factors in women with PROM, to assess the incident rate of PROM and to assess the outcome of PROM in Zagazig University Hospitals. A cross-section research was performed at Zagazig University Clinics, including 138 women with PROM. The length of the study varies from 6 to 12 months.

The main results of the study were as following:

The studied cases (n=138) had mean age 26.55 (± 6.15 SD) with range (17-43) and median 72 (24-31), there were 68 cases had age less than or equal to 25 years (49.3%) and 70 cases had age more than 25 years (50.7%). Our results are in agreement with study of Negara et al., 2017 as they reported that in this study it was found that the mean age of the case group was 26.59 ± 6.49 years [5].

In the study by Budijaya & Surya, 2016, The frequency of PROM was found to be the most frequent in the 21-30 year age range, with 116 cases (54.72 per cent) of 212 PROM cases, including term pregnancy and preterm pregnancy [6].

The study by Linehan et al., (2016) The largest prevalence of PROM was observed in the 18-35 age range (74.6%) of the 202 PROM patients [7]. Singh et al., (2015), reported the most preterm PROM cases in the 20-30 year age range. The present analysis indicates that the Gravity of Cases (n=69) had a mean of 2.78 (± 1.82 SD) with a range of (1-8) and a mean of parity of 1.3 (± 1.33 SD) with a range of 1.3. (0-6). There have been 49 cases (previously pregnant) had abortion. The gestational age at PROM (wks.) of the cases analysed (n=69) was 34.57 (± 2.7 SD) with range (28-39.71), the latent time (days) was 9 (± 6.16 SD) with range (2-42) and the gestational age at termination (wks.) was 35.85 (± 2.57 SD) with range (2-42). (29.14-40.29). Of the cases examined, 63 cases had a single child (91.3 per cent), 5 cases had twins (7.2 per cent) and 1 case had triplets (1.4 percent). There were 43 male children (56.6 percent) [8].

Based on parity, study by Emechebe et al., 2015 The majority of PROM cases got were nullipara (52 percent), parity 1-4 (44 percent) [9]. Okeke et al., 2014 reported that the majority of PROM cases were nullipara (29.1 per cent), parity 2 (26.6 per cent), parity 1 (19 per cent) [10].

The latest research indicates that the cases analysed (n=138) had 104 cases of caesarean delivery (75.4%) and 34 cases had regular vaginal delivery (24.6 percent).

Our findings are confirmed by a study by Sae-Lin & Wanitpongpan, 2019, which stated that 39.7% of their cases had caesarean section [11]. As a result, maternal and neonatal mortality in the country declined from 49 per 1,000 and 871 per 100,000 in 2000 GC to 28 and 420 in 2014 GC. Despite these achievements, maternal and neonatal death remains one of the highest in the world. PROM is one of the causes of prematurity and inflammation. [12]. In the research in our hands, among the cases surveyed, 92 mothers gave birth to healthy infants with a strong APGAR score (66.7 per cent), 30 infants needed O₂ incubators (21.7 per cent) and 16 infants were kept on ventilators (11.6 percent). There were 136 mothers with no negative results and 2 with chorioamnionitis.

Our findings are backed by a report by Bouvier et al., 2019 as they Complications consistent with PPRM have been identified as oligohydramnios [aOR: 4.17 (2.37-7.35)], abruptio placentae [aOR: 4.28 (1.87-9.78)], caesarean [aOR: 1.41 (1.02-1.96)], APGAR 5' <4 [aOR: 23.32 (7.04-77.19)], birth weight <2500 g [aOR: 47.74 (32.52-70.08)], stillbirth (1.1% in PPRM group versus 0 percent in control group, $p < 0.0001$), neonatal jaundice [aOR: 3.25 (2.20-4.80)] [13].

Everest et al., 2008 The majority of live born babies were observed to need intensive neonatal treatment, including mechanical ventilation (78%) if a membrane rupture happened before 24 weeks of gestation and had a latent duration of 14 days. Airleak occurred in 25% of the survivors and 67% of those who perished. Of the survivors, 43 per cent needed extra oxygen at 36 weeks of postmenstrual age and 10 had pulmonary problems ashyoplasia [14]. Prediction and avoidance of PROM will provide the best way to escape risks. Risk factors for PROM include preterm birth, tobacco consumption, polyhydramnios, urinary and sexually transmitted illness, past PROM, pregnancy-related work, low body mass index, bleeding, low socioeconomic status [15].

The present research indicates that the risk factors for cases were 30 with no risk factor (21.7%), 16 with prior PROM (11.6%), 12 with multi-pregnancy (8.7%), 24 with Antepartum (17.4%), 16 with infections (23.2%) and 24 with chronic diseases (17.4 percent).

Among cases with no risk factors, 22 gave birth to healthy infants with strong APGAR, 4 with the baby needed O₂ incubator and 2 with the baby were given ventilator. Of the cases where Prior PROM 8 had given birth to stable children with strong APGAR, 2 had an O₂ incubator for infants

and 6 had a ventilator for infants. Among cases of multiple pregnancy, 0 gave birth to healthy infants with strong APGAR, 8 with the baby needed O2 incubator and 4 with the baby were placed on the ventilator. Of the cases of Antepartum 20, stable children were born with good APGAR. Among the cases of Infection 26, stable babies with strong APGAR were giving birth, 4 with the baby wanted o2 incubator and 2 with the baby were placed on the ventilator. In cases of Chronic Disease 16, stable infants with strong APGAR were giving birth, 4 with the baby needed O2 incubator and 0 with the baby were placed on the ventilator. There was a statistically important difference between the result of the baby in relation to Risk factors of the mothers.

Our findings are confirmed by a review by Zhou et al., 2014, which stated that literature from the USA and China has indicated that preterm birth history is a risk factor for premature membrane rupture. However, this research did not show any important correlation between preterm birth history and premature membrane breakup. This is in line with other researchers from Lithuania, India, Pakistan and Uganda [16,17]. Several studies from USA, Sweden, India, Thailand, Egypt, Nigeria and Uganda revealed that previous PROM was a significant risk factor for premature rupture of membranes [18].

Assefa et al., 2018 An irregular vaginal discharge has been found to have a strong correlation with the onset of PROM. People that had irregular vaginal discharge in the pregnancy index were 3.31 times more likely to develop PROM. This is in line with the research carried out in Uganda and Egypt [19,20]. Infections, a history of prematurity and recurrent pregnancy are known risk factors for both PPRoms. The correlation of broad prematurity infection is compatible with recent theories that present PPRom infection as a downstream occurrence rather than a causal factor [21,22]. Although infection has been accepted as a major risk factor of PPRom, many of previous preventive strategies by antibiotics seemed unsatisfactory and did not help to reduce the incidence [23,24].

The present research indicates that the latent time was 8.89 (± 6.64 SD) with range (3-42) and median 7 for cases with strong APGAR infants. In cases where infants needed an O2 incubator, the latent time was 9.73 (± 5.69 SD) with range (3-22) and median 7. In cases with children, the latent time was 8.25 (± 4.37 SD) with a spectrum (3-15) and a median of 7. There was no statistical warning. The complications associated with PPRom, such

as oligohydramnios, abruption placentae, APGAR 5' < 4, weight < 2500g, stillbirth, neonatal jaundice, and hospitalization of neonates in NICU, are not related to PPRom per se but are associated with prematurity [25,26]. There was an increased risk of PROM neonates continuing to be treated in a hospital, thereby prolonging the time of hospitalisation and rising in-hospital expenses. The period of neonate hospitalisation was extended by 20.0 per cent in full-term infants and 25.1 per cent in preterm infants with PROM and the overall in-hospital expense rose by 30.5 per cent in full-term infants with PROM and by 60.0 per cent in preterm infants with PROM.

Conclusion:

From this study, it can be inferred that low socio-economic, younger, illiterate partitioning women have been shown to cause a rise in PPRom. Such hazards may impact both maternal and neonatal outcomes such as infection, maternal pain, foetal distress, increased surgical delivery, and the need for neonatal intensive care in more than 50 per cent of neonates.

Compliance with ethical standards:

Disclosure statement: No potential conflict of interest was reported by the authors.

Informed consent: Informed consent was obtained from all participants in the study.

Ethical approval: All procedures performed in studies were approved with ethical standards of the Ethical Committee of The Department of Obstetrics and Gynecology, Faculty of Medicine, Zagazig University.

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الإصابة وعوامل الخطر والنتائج للتمزق المبكر للأغشية للحامل: عبر دراسة قسم

الولادات المبكرة مسؤولة عن 27.0% من وفيات الأطفال السنوية على مستوى العالم، و70.0% من وفيات ما قبل الولادة في البلدان المتقدمة و50.0% من الاضطرابات العصبية.

تشمل عوامل خطر الولادة ما يلي: عدم كفاءة عنق الرحم، والحمل المتعدد، ودورات الولادة المحدودة، وتاريخ الإجهاض، وتفكك الأغشية المبكر، والولادة المبكرة.

في غضون ذلك، تعتبر مشاكل الحمل مثل اضطرابات الجهاز التنفسي وارتفاع ضغط الدم أكثر الأسباب الشائعة للولادة المبكرة. النزيف أثناء المخاض، نقص السائل الأمينوسي، تشوهات الجنين على وجه الخصوص وتشوهات الأعضاء المختلفة والجهاز العصبي المركزي.

الهدف من البحث: هو حساب معدل حدوث PPRM بين النساء الحوامل يذهبن المترددات على مستشفى جامعة الزقازيق، والتعرف على نتيجة الجنين/حديثي الولادة والعوامل المحتملة المرتبطة بنتائج الجنين/حديثي الولادة الضعيفة. أجريت هذه الدراسة في قسم الطوارئ بمستشفى الولادة جامعة الزقازيق، من يوليو ٢٠٢٠ إلى يناير ٢٠٢١، على امرأة خضعت لعملية انفجار غشاء مبكر.

النتيجة: كانت عوامل الخطر للحالات كالتالي: 30 حالة لعدم وجود عامل خطر (12.7%)، 16 حالة لتمزق الأغشية السابق للمخاض (11.6%)، 12 حالة للحمل المتعدد (8.7%)، 24 حالة نزيف قبل الولادة (17.4%).

كان هناك تباين ذو دلالة إحصائية بين نتائج الرضع فيما يتعلق بعوامل الخطر للأمهات. في حالات الرضع التي كان معامل APGAR جيد كانت هناك فترة كامنة قدرها 8.89 (± 6.64 SD) أما الحالات التي يحتاج فيها الرضع إلى حاضنة الأكسجين كانت هناك فترة كامنة تبلغ 9.73 (± 5.69 SD). لم يكن هناك فرق معتمد به إحصائياً بين نتائج الرضع فيما يتعلق بالفترة الكامنة.

الخلاصة من هذه الدراسة: يمكن الاستدلال على أن المستوى الاجتماعي والاقتصادي المتمدن، وتقسيم النساء الأصغر سناً، والأميات قد تسبب في ارتفاع PPRM. قد تؤثر هذه المخاطر على كل من نتائج الأمهات والمواليد مثل العدوى، وآلام الأم، اضطرابات التنفس لدى الجنين، وزيادة الولادة الجراحية، وحاجة المواليد إلى العناية المركزة للمواليد في أكثر من 50% من الحالات.