ORIGINAL RESEARCH

Evaluation of maternal and neonatal outcomes in the case of preterm premature rupture of membranes and their relationship to prenatal maternal indicators: Across-sectional descriptive study

Mirfat Mohamed Labib El-Kashif*[1], Azza Mohamed Fathy[2], Howaida Amin Hassan Fahmy Elsaba[1]

[1] *Departement of Maternity, Obstetrics and Gynaecology Nursing, Faculty of Nursing, Port Said University, Egypt*
[2] *Department of Pediatric Nursing, Faculty of Nursing, Port Said University, Egypt*

Received: February 18, 2020 **Accepted:** March 3, 2020 **Online Published:** March 16, 2020
DOI: 10.5430/jnep.v10n6p55 **URL:** https://doi.org/10.5430/jnep.v10n6p55

ABSTRACT

Background and aim: Preterm premature rupture of membranes is one of the most important causes of pregnancy complication and a significant role in the occurrence of perinatal morbidity and mortality. The present study aims to evaluate the maternal and neonatal outcomes in the case of preterm premature rupture of membranes and their relationship to prenatal maternal indicators.
Subjects and methods: A cross-sectional descriptive design was used to evaluate 68 pregnant women with a gestational age of 32 to before 37 weeks, and singleton pregnancy complicated by preterm premature rupture of membranes who fulfilled the inclusion criteria. The data were collected by convenience sampling using standardized tools.
Results: A linear correlation was used to show a correlation between maternal clinical indicators with the predictive maternal and neonatal outcome using a Spearman Rho correlation coefficient. The most significant neonatal outcomes are neonatal intensive care unit admission, neonatal respiratory distress syndrome, and early neonatal sepsis. More than two-thirds of the studied women had expectant management, and less than one-fourth of them have postnatal sepsis.
Conclusion and recommendation: The prenatal maternal indicators are the significant values for maternal and neonatal outcome in case of preterm premature rupture of membranes, so A further larger prospective study is recommended to demonstrate the difference in incidence, management protocol of preterm premature rupture of the membranes in the delivery and maternity health care services.

Key Words: Preterm premature rupture of membranes, Prenatal maternal indicators, Maternal and fetal outcome

1. INTRODUCTION

The preterm pre-labor rupture of membranes (PPROM) is defined as the rupture of membranes prior to the onset of labor at before 37 weeks of gestation, which is indicated by the leakage of amniotic fluid. Specific tests confirm the diagnosis of PPROM such as nitrazine test, which depends on the presence of the pH of the amniotic fluids.[1,2] Vaginal examination is not recommended in case of PPROM because it increases the hazards for infection and lowers the latent period to childbirth.[3] One of the most important contributing factors of PPROM is the presence of choriodecidual infection.[4] In the case of a pregnant woman becoming infected, microorganisms begin to attack the chorionic tissues and are excreted endotoxins and exotoxins. Thus, the chorionic

*Correspondence: Mirfat Mohamed Labib Al-Kashif; Email: drmirfat_k@yahoo.com; Address: Maternity, Obstetric and Gynecological Nursing Department, Faculty of Nursing, Port Said University, Port Said, Egypt.

tissues begin to secrete cytokine as an automatic reaction. The cytokines are then spread in the maternal blood plasma, in the amnion, and the fetus's bloodstream. The infection is recognized within 72 hours before birth by the presence of interleukin-6 (IL-6) in the maternal blood serum.[5] This is in addition to increasing the concentration of C-reactive protein (CRP) in the mother blood which is one of the most accurate ways to predict early neonatal infection, which is sensitive when the measurement reaches 90%.[6] Antibiotics are one of the most common treatments of PPROM, that reduce complications of both mother and the neonatal, and prolong the gestational age, as well as a prevention treatment for Group B Streptococcus in all PPROM.[7]

The prevalence of PPROM varies according to the population–sample studied. The premature rupture of membranes occurs between 5% and 15% of pregnancies, 10% occurs at term, and 2% to 3.5% were preterm.[8] In Egypt, the prevalence of PPROM ranges from 2.4% in 2011 to 4.7% in 2015 with the highest rate during 2013 (5.3%).[9]

PPROM has significant complications for the mother, fetus, and the newborn. The maternal complication may include the chorioamnionitis, which amounts to 25%-35% in addition to inflammation of the uterus after birth and increase the incidence of cesarean delivery.[10] Fetus and newborn are vulnerable to complications from PPROM as; intra-uterine fetal distress, premature baby, neonate respiratory distress syndrome and sepsis. This is in addition to an increase in the risk of fetal and neonatal mortality.[11] The risks to the fetus and the neonatal from PPROM depend on the degree of oligo-hydroniums, the latency period duration, and the gestational age at the time of PPROM.[12] The colonized bacteria of the maternal perineum may get to the baby before or during labor and delivery by direct contact to the body of the baby. So, the baby may have pneumonia or sepsis as a result of aspiration and swallowing of infected amniotic fluid in the uterus or aspirate infected secretion from the birth canal during delivery.[1]

The clinical signs of maternal infection and laboratory markers are maternal fever, tachycardia, uterine tenderness, offensive vaginal discharge, elevated C-reactive protein, elevated white blood cell count or clinical chorioamnionitis. These signs are considered indicators of the maternal infection colonization and prediction of maternal and neonatal outcome in case of preterm premature rupture of membranes. Furthermore, positive genital tract culture with or without manifestation in case of PPROM, and prolonged rupture of membranes might be linked to maternal infection colonization and predictive values for pregnancy outcome.[1]

1.1 Significant of the study

PPROM is one of the recognizable causes of premature birth which accounts for approximately 30%-40% of preterm deliveries. With the presence of neonatal sepsis, the risk of the neonatal mortality might be increased up to four-time.[13,14] Around 30% of preterm deliveries in Egypt are related to PPROM.[15] PPROM is one of the most important causes of pregnancy complication and has a significant role in the occurrence of perinatal morbidity and mortality. At present, there is no practical way to prevent PPROM because of lack of knowledge to the leading cause, as well as the control of occurrence.[16] Therefore, accurate prediction of maternal chorioamnionitis of the mother and early-onset neonatal infection remains a true challenge to PPROM management. Late diagnosis and treatment of PPROM increase the probability of adverse long-term outcomes and disabilities. The maternal indicators in case of PPROM help to differentiate women who require active management or expectant management. Also, maternal indicators can emphasize the possibility of vaginal delivery to avoid the risk of caesarean delivery when induction is not possible.[6]

It is the responsibility of midwives and nurses to provide the proper health care that achieves safe medical delivery. Indeed, the nurses have the permanent duty in labour, and ideal position to interact on many health interventions. These responsibilities focus on patient health education, intra-natal care, and documentation of reports. The nurses' documentation should include all the information in the patient record and care during labor as they are considered more significant to identify the most effective measures for the prevention, diagnosis and treatment of chorioamnionitis. Also, neonatal health care staff should be aware of maternal chorioamnionitis in expectation of neonatal needs.[17]

The prenatal maternal indicators of pregnancy outcome in case of preterm premature rupture of membranes, however, have been inadequately studied. So, the present study is inspired by the conceptual framework of world health organisation (WHO) recommendations on the interventions aiming to improve preterm birth outcomes as the health care staff should have information about the assessment of clinical markers of imminent preterm delivery.[18] Furthermore, the results of this study provide important evidence for health care professionals to develop clinical evidence-based programs that contribute to raise the efficiency of health professionals and setting treatment priorities regarding the phenomenon of preterm premature rupture of membranes.

1.2 Aim of the study

The present study aims to evaluate the maternal and neonatal outcomes in the case of preterm premature rupture of mem-

branes and their relationship to prenatal maternal indicators.

1.3 Research questions

1) What are the possible maternal indicators for the prediction of maternal and neonatal outcome in case of preterm premature rupture of membranes?
2) What are the possible maternal and neonatal outcomes from this study?
3) What is the name of the organism that shows positive in the high vaginal swab for the participants?

2. Subjects and methods

2.1 Study design

Across -sectional descriptive design was conducted.

2.2 Sampling and data collection

This study was conducted in the inpatients' ward of the obstetric and gynaecological departments, paediatric departments, and neonate intensive care unit (NICU) at Port-Said General hospital and Specialized Women and Obstetrics Hospital (Health insurance), Port Said city, Egypt from January 2019 to December 2019. A total of 68 pregnant women with a gestational age of 32 to before 37 weeks and singleton pregnancy complicated by PPROM who have fulfilled the inclusion criteria were selected. All PPROM cases were confirmed by a test of dipstick of an immunochromatographic that uses monoclonal antibodies to identify IGFBP-1 from amniotic fluid. The researchers collected data from the studied sample prospectively at the admission and after that. Consequently, the collection of data was not carried on a regular basis, rather on days where the eligible women were available to assemble the data. All the eligible patients admitted with PPROM were selected by a convenience sample method.

2.3 Exclusion criteria

Spontaneous labor at admission, and those who gave birth more than three days after admission and any medical or obstetrics factors pose a risk to the pregnancy.

2.4 Tools of data collection

Standardized tools were used to collect data after obtained informed consent from all participants. All tools were revised by an expert professor in the field of maternity, obstetrics, and gynaecology nursing, and paediatrics, neonates' health nursing to check its validity. The tools were collected from 10 of the target sample of the study who have fulfilled the inclusion criteria to test applicability and clarity. Appropriate modifications were made to the research tools according to the results of the pre-test. The standardized tools were divided into the following:

The first tool: Maternal assessment tool which includes the following: Socio-demographic characteristics of the participants such as maternal age, education, occupation and social class. Obstetric characteristics such as gravida, parity, abortion and previous PPROM. Current obstetric condition such as gestational age at (onset of leaking, hospital admission and delivery), leaking duration before admission, cervical dilatation and uterine contraction at admission. Also, vital signs of the participants and laboratory results as WBCS. Moreover, clinical findings such as uterine tenderness, offensive vaginal discharge, maternal postnatal sepsis and clinical chorioamnionitis. Time of delivery after admission, the type of management (active or expectant), and a sample of the vaginal swab.

The second tool: Neonatal assessment tool which includes the following: Clinical assessment of the neonate such as hemoglobin, WBCs, Apgar score at 1st minute and 5th minutes and weight in kg. The neonatal outcome such as early neonatal sepsis, NICU admission, early neonatal death, stillbirth, and respiratory distress syndrome.

The third tool: Egyptian Socioeconomic Scoring Tool that was designed by Fahmy and El-Sherbini (1988):[19] In this tool, the social classes are estimated according to the following criteria: monthly income, education and occupation of the couple, housing condition, and family size. The score was distributed as follows: a high social class (25-30), middle social class (20 -< 25), low social class (15 -< 20), and very low social class (< 15).

The fourth tool: Apgar Score (Apgar et al. 1985)[20] is a simple method to assess the condition of the new-born, performed in the 1st minute and after 5th minutes of fetus expulsion. It is based on the assessment of five physical signs, namely, heart rate, respiratory effort, reflex irritability, muscle tone, and colour. For each vital sign, the baby is given 2, 1 or 0 points, and the points are then totalled. An Apgar score of 8-10 indicates a new-born is in good condition and requires only nasopharyngeal suctioning and perhaps some oxygen near the face (called blow-by oxygen). A score of 4-7 shows moderate birth asphyxia, and a score of 1-3 sever birth asphyxia, and urgent resuscitative measures are then necessary.

Outcome measures

Clinical chorioamnionitis diagnosed according to the following criteria: The temperature of more than 37.8 °C in a pregnant woman without evidence of any other localized infections. Besides any two of the following criteria: either foul-smelling amniotic fluid or uterine tenderness, maternal tachycardia more than 120 beats/minute, and fetus tachycardia, more than 160 beats/minute.[21]

Early-onset neonatal sepsis (EONS) is defined as the neonatal positive microbiological culture during the first seven days of life or the early 72 hours of birth. In the case of very low birth weight due to the maternal intrapartum transmission of invasive organisms.[22]

Active management is defined as systemic delivery at admission, whatever the gestational age, infectious or medical condition of the women.[6]

Expectant management is defined as the management approach that includes close monitoring for the infectious status of the women, especially for women at gestational age from 34 to 37 weeks.[6]

Field work

At admission and after confirmation of the diagnosis, serum samples were drawn from all studied women to assess the maternal WBC count. A sample of the vaginal swab was taken and cultured to identify genital bacteria. For the contaminated vaginal sample with bacteria and the woman under active labour, the antibiotic started at admission according to each hospital protocol. Otherwise, the antibiotic was administered after 12 hours of PPROM in case of expectant management. After the official permission was granted, the researchers collaborated with perinatal nurses and neonatal staff nurses to provide health care to all studied women and their neonates. This is in addition to in delivery help either active or expectant management. After the rationale of the study was clarified to all studied women, the researchers in the field of maternity, obstetrics, and gynaecology were monitor and documented maternal clinical outcomes as uterine tenderness, offensive vaginal discharge, maternal postnatal sepsis and clinical chorioamnionitis. In addition to that, a researcher in the field of paediatric nursing assessed and documented the neonatal outcome as: early neonatal sepsis, NICU admission, early neonatal death, stillbirth, and respiratory distress syndrome, as well as provide the necessary care to the new-born. The blood sample was drawn from the newborn umbilical cord to monitor the haemoglobin and WBCs. The researchers followed all eligible women through pregnancy, delivery and the puerperium. The researchers provided health education to the studied women, either about caring for their condition or their new-borns.

2.5 Ethical consideration

The Ethical Committee at the Faculty of Nursing; Port Said University approved the present study. All the participants were given informed consent according to the Second Declaration of Helsinki II, after clarifying the aim of the study to them.

2.6 Handling and analyzing data

The raw studied data were coded and entered into SPSS system files (SPSS package version 20, Chicago, USA). Descriptive statistics, including mean, median, standard deviation, frequency, distribution, and interquartile range, were used to describe different characteristics. Kolmogorov – Smirnov test was used to examine the normality of data distribution. Univariate analysis, including the Chi-Square test, was used to test the significance of the results of qualitative variables. Odds ratio and 95% confidence interval was calculated for different parameters of the studied pregnancy outcomes. A linear correlation was conducted to show the correlation between some of the pregnancy-related outcomes with the clinical characteristics among the studied mothers and neonates using a Spearman Rho correlation coefficient. The significance of the results is at 5% level of significance.

3. RESULTS

The mean of the studied women aga is 29.1 years ± 6.8 SD. Half of them (50%) is uneducated while most of them (89.7%) are housewives. Less than two-thirds (61.8%) of the studied women live in a rural area, and more than half (54.4%) of them have low social class. Table 1 shows the socio-demographic characteristics of the studied pregnant women.

Table 1. Socio-demographic characteristics of the studied pregnant women (n = 68)

Socio-demographic characteristics	Studied pregnant women (n = 68)	
	No.	%
Age (years)		
Less than 20	5	7.4
20-<30	34	50.0
30-<40	22	32.4
40-<50	7	10.3
Min-Max, Mean ± SD	17.0-42.0, 29.1 ± 6.8	
Educational level		
Illiterate	34	50.0
Read and write	7	10.3
High school	11	16.2
University graduate	16	23.5
Work of the female		
Housewife	61	89.7
Working	7	10.3
Residence		
Rural	26	38.2
Urban	42	61.8
Social class		
Low	37	54.4
Middle	23	33.8
High	8	11.8

More than one-third of the studied women (35.3%) had pre-

vious PPROM. The mean gestational age at the onset of leakage is 34.7 ± 1.4 weeks, which the same gestational age at hospital admission while the mean gestational age at delivery is 34.8 ± 1.3. The leaking duration hours before admission ranged from 4to 48 hrs. Vital signs of the studied women were monitored upon admission, the temperature of pregnant women ranged between 36.2°C-39.1°C, while less than half of them had tachycardia. The mean WBCs (10^3/ul) count among women was 8.9 ± 3.5. According to the time of delivery after admission, more than two-thirds of the studied women went to delivery after > 24 hrs of admission. For maternal clinical findings, nearly one fourth (20.6%) of the studied women had uterine tenderness, nearly one third (32.4%) had offensive vaginal discharge, less than one fourth (19.1%) had postnatal sepsis, while more than one fourth (22.1%) had clinical chorioamnionitis. Table 2 shows the distribution of the Obstetric and clinical characteristics of the studied women.

The microorganism isolated from the studied women high vaginal swab was Escherichia Coli (53.3%), followed by Staphylococci epidermis (26.7%), and Pseudomonas (20.0%), as shown in Figure 1. More than two-thirds of the studied women had expectant management, and nearly one third had active management, illustrated in Figure 2.

Table 2. Distribution of the Obstetric and clinical characteristics of the studied pregnant women

Obstetric history	**Studied pregnant women (n = 68)**	
Obstetric history		
Number of Gravida: Min-Max, Median (IQR)	0-13	4 (1-7)
Number of parity: Min-Max, Median (IQR)	0-11	1 (0-4)
Number of abortions: Min-Max, Median (IQR)	0-7	0 (0-1)
Previous preterm premature rupture of membranes (No./%)	12	17.6
Current obstetric condition		
Gestational age at onset of leaking (PPROM): Min-Max, Mean ± SD	32-36	34.7 ± 1.4
Gestational age at admission: Min-Max, Mean ± SD	32-36	34.7 ± 1.4
Gestational age at delivery: Min-Max, Mean ± SD	32-36	34.8 ± 1.3
Leaking duration before admission [hours] : Min-Max, Median (IQR)	4-48	8 (6-17.5)
Cervical dilatation [cm]: Min-Max, Median (IQR)	0-6	3 (2-4)
Uterine contraction [per 30 minutes]: Min-Max, Median (IQR)	0-3	1 (0-2)
Vital signs of a pregnant woman		
The temperature of pregnant women Min-Max, Mean ± SD	36.2-39.1	37.2 ± 0.7
Tachycardia (No./%)	31	45.6
Respiratory rate [per minute]: Min-Max, Mean ± SD	18-24	20.2 ± 1.8
Systolic blood pressure [mmHg]: Min-Max, Mean ± SD	100-140	117.1 ± 9.8
Diastolic blood pressure [mmHg]: Min-Max, Mean ± SD	53-88	71.9 ± 7.9
Laboratory results at admission		
WBCs [10^3/ul]: Min-Max, Mean ± SD	6.3-16.85	8.9 ± 3.5
Clinical findings: (No./%)		
Uterine tenderness	14	20.6
Offensive vaginal discharge	22	32.4
Maternal postnatal sepsis	13	19.1
Clinical chorioamnionitis	15	22.1
Time of delivery after admission		
≤ 24 hrs of admission	21	30.9
> 24 hrs of admission	47	69.1

The mean of neonatal hemoglobin (gm/dl) was 11.4 ± 2.1, and WBCs (10^3/ul) was 8.2 ± 3.1. The Apgar score measurement at 1st minute was 6.51 ± 0.90, and 8.34 ± 0.82 at 5th minutes. Also, the mean of weight (Kg) of the neonate was 2.01 ± 0.30. Nearly two-thirds of the neonate admitted to NICU, more than one-third of them had respiratory dis-

tress syndrome. While 11.8% of them had early neonatal sepsis, followed by 7.4% had an early death, and 2.9% had a stillbirth as shown in Table 3.

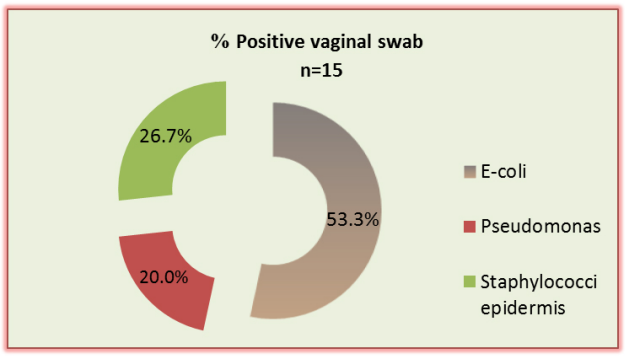

Figure 1. High vaginal swab for the studied women (n = 68)

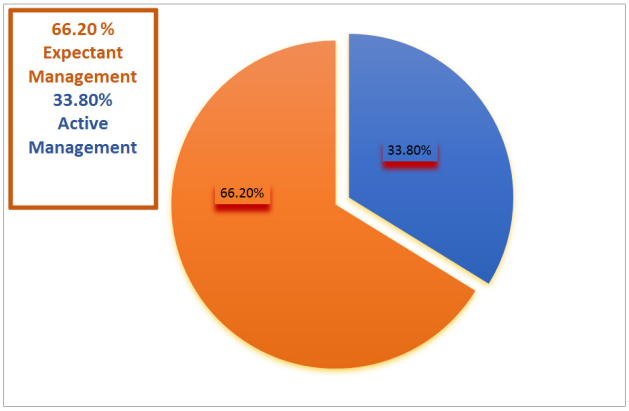

Figure 2. Type of management among the studied women (n = 68)

A linear correlation was conducted to show the correlation between maternal indicators with the predictive outcome among the studied women using a Spearman Rho correlation coefficient as shown in Table 4. The induction of labor was significantly correlated with the presence of uterine tenderness, offensive vaginal odor, increase the maternal WBCS, maternal temperature, the gestational, and age at admission and delivery. It is also clear that the low Apgar score at 1st and 2nd minute and neonatal hemoglobin had a statistical significance with the induction of labor. The time of delivery after admission is correlated with gestational age at present PPROM and leaking hours before admission. The findings have shown that the caesarean section was indicated in the presence of uterine tenderness, offensive vaginal odor, increase the maternal WBCS and temperature with increasing the leakage hours before admission and gestational age at admission, as well as the neonatal Hb and Apgar score at 1st and 2nd minute. Also, the same table reports that postpartum maternal sepsis and chorioamnionitis were significantly associated with all maternal clinical indicators and neonatal outcome except maternal Hb during pregnancy with clinical chorioamnionitis and neonatal weight with postpartum maternal sepsis. In addition to that, the early neonatal sepsis and NICU admission were significantly correlated with neonatal Hb and Apgar score at 1st and 2nd minute, also with the clinical maternal indicators, except gestational age at present PPROM and at admission, and maternal Hb during pregnancy; also, gestational age at admission, maternal temperature and level of Hb with NICU admission did not reach the level of significance.

Table 3. Distribution of clinical assessment and outcome among the studied neonates (n = 68)

Neonatal outcome	**Neonates of the studied women (n = 68)**	
Clinical assessment of the neonate		
Hemoglobin (gm/dl): Min-Max, Mean ± SD	8.5-16.7	11.4 ± 2.1
WBCs [10^3/ul]: Min-Max, Mean ± SD	5.89-15.98	8.2 ± 3.1
APGAR score at 1st minute: Mean ± SD	6.51 ± 0.90	
APGAR score at 5th minutes: Mean ± SD	8.34 ± 0.82	
Weight (kg): Mean ± SD	2.01 ± 0.30	
Neonatal outcome	**NO**	**%**
Early neonatal sepsis	8	11.8
NICU admission	43	63.2
Early neonatal death	5	7.4
Stillbirth	2	2.9
Respiratory distress syndrome	25	36.8

4. Discussion

In the literature based on the results of the comparative study, carried out by Noor et al.[23] PPROM was more prevalent among participant belonging to low socioeconomic level, and those uneducated or had a low level of education and had previous preterm labor. The present study result is in line with the literature. However, the prevalence of the previous PPROM among the present studied women was higher than what was reported by Khan & Khan.[24] Meanwhile, a recent cross-sectional study showed that there is a high statistically relation between the age, occupation, and family income and the existence of pathogens in pregnant women urine. And the researcher attributed this to the link between the low socioeconomic level, with the inadequate nutrition and a weakened immune system, especially during pregnancy.[25]

In the result of a previous prospective study, it was observed that the mean gestational age at PPROM was 38.5 weeks. About (32.1%) of women had active management and (67.9%) had expectant management while (14%) of women had a delivery at 34-36 weeks.[6] In the study done by Khan & Khan,[24] less than two-thirds of the women between 28-34 weeks of gestation age had spontaneous delivery after 72 hours. The current study showed almost the same results.

Table 4. Correlation between some of the pregnancy-predictive outcome with the maternal indicators among the studied mothers and neonates (n = 68)

Maternal indicators	Clinical chorioamnionitis (No/yes)		Early neonatal sepsis (No/Yes)		Postpartum maternal sepsis (No/Yes)		NICU (No/Yes)		CS (No/Yes)		Delivery after admission (≤12/>12 hrs)		Induction of labor (No/Yes)	
	r	*p*	*r*	*p*	*r*	*p*	*r*	*p*	*r*	*p*	*r*	*p*	*r*	*p*
Gestational age at present PPROM	0.349	.004*	0.112	.362	0.267	.028*	0.244	.045*	0.284	.019*	-0.294	.015*	-0.129	.296
Gestation age at admission	-0.431	< .0001*	-0.225	.065	-0.324	.007*	-0.216	.077	-0.141	.253	-0.174	.155	-0.279	.021*
Gestation age at delivery	-0.468	< .0001*	-0.248	.041*	-0.355	.003*	-0.248	.041*	-0.170	.166	-0.115	.350	-0.289	.017*
Leaking hours before admission	0.666	< .0001*	0.343	.004*	0.553	.0001*	0.325	.007*	0.424	< .0001*	-0.300	.013*	0.207	.091
Temperature of pregnant women	0.672	< .0001*	0.253	.037*	0.413	< .0001*	0.235	.054	0.486	< .0001*	-0.083	.501	0.270	.026*
Maternal WBCs during pregnancy	0.714	< .0001*	0.321	.008*	0.454	.0001*	0.271	.025*	0.316	.009*	-0.134	.275	0.240	.048*
Maternal Hb during pregnancy	-0.214	.080	0.038	.756	-0.344	.004*	0.027	.826	-0.210	.086	0.071	.567	-0.084	.494
Apgar score at 1st minute	-0.640	< .0001*	-0.44	< .0001*	-0.540	< .0001*	-0.371	.002*	-0.433	< .0001*	0.073	.552	-0.301	.013*
Apgar score at 5th minutes	-0.631	< .0001*	-0.525	< .0001*	-0.543	< .0001*	-0.407	.001*	-0.472	< .0001*	0.077	.532	-0.306	.011*
Neonatal weight	-0.415	< .0001*	-0.127	.303	-0.235	.054	-0.085	.492	-0.057	.643	-0.179	0.145	-0.062	.615
Neonatal Hb	-0.623	< .0001*	-0.286	.018*	-0.429	< .0001*	-0.134	.272	-0.316	.013*	0.059	.625	-0.266	.027*
Offensive vaginal odor	0.717	< .0001*	0.275	.023	0.476	< .0001*	0.156	.203	0.388	.001*	-0.120	.329	0.240	.049*
Uterine tenderness	-0.624	< .0001*	-0.287	.018*	-0.430	< .0001*	-0.135	.273	-0.300	.013*	0.060	.626	-0.267	.028*

Note. r: Spearman Rho correlation coefficient; *significant at $p \leq .05$

In the present study, nearly than one fourth (20.6%) of the studied women had uterine tenderness, nearly one third (32.4%) had offensive vaginal discharge, less than one fourth (19.1%) had postnatal sepsis, while more than one fourth (22.1%) had clinical chorioamnionitis. Also, the temperature of pregnant women ranged between 36.2°C-39.1 °C , while less than half of them had tachycardia and the mean WBCs (10^3/ul) count among them was 8.9 ± 3.5. The current research results were higher than the results of previous research.[24] This might be justified according to the type and severity of infection, hospital protocol differences for the type of prophylaxis antibiotics administered to the women besides, the provision of advanced medical facilities in each hospital.

According to the neonatal outcome, the present study revealed that nearly a two-thirds of the neonate was admitted to NICU, more than one-third of them had respiratory distress syndrome. It is clear that these results are closely related to the decline of the Apgar score at the 1st and 5th minutes of births, in addition to the sharp decrease in birth weight and EONS, which requires the neonatal intensive care services. As such, more efforts have to be made to develop the neonatal intensive care unit so that they should be equipped with better facilities to handle such sort of health complications and to improve the neonatal outcome. The current study results were in accordance with the study of Kadikar et al.[26] Also, it was reported that the low birth weight and low Apgar score were the reasons for the neonatal intensive care unit admission.[27]

The prediction of EONS is the first and most important priority for the management of women with preterm premature rupture of membranes because it is the main risk factors for both morbidity and mortality of the neonate. In the literature, the review study by Cortese et al.[28] showed that premature labour, premature and prolonged duration of membranes rupture > 18 hours, infection during labour, and low socioeconomic class are strongly correlated with EONS.[28] On the same line, in the matched case-control study in china,

the multivariate logistic regression analysis represents that the predisposing factors for EONS were the maternal age over 35 years, premature rupture of membranes, and caesarean section.[29] Also, neonatal risk causes for EONS include neonatal Apgar scoring at 1 & 5 minutes, anaemia, fetal distress, metabolic disorders, wet lung, intraventricular bleeding and hypothermia.[30] Additionally, in univariate analysis, WBC count, C-reactive protein, and colonization of abnormal pathogens in the female genital tract were all correlated with EONS.[6] The present study results confirmed the previous results in the literature. In contrast, other studies did not prove any significant predictive value of the WBC count.[31,32] The current study showed the same results. In contrast, some studies have shown different results.[33,34]

In the study done by khan & Khan[24] caesarean section was commonly done in case of fetal malpresentation and distress. The present study had a similar finding regarding distress; moreover, the caesarean section was mostly performed to reduce clinical chorioamnionitis manifestations. It was mentioned that the induction of labour depended on the risk of the microorganism, gestational age, signs of maternal or fetal clinical chorioamnionitis, and the maturation of fetal lung.[35] For the current study, the induction of labor depends to some extent on the same reasons as in the previous survey.

It was reported that the leaking duration period of the ruptured membrane has important indicators for pregnancy outcome. As the more extended leaking period of the membrane rupture is correlated with histological chorioamnionitis, funisitis and congenital infection.[32] Other studies reported that the prolonged duration of the membrane rupture period had a significant factor for chorioamnionitis.[36,37] It is clear that the current study has the same result as the previous studies.

Previous studies have reported that high vaginal swab can identify the type of bacteria and guide the antibiotic regimen in pregnant women with PPROM. In a cross-sectional study, E. coli was the most common isolated bacteria from lower genital tract culture followed by Staphylococcus aureus and Candida species.[38] The result of the current study supported the previous research in that the bacteria E. coli is the most isolated bacteria from the high vaginal swab.

Limitation

The researcher followed the patients until discharged from the hospitals; recall and temporal bias were the essential limitations. Also, the sample size is small, but it was the only sample available at the time and setting of data collection. The study used convenient sampling, which may limit the generalizability of the study results to other populations. So, further large prospective studies in the future are recommended. Despite the fact that the current study is a prospective design, the results of this study can be considered valuable and contribute to the knowledge of the preterm premature rupture of membranes that can be used to address this problem.

5. Conclusion

The results of present study highlight that Preterm premature rupture of membranes is still a significant clinical problem in obstetric practice. So, the results of present study conclude that the prenatal maternal indicators are the significant values for the maternal and neonatal outcome. The most significant indicators shown in this study are the gestational age at (onset of leaking, hospital admission, and at delivery), leaking duration before admission, manifestations of clinical chorioamnionitis and the WBCS count. The most significant neonatal outcomes are NICU admission, neonatal respiratory distress syndrome, and early neonatal sepsis. Moreover, the time of delivery after admission, the type of management (active or expectant) and the postnatal sepsis are significant among the studied sample.

5.1 Recommendations

Based on the results of this research, the following recommendations are proposed:

1) The maternity and neonatal nurses should be more attentive to the women and neonate who are diagnosed with the PPROM.

2) A further larger prospective study is recommended to demonstrate the difference in incidence, management protocol of preterm premature rupture of the membrane in the obstetrics, gynecology and neonate health care services.

3) Generalize the results of the current study to all maternity health settings all over Egypt.

4) Design and implement counselling programs for the women experiencing PPROM.

5) The need for hospital-based policy and protocol addressing PPROM problems to staff nurses at the obstetrics, gynaecology and paediatric departments.

Acknowledgements

The authors would like to thank the nurses in the inpatients' ward of the obstetric and gynaecological departments and paediatric departments, and neonate intensive care unit (NICU) at Port-Said General hospital and Specialized Women and Obstetrics Hospital (Health insurance), Port Said city, Egypt for their kind help in undertaking this study.

Conflicts of Interest Disclosure

The authors declare that there is no conflict of interest.

REFERENCES

[1] Chan GJ, Lee AC, Baqui AH, et al. Risk of early-onset neonatal infection with maternal infection or colonization: a global systematic review and meta-analysis. PLoS Med. 2013; 10: e1001502. PMid:23976885 https://doi.org/10.1371/journal.pmed.1001502

[2] El-Messidi A, Cameron A. Diagnosis of premature rupture of membranes inspiration from the past(1) and insights for the future. Journal of Obstetrics and Gynaecology Canada. 2010; 32(6): 561-9. https://doi.org/10.1016/S1701-2163(16)34525-X

[3] American College of Obstetricians and Gynecologists' Committee on Practice Bulletins-Obstetrics. Practice Bulletin No. 172: Premature Rupture of Membranes. Obstet Gynecol. 2016; 128(4): e165-77. PMid:27661655 https://doi.org/10.1097/AOG.0000000000001712

[4] Singh K, Mercer B. Antibiotics after preterm premature rupture of the membranes. Clin Obstet Gynecol. 2011; 54(2): 344-350. PMid:21508705 https://doi.org/10.1097/GRF.0b013e318217ec5d

[5] Murtha AP, Sinclair T, Hauser ER, et al. Maternal serum cytokines in preterm premature rupture of membranes. Obstet Gynecol. 2007; 109: 121-7. PMid:17197597 https://doi.org/10.1097/01.AOG.0000250474.35369.12

[6] Popowski T, Goffinet F, Maillard F, et al. Maternal markers for detecting early-onset neonatal infection and chorioamnionitis in cases of premature rupture of membranes at or after 34 weeks of gestation: a two-center prospective study. BMC Pregnancy Childbirth. 2011; 11: 26. PMid:21470433 https://doi.org/10.1186/1471-2393-11-26

[7] Verani JR, McGee L, Schrag SJ. Prevention of perinatal group B streptococcal disease revised guidelines from CDC, 2010. MMWR Recomm Rep. 2010; 19(59RR 10): 1-36.

[8] Hernández Y, López Farán JA, Gámez C. Comparison of maternal and perinatal outcomes in the conservative treatment preterm premature membrane rupture between the use of Erythromycin and clindamycin. Ginecol Obstet Mex. 2011; 79(7): 403-10.

[9] Abouseif HA, Mansour AF, Hassan SF, et al. Prevalence and outcome of Preterm Premature Rupture of Membranes (PPROM) among pregnant women attending Ain Shams maternity hospital. The Egyptian Journal of Community Medicine. 2018; 36(2). https://doi.org/10.21608/ejcm.2018.11055

[10] Mercer BM. Antibiotics in the management of PROM and preterm labor. Obstet Gynecol Clin North Am. 2012; 39: 65-76. PMid:22370108 https://doi.org/10.1016/j.ogc.2011.12.007

[11] Dars S, Malik S, Samreen I. Maternal morbidity and perinatal outcome in preterm premature rupture of membranes before 37 weeks gestation. Pak J Med Sci. 2014; 30(3): 626-29.

[12] Patil S, Patil V. Maternal of Membranes. IOSR Journal of Dental and Medical Sciences. 2014; 13(12): 56-83. https://doi.org/10.9790/0853-131275683

[13] Tavassoli F, Ghasem M, Mohamadzade A. and Sharifian J (2010). Survey of Pregnancy Outcome in Preterm Premature Rupture of Membranes with Amniotic Fluid Index <5 and $\geq$ 5. Oman Med J; 25(2): 118-23. PMid:22125713 https://doi.org/10.5001/omj.2010.32

[14] Ashraf MN, ul Haq MZ, Ashraf MW, et al. Early-onset neonatal sepsis in preterm premature rupture of membranes. Pakistan Armed Forces Medical Journal. 2015; 65(2): 226-30.

[15] Buhimschi C, Norman JE, Creasy RK, et al. Pathogenesis of spontaneous preterm labor maternal-fetal medicine: principles and practice. 7th ed. Philadelphia: Saunders/Elsevier; 2013; 599-623.

[16] Okeke TC, Enwereji JO, Okoro OS, et al. The Incidence and Management Outcome of Preterm Premature Rupture of Membranes (PPROM) in a Tertiary Hospital in Nigeria. 2014; 2(1): 14-17. https://doi.org/10.12691/ajcmr-2-1-4

[17] Marie HT, Rachel B, Mollie GB, et al. Chorioamnionitis: Prevention and Management. Copyright © 2013 Lippincott Williams & Wilkins. Unauthorized reproduction of this article is prohibited.

[18] WHO recommendations on interventions to improve preterm birth outcomes handbook, 2015' WHO recommendations on interventions to improve preterm birth outcomes: evidence base. Available from: http://www.who.int/reproductivehealth/publications/maternal_perinatal_health/preterm-birth-guideline

[19] Fahmy SI, El-Sherbini AF. Determining simple parameters for social classification for health research. The Bulletin of the High Institute of Public Health. 1988; 13: 95-108.

[20] Apgar V, Holaday DA, James LS. Evaluation of The Newborn Infant. Second report. JAMA. 1985; 168. PMid:13598635 https://doi.org/10.1001/jama.1958.03000150027007

[21] Gibbs RS, Blanco JD, St Clair PJ, et al. Quantitative bacteriology of amniotic fluid from women with clinical intraamniotic infection at term. The Journal of Infectious Diseases. 1982; 145(1): 1-8. PMid:7033397 https://doi.org/10.1093/infdis/145.1.1

[22] Mukhopadhyay S, Puopolo KM. Risk assessment in neonatal early onset sepsis. Semin Perinatol. 2012; 36: 408e15. PMid:23177799 https://doi.org/10.1053/j.semperi.2012.06.002

[23] Noor S, Fawwad A, Shahzad H, et al. Foetomaternal outcome in patients with or without PROM. J Ayub Med Coll Abbottabad. 2010 Jan-Mar; 22(1): 164-7.

[24] Khan SH, Khan AA. Study on preterm pre mature rupture of membrane with special reference to maternal and its fetal outcome. Int J Reprod Contracept Obstet Gynecol. 2016 Aug; 5(8): 2768-2774. https://doi.org/10.18203/2320-1770.ijrcog20162663

[25] Al-Kashif MML. Urinary Tract Infection among Pregnant Women and its Associated Risk Factors: A Cross-Sectional Study. Biomedical & Pharmacology Journal. December 2019; 12(4): 2003-2010. https://doi.org/10.13005/bpj/1832

[26] Kadikar GK. A study of feto-maternal outcome in cases of premature rupture of membrane. IJSR. 2014; 3: 3.

[27] Al-Kashif MML. A study of Maternal and Neonatal Outcome after Threatened Miscarriage: A prospective follow-up-controlled design. International Medical Journal (IMJ). 2020; 25(2): 2020.

[28] Cortese F, Scicchitano P, Gesualdo M, et al. Pediatrics and Neonatology. 2016; 57: 265-273. PMid:26750406 https://doi.org/10.1016/j.pedneo.2015.09.007

[29] Jiang Z, Ye GY. 1:4 matched case-control study on influential factor of early onset neonatal sepsis. Eur Rev Med Pharmacol Sci. 2013; 17: 2460e6.

[30] Satar M, Ozlu F. Neonatal sepsis: a continuing disease burden. Turk J Pediatr. 2012; 54: 449e57.

[31] Perrone G, Anceschi MM, Capri O, et al. Maternal C-reactive protein at hospital admission is a simple predictor of funisitis in preterm premature rupture of membranes. Gynecol Obstet Invest. 2012; 74(2): 95-9. PMid:22710247 https://doi.org/10.1159/000337717

[32] Daunoraviciene L, Lenkutiene R, Musteikyte A, et al. Preterm premature rupture of membranes at 32–34 weeks of gestation: duration of membrane rupture period and maternal blood indicators relation with congenital infection. ACTA MEDICA LITUANICA. 2014. 21(4): 161-170. https://doi.org/10.6001/actamedica.v21i4.3045

[33] Nayot D, Penava D, Da Silva O, et al. Neonatal outcomes are associated with latency after preterm premature rupture of mem-

branes. J Perinatol. 2012 Dec; 32(12): 970-7. PMid:22422118 https://doi.org/10.1038/jp.2012.15

[34] Dagklis T, Petousis S, Margioula-Siarkou C, et al. Parameters affecting latency period in PPROM cases: a 10-year experience of a single institution. J Matern Fetal Neonatal Med. 2013 Sep; 26(14): 1455-8. PMid:23488655 https://doi.org/10.3109/14767058.2013.784257

[35] Cobo T, Palacio M, Martínez-Terrón M, et al. Clinical and inflammatory markers in amniotic fluid as predictors of adverse outcomes in preterm premature rupture of membranes. Am J Obstet Gynecol. 2011; 205: 126.e1-8. PMid:21621184 https://doi.org/10.1016/j.ajog.2011.03.050

[36] Ekin A, Gezer C, Taner CE, et al. Risk factors and perinatal outcomes associ-ated with latency in preterm premature rupture of membranes between 24 and 34 weeks of gestation. Arch Gynecol Obstet. 2014 Sep; 290(3): 449-55. PMid:24695905 https://doi.org/10.1007/s00404-014-3227-3

[37] Test G, Levy A, Wiznitzer A, et al. Factors affecting the latency period in patients with preterm premature rupture of membranes. Arch Gynecol Obstet. 2011 Apr; 283(4): 707-10. PMid:20306063 https://doi.org/10.1007/s00404-010-1448-7

[38] Rani SH, Mehra R, Gupta V, et al. Vaginal flora in preterm premature rupture of membranes and their sensitivity to commonly used antibiotics. 2014. Asian Journal of Medical Sciences. Oct-Dec 2014; 5(4). https://doi.org/10.3126/ajms.v5i4.9889