

MANAGEMENT OUTCOME OF PREMATURE RUPTURE OF MEMBRANES IN A TERTIARY HEALTH FACILITY IN SOUTH WESTERN NIGERIA

B.K Suleiman^{1,2}, O.O Bello^{2,3*}, A.M Tijani¹ and T.A.O Oluwasola^{2,3}

1. Department of Obstetrics and Gynaecology, Ladoke Akintola University of Technology Teaching Hospital, Ogbomoso, Nigeria.
2. Department of Obstetrics and Gynaecology, University College Hospital, Ibadan, Nigeria.
3. Department of Obstetrics and Gynaecology, College of Medicine, University of Ibadan, Ibadan, Nigeria.

Correspondence:

Dr. O.O. Bello

Dept. of Obstetrics and Gynaecology,
University College Hospital,
Ibadan, Oyo State,
Nigeria.
Email: bellodoyin@yahoo.com

ABSTRACT

Background: Pre-labour Rupture of Membranes (PROM) contributes immensely to the potential risk of maternal morbidity and mortality.

Objective: To explore the incidence and management outcome of PROM at Ladoke Akintola University of Technology Teaching Hospital (LTH), Ogbomoso, Nigeria

Methods: A retrospective study of 61 cases of PROM managed at LTH, Ogbomoso over a 3-year period. Information on the socio-demographics and obstetrics characteristics, management instituted, and outcomes were obtained using a structured proforma. Data were analysed using SPSS version 20. Level of statistical significance was set at <0.05 and 95% confidence interval.

Results: The incidence of PROM was 4.1% with a perinatal mortality rate of 0.18 per 1000 deliveries. Twenty (33%) were pre-term while 41 (67%) were term PROM with 10% of the perinatal death occurring among those with preterm PROM. The mean age of the women was 36.9 (SD=2.1) years and median parity of 1(range 1-5) children. There was a significant association between the women's gestational age at which PROM occurred with the latency period ($p < 0.001$). Fetal birth weight, APGAR score and Neonatal Intensive Care Unit (NICU) admission were all significantly associated with the gestational age at which PROM occurred ($p < 0.05$). There was a significant difference between the intervention instituted and mode of delivery ($p = 0.009$).

Conclusion: The incidence of PROM at term was high and conservative/expectant management was effective. The latency period and fetal outcomes such as birth weight, apgar score and NICU admission were determined by the gestational age at which PROM occurred.

Keywords: PROM, Incidence, Preterm, Term

INTRODUCTION

Pre-labour or premature rupture of membranes is the rupture of membranes before the onset of labour after the age of viability and could be term or preterm depending on the gestational age it occurred.^{1,2} PROM poses one of the most important therapeutic predicaments in current obstetric practice, complicating approximately 5% to 10% of term pregnancies and between 2.3% and 30% of preterm deliveries.^{3,4,5} It is associated with a perinatal morbidity and mortality with a rate in excess of 20%, and the outcomes are primarily dependent on the gestational age at delivery. However, other factors that affect fetomaternal outcomes include previous history of PROM, presence of bacterial vaginosis, poor nutrition and poor socioeconomic status.^{6,7} On the other hand, the adverse effects and outcome of PROM can be minimized by

making prompt diagnosis, commencing antibiotic therapy, stimulating labour and delivery.^{2,6,8,9}

Rupture of membranes results from a variety of factors that lead to accelerated membrane weakening which could be caused by an increase in local cytokines, imbalance in the interaction between matrix metalloproteinases and their tissue inhibitors, increased collagenase and protease activities, as well as other factors that can cause increased intrauterine pressure.¹⁰ The major risk factors often identified are previous history of PROM, previous genital infection especially bacterial vaginosis, cervical incompetence, uterine over-distension, poor nutrition and poor socio-economic status.^{6,11,12}

Diagnosis is generally confirmed by either direct visualization of amniotic fluid egressing from the cervical os during a sterile speculum examination, demonstration of a vaginal pH >6.0, or ferning on microscopic examination.¹³ Management is highly variable depending on gestational age and the clinical setting¹⁴ and in some cases the management of PROM at term could be controversial. The major problem regarding management of these patients is timely and accurate diagnosis and whether to allow them wait for spontaneous commencement of labour or to stimulate their labour. Patients' wishes and desires have also been documented as pertinent in decision making.^{11,15}

In developing countries extra uterine survival of fetuses at gestational ages less than 28 weeks is quite slim which informed the decision to manage PROM occurring before 34 weeks gestation conservatively, usually with antibiotics, steroids therapy for lung maturity, strict bed rest and continuous fetal monitoring and surveillance. These measures have occasionally proved to improve neonatal outcomes.^{6,16,17} Notwithstanding, the management of PROM at term remains controversial with some researchers supporting the stimulation of labour against, expectant management so as to decrease the risk of chorioamnionitis without increasing the caesarean delivery rate.^{6,16,18}

It has been documented that intra-amniotic infection occurs in 13%–60% of women with PROM aside the incidences of pre-term birth and birth asphyxia which have been documented as being common contributors to maternal and fetal mortality in developing countries.⁴ Nigeria is included among the few countries responsible for more than 50% of the maternal and neonatal deaths globally.¹⁹ It is against this background that this study aimed to compare the fetomaternal outcomes following management of women with term and preterm PROM.

METHODS

This was a 3-year retrospective descriptive study of cases of PROM managed at the LAUTECH Teaching Hospital (LTH), Ogbomoso between January 1, 2013 and December 31, 2015. LTH is a tertiary health facility that provides antenatal care for pregnant women and serves as a referral centre in Ogbomoso and its environs. The hospital conducts two antenatal clinics weekly on Tuesdays and Thursdays and booking clinics on Mondays and Fridays with an average delivery rate of 1,500 per year.

All cases of PROM in the hospital were identified following a manual search of the antenatal admission and labour ward register. Medical records of the cases

were retrieved from the medical records unit and cases of PROM with established labour, those with gestational age less than 28 weeks, those with multiple gestations and fetal anomalies were excluded. Information on the socio-demographics and obstetrics characteristics and materno-fetal outcomes were obtained using a structured proforma. Data was analysed using the Statistical Package for Social Sciences (SPSS) version 20.0 and statistical level of significance was set at <0.05.

In this study, gestational age was established from the first day of the last menstrual period or dating scan (first trimester), while rupture of membranes that occurred more than 8 hours prior to the onset of labour at or beyond 37 weeks of gestation was defined as term PROM while those between 28 weeks and 36 weeks and 6 days were classified as preterm PROM (PPROM). Latency period is defined as the time interval between rupture of membranes and onset of labour either spontaneously or by induction.

Diagnosis of PROM was established by the obstetric resident doctor or attending obstetrician based on a history of drainage of liquor before the onset of labour, sterile speculum examination confirming the presence of pooled amniotic fluid in the posterior fornix or visualization of amniotic fluid leakage from the cervical os on valsalva manoeuvre and transabdominal ultrasound demonstrating oligohydramnios. Each patient with PPRM were observed in the labour ward or antenatal ward for at least 72 hours. All patients were investigated for the possible cause(s) of PROM and those with PPRM received prophylactic antibiotic (erythromycin 500mg every 6 hours). Those at a gestational age less than 34 weeks also received steroid – dexamethasone (four intramuscular doses of 6mg 12 hours apart for 48 days) for the enhancement of fetal lung maturity according to the unit's protocol. The administration of tocolysis (oral calcium channel blocker-nifedipine) for a duration of 48 hours was given to women who had not completed steroid but were having uterine contractions. Investigations done depend on the history and clinical examination findings but included blood film for malaria parasite, full blood count, high vaginal swab microscopy, culture and sensitivity, C-reactive proteins. All patients at gestational age less than 36 weeks were managed conservatively with close fetomaternal surveillance for signs and symptoms of maternal chorioamnionitis or sepsis, and perineal pad as well as regular fetal heart rate and activity monitoring via intermittent cardiotocography (CTG), intermittent auscultation with pinnard stethoscope or sonicaid 4 hourly, fetal kick chart and transabdominal ultrasonography. Conservative management was aborted and

labour induced if there was evidence of chorioamnionitis, fetal heart rate anomalies, non-reassuring CTG, severe oligohydramnios, placental abruption, cord prolapse, or onset of spontaneous labour. If undelivered by 37 weeks, the patient was offered induction of labour or caesarean delivery based on detailed fetomaternal assessment for the best route of delivery by the most senior obstetrician on the team.

RESULTS

Of the 1621 deliveries during the study period, 66 were confirmed cases of PROM out of which 61 met the inclusion criteria and were analysed. The incidence of PROM was 4.1% of which a third 20 (33%) occurred preterm.

The mean age of the women was 36.9 (SD=2.1) years and median parity of 1 (range 1-5) child. The mean gestational age at occurrence of PROM was 38.1±1.9 weeks while the peak incidence of PROM occurred in the 35-39 years age category. Almost half, 49.2% of the women had tertiary level of education, among whom, majority 45.9% were engaged in skilled occupation while 31.1% were unemployed. A higher proportion, 45.9% were multipara while 19.7% were nullipara (Table 1).

Table 1: Socio-demographic characteristics of the participants.

Variable	Frequency n=61	Percentage (%)
Age in years		
<30	7	11.5
30 – 34	18	29.5
35 – 39	24	39.3
≥40	12	19.7
Mean age ± SD	36.9 ± 2.1	
Tribe		
Yoruba	53	86.9
Hausa	1	1.6
Igbo	7	11.5
Level of education		
Primary	7	11.5
Secondary	24	39.3
Tertiary	30	49.2
Occupation		
Skilled	28	45.9
Unskilled	14	23.0
Unemployed	19	31.1
Parity		
Nullipara	12	19.7
Primipara	21	34.4
Multi para	26	45.9
Median (Range)	1(1-5)	
Gestational age at PROM (weeks)		
<37	20	33.0
≥37	41	67.0
Mean ± SD	38.1±1.9	

A total of 36 (59%) women had onset of labour (latency period) within 24 hours following rupture of membranes with mean latency of period of 22.7 ± 6.4 hours. More than half, 54.1% of the women were admitted into the antenatal ward and managed conservatively. Less than half 27 (45.9%) of the women had labour induced and over two-third (70.5%) of them had spontaneous vaginal delivery (Table 2).

Table 2: Latency period, intervention and mode of delivery.

Variable	Frequency n=61	Percentage (%)
Latency period (in hours)		
<24	36	59.0
≥24	25	41.0
Mean	22.7 ± 6.4	
Intervention given		
Conservative management	33	54.1
Induction of labour	27	45.9
Mode of delivery		
Spontaneous vaginal delivery (SVD)	43	70.5
Caesarean section	18	29.5

More than two-thirds 68.8%, of the babies weighed ≥2.5kg and nearly three-quarters of the babies had APGAR score of ≥7 at 1st minute while up to 83% of them had apgar score of ≥7 at the 5th minute. Neonatal death was documented in 4.9% of the neonates with a perinatal mortality rate of 0.18 per 1000 deliveries while about a third (29.5%) of the neonates were admitted in the neonatal intensive care unit (NICU) on account of prematurity (77.8%), low birth weight (66.7%), and presumed neonatal sepsis (50.0%). (Table 3).

A lower proportion (21.9%) of the women with term PROM had a latency period of ≥24 hours compared with 80.0% of the women with preterm PROM who also had latency period of ≥24 hours. An association was found between the gestational age at which PROM occurred and the latency period (p< 0.001), but not with maternal age or parity. Fourteen (70%) of the babies delivered before 37 weeks weighed less than 2.5kg while 36 (87.8%) of those delivered at term weighed 2.5kg or more. This shows that the gestational age at which the babies were delivered had a significant influence on the birth weight (p=<0.001). The gestational age at which PROM occurred had significant influence on the apgar score at 1st and 5th minutes as well as the need for NICU admission (p value < 0.00), (Table 4).

Majority (85.3%) of the women that had conservative management compared with 52.2% who underwent

Table 3: Fetal Outcome.

Variable	Frequency n=61	Percentage (%)
Birth weight (in kg)		
<2.5	19	31.2
≥2.5	42	68.8
Mean ± SD	22.7 ± 6.4	
APGAR Score (at 1min)		
<7	16	26.2
≥7	45	73.8
APGAR Score (at 5min)		
<7	10	16.4
≥7	51	83.6
Need for NICU admission		
Yes	18	29.5
No	43	70.5
Indication for NICU admission* (n = 18)		
Prematurity	14	77.8
Low birth weight (<2.5kg)	12	66.7
Presumed neonatal sepsis	9	50.0
Birth asphyxia	7	38.9
Perinatal survival		
Alive	58	95.1
Dead	3	4.9

*Multiple options

NICU – neonatal intensive care unit

Table 4: Relationship between the maternal characteristics and fetal outcomes with gestational age at PROM

Variable	Gestational Age at PROM (weeks)		Chi-square	P-value
	<37 n (%) (n= 20)	≥37 n (%) (n= 41)		
Age in years				
<30	3(15.0)	4(9.8)	2.423	0.489
30 – 34	8(40.0)	10(24.3)		
35 – 39	6(30.0)	18(43.9)		
≥40	3(15.0)	9(22.0)		
Parity				
Nulliparous	5 (41.7)	7(58.3)	0.604	0.739
Primiparous	6(28.6)	15(71.4)		
Multiparous	9(32.1)	19(67.9)		
Latency period (in hours)				
<24	4(20.0)	32(78.1)	18.728	<0.001*
≥24	16(80.0)	9(21.9)		
Birth weight (in Kg)				
<2.5	14(70.0)	5(12.2)	X ² = 20.945	<0.001*
≥2.5	6(30.0)	36(87.8)		
APGAR Score (at 1min)				
<7	13(65.0)	3(7.3)	Fisher Exact test	<0.001*
≥7	7(35.0)	38(92.7)		
APGAR Score (at 5min)				
<7	9(45.0)	1(2.4)	Fisher Exact test	<0.001*
≥7	11(55.0)	40(97.6)		
Need for NICU admission				
Yes	14(70.0)	4(9.8)	Fisher Exact test	<0.001*
No	6(30.0)	37(90.2)		
Perinatal survival				
Alive	18(90.0)	40(97.6)	Fisher Exact Test	0.861
Dead	2(10.0)	1(2.4)		

*Significant X² = Pearson Chi square test

Table 5: Relationship between Intervention and Mode of delivery.

Variable	Mode of delivery		Chi-square	P-value
	SVD n (%)	C/S n (%)		
Intervention				
Conservative management	29(85.3)	5(14.7)	9.222	0.009*
Induction of labour	14(52.2)	13(47.8)		

*Significant $X^2 =$ Pearson Chi square test

SVD – Spontaneous vaginal delivery

C/S – Caesarean section

induction of labour had spontaneous vaginal delivery. There was a significant difference between the intervention given and the mode of delivery ($p=0.009$), (Table 5).

DISCUSSION

This study explored the incidence and management of PROM and compared the feto-maternal outcomes in term and preterm PROM at LTH. The incidence of PROM was 4.1% which was similar to the finding of a study in Egypt²⁰ but higher than reports obtained in some previous Nigerian and foreign studies.^{2,6,22-24} This incidence was, however, lower than the observed incidence of 7.4%, 10.3%, 12.5% and 17.6% previously reported from Borno and Osun state, Nigeria, East China and Ethiopia.^{13,21,25, 26} The observed variation might be because gestational age of viability differs in different countries. In addition, the low incidence reported by Eleje *et al.*, Emechebe *et al.*, and Adeniji *et al.* may also be due to relative difference in delivery rates from centre to centre.^{2,6,23} However, the incidence of PROM varies from 2-18% of all pregnancies and most studies fall within this range including our study.^{27,28}

The finding that socio-demographic factors have no significant association with the occurrence of PROM agrees with report from Ethiopia by Assefa and colleagues.²⁸ However, a higher proportion of the women were in their advanced reproductive years (≥ 35 years of age), had tertiary education and were involved in skilled occupation.

Majority of the women in this study had PROM at term and this was similar to reports from other studies.^{6,13,23,29-31} However, Mohan *et al.* reported that PROM occurred in higher proportion among women at late preterm gestation (34-36 weeks).²⁴

In addition, the peak incidence occurred at the reproductive age group of 35-39 years unlike the lower reproductive age group reported in other studies.^{2,21} Furthermore, PROM occurred mainly among multiparous women, a finding in keeping with result

of similar studies, though maternal age and parity were not statistically significant with the occurrence of PROM.^{2,6,15,21,23} This might not be unrelated to previous deliveries with varying degrees of repeated trauma to the cervix which may interfere with the ability of the cervix to hold pregnancy to term thus predisposing multiparous women to PROM.

With respect to the management outcome, there was a statistically significant difference in the caesarean section and operative vaginal delivery rate based on the type of management received. The women who were managed conservatively had over two-thirds of them delivered via spontaneous vaginal delivery (SVD) which was in keeping with the findings of Akintayo *et al.*²⁵ It has also been documented that stimulation of labour, in contrast to expectant management, does not increase the caesarean delivery rate.^{16,18}

Gestational age at the occurrence of PROM had a significant association with the latency period. A higher proportion had latency period within 24 hours following rupture of membranes, especially in women whose gestational age was >37 weeks. This observation was not consistent with the findings by Ibishi *et al.* that reported no association between latency period and gestational age even among women in the term pregnancy group with latency period of <24 hours.²⁹ This observation was expected since PROM occurred mainly at term in this study and this may account for the relatively low adverse outcomes seen in this study. In a similar study by Emechebe *et al.* in Calabar, Nigeria, a longer latency period was reported which could be associated with a high incidence of infection.⁶

No maternal mortality was recorded in our study, a finding comparable with the studies by Mohan *et al.* and Akintayo *et al.* However, this report was at variance with some recent studies in low-resource settings where maternal mortality was reported.^{24,32} This observation was expected since PROM occurred mainly at term in this study and may account for the relatively low adverse outcomes found in this study.

During the period of review there were three fetal deaths resulting in perinatal mortality rate of 0.18 per 1000 deliveries. This was lower than 0.26 per 1000 deliveries and 0.33 per 1000 deliveries reported in Anambra, Nigeria and India respectively.^{2,24} The difference may be due to the relatively fewer deliveries recorded in the index study. The two perinatal deaths which occurred in the preterm PROM group were directly related to complications of prematurity while the one that occurred in the term PROM group was a result of overwhelming neonatal sepsis. The live birth rates were 90% and 97.6% in the preterm and term PROM groups.

The fetal outcomes that were significantly associated with the occurrence of PROM were apgar scores both at 1 and 5 minutes, higher birth weight babies, and NICU admission. The reported significant association in the apgar scores with the gestational age at which PROM occurred. In addition, over 90% of the babies delivered at term had APGAR scores of ≥ 7 at both 1 and 5 minutes correspondingly. However, this contradicts the findings at Ile-Ife with a finding suggestive of no significant relationship between apgar scores with regards the gestational age at which PROM occurred.²⁵

Furthermore, the association between fetal birth weight and occurrence of PROM in our study was expected because PROM occurred in the majority at term. Thus, substantiating why more of the babies at term weighed ≥ 2.5 kg. This result corresponded with reports by Eleje *et al.* and Idrisa *et al.* in Nnewi and Maiduguri respectively.^{2,21} This could also explain why less than one-third of the babies needed NICU admission.

There was an association between the gestational age at PROM and need for NICU admission as 90% of the preterm neonates required admission compared to 9.8% of the babies delivered at term in this study. This indicates gestational age approach to management was important and should be adjusted for in analysing individual hospital's NICU outcome.²⁴

Despite the limitations inherent to a retrospective study and the small sample size, this study provides an unbiased comparison between preterm PROM and term PROM in women and their babies. Variables such as previous history of PROM, previous abortion and length of hospital stay which are vital to materno-fetal outcome were not explored in this study.

CONCLUSION

Premature rupture of membranes remains an important obstetric concern associated with maternal

and perinatal morbidity especially when it occurs before term. Latency period, birth weight, apgar score and NICU admission were factors determining its fetal outcome. However, management modalities are dependent on multiple maternal and fetal factors. Conservative treatment with resultant advancement in the gestational age before delivery could increase the chances of having a vaginal birth. Further research on a wider range comparing the management of PROM and its incidence at the three levels of care is recommended.

REFERENCES

1. **Caughey AB**, Robinson JN, Norwitz ER. Contemporary Diagnosis and management of premature rupture of membranes. *Rev. Obstet Gynecol.* 2008;1(1):11-22.
2. **Eleje GU**, Ezebialu IU, Umeobika JC, *et al.* Pre labour rupture of membranes at term: A review of management in a Health care institution. *Afrimed Journal* 2010;1(2):10-14.
3. Royal College of Obstetrician-Gynaecologists (RCOG), Scientific Advisory Committee. Preterm Prelabour Rupture of Membranes. Clinical Green Top Guidelines No. 44. London, UK: RCOG, November 2006:381391. Available at http://www.rcog.org.uk/resources/Public/pdf/green_top44_preterm.pdf. Accessed on 28th July, 2019.
4. ACOG Committee opinion. Antenatal corticosteroid therapy for foetal maturation. *Obstet Gynaecol* 2017;130:e102-109.
5. **Dayal S**, Hong P. Premature rupture of membranes. Copyright© 2019, StatPearls Publishing LLC Bookshelf ID: NBK532888 PMID: 30422483.
6. **Emechebe CI**, Njoku CO, Anachuna K *et al.* Determinants and complications of pre-labour rupture of membranes (PROM) at the University of Calabar Teaching Hospital (UCTH), Calabar, Nigeria. *Sch. J. App. Med. Sci.* 2015; 3(5B): 1912-1917.
7. **Odunsi A**, Odutayo R. Premature Rupture of Foetal Membranes. In: (Eds) Okonofua F, Odunsi A. contemporary obstetrics and gynaecology for developing countries. women's health and action research centre. 2003; 23: 430-453.
8. **Duncan JR**, Tobiasz AM, Dorsett KM, *et al.*, Fetal pulmonary artery acceleration/ejection time prognostic accuracy for respiratory complications in preterm prelabor rupture of membranes. *J. Matern. Fetal. Neonatal. Med.* 2018;26:1-5.
9. **Tsakiridis I**, Mamopoulos A, Chalkia-Prapa EM, *et al.* Preterm premature rupture of membranes: A review of 3 national guidelines. *Obstet Gynecol Surv.* 2018;73(6):368-375.

10. RCOG. PRACTICE Bulletin No. 160: premature rupture of membranes. *Obstet Gynecol.* 2016; 127(1):e39-51.
11. **Osaikhuwomwan JA**, Osemwenkha AP. Maternal characteristics and timing of presentation following pre-labour rupture of membranes. *Niger Med J* 2014; 55:58-62.
12. **Beazley JM**, Special Circumstances affecting labour. In: Whitfield CR(ed) Dewhurst's textbook of Obstetrics and Gynaecology for postgraduates. 8th ed. Oxford: Blackwell Scientific Publication; 2012.313-332.
13. **Xia H**, Li X, Li X, *et al.* The clinical management and outcome of term premature rupture of membrane in East China: results from a retrospective multicenter study. *Int J Clin Exp Med.* 2015; 8(4): 6212–6217.
14. **Gabbe SG**, Niebyl JR, Simpson JL, *et al.* Obstetrics: normal and problem pregnancies, chapter 29. 6th ed. Philadelphia: Elsevier; 2012.
15. **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." *American Journal of Clinical Medicine Research*, 2014; 2(1): 14-17.
16. **Omole-Ohoni A**, Ashimi A, Adeleke S. Pre labour rupture of membrane at term; Immediate vs delayed induction of labour. *West Afr J Med.* 2009;28(3):156-160.
17. **Waters TP**, Mercer BM. The management of preterm premature rupture of the membranes near the limit of fetal viability. *Am J Obstet Gynecol* 2009; 201:230–240.
18. **Obi SN**, Ozumba BC. Preterm Premature Rupture of Membranes: The dilemma of management in a developing Nation. *J Obstet Gynecol.* 2007;27(1):37-40.
19. **Akinyemi JO**, Bamgboye EA, Ayeni O. Trends in neonatal mortality in Nigeria and effects of bio-demographic and maternal characteristics. *BMC Pediatr.* 2015; 15: 36.
20. **Abouseif HA**, Mansour AF, Hassan SH, *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): 99-107.
21. **Idrisa A**, Pius S, Bukar M. Maternal and neonatal outcomes in premature rupture of membranes at university of Maiduguri teaching hospital, Maiduguri, North Eastern Nigeria. *Trop J Obstet Gynaecol* 2019; 36:15 20.
22. **Kurasawa K**, Yamamoto M, Usami Y *et al.* Cervical ripening in pre-induction treatment for premature rupture of membrane. *J Obstet Gynecol Res* 2014; 40(1):32-39.
23. **Adeniji OA**, Atanda OA, Interventions and Neonatal outcomes in patients with Premature Rupture of fetal membranes at and beyond 34 weeks gestational age at a tertiary health facility in Nigeria. *British J. Med and Med Research.* 2013;3(4):1388-1397.
24. **Mohan SS**, Thippeveeranna C, Singh NN, *et al.* Analysis of risk factors, maternal and fetal outcome of spontaneous preterm premature rupture of membranes: a cross sectional study. *Int J Reprod Contracept Obstet Gynecol.* 2017;6(9):3781-3787.
25. **Akintayo AA**, Adeyemi AB, Kuti O, *et al.* Premature rupture of membranes at term: immediate induction of labor versus expectant management. *Trop J Obstet Gynaecol*, 2014; 31(2): 31-37.
26. **Takele DD**, Hailemariam S, Elias Al. Incidence, maternal and perinatal outcome of premature rupture of fetal membrane cases in Jimma University Teaching Hospital, South West Ethiopia. *EC Gynaecology* 2017; 5.4: 163-172.
27. **Frohn WE**, Simmons S, Carlan SJ. Prostaglandin E2 gel versus misoprostol for cervical ripening in patients with premature rupture of membranes after 34 weeks. *Obstet Gynecol* 2002; 99(2) 206-210.
28. **Assefa NE**, Berhe H, Girma F, *et al.* Risk factors of premature rupture of membranes in public hospitals at Mekele city, Tigray, a case control study. *BMC Pregnancy and Childbirth*, 2018;18:386.
29. **Ibishi VA**, Isjanovska RD. Prelabour rupture of membranes: mode of delivery and outcome. *open access maced J Med Sci.* 2015; 3(2): 237–240.
30. **Liu J**, Feng Z-C, Wu J. The incidence rate of premature rupture of membranes and its influence on fetal-neonatal health: A report from mainland China. *J Trop Pediatr* 2010; 56:36-42.
31. **Endale T**, Fentahun N, Gemada D, *et al.* Maternal and fetal outcomes in term premature rupture of membrane. *World J Emerg Med* 2016; 7:147-152.
32. **Kayiga H**, Lester F, Amuge PM, *et al.* Impact of mode of delivery on pregnancy outcomes in women with premature rupture of membranes after 28 weeks of gestation in a low-resource setting: A prospective cohort study. *PLoS ONE.* 2018; 13(1): e0190388.