Original Article

Maternal and neonatal outcomes in premature rupture of membranes at University of Maiduguri Teaching Hospital, Maiduguri, North-Eastern Nigeria

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ABSTRACT

Background: Premature rupture of membrane (PROM) is linked to significant adverse events in the prenatal, peripartum and neonatal period. Both, PROM and PPROM are associated with maternal and neonatal morbidities and mortalities. Severe oligohydramnios after PROM is associated with foetal abnormalities, pulmonary hypoplasia, respiratory distress syndromes, intrauterine growth restriction, intrauterine foetal death, foetal/neonatal sepsis, presence of meconium and an Apgar score lower than seven at five minutes.

Objective: To determine the factors that influenced maternal and neonatal outcomes following a premature rupture of membranes.

Subjects and Methods: This retrospective cross-sectional study was conducted over five years between 1st January 2012 and 31st December 2016 on mother neonate pair delivered at the University of Maiduguri Teaching Hospital Maiduguri.

Results: During the period of the study there were 7200 deliveries at the labour ward of (UMTH), out of which 91 (1.3%) had PROM. Seventy three (80.2%) of the case files were retrieved and analysed. Thirty six women (49.3%) were delivered by emergency caesarean section (EMCS), while 37 (50.7%) were delivered vaginally (SVD). In the bivariate (crude) analysis, Apgar score < 7 at 5 minutes (P = 0.008, OR 95 % CL: 0.092 (0.011, 0.742), birth weight ≥ 2500g (P = 0.006, 8.944 (1.892, 42.284), and absence of APH (P = 0.007, 4.83 (1.440, 16.196) were factors modifying neonatal outcome. When adjusted regression with only factors with P value < 0.2 in crude analysis were done, only birth weight ≥ 2500 g (P = 0.024, 6.677 [1.286, 34.664]) and absence of APH (P = 0.038, 4.406 [1.085, 17.883]) were independent predictors of neonatal outcome. Thus, neonates with birth weight ≥ 2500 g were about 6.7 times more like to show favourable outcome than those with birth weight < 2500g while those without APH showed 4.4 times more likelihood for a favourable neonatal outcome. Antenatal corticosteroids use also was associated with favourable outcome as it had significantly improved preterm neonatal survival.

Conclusion: Intervention with steroids, antibiotics in labour and delivery within 24 hours of PROM will greatly reduce maternal complications and enhances favourable neonatal outcome.

Key words: Amniotic membrane; maternal corticosteroid; premature; preterm outcome.

Background

Amniotic fluid is that fluid that is encased by amniotic membranes and it provides a protective environment for the

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developing fetus.[1] Adequate volume of amniotic fluid is an important parameter in the evaluation of fetal well-being. A decrease in its volume can occur due to premature rupture of membranes (PROM).[2] Premature rupture of membranes (PROM) is defined as the rupture of membranes before the onset of labor.[3] When this happens before the 37th week of pregnancy it is called preterm premature rupture of membranes (PPROM). In PPROM use of corticosteroid has positively contributed to preterm birth outcome.[1,3] It has no known aetiology but, sub clinical infection has been postulated.[4,5] Other workers suggested that the rupture of membrane is related to factors other than infection, membrane dysfunction on a molecular level, collagen destruction, and programmed cell death in fetal membranes. Amniotic fluid volume is determined by ultrasound technique called amniotic fluid index (AFI) and if <5 cm is regard as oligohydramnios and severe oligohydramnios when less than 3 cm.[6] It continues to be obstetric enigma in terms of cause and management despite advanced perinatal care.[1,6]

A prolonged PROM is the rupture of membranes that persists for more than 24 hours prior to the onset of labor. The interval between rupture of membranes and onset of labor is called latent period of leaking, which is the key factor for determining maternal and fetal outcome.[3,7] Severe oligohydramnios after PROM is associated with fetal abnormalities, pulmonary hypoplasia, respiratory distress syndromes, intrauterine growth restriction, intrauterine fetal death, fetal/neonatal sepsis, presence of meconium, and an Apgar score lower than seven at five minutes.[3] In addition to the presence of chorioamnionitis, the long length of time of premature rupture of membranes and the oligohydramnios are risk factors for adverse perinatal outcomes.[8-11]

PPROM is one of the main causes of prematurity and its complications, such as respiratory distress syndrome, neonatal sepsis, necrotizing enterocolitis, intraventricular hemorrhage and periventricular leukomalacia and varying degrees of hypoplasia and bronchopulmonary dysplasia. It contributes greatly to neonatal morbidity and mortality.[2,11] PROM occurs in approximately 5%–10% of all pregnancies, of which approximately 80% occur at term.[12-14] It has been shown to be the cause of 18%–20% and 21.4% of prenatal mortalities and morbidity respectively.[12] PPROM affects 32% to 40% of preterm deliveries, with 60% to 80% of these patients entering spontaneous labor within 48 hours, and the subsequent neonatal sequelae of preterm delivery ensuing.[15] An incidence of 5.1% to 12.5% among black women in contrasted with 1.5% to 2.2% among white women.[16] Among the recent reports from Nigeria, Okeke *et al*.[17] and Emechebe *et al*.[18] reported incidence of 3.3% and 6.3%, respectively. Studies also have shown improved neonatal survival with administration of antenatal corticosteroids in PPROM before 34 weeks of gestation.[19,20]

Maternal complications include intra-amniotic infection, which occurs in 13%–60% of women with PROM, placental abruption, and postpartum endometritis. While pre-term birth, infection, hypertensive disease, and asphyxia are cited as the most common contributors to maternal and fetal mortality in developing countries.[19-21] Nigeria is one of the few countries that contribute to about more than 50% of the maternal and neonatal deaths globally. Generally, the three main causes of neonatal death associated with PROM are sepsis, asphyxia, and pulmonary hypoplasia. Therefore, prompt diagnosis and proper management is very important to limit various fetal/neonatal and maternal complications. The aim of the study was to document the Prevalence of PROM among parturient mothers and determine the maternal and neonatal survival following a premature rupture of membranes at neonatal and labor wards of the University of Maiduguri Teaching Hospital Maiduguri, North-Eastern Nigeria.

Subjects and Methods

Study area

This retrospective study was conducted over a 5-year period at the labor ward of the Department of Obstetrics and Gynaecology and the Special Care Baby Unit (SCBU) of the Department of Paediatrics of the University of Maiduguri Teaching Hospital (UMTH). This is a tertiary institution with 600 bed capacity that serves as referral Hospital for the six states in the North-Eastern zone of Nigeria. It also receives referral from neighboring countries like Niger, Chad, Cameroon and Central African Republic. The labor ward has eleven bed delivery suites and operating theatre, while the SCBU has 36 bed neonatal unit which admit sick babies from the facility labor ward and those babies referred from other hospitals. It has 8 incubators, 2 warm cots, 20 neonatal beds and four resescutaires and central oxygen source. The unit has compliments of 2 consultants, 1 senior registrar, 2 registrars and 2 house officers and at least 3 nurses per shift.

Study sample

All pregnant women who had history of premature rupture of amniotic membrane (PROM) or came to labor ward with draining of liquor before onset of labor and delivered at our labor ward with their babies were entered into the study from 2012 to 2016. The diagnosis of ruptured amniotic membrane was established by Obstetric residents or the attending Consultant Obstetrician clinically at the labor ward. Gestational age was established from the first day of last menstrual period and/or dating scan. Those excluded from the study were multiple gestations, in active labor or fetal malformations.

Data extraction

Out of 91 folders 73 were traced and had complete information, giving the retrieval rate of 80.2%. Data were extracted from the available folders. The parameters entered into the proforma include: maternal age, height, weight, history of hypertension, diabetes mellitus, history of urinary/genital tract infection, history abortion or loss of pregnancy, antenatal care, parity, previous PROM, PROM to onset of labor, color of liquor, mode of delivery, also extracted includes prenatal/antenatal corticosteroids and/or antibiotics administrations. Data extracted from the folders of their corresponding neonates that were managed in SCBU includes: Apgar score at 1 minute and 5 minutes, birth weight, respiratory system findings, color of the baby, indication for admission such neonatal as sepsis, pneumonia, RDS, and prematurity.

Data analysis

Details from the study proforma were entered into the excel spread sheet. Descriptive analyses of frequencies, mean, median, and percentages for categorical variables were performed using SPSS v 16 (Chicago, IL, USA). The univariate logistic regression analysis was used to determine the relationship between predictors of maternal and neonatal implications, morbidities, and outcomes. Those variables that showed a statistically significant association in the univariate logistic regression analysis were entered into multivariate logistic regression to identify independent factors associated maternal and neonatal morbidities and outcomes. Also 95% confidence interval with corresponding odd ratio was used to determine the statistical significance of relationship among the variables. *P* value of less than 0.05 was used as cut off point of statistically significant association.

Ethical clearance

Ethical clearance was granted by the Research and Ethics Committee of the University of Maiduguri Teaching Hospital (UMTH). Data extraction was in strict compliance with confidentiality.

Results

The study duration was over five (5) years (1 January 2012-31 December 2016) and during this period, there were 7200 deliveries at the labor ward of the study center (UMTH) and of these 91 cases had PROM, giving a prevalence of (1.3%), out of which 73 (80.2%) cases were retrieved and analyzed. Eighteen were excluded due to incomplete information. Thirty-six women (49.3%) were delivered by emergency caesarean section (EMCS), while 37 (50.7%) were delivered vaginally (SVD). Of the 37 women delivered vaginally, 32 (86.5%) were cephalic presentation with 10 (31.3%) been forceps/vacuum assisted extraction, and 5 (13.5%) assisted breech deliveries.

Table 1: Socio-demographic characteristics of parturient mothers diagnosed with PROM

Variables	Responses	Frequency	Percent
Maternal age (yrs)	<18	5	6.8
	18-35	59	80.8
	>35	9	12.3
ANC	Booked	51	69.9
	Unbooked	22	30.1
Parity	Primipara	25	34.2
	Multipara	31	42.5
	Grandmultip	17	23.3
Duration of AF leaking (hrs)	≤24	22	30.1
	>24	51	69.9
Obesity	Yes	17	23.3
	No	56	76.7
Teenage pregnancy	Yes	5	6.8
	No	68	93.2
Maternal education	No formal education	50	68.5
	Prim/secondary	10	13.7
	Tertiary	13	17.8
Maternal occupation	FTHW	58	79.4
	Civil servant	7	9.6
	Self employed	8	11.0
Socioeconomic status	High social class	9	12.3
	Middle social class	6	8.2
	Low social class	58	79.5

Table 1 Presents the socio-demographic characteristics of mothers that had PROM. 59 (80.8%) of the mothers with PROM were within the age range of 18–35 years. Mothers who were <18 years accounted for population (6.8%). Only 17.8% of the patient had tertiary education as most of them either had no formal education (68.5%) or with primary/secondary education (13.7%). 79.5% of the mothers were in the lower class while (8.2%) in the middle class of the social diversity. Majority of the women were full time house-wife (79.4%). Majority of the mothers (69.1%) had booked for ANC with 42. 5% of the 73 mothers being multipara. 51 (69.9%) mothers had AF leakage >24 hours, 23.3% (17) of them were obese.

Table 2 Present the three models on multivariate regression analysis of factors modifying maternal and neonatal favorable outcome with varying sensitivity cut-off using *P* value in the bivariate (crude) analysis. Table 2 (model 1) presents adjusted analysis without recourse to the *P* value in the crude analysis. When further models applies and adjusted analysis using a *P*- value cut-off of <0.5 in the corresponding bivariate analysis and Table 2 adjusted output using *P* value <0.2 as cut-off from the bivariate (crude) analysis there were no significant differences observed.

In the bivariate (crude) analysis, APGAR score <7 at 5 minutes ($P = 0.008$, OR 95% CL: 0.092 (0.011, 0.742), birth weight ≥2500 g ($P = 0.006$, 8.944 (1.892, 42.284), and absence of APH ($P = 0.007$, 4.83 (1.440, 16.196) were factors modifying

neonatal outcome. While neonates with APGAR score <7 have 90% reduction in favorable outcome compare with neonates with APGAR score ≥ 7, neonates with birth weight ≥2500 g were 8.9 time more likely to produce favorable outcome. Those without APH were 4.8 time favored with outcome.

When the regression analysis was adjusted with consideration to only factors with *P* value <0.2 in crude analysis as shown in model 3, only birth weight ≥ 2500 g ($P = 0.024$, 6.677 [1.286, 34.664]) and absence of APH ($P = 0.038$, 4.406 [1.085, 17.883]) were independent predictors of neonatal outcome. After adjustment, neonates with birth weight ≥2500 g were about 6.7 times more like to show favorable outcome than those with birth weight <2500 g while those without APH showed 4.4 times more likelihood for a favorable neonatal outcome.

Table 2: Model 1: Multivariate regression analysis of factors modifying neonatal favourable outcome with varying sensitivity cut-off point

Variable		COR						AOR		
	Responses	Total number	Favourable	Un-favourable	*P*	OR	95% CI	*P*	OR	95%CI
ANC	Yes	51	20 (39.2	31 (60.8)	Ref					
	No	22	5 (22.7)	17 (77.3)	0.137	0.460	0.145-1.432	0.815	1.235	0.210-7.260
Mat age (yrs)	<18	5	2 (40.0)	3 (60.0)	0.322	5.330	0.343-82.837	0.588	2.455	0.095-63.331
	18-35	59	22 (37.3)	37 (62.7)	0.154	4.761	0.557-40.623	0.688	1.686	0.132-21.529
	>35	9	1 (11.1)	8 (88.9)	Ref					
Parity	Primi	25	7 (28.0)	18 (72.0)	Ref					
	Multip	31	12 (38.7)	19 (61.3)	0.402	1.624	0.523-5.044			
	G/multip	17	6 (35.3)	11 (64.7)	0.616	1.403				
Liquor drainage (hrs)	≤24	22	8 (36.4)	14 (63.6)	Ref					
	>24	51	17 (33.3)	34 (66.7)	0.802	0.879	0.308-2.490	0.243	0.387	0.079-1.901
A/S at 5 min	<7	16	1 (6.2)	15 (93.98)	0.008	0.092	0.011-0.742	0.111	0.124	0.009-1.620
	>7	57	24 (42.1)	33 (57.9)	Ref					
Birth weight (g)	<2500	23	2 (8.7)	21 (91.3)	Ref					
	≥2500	50	23 (46.0)	27 (54.0)	0.006	8.944	1.892-42.284	0.013	11.303	1.655-77.192
Mat. anemia	Yes	8	2 (25.0)	6 (75.0)	Res					
	No	65	23 (35.4)	42 (64.6)	0.559	1.643	0.306-8.807	0.553	0.523	0.061-4.455
Mat fever	Yes	15	6 (40.0)	9 (60.0)	Ref					
	No	58	19 (32.8)	39 (67.2)	0.598	0.731	0.227-2.353)			
APH	Yes	27	4 (14.8)	23 (85.2)	Ref					
	No	46	2 (45.7)	25 (54.3)	0.007	4.830	1.440-16.196	0.030	5.423	1.183-24.859
Preeclampsia	Yes	30	8 (26.7)	22 (73.3)	Ref					
	No	43	17 (39.5)	26 (60.5)	0.254	1.798	0.652-4.957	0.968	1.029	0.253-4.177
Cervical incompetence	Yes	9	2 (22.2)	7 (77.8)	Ref					
	No	64	33 (35.9)	41 (64.1)	0.417	1.963	0.376-10.247	0.494	2.166	0.237-19.802

*A/S, Apgar score at 5 minutes; APH, Antepartum haemorrhages; Mat, Maternal; ANC, Antenatal care

Table 3: Antenatal corticosteroids and associated neonatal outcome

Variable	Outcome			Total	χ^2	*P*
Gestational age (wks)	Alive with complication	Alive without complication	Dead			
≤24	0 (0.0)	0 (0.0)	0 (0.0)	0		
24-28	0 (0.0)	2 (100.0)	0 (0.0)	2	3.132	0.002
29-32	0 (0.0)	3 (60.0)	2 (40.0)	5		
33-34	1 (100.0)	0 (0.0)	090.0)	1		
35-≤37	0 (0.0)	3 (100.0)	0 (0.0)	3		
>37	25 (40.3)	32 (51.6)	5 (8.1)	62	6.721	0.031*
Total	26	40	7	73		
Birth weight						
≤1000	0 (0.0)	5 (83.3)	1 (16.7)	6	1.220	0.033
1000-1449	0 (0.0)	7 (87.5)	1 (12.5)	8		
1500-2449	1 (11.1)	7 (77.8)	1 (11.1)	9		
>2500	24 (48.0)	22 (44.0)	4 (8.0)	50	12.331	0.209
Total	25	41	7	73		

Factors including ANC, maternal age, parity, APGAR score at 5 minutes, maternal anemia, preeclampsia, and cervical incompetence show no correlation with the neonatal.

Table 3 Shows neonates whose mother had premature rupture of membrane and had corticosteroids. There was no case of PROM less than 24 weeks gestation. Two women with PROM between 24 and 28 weeks given corticosteroids both babies survived with no complications. Five women with PROM between 29 and 32 weeks gestation given corticosteroids, 3 of their babies alive without complications, and 2 died. One mother with PROM at gestational 33–34 weeks given corticosteroids, baby is alive but was treated for severe neonatal jaundice. There were 3 women with gestational age at 35–37 weeks had corticosteroids. All the babies are alive with no complications, $P = 0.002$. There were 62 women with PROM >37 weeks who did benefitted from corticosteroids. Of these 32 babies alive with no complications. 25 babies alive with various morbidities and five died, $P = 0.031$. Based on birth weight, 5 babies ≤1000 g alive with complications while one died. There were 24 babies alive with complication among those with birth weight >2500 g, while 4 died. There were 22 babies alive with complication among those with birth weight >2500 g, $P = 0.209$.

Of the 73 neonates, 11 (15.1%) were delivered preterm, while the remaining 62 (84.9%) were term neonates. Of the 11 preterm delivered following PPROM and whose mother had corticosteroids only 2 (18.2%) died.

Discussion

This retrospective study was conducted to determine the prevalence of PROM/PPROM and as it relates to the neonatal and maternal survival in this part of the world. It was also an audit to review of factors that determine the survival of preterm neonates. In this study, our finding reveals the overall incidence of PROM was 10.3/% PPROM 3.2/%, PROM at term 6.9/%. This was higher than that reported by Endale *et al*.[12] Ladfors *et al*.[22] but was similar to 6.9% reported by Dars *et al*.[23] among term newborns and Eleje *et al*.[24] who reported 2.4% from south-eastern Nigeria.

Unlike reports from other studies,[11,25] who reported that low social class, primiparity, advanced maternal age had influenced the outcome of PROM negatively, in this study mothers in lower social class constituted 79.5%, multipara mothers accounted for 65.8% and majority of the mothers 80.3% were between 18 and 35 years. The result of this study was higher than that by Sharma *et al*.[26] who reported that the incidence of PROM at term accounted 8%, but when PROM before 37 weeks of gestation was included, it was similar to our report. No significant direct relationship was established between the duration of PROM and adverse maternal or neonatal outcome. This supported the report by Eleje *et al*.,[24] that mothers with PROM greater than 24 hours were not associated with unfavorable outcome to the mother and neonatal pair. This may not be unrelated to the general practice of restriction/limited vaginal examination as a routine foe all cases of PROM.

In this report, 69.9% of the women had ANC and delivered in the hospital following rupture of amniotic membrane. 69.9% were delivered after 24 hours of rupture of membranes which was not a surprise finding as all had corticosteroids given. These findings corroborated with similar work by Wang *et al*.[27] who documented 54.8% of the mothers were delivered via emergency caesarean sections due to previous scar and/or failed trial of labor or latent period was beyond 24 hours, 45.2 had spontaneous vaginal delivery. This concurs with similar findings reported by Omole-Ohonsi *et al*,[28] that CS did not influence the outcome delivery. 42 (57.5%) had pre-labor course antibiotic to reduce the risk of chorioamnionitis/puerperal sepsis and neonatal sepsis. Passos *et al*.[29] also reported that all mothers who had pre-labor antibiotics had low risk of sepsis in mother-neonate pair.

In this study (84.9%) of the PROM cases occur after 37-week gestation. These women didn't require corticosteroids and labor should have been stimulated within 24 hours of PROM. It is said that spontaneous rupture of membrane occur due to rise in fetal plasma cortisol, increase in maternal oestrogen followed immediately by fall in maternal progesterone and these change in oestrogen-progesterone ratio promote release of prostaglandin thereby thinning of amniotic membrane leading to rupture of membrane and has been reported in literature which further support these report.[21]

Regression analyses of all the maternal variables with initial bivariate (crude) analysis and APGAR score of >7 at 5 minutes, were factors that had a favorable influence on the subsequent management and outcome on the neonates. Birth weight of ≥2500 g, was also a factor that had influence on smooth neonatal transition and subsequent adaptation to extra uterine life. Absence of antepartum hemorrhage, had favorable outcome on neonatal transition and maternal postpartum condition. This finding was also supported by similar works in which low APGAR score, low birth weight and stained amniotic fluid were unfavorable factors.[12]

In this study, use of corticosteroids in parturient mothers with PPROM, showed significant improvement in the survival outcome of the preterm neonates as 9/11 (81.8%). This finding is similar to report by Alex *et al*.[2] Use of corticosteroids enhances surfactants production and lung maturity among preterm birth hence

favorable outcome. The common morbidities associated with these neonates were neonatal jaundice 42.5%, perinatal asphyxia 31.5%, respiratory related problems 42.5%, and sepsis 56.2%.

The common morbidities and complications among mothers consisted of malaria 19.2%, urinary tract infections 15.1%, fever 20.5%, and anemia 11.0% which were treated successfully during the peripartum period. These findings concur with similar outcomes observed by other workers.[12,23] No maternal mortality was recorded amongst women with PROM probably due to prompt administration of antibiotic to the parturient women admitted with PROM. Overall these reports neonatal mortality of 9.6% was higher than reports from other developing countries.[3] Also, these report may not be representative statistics of 5-year study and so should be applied with caution, but we believe that there are lessons to learn from these findings.

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Conflicts of interest

There are no conflicts of interest.

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