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Expectant Management of Preterm Ruptured Membranes before 34 Gestational Weeks at the University Hospital of Kinshasa, a Tertiary Referral Hospital in the Democratic Republic of Congo

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Abstract

Premature Rupture of Membranes (PROM) with the resulting prematurity remains a major public health issue in the Democratic Republic of Congo (DRC). This study aimed to assess expectant management of PPROM before 34 weeks at the university hospital of Kinshasa. We conducted a retrospective analysis of expectantly managed PROM before 34 weeks between January 2008 and December 2018. Maternal and fetal outcomes were collected, and all data were analyzed using the SPSS 23.0 software. Of the 113 patients included in the study, 2.6% were diagnosed with PROM before 34 weeks. We observed prolongation of the pregnancy duration; the median latency period was eight days, and the average gestational age at delivery of 32.85 ± 2.5 weeks. Chorioamnionitis (23%), severe oligoamnios (7%), and acute fetal distress (4%) were complications observed during the latency period. In the postpartum period, endometritis (6.2%), neonatal jaundice (39.8%), anemia (25.7%), ulcerative necrotizing enterocolitis (6.2%), cerebromeningeal hemorrhage (5.3%), and acute respiratory distress syndrome (4.4%) were complications observed. The risk of infection during the latency period was significantly associated with irregular (P = 0.045) or lack (P = 0.006) antenatal care (ANC) attendances and C-Reactive Protein (CRP) results < 6 (P = 0.013). The risk of neonatal death was significantly associated to infection during the latency period (P = 0.011), irregular (P = 0.009) or lack of ANC (P = 0.000) attendances,

Birth weight <1000 g ($P = 0.039$) as well as Gestational age at birth between 28 to 30 Weeks (S) ($P = 0.021$). These findings report first-time pregnancy outcomes related to the management of PPROM before 34 weeks in our setting. We found that the conservative attitude adopted allowed the prolongation of pregnancies, reducing the risks associated with prematurity. Nevertheless, attendance in good quality ANC could reduce the frequency of PROM and related adverse outcomes.

Keywords

Premature Rupture of Membranes, Gestational Age, Expectant Management, Pregnancy Outcomes, D. R. Congo

1. Introduction

Premature rupture of membranes (PROM) is the rupture of the fetal membranes before labor initiation. In most cases, this occurs near term, but when membrane rupture occurs before 37 weeks gestation, it is called preterm premature rupture of membranes (PPROM) [1]. PPROM is often the consequence of a premature weakening of the membranes due to various constitutional and external causes, among which infection seems to play a dominant role. The resulting vaginal fluid losses are a frequent reason for obstetrics consultations [1] [2].

Worldwide, the incidence of PPROM varies between 2% to 3% for single pregnancies, 7% - 20% for multiple pregnancies, almost 10% for term pregnancies, and 3% for preterm pregnancies. It is responsible for 30% to 60% of premature deliveries and about 10% of perinatal deaths [3] [4]. In the Democratic Republic of Congo (DRC), the frequency of PROM is 18.3%, with prematurity as the main complication causing 80% of perinatal mortality [5].

The management of PROM depends mainly on the fetus's gestational age and other complicating factors such as the presence or not of infection and the fetal state. In term pregnancies, active management with immediate delivery is associated with lower adverse perinatal outcomes. However, the ideal management of patients with PPROM is not well defined. Before 34 weeks of gestation, management remains controversial. Some authors recommend immediate delivery by induction of labor or cesarean section (depending on each case); others prefer expectant management to prolong the pregnancy and gain more days. The primary maternal risk with expectant management of PPROM is infection [6]. The risk of postponing delivery must be balanced against iatrogenic prematurity [7]. Prematurity is accompanied by a significant increase in neonatal morbidity and mortality, mainly when the PPROM occurs earlier [8]. Prophylactic antibiotics in cases of PPROM before 34 weeks are recommended to reduce the risk of maternal and fetal infections [9]. Moreover, tocolysis and antenatal corticosteroids are also included in the treatment to reduce prematurity and prolong the pregnancy closer to 34 weeks, during which neonatal morbidity is similar to that of

children born in term [10]. Between 34 and 37 weeks, the risk of rare severe morbidity related to prematurity is balanced against an acute infection or a maternal-fetal placental abruption. Hence, physicians should avoid the urge to prolong pregnancy [11].

In D.R. Congo, a country with limited resources, the lack of neonatal intensive care unit (NICU) access is a limiting factor in the proper management of PPROM and prematurity that remains a major public health issue. Therefore, to improve the neonatal prognosis, the department of gynecology and obstetrics of the university hospital of Kinshasa, a tertiary referral hospital, implemented the expected management of PPROM with the postponed delivery close as possible to 34 weeks gestation. However, the benefit of such as attitude has never been evaluated. Hence, the current study aimed to assess expectant management of PPROM before 34 weeks applied in the University hospital of Kinshasa, D.R. Congo.

This study determines the frequency of PPROM before 34 gestation weeks in the university hospital of Kinshasa, identifies maternal-neonatal complications associated with the expectant management of PPROM, and assesses factors associated with these complications.

2. Materials and Methods

2.1. Materials and Methods

2.1.1. Study Design and Setting

We conducted a retrospective study using medical records of pregnant women admitted to the University Hospital of Kinshasa, a tertiary referral hospital, in Kinshasa (Capital city of the DRC), from January 2008 to January 2018.

2.1.2. Population Studied

We included 113 patients with singleton pregnancies admitted for spontaneous PROM between 28 and 34 weeks of gestation (confirmed by the clinical, laboratory, and/or imaging tests) and treated by expectant management. The gestational age of each patient was based on their last menstrual period (LMP) and confirmed by the 1st-trimester obstetric ultrasonography. Twin pregnancies and those associated with maternal chronic diseases such as chronic arterial hypertension, pre-eclampsia, systemic lupus erythematosus, diabetes mellitus, and thrombophilia were excluded.

2.1.3. Operational Definitions

In our research, before 28 completed weeks, pregnancy losses are considered miscarriages because of the lack of NICU access in countries with limited resources (including DRC).

The diagnosis of PROM was made in the presence of the following clinical/laboratory signs: typical history of fluid loss by the external cervical os, clinical presence of a moist vulva, visualization of fluid in the vaginal sac during the specular examination, and a positive crystallization test. Obstetric ultrasound was

not used to diagnose PROM; however, in the presence of oligohydramnios associated with suggestive and/or doubtful clinical signs, patients were treated for PROM. Oligohydramnios was defined by an amniotic fluid index (AFI) measuring less than 5 cm or by the largest pocket of amniotic fluid measuring less than 2 cm in the ultrasonic examination.

According to the University Hospital of Kinshasa's protocol, pregnant women diagnosed with PPROM between 28 and 34 weeks of gestation are hospitalized and monitored expectantly. Maternal monitoring occurs through clinical evaluation daily and laboratory every 2 - 3 days. For maternal infectious screening, the following tests are ordered: blood count, C-Reactive Protein (CRP) test, urine type 1, urine Sediment Examination, urine culture, and bacterioscopy of vaginal secretions. Fetal monitoring occurs through daily cardiotocography and obstetric ultrasound with Doppler. Antibiotic prophylaxis is always performed upon admission immediately after the diagnosis of PPROM. Tocolytic therapy is also included in the treatment. Delivery is indicated according to the obstetric and pediatric conditions and the availability of a NICU. It is immediate when there are clinical or laboratory signs of maternal infection and chorioamnionitis. Clinical chorioamnionitis was defined as an axillary temperature > 38˚C and no other cause of diagnosed fever, in addition to CRP > 6 mg/dl or fetal tachycardia. Neonatal infection was diagnosed by positive culture from a sample collected in an ordinarily sterile location associated with clinical signs of infection or elevated neonatal CRP (>6 mg/dl).

The risk of maternal infection is defined as "the potential causes linked to microbiological contamination which can lead to infectious consequences" [12]. According to previous studies [13] [14] [15], the maternal infectious risk was considered when the patient met the following criteria: history of excess digital vaginal examinations before reaching our hospital, a latency period on admission ≥ 12 hours, irregular or no antenatal care attendance (ANC), a suspicion of local infection (cervicovaginal and urinary tract), poor hygiene. The risk of Early-Onset Neonatal Infection with Maternal Infection was defined by:

- Maternal fever > 38.0˚C, isolated or not (signs of associated chorioamnionitis) in per-partum, and this regardless of the status of the Group B Streptococcus (GBS) screening results;
- Maternal colonization with GBS during the current pregnancy (positive GBS screening results either by culture, either by rapid per-partum PCR, and/or GBS bacteriuria), except for those who have given birth by cesarean section before the onset of labor and with intact membranes;
- History of neonatal GBS infection in a previous pregnancy;
- In case of unknown GBS status (culture not performed or result not available, rapid intrapartum PCR with invalid or unavailable result) and: a membrane rupture time > 12 hours or spontaneous and unexplained prematurity < 37 weeks;
- Local infection (cervicovaginitis and/or urinary tract infection).

2.1.4. Data Collection

The data were registered from medical records containing the needed informationusing Microsoft Excel (Microsoft Corporation, Red-mond, WA, USA, 2007). The following variables were collected: ANC attendance, Apgar score at the 1st and 5th minutes, birth weight, length of stay in the NICU, presence of neonatal infection (neonatal sepsis), need for oxygen therapy within 24 hours of delivery, use of surfactant, the number of deliveries between 48 hours and 7 days after the diagnosis of PPROM, presence of chorioamnionitis and maternal sepsis, the time between PPROM diagnosis and labor (latency period), type of delivery, and demographic data of the pregnant women (age, ethnicity, parity, smoking, drinking, and the presence of comorbidities). Patients were categorized as having an adverse perinatal outcome based on the presence of at least one adverse perinatal outcome. Perinatal adverse outcomes included the following: chorioamnionitis, maternal sepsis, neonatal sepsis, Apgar score < 7 at the 5th minute, admission to the NICU, use of surfactant, and oxygen therapy after delivery.

2.2. Statistical Analysis

The data were analyzed using the SPSS 23.0 (SPSS Inc., Chicago, IL, USA). The quantitative variables were summarized as mean ± standard deviation (SD). The median and interquartile range (IQR) were used when the dispersion of values apart from the SD was relatively large. The categorical variables were summarized as frequencies and compared using the Pearson chi-square test. The odds ratios (ORs) with 95% confidence intervals (CIs) were used to measure the association between the occurrence of infection during the latency period or neonatal death and study variables. A P-value of less than 0.05 was considered statistically significant.

3. Results

3.1. Frequency of PPROM Occurring before 34 Weeks

From January 2008 to January 2018, 4274 deliveries were recorded in the university hospital of Kinshasa. Among the 509 (11.9%) deliveries diagnosed with PPROM registered, 396 (9.3%) occurred after 34 weeks, and 113 (2.6%) occurred before 34 weeks of gestation. For the final statistical analysis, 113 participants with PPROM before 34 weeks were included (**Figure 1**).

3.2. Clinical Characteristics of the Study Population

The clinical characteristics of participants and their newborns are shown in **Table 1**.

For the majority of respondents, ANC attendance was irregular (49/113, 43.4%), gestational age at admission in the hospital varied between 31 - 33 weeks (66/113, 58.4%), labor occurred spontaneously (62/113, 54.9%), and gestational age at delivery varied between 31 - 33 weeks (64/113, 56.6%). Most participants had a vaginal delivery (95/113. 84.1%). Among 18 (15.9%) women who underwent

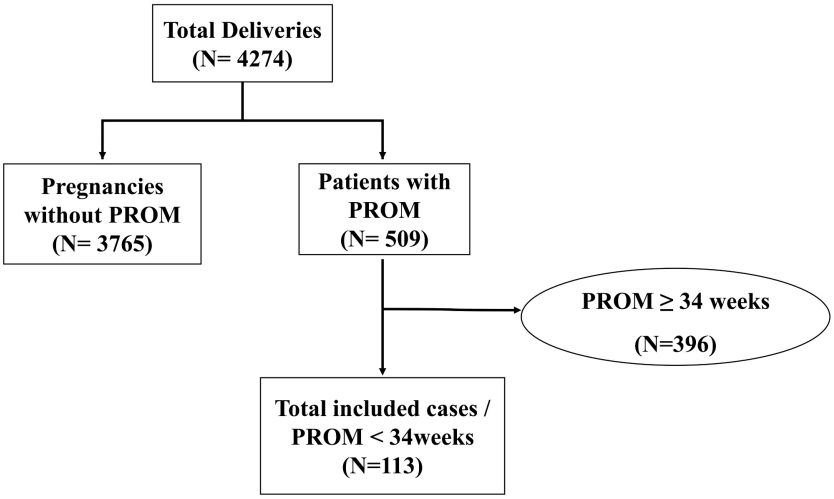

Figure 1. Flowchart of the cases included in the study.

cesarean, 17 (15%) were scheduled for c-section, and one was an emergency (0.9%) (Table 1). Most newborns weighed more than 1500 g (68/113; 60.2%) (Table 1).

3.3. Perinatal Outcomes in PPROM before 34 Weeks after Expectant Management

3.3.1. Prolongation of Pregnancy

In Table 2, we compare the gestational age between the day of admission to the hospital and the day of delivery.

Compared to gestational age at the day of admission to the hospital, the proportion of pregnanciesaged between 28 - 30 gestation weeks significantly decreased ($P = 0.0002$) on the day of delivery (birthday), while the proportion of pregnancies of at least 34 weeks increased considerably ($P < 0.0001$) (Table 2). Interestingly, the median duration of the latency period was eight days and ranged from 0.17 and 39.08 days (Table 1), indicating that the expectant management of PPROM allowed the prolongation of pregnancy for around a week.

3.3.2. Maternal Outcomes

Figure 2 shows maternal outcomes in patients with PPROM before 34 weeks treated by expectant management during the latency and postpartum period.

During the monitoring in the latency period, most patients (62/113; 54.9%) spontaneously entered labor without complications. Intra-uterine infection (chorioamnionitis) (6/113, 23%), risk of maternal infection (8/113, 7.1%), and severe oligohydramnios (8/113, 7.1%) were complications mostly observed during this period (Figure 2).

After delivery (postpartum period), most respondents (101/113, 89.4%) had a good evolution. Assessing adverse postpartum outcomes, we observed that endometritis occurred in seven patients (6.2%), infection of the episiotomy wounds in four patients (3.5%), and infection of the cesarean wound in one patient (0.9%) (Figure 2).

Table 1. Clinical characteristics of participants.

Variables	N (%)	Mean ± SD	Median (IQR)
Maternal characteristics			
▪ **Antenatal care (ANC) attendance**			
- Regular	29 (25.6)		
- Irregular	**49 (43.4)**		
- Not attended	**35 (31.0)**		
▪ **PPROM duration at admission (h)**			**15 (1 - 40.80)**
- 0 - 24	**78 (69.0)**		
- 25 - 48	12 (10.6)		
- 49 - 72	7 (6.2)		
- >72	16 (14.2)		
▪ **Gestational age at admission (weeks)**		**32 ± 3**	
- 28 - 30	39 (34,5)		
- 31 - 33	**66 (58.4)**		
- 34	8 (7.1)		
▪ **Latency duration (d)**			**8 (0.17 - 39.08)**
- <8	53 (46.9)		
- ≥8	60 (53.1)		
▪ **Mode of Labor Onset**			
- Spontaneous	**62 (54.9)**		
- Inducing labor	34 (30.1)		
- No labor onset (Scheduled cesarean)	17 (15)		
▪ **Reasons for labor induction**			
- Infection (chorioamnionitis)	26 (23)		
- Risk of Infection	8 (7.1)		
▪ **Gestational age at delivery (weeks)**		**32.8 ± 2.5**	
- 28 - 30	14 (12.4)		
- 31 - 33	**64 (56.6)**		
- ≥34	35 (31.0)		
▪ **Type of delivery**			
- Vaginal	**95 (84.1%)**		
- Cesarean section (c-section)	18 (15.9%)		
○ Scheduled c-section	17(15%)		
○ Emergency c-section	1 (0.9)		
Newborn's characteristics			
▪ **Birth weight (g)**			
- <1000	20 (17.7)		
- 1000 - 1500	25 (22.1)		
- 1501 - 2000	**31 (27.4)**		
- >2000	**37 (32.8)**		

Table 2. Comparison of gestational age at admission and at delivery.

Gestational age (weeks)	at admission	at delivery	*P value*
28 - 30	39 (34.5)	14 (12.4)	0.0002
31 - 33	**66 (58.4)**	**64 (56.6)**	0.8893
≥34	8 (7.1)	35 (31.0)	<0.0001

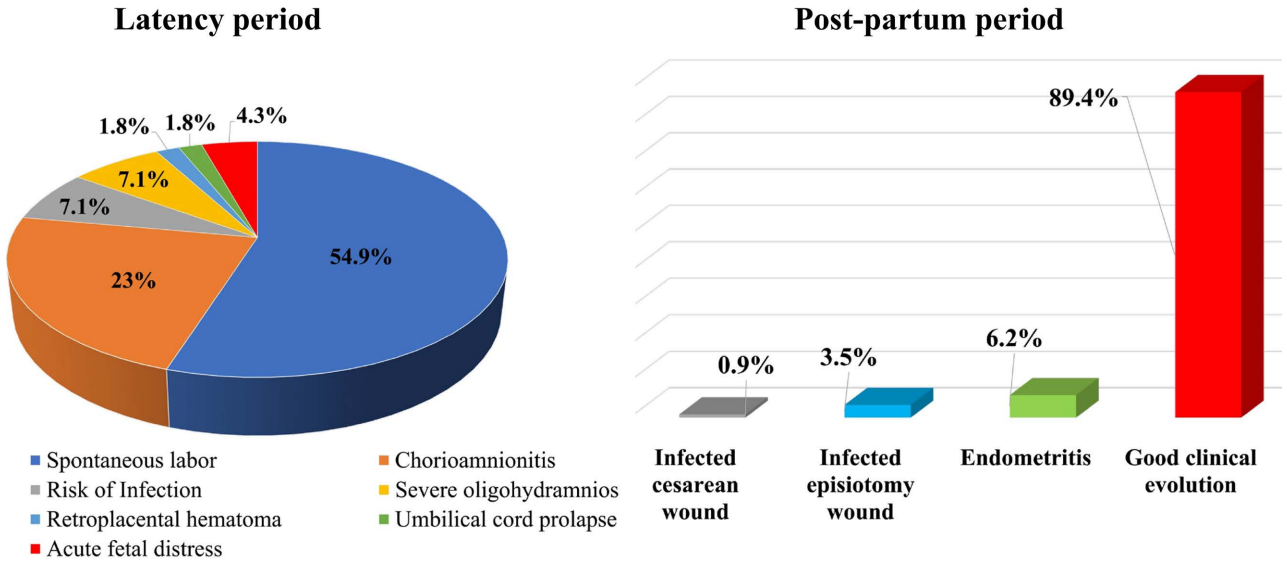

Figure 2. Maternal outcomes during latency and postpartum periods.

3.3.3. Neonatal Outcomes

Table 3 shows the frequencies of newborn outcomes observed in early and late neonatal periods.

In the early neonatal period, we observed that the risk of EONNI-MI was present for 46 newborns (40.7%) (Table 3). A significant proportion of these premature infants had hypoglycemia (28/113, 24.8%), and 7.9% (9/113) were affected by EONNI-MI (Table 3).

The most common complication in the late neonatal period was neonatal jaundice with 39.8% (45/113), followed by anemia with 25.7% (29/113) (Table 3).

The frequency and direct causes of neonatal death are presented in Figure 3.

This study found a high frequency of neonatal death among newborns (39/113, 34.5%) (Figure 3). These deaths were primarily caused by EONNI-MI (12/79, 30.7%), followed by prematurity (6/79; 15.4%) (Figure 3).

3.4. Factors Associated with Maternal and Neonatal Outcomes in PPROM before 34 Weeks Undergoing Expectant Management

3.4.1. Factors Associated with Maternal Outcomes

Our results show that most respondents irregularly attended or did not attend ANC appointments. Besides, the majority of them were infected or had a risk of infection during the latency period. Therefore, we assessed the potential factors

Table 3. Frequency of neonatal outcomes.

Early neonatal period n (%)		Late neonatal period n (%)	
No complication	16 (14.2)	No complication	21 (18.6)
Perpartal asphyxia	4 (3.5)	Neonatal jaundice	**45 (39.8)**
HMD	1 (0.9)	NEC	7 (6.2)
Hypoglycemia	**28 (24.8)**	ARDS	5 (4.4)
Hypocalcaemia	7 (6.2)	Anemia	**29 (25.7)**
EONNI-MI	**9 (7.9)**	CMH	6 (5.3)
Risk of EONNI-MI	**46 (40.7)**		
CMH	2 (1.8)		
Total	113 (100)	Total	113 (100)

HMD: hyaline membrane disease; EONNI-MI: Early-Onset Neonatal Infection with Maternal Infection HCM: cerebromeningeal hemorrhage; NEC: Necrotizing enterocolitis; ARDS: acute respiratory distress syndrome; CMH = Cerebromeningeal hemorrhage.

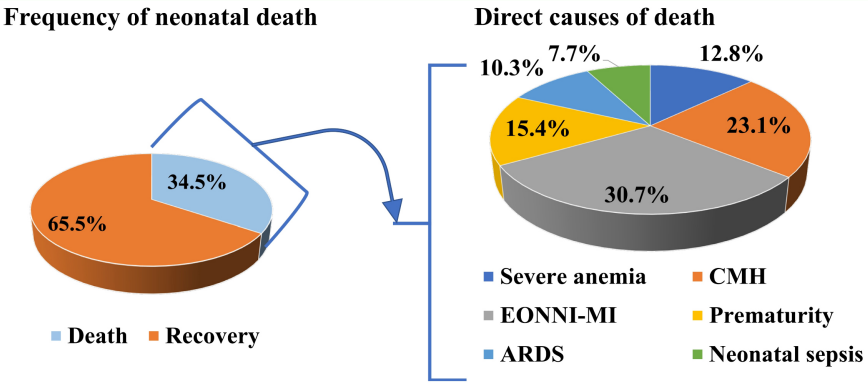

Figure 3. Frequency and etiology of neonatal death.

associated with the occurrence of infection during the latency.

Table 4 shows risk factors for infection during the latency period in bivariate analysis.

Most women infected during the latency period did not attend the ANC appointment (21/48, 43.8%) or attended irregularly (16/48, 33.3%). They had more than eightdays of latency period (27/48, 56.3%) and increased CRP results (44/48, 91.7%) (Table 4).

Compared to patients who regularly attended ANC, those who never attended ANC had a 4-fold risk, and those who irregularly attended had a 4-fold risk of developing infection (Table 4). The risk of infection was also 8-fold higher in patients with CRP less than 6 mg/dl than those with CRP results equal to or higher than 6 mg/dl (Table 4).

3.4.2. Factors Associated with Newborn Outcomes

Our results showed that the frequency of neonatal death was high. Therefore, in Table 5, we assessed factors associated with neonatal death.

Table 4. Bivariate analysis showing risk factors for the occurrence of infection during the latency period.

Variables	No infection n (%)	Infection n (%)	OR (95% CI)	*P-value*
ANC attendance				
- Not attended	14 (21.5%)	21 (43.8%)	3.829 (1.465 - 10.008)	**0.006**
- Irregular	18 (27.7%)	16 (33.3%)	2.854 (0.981 - 8.303)	0.045
- Regular	33 (50.8%)	11 (22.9%)	1	
Latency period (days)				
- 0 - 7	33 (50.8%)	21 (43.8%)	1.168 (0.341 - 4.004)	0,804
- ≥8	32 (49.2%)	27 (56.3%)	1	
CRP (mg/dl)				
- ≤6	37 (56.9%)	4 (8.3%)	7.606 (1.530 - 37.824)	**0.013**
- >6	28 (43.1%)	44 (91.7%)	1	
Total	**65 (100)**	**48 (100)**		

OR: odds ratio; 95% CI: 95% confidence interval.

Among 39 patients with neonatal death, 18 did not attend ANC appointments (46.2%), 15 (38.5%) were infected during the latency period, 13 (33.3%) gave birth to babies weighing less than 1000 g, and 23 (58.9%) delivered before 31 gestational weeks (Table 5). The risk of neonatal death was 4-fold higher in patients who did not attend ANC appointments than those who attended regularly and 2-fold higher in infected women during the latency period than those who were not infected.

This risk was around 2-fold more increased in newborns weighing less than 1000 g than in those weighing at least 2000 g, 4-fold higher when age at birth varied between 28 and 30 weeks than those with at least 34 weeks (Table 5).

4. Discussion

This study aimed to assess expectant management of PPROM before 34 weeks as a therapeutic strategy used in the University hospital of Kinshasa to improve the maternal and neonatal prognosis. Therefore, we determined the frequency of PPROM before 34 gestation weeks and identified maternal-neonatal complications associated with the conservative management. Finally, we assess risk factors related to these complications.

Previous studies reported that PPROM before 34 weeks of gestation occurs in 1% of pregnancies [3] [16]-[22]. However, our results showed that PPROM before 34 weeks rate was higher and represented 2.6% of deliveries. This discrepancy

Table 5. Bivariate analysis showing risk factors for the occurrence of neonatal death.

Variables	Death n (%)	Recovery n (%)	OR (95% CI)	*P value*
ANC attendance				
- Irregular	18 (46.2)	31 (41.9)	1.645 (1.419 - 3.869)	0.009
- Not attending	13 (33.3)	22 (29.7)	3.983 (4.970 - 12.413)	0.000
- Regular	8 (20.5)	21 (28.4)	1	
Infection during latency				
- Yes	15 (38.5)	33 (44.6)	2.288 (1.584 - 5.841)	0.011
- No	24 (61.5)	41 (55.4)	1	
Birth weight (g)				
- <1000	13 (33.3)	7 (9.5)	1.639 (1.169 - 2.415)	0.039
- 1000 - 1500	10 (25.7)	15 (20.3)	1.306 (1.294 - 3.997)	0.004
- 1505 - 2000	7 (17.9)	24 (32.4)	0.958 (0.358 - 2.562)	0.932
- >2000	9 (23.1)	28 (37.8)	1	
Age at birth (weekdays)				
- 28 to 30	23 (58.9)	20 (27)	3.642 (1.217 - 10.898)	0.021
- 31 to 33	10 (25.7)	35 (47.3)	0.905 (0.285 - 2.875)	0.865
- ≥34	6 (15.4)	19 (25.7)	1	
Total	39	74		

OR: odds ratio; 95% CI: 95% confidence interval.

might be due to the difference in the accessibility, the use, and the quality of ANC services in study settings. These prior studies were from developed countries where good quality ANC care services were given, allowing early screening and management of risk factors for PPROM. Besides, this discrepancy could be accountable to the difference in the use of ANC care services in the different settings. Indeed, we observed that only 31% of our study population regularly attended ANC appointments in our study. This result is in line with World Health Organization (WHO) reports showing that, in sub-Saharan Africa, during the last two decades, the number of women attending ANC four or more times has

remained static [23], while in developed countries, this number increased.

Gestational age at delivery is one of the significant determinants of neonatal survival and morbidity [24]. Generally, women with PPROM should be expectantly managed at least until 34 weeks of gestation [17]. This conservative attitude aims to prolong the pregnancy and minimize prematurity complications. In our study, the proportion of pregnancy of at least 34 weeks significantly increased; the latency period's median duration was eight days, and the mean gestational age at delivery was 32.85 ± 2.5 weeks, indicating that our expectant management of PPROM effectively prolongs the pregnancy for around a week. Interestingly, prior studies suggested that the ability to extend latency for at least 1 to 7 days will result in improved neonatal outcomes by allowing time for treatment of the fetus (antenatal steroids and antibiotics, or other additional therapies) [25] [26] [27]. In addition, infants born before 32 gestational weeks have an increased risk of morbidity and mortality. This includes intraventricular hemorrhage, hyaline membrane disease, and necrotizing enterocolitis [28]. Together, these data suggest that prolonging pregnancy for about a week after admission could have positively affected pregnancy outcomes.

Infection represents the main maternal risk with expectant management of PPROM. In our study. In line with previous studies [29] [30] [31], we found that chorioamnionitis was mainly the maternal complication during the latency period, and endometritis was the most observed in postpartum period. Indeed, maternal risks with expectant management of PPROM includes chorioamnionitis (13% - 60%), endometritis (2% - 13%), sepsis (<1%), and maternal death (1 - 2 cases per 1000) [29]. Infection may be associated with PPROM as a cause or consequence. Often, infection before PPROM is subclinical [9] [26] and is thought to originate in the lower reproductive tract [32]. Following rupture of membranes, previous studies reported that ascending bacterial invasion can lead to intrauterine infection in up to 60% of cases without antibacterial treatment [33]. Therefore, better quality and use of ANC services (early detection risk factor of PPROM), maternal infectious screening, and antibiotic prophylaxis during expectant management might be critical in preventing and controlling the infection.

Neonatal complications in PPROM are primarily related to the gestational age at rupture of membranes and ascending infection [34]. We observed a high frequency of neonatal death, mainly caused by neonatal infection with Maternal Infection in the early neonatal period. Moreover, the risk of neonatal death increased in patients who did not attend ANC appointments in infected women during the latency period, when the newborn weight was less than 1000 g, and when the age at birth varied between 28 and 30 weeks. Our results align with Caughey AB *et al.* (2), reporting a 4-fold increase in perinatal mortality and a 3-fold increase in neonatal morbidity associated with PPROM. Newborns may acquire early-onset neonatal infection from endogenous bacteria in the mother's reproductive tract, which can cause disease in the newborn [35]. These ascend-

ing infections may occur before or during labor. After crossing through the vaginal canal, and amniotic sac, colonized bacteria from the maternal urogenital tract spread into the amniotic fluid [36] [37].

This study has some limitations. Due to their limited incomes, some patients couldn't complete all the required laboratory explorations, increasing our difficulties in analyzing biological results. However, this is the first large study assessing the impact of the conservative management of PROM in our setting, demonstrating the beneficial effect of that attitude on maternal and newborn outcomes.

5. Conclusion

In the university hospital of Kinshasa, the expectant management of PROM before 34 weeks allowed the prolongation of pregnancies, which could have positively affected pregnancy outcomes by reducing the risks related to prematurity. However, efforts to limit infectious complications that arise during the hospitalization of these premature babies remain needed. Moreover, awareness of communities on the importance of routine and timely ANC attendance could allow the early diagnosis and management of PROM. Further studies are required 1) to explore the challenges faced by women who visited ANC clinics and barriers to utilization of ANC among pregnant women; 2) to assess the impact of ANC attendance on PROM and related outcomes.

Ethical Consideration

The study was approved by the Ethics Committee of the School of Public Health, Kinshasa University, D.R. Congo, and patient consent was not necessary since it was a retrospective study.

Authors' Contributions

M.R.M was involved in conceptualization, funding acquisition, supervision, validation, Writing-review editing; M.A.M. performed the investigation, Data curation, formal analysis, Writing-original draft; M.A.M., L.A.J, K.K.B. and S.M. performed Data curation, Validation, Visualization, MAM was involved in the Methodology, Formal analysis, Software; TUA was in charge of Project administration, Resources, Supervision; BT supervised the Data curation, Validation, Visualization, Supervision; and K.P.M. prepared the draft manuscript, K.P.M. was involved in Data curation, Validation, Visualization, Writing-original draft, Writing-review editing.

Declaration of Competing Interest

The authors declare that there are no conflicts of interest.

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