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Determinants of preterm premature rupture of membranes and associated perinatal and maternal outcomes at General Justice Gizenga Mpanza Hospital, South Africa

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Abstract

Preterm Premature Rupture of Membranes (PPROM) is defined as the rupture of fetal membranes prior to the onset of labor, before 37 weeks gestation and remains a significant obstetric complication of pregnancy with high rates of perinatal morbidity and mortality worldwide. The aim of our study was to establish the determinants of PPROM <34 weeks at this GJG MRH hospital which has a high incidence of PPROM. It was a descriptive , retrospective chart review of women diagnosed with PPROM over a 1 year period from 1st of January 2018 to 31st of December 2018. Detailed clinical and demographic information was recorded. Statistical analysis was carried out using SPSS (Version 28.0 IBM, Armonk, New York, USA) of 7071 singleton deliveries, 428 were diagnosed with PPROM. Majority (69%) were between the age groups of 21 to 30 years. Women belonging to age groups of <20 years and >=30 years, including women who attend antenatal clinics >=4 times were less likely to experience PPROM. History of abortions, previous preterm delivery, previous PPROM and women who had infectious components were determinants of PPROM. Among the neonates delivered by women who had PPROM, 56.3% had an unfavorable outcome. *(Afr J Reprod Health 2024; 28 [2]: 31-42).*

Keywords: PPROM, determinants, maternal complications, fetal complications

Résumé

La rupture prématurée des membranes (PPROM) est définie comme la rupture des membranes fœtales avant le début du travail, avant 37 semaines de gestation et reste une complication obstétricale importante de la grossesse avec des taux élevés de morbidité et de mortalité périnatales dans le monde. Le but de notre étude était d'établir les déterminants de la PPROM <34 semaines dans cet hôpital GJG MRH qui a une incidence élevée de PPROM. Il s'agissait d'un examen descriptif et rétrospectif des dossiers de femmes diagnostiquées avec PPROM sur une période d'un an allant du 1er janvier 2018 au 31 décembre 2018. Des informations cliniques et démographiques détaillées ont été enregistrées. L'analyse statistique a été réalisée à l'aide de SPSS (version 28.0 IBM, Armonk, New York, USA) sur 7 071 accouchements uniques, 428 ont été diagnostiqués avec PPROM. La majorité (69 %) appartenait au groupe d'âge de 21 à 30 ans. Les femmes appartenant aux groupes d'âge <20 ans et >=30 ans, y compris les femmes qui fréquentent les cliniques prénatales >=4 fois, étaient moins susceptibles de souffrir de PPROM. Les antécédents d'avortements, les accouchements prématurés antérieurs, les antécédents de PPROM et les femmes présentant des composantes infectieuses étaient des déterminants de la PPROM. Parmi les nouveau-nés accouchés par des femmes atteintes de PPROM, 56,3 % ont eu une évolution défavorable. *(Afr J Reprod Health 2024; 28 [2]: 31-42).*

Mots-clés: PPROM, déterminants, complications maternelles, complications fœtales

Introduction

Preterm premature rupture of membrane (PPROM) remains one of the most challenging complications of pregnancy with ongoing debate on formulating optimal management strategies. Despite progress in obstetric and neonatal care over the past 20 years, the perinatal outcome in PPROM remains dismal. Serious complications of PPROM include chorioamnionitis leading to maternal and/or neonatal sepsis, placental abruption and stillbirth. Other neonatal complications include musculoskeletal morbidities, pulmonary hypoplasia/respiratory distress syndrome, intraventricular hemorrhage and necrotising enterocolitis.

Preterm premature rupture of membranes (PPROM) complicates 30-40% of all preterm births[1]. Serious complications of PPROM include chorioamnionitis leading to maternal and/or neonatal sepsis, placental abruption and stillbirth. The burden of neonatal morbidity and mortality has been considered so high that termination of pregnancy is generally offered due to extremely low fetal survival and concerns about lifelong neurological disability secondary to extreme prematurity[2]. Preterm premature rupture of membranes increases the perinatal mortality by 4 fold and neonatal morbidity by 3 fold[3]. The etiology of PPROM is obscure. In earlier studies low levels of amniotic fluid index[4,5] and HIV infection[6,7] have been implicated in the adverse pregnancy outcomes in patients diagnosed with PPROM. The results of these studies are inconclusive. More recently studies have focused on identifying determinants of PPROM [8,9] as understanding of these determinants are imperative to appropriate counseling and management of women facing this difficult complication. At GJGMRH hospital, the incidence of PPROM is high. Therefore, the aim of our study was to establish the determinants of PPROM at this hospital.

What this study adds

This study identified significant maternal morbidity =12.1% (=52/428), (p=0.02) of women that developed sepsis which was significant. This should alert healthcare workers to identify, monitor and manage sepsis timeously to prevent poor maternal outcomes. Neonatal outcomes were relatively favorable; 55.1% (n=152/276) of infants survived to hospital discharge; this would assist in counseling patients with PPROM. This can assist healthcare workers in decision making and optimal utilization of limited resources.

Methods

Study setting

The study was conducted at General Justice Gizenga Mpan za regional hospital (GJGMRH) is a 545-bedded Regional and district Hospital. The hospital is located in Kwa-Dukuza within the Ilembe health district in the province of Kwazulu Natal. The Hospital serves an estimated population of 600 000 from the Ilembe District. The institution also serves the three referring District Hospitals, two Community Health Centres and thirty-three primary health care clinics. The hospital has an average of 78% bed occupancy rate and an average length of stay of six (6) days. The hospital on average conducts 550 to 600 deliveries per month.There have been conflicts of autonomy of pregnant women with PPROM and her obligation of beneficence towards the fetus. Ethical dilemmas may arise when parents and medical professionals caring for women with PPROM and preterm deliveries disagree on the best course of action with regards to initiation, limitation or withdrawal of life sustaining medical treatment for their critically low birth weight neonates.

Ethical approval

The Biomedical Research Ethical Ethics committee approval was obtained from the Biomedical Research and Ethics Committee (BREC), University of KwaZulu Natal (Ref. Number: BREC 00005785/2023).

Study design

The retrospective chart reviews were conducted by the principal investigator (R.L. Rattan) using a predesigned data tool to obtain detailed maternal and neonatal information. Information regarding details of delivery, maternal and neonatal outcome were extracted from the admission files of both the mother and the neonate.

Maternal parameters including maternal age, parity, singleton pregnancies, and gestational age at PPROM were reviewed. Furthermore, parameters including weeks of gestation at delivery, mode of delivery, clinical chorioamnionitis, and obstetric complications were investigated. For obstetric history, data were collected on gravidity and parity, previous surgery on the genital tract or uterus including cesarean section and cervical cerclage, previous preterm labor or PPROM and current obstetric history. The medical history, HIV, syphilis, rhesus status were obtained from the first antenatal visit notes.

The neonatal folder was analyzed for birth weight, Apgar scores (5 minutes), the neonatal outcomes and any complications including, neonatal death, admission to the NICU, and major neonatal conditions (including patent ductus

arteriosus (PDA), respiratory distress syndrome (RDS), intraventricular hemorrhage (IVH), periventricular leukomalacia (PVL), necrotizing enterocolitis (NEC), and sepsis. Details of the type of pregnancy loss that occurred are presented by allocating newborns into one of five mutually exclusive groups: This includes intrauterine fetal death and post delivery losses or deaths before 20 weeks gestation, 20 to 24 weeks, 25 weeks to 29 weeks gestation and 30 to 34 weeks gestation. The primary outcome was the occurrence of perinatal mortality/morbidity before discharge.

Statistical analyses

The variables on the data sheet were captured on a Microsoft Excel spreadsheet and imported into SPSS version 28. Data were analyzed using statistical software SPSS version 28. Data was checked for normality before applying appropriate tests of significance. A descriptive statistical analysis of the data (means, standard deviations, ranges, frequencies and percentages are presented. Maternal, fetal, and neonatal parameters were analyzed using a Chi-squared test, Fisher's exact test, a two-tailed student's *t*-test, and Mann-Whitney U test. The measure of association was reported as odds ratios with corresponding 95% confidence interval and p-value of <0.05. After bivariate analysis, the factors that were statistically significant were entered for multivariate logistic regression analyses to determine the factors independently associated with PPROM among pregnant women admitted at General Justice Gizenga Mpanza Regional and District Hospital. The level of significance was set at p-value <0.05.

Results

There were a total of 7 071 deliveries in 2018. A total of 447 PPROM cases were reviewed, 19 files were removed due to poorly documented maternal files together with insufficient information to assess eligibility and multiple pregnancy. In total 428 women and neonatal files were available for analysis.

Maternal characteristics

The maternal records together with corresponding fetal medical files of 428 patients diagnosed with PPROM <34 weeks gestation from 1st January 2018 to 31st December 2018 were reviewed. The age of the participants ranged from 14 to 42 years with a mean age of 26.35 ± 6.9 years. Most participants were in the age group 21 - 30 years (n = 120; 53.1%). The mean gestational age at booking was 17.8 +- 7.2 weeks and at delivery was 31.2 +- 7.2 weeks. The median age at delivery was 28 weeks. After multivariate logistic regression analysis, women belonging to the age groups <20 years (AOR = 0.08, 95% CI: 0.03 - 0.62, p = 0.003) and ≥35 years (AOR = 0.02, 95% CI: 0.001 - 0.16, p = 0.001) were less likely to have PPROM. Women who attended antenatal clinics were ≥ 4 times less likely to experience PPROM compared to their counterparts who had <4 antenatal visits or no antenatal visits (AOR = 0.21, 95% CI: 0.05 - 0.87, p =0.036).

Among patients with PPROM 16 (3.7%) were diagnosed with gestational diabetes, 71 (16.6%) with gestational hypertension, 82 (19.2%) with urinary tract infections and 36 (8.4%) with lower genital tract infection; 36 (8.4%) with chorioamnionitis and 12 (2.8%) with chronic hypertension. The risk of neonatal morbidity has been correlated with the residual amount of amniotic fluid between 22 and 24 weeks..One third, 33/99, 33% of intrauterine deaths (IUD)=<22 weeks showed retroplacental bleeds on ultrasound. The group with an amniotic Fluid Index (AFI) of >=5cm had a greater neonatal survival rate as compared to those with an AFI of <5 cm. Those with AFI =<5cm had higher risks of neonatal morbidity. Mothers were more susceptible to chorioamnionitis resulting in increased cesarean section rates. An AFI<5 cm at 24 weeks were associated with limb deformities, pulmonary hypoplasia and craniofacial defects. There was no difference in the outcome of HIV positive patients as compared to HIV negative patients with regard to the incidence PPROM. However, another study conducted by Hoover DR, et al. among pregnant patients in urban Malawi showed an increase in PPROM in HIV positive patients with a low CD4 count. The rate of major neonatal conditions in the current study was 51.6%. Among 428 PPROM cases, respiratory distress syndrome was found in 106 (24.8%), periventricular leukomalacia was found in 18 (4.2%), necrotizing enterocolitis was found in 16 (3.7%), Downs syndrome was found in 1 (0.2%), hypoxic-ischemic encephalopathy was found in 11 (2.6%) and neonatal sepsis was found

Table 1: Maternal characteristics of cases of PPROM < 34 weeks of gestation

Variables	No. of Observation	Mean (SD); n(%)	Range
Mean age in Years	428	26.4 +- 6.9	14 - 42
Age Groups			
<20 years	131	131 (30.6%)	
21 - 30 years	244	244 (57%)	
>30 years	53	53 (12.4%)	
Pregnancy			
Singleton	428	428 (100%)	
Twin	0	0 (0%)	
Parity			1 - 6
Primiparous	235	235 (54.9%)	
Multiparous	193	193 (45.1%)	
Gestational age @ booking (weeks)	424	17.8 +=7.2	6 - 34
Gestational age @ delivery (weeks)	426	31.2 +=7.2	22 - 34
<20 (miscarriages)	121	121 (28.3%)	
20-24 (miscarriages)	99	99 (23.1%)	
25-29 (live born))	102	102 (23.8%)	
30-34 (live born)	104	104 (24.3%)	
HIV Status	428	428 (100%)	
Negative	227	227 (53.1%)	
Positive	201	201 (46.9%)	
Antenatal Care	289	289 (67.5%)	
No. of Visits			
<4	112	112 (38.8%)	
>=4	177	177 (61.2%)	
RPR (Rapid Plasma Reagin)	421	421 (98.4%)	
Non Reactive	402	402 (93.9%)	
Reactive	19	19 (4.4%)	
AFI (Amniotic Fluid Index01)	296	296 (69.2%)	
<5 cm	133	133 (31.1%)	
>=5 cm	163	163 (38.1%)	

in 69 (16.1%). The rate of sepsis was found to be 10 (27.8%) in newborns whose mothers were found to have chorioamnionitis. This rate was found to be 4 (11.1%) in newborns whose mothers did not develop chorioamnionitis. The difference between the groups were found to be statistically significant (p=0.002). While the majority 232 (54.2%) of the study subjects were delivered vaginally, (196),45.7% were delivered by lower segment cesarean section (LSCS) (Table2). Of the vaginal deliveries, 176 (75.9%) went into spontaneous labor, and 56 (24.1%) of patients were induced.

Among the neonates delivered by mothers who had PPROM, 56.3% (n = 241) had an unfavorable outcome (either born alive but admitted in the neonatal ward for ventilatory support, stillbirth, neonatal death, fifth minute Apgar score < 5 or birth weight < 2500 g. The mean birth weight was 2087.47±533.47g with a range of 750 - 3028 g. The perinatal loss rate among neonates born by women with PPROM was 35.5% (n = 152).

Gestational age at PPROM is an important confounder in pregnancies with the live birth rate rising from 34% (17/50) in pregnancies with PPROM at <20 weeks to 65% (26/40) in pregnancies with PPROM between 30-34 weeks (p=0.03). There was a trend towards improved survival with advancing gestational age at PPROM, but this did not reach the threshold for statistical significance (p=0.352) (Table 3). The rate of survival to discharge amongst liveborn infants was 64.5% (276/428).

Delivery after PPROM

It was possible to calculate the latency between PPROM and birth in 423/428 (99%) of singleton

Table 2: Clinical outcomes of PPROM

Variables	No of observation	n(%)	Range
Mode of delivery			
Vaginal delivery	232	232 (54.2%)	
Cesarean delivery	196	196 (45.8%)	
Neonatal outcomes			
Birthweight (gms) (mean ± SD)	428	2087.47±533.47	750-3028
Very low birthweight (VLBW)	116	116 (27.1%)	
Ventilatory support	214	214 (50.0%)	
Perinatal death	152	152 (35.5%)	
Apgar scores			
<5	116	116	
>5	312	312	
Obstetrical complications	253	253 (59.1%)	
Gestational diabetes	16	16 (3.7%)	
Gestational hypertension	71	71 (16.6%)	
Urinary tract infection	82	82 (19.2%)	
Preeclampsia	12	12 (2.8%)	
Clinical chorioamnionitis	36	36 (8.4%)	
Lower genital tract infection	36	36 (8.4%)	
Major neonatal conditions	221	221 (51.6%)	
Respiratory distress syndrome	106	106 (24.8%)	
Periventricular leukomalacia	18	18 (4.2%)	
Hypoxic-ischemic encephalopathy	11	11 (2.6%)	
Downs syndrome	1	1 (0.2%)	
Necrotizing enterocolitis	16	16 (3.7%)	
Neonatal sepsis	69	69 (16.1%)	

Table 3: Infant outcomes for singleton pregnancies. p values compare outcomes by gestational age category at PPROM and are calculated by chi squared test

Singleton Pregnancies	Whole Cohort	Gestation at PPROM (weeks)				
		<20	20-24	25-29	30-34	p value
Live birth	276/428 64.5%	17/50 34%	32/85 38%	48/101 48%	26/40 65%	0.03
Survival to hospital discharge(with morbidity)	152/276 55.1%	28/50 56%	39/85 46%	52/101 51%	19/40 48%	0.352
Survival without severe morbidity	124/207 42.5%	12/37 32.4%	36/65 40%	56/65 48%	20/40 50%	0.153

pregnancies. In the immediate period after PPROM the chance of birth was high: 27% (60/423) of births occurred within 72 hours of PPROM and a further 12% (27/423) by 7 days after PPROM (Table 4). Amongst those women that remained pregnant the chance of birth was 21% (29/136) in the second week after PPROM and from the third week onwards the chance of giving birth was approximately 16% of those who remained pregnant per week.

Determinants of preterm premature rupture of the membrane

Determinants of preterm premature rupture of the membrane included previous history of abortion, history of PPROM, records of previous preterm delivery, urinary tract infections and lower genital tract infections during pregnancy and hypertensive disorders of pregnancy. Women with a previous history of abortion were more than four times likely

Table 4: Latency between PPROM and birth in singleton pregnancies. p value compares latency by gestational age category at PPROM and are calculated by chi squared test

Singleton Pregnancies		**Whole group**	**Gestation at PPROM (weeks)**				
	n	**423**	**<20 90**	**20-24 120**	**25-29 130**	**30-34 80**	**P value**
Latency between PPROM and Birth	<72 hr	114 (27%)	33(37%)	31(26%)	33(25%)	17(21%)	0.29
	72 hr to 7 days	51 (12%)	8(9%)	13(11%)	14(11%)	17(21%)	
	7 days to <28 days	93 (22%)	13(14%)	20(17%)	39(30%)	17(21%)	
	>=28 days	161 (38%)	36(40%)	55(46%)	43(33%)	26(33%)	
	Unspecified	4 (1%)	0(0%)	0(0%)	1(1%)	3 (4%)	

Table 5: Bivariate and multivariable analysis for the determinants of PPROM at General Justice Gizenga Mpanza Regional and District Hospital (n = 428, reference=1.0)

Determinants of PPROM	No of observations	COR (95% CI)	AOR (95% CI)	p value
Age of mothers (yrs)				
≤20	131 (30.6%	2.15 (1.05,4.40)	0.06, (0.01 - 0.32)	0.0012
21-30	244 (57.0 %)	1.0	1.0	
>30	53 (12.4%)	2.2 (1.11,4.34)	0.01, (0.001 - 0.12)	0.001
No of ANC visits				
< 4 visits	162 (41.6%)	2.54, (3.15-7.71)	0.21, (3.04 -10.82)	0.0316
≥4 visits	227 (58.4%)	1.0	1.0	
Having hypertensive disorders of pregnancy				
Yes	74 (17.3%)	1.83, (0.95-4.43)	2.2, (1.38 - 7.54)	0.01
no	354 (82.7%)	1.0	1.0	
Abortion				
Yes	125 (29.2%)	3.71, (2.89-9.14)	4.2 (2.17- 14.32)	0.008
no	303 (70.8%)	1.0	1.0	
Previous history of PPROM				
Yes	161 (37.6%)	5.89, (3.67-9.67)	4.41, (1.12 - 17.17)	0.001
no	267 (62.4%)	1.0	1.0	
Previous history of preterm delivery				
Yes	122 (28.5%	9.16(4.88, 25.127)	2.04, (10.85 - 18.81)	0.01
no	306 (71.5%)	1.0	1.0	
Urinary tract infection				
Yes	119 (27.8%)	5.2421 (2.736,9.913)	2.93, (1.6 – 7.96)	0.02
no	309 (72.2%)	1.0	1.0	
Lower genital tract infection				
Yes	36 (8.4%)	4.01, (5.85 to 8.16)	2.01, (6.85 to 7.16)	0.04
no	392 (91.6%	1.0	1.0	

predisposed to PPROM as compared with women who did not experience abortions (AOR=4.2, 95% CI: (2.17, 14.32)]. Furthermore, women who had hypertensive disorders of pregnancy (n=83) had a 2 fold increase and those who have a history of previous PPROM three times more likely to develop PPROM than those who do not have respectively (AOR=2.2, 95% CI: (1.38 to 7.54)), (AOR=3.41, 95% CI: (1.12 to 7.17). Women with previous records of preterm delivery were two times more likely to develop PPROM than those who did not have (AOR=2.04, 95% CI: (0.85 to 4.81)]. Women who had urinary tract infections were close to two times more likely to develop PPROM in contrast to those who are not (AOR=1.93, 95% CI: (0.71 to 3.96) and women with lower genital tract infections during pregnancy were two times more likely to develop PPROM in contrast to those who did have such infection (AOR=2.01, 95% CI: (0.85 to 5.16) (Table 5).

Discussion

Although the cause of premature rupture of the membrane is multifactorial, the key determinants of preterm premature rupture of the membrane in our study included previous history of abortion, history of PPROM, records of previous preterm delivery, urinary tract infections, lower genital tract infections during pregnancy and hypertensive disorders of pregnancy.

Furthermore, the results of this study of PPROM =< 34 weeks gestation illustrates the diverse neonatal and maternal outcomes possible with this condition. Whilst 55.1% (152/276) of women had neonates that survived to hospital discharge, only 42.5% of women (124/207) had neonates that survived without severe morbidity. Maternal sepsis developed in 12.1% (52/428) of women.

We analyzed the risk factors in detail, especially those contributing to the infectious etiology of PPROM. These included current lower genital tract and urinary tract infections. In addition to the above, we analyzed the history of recent vaginitis and urinary infection, which, if not properly treated, increases the risk for PPROM. In our study, 119 (52.2%) patients had urinary tract infection and 19 (8.3%) had lower genital tract infection (vaginitis). In a similar study done in Oman in 2013, Al-Riyami et al found that the most common risk factor of PPROM was infection 55%[10]. Mohan and co-workers in their study reported that almost half of the women had current urinary tract infection or vaginitis on admission. Furthermore, about a quarter of women also had recent urinary or vaginal infection[11]. Hence, early detection and prompt treatment of these infections may prevent PPROM occurring due to infectious etiology.

This study identified a previous history of abortion as a risk factor for premature rupture of the membrane. A woman who experienced a previous abortion in our study was 4.2 times more likely to develop premature rupture of the membrane when compared with women who did not have abortion experience. Our finding is supported by similar results reported from China[12], Northern Ethiopia, hospitals found in Mekelle city[13], India[14], and Brazil[15]. A more recent study showed that abortion history increased the risk for PPROM by seven-fold compared to women with no such history[16]. Similarly, women who had a history of previous abortion were 3.7 times more likely to have premature rupture of membrane compared to women who did not experience abortion [17]. More recently mothers who had a previous history of abortion were 2.8 times more likely to experience PPROM than those who hadn't[18].

Women in our study who had a previous history of premature rupture of the membrane were 4.4 times more likely to develop premature rupture of the membrane as compared to their counterparts compared to 4.7 times in another study[17] and seven-fold[16]. These results are supported by studies conducted in America[19], Iran[20], Thailand[21], India[14], Nigeria[22] as well as a study done in Tigray region hospitals found in Mekelle city (Ethiopia)[13,23]. The Preterm Prediction Study, a large prospective study conducted by the National Institute of Child Health and Human Development Maternal-Fetal Medicine Units Network, observed that women with a history of PPROM had a 13.5 percent rate of PPROM in a subsequent pregnancy compared to 4.1 percent in women with no such history[24].

A history of preterm delivery was statistically associated with the occurrence of PPROM, which is similar to the findings from literature from Canada[25], China[26] and the USA[27]. In contrast, the study in Ethiopia revealed no

association between history of preterm delivery and PPROM[13]. In our study, women with records of previous preterm delivery were two times more likely to have PPROM compared to those patients who gave no history of preterm deliveries in previous pregnancy.

The prevalence of PPROM varies from country to country and within areas in the same country. The prevalence of PPROM among women admitted at the General Justice Gizenga Mpanza regional and district Hospital was 6.1%. Our prevalence is higher than the 2.0% reported in an earlier study conducted locally[6], 0.8% and 2.2% in India[28,29], 2.3% in Canada[25], 2.4% in Egypt[31] but lower than 7.5% reported in Uganda[32],13.7% in Cameroon [33], 17.9% in Nigeria[22] and 9.2% in Ethiopia[34]. The diversity in the definitions of PPROM in the various studies could explain some of these differences. The higher rate of PPROM in our study could also be explained by the fact that GJG MRH hospital is a main referral hospital in the area. In our study 39 (10.0%) women did not attend antenatal care. It was observed that among the 39 women who did not have any antenatal care, one delivered an infant with Down Syndrome, 12 developed respiratory distress syndrome and 4 developed periventricular leukomalacia. Furthermore, our finding revealed that women who attended four or more antenatal care were less likely to have PPROM as compared to women who attended antenatal care less than four times. This finding is in line with studies conducted in India [14] and Uganda[35].

In our study, after multivariate logistic regression analysis, women belonging to the age groups <20 years (AOR = 0.06, 95% CI: 0.01 - 0.32, p = 0.001) and ≥30 years (AOR = 0.01, 95% CI: 0.001 - 0.12, p = 0.001) were less likely to have PPROM. This finding differs from what was found in the study done in Brazil where women aged ≥30 years were instead more likely to develop PPROM[15]. This discrepancy might be due to differences in the study population and study setting.

We observed that as the gestational age advanced at birth the chance of live birth and infant survival to hospital discharge improved. However, it was noticed that even among those born between 30 and 34 weeks gestation, 42.3% (n=11/26) of the infants had severe morbidity, illustrating the complexities of these cases and the need for ongoing multidisciplinary team care, including neonatologists, even at relatively advanced gestations.

The median gestational age at birth of surviving infants in our study was 28 weeks gestation, and the median length of hospital stay after birth for surviving infants was 59 days, IQR 17-100 days. Whilst this is shorter than studies from Australia[36] (median 76 days, IQR 44-111 days) and Japan[37](155 days, standard deviation SD 53 days), it is still a significant amount of time and likely and likely to have a substantial impact on the neonatal outcome in the medium term.

As gestational age at PPROM increased, the risk of an adverse neonatal outcome decreased. In our study the perinatal mortality rate was 35.5% (n=152) which consisted of 59 fresh stillbirths, 29 neonatal deaths and 67 macerated stillbirths. The live birth rate increased from 34% (17/50) in pregnancies with PPROM at <20 weeks to 65% (26/40) in pregnancies with PPROM between 30-34 weeks (p=0.03). There was a trend towards improved survival with advancing gestational age at PPROM, but this did not reach the threshold for statistical significance (p=0.352). In another study, the neonatal mortality rate was calculated to be 53.4% in the group born before the 28th gestational week, 8.4% in the group born between the 29th and 32nd gestational week and 3.4% in the group born after the 33rd gestational week[3]. A study from Rwanda reported that the overall perinatal mortality rate was 38.5% and the neonatal mortality rate was 23.8%. Mortality was significantly associated with gestational age at delivery. Mortality was significantly higher in infants born between 24- 28 weeks (73.5%) compared to infants born at 29-31 weeks (35.1%) and infants born at 32- 34 weeks (10.5%). In addition, the mortality risk was also related to birthweight with the highest risk being observed in the extreme low birthweight group (< 1000g) compared to infants weighing between (1000-1500g) and between 1500-2500 g respectively[38].

When the relationship between the gestational age in weeks was compared with the apgar scores at 5 minutes, the apgar scores at the 5th minute was found to be , <=7 in 64.7% (75/116) and 45.7% (53/116) respectively , in neonates born before the <20 weeks gestation and between 20-24 gestational weeks. These rates were found to be 14.7% (17/116) and 10.3% (12/116), respectively

in neonates born between the 25-29 and 30-34 gestational weeks (p=0.000) respectively. Though advances in perinatal and neonatal practices have led to improved neonatal survival rates, they remain widely variable[39,40]. Our results of survival rates to discharge of 55.1% differ from other studies that reported ranges of survival rates at PPROM from as low as 24% to as high as 70%[36,41-43]. Sim et al. showed an overall neonatal survival rate to discharge of 33.8%[36]. Additionally, the reported neonatal survival rate to discharge was 20% in the retrospective study done by Linehan et al. in PPROM[42]. Esteves et al. found that neonatal survival rate to discharge of PPROM of 18.7% between 18 to 20 weeks gestation and 42.8% between 22 to 24 weeks of gestation [43]. In our study, amongst the newborn that survived to hospital discharge, 207 (48.4%) avoided severe morbidity, this is higher than recently published observational studies[44-47]. Maternal sepsis developed in 12.1% (52/428) of women with singleton pregnancies. The rate of maternal infectious morbidity in previous studies of singleton pregnancies is similar to our 12.1%[42,44,45].

PPROM poses a significant risk to both mother and developing fetus, leading to complications like, preterm birth, respiratory distress syndrome (RDS) and cerebral palsy[48]. Antenatal steroids viz. Betamethasone and dexamethasone enhances fetal lung maturity and prevents respiratory distress syndrome (RDS), intraventricular hemorrhage (IVH), necrotising enterocolitis (NEC) and neonatal mortality[49]. The American College of Obstetricians and Gynaecologists (ACOG) recommends the administration of steroids between 24 and 34 weeks of gestation. Of the 447 patients with PPROM, 22 did not receive steroids. 80 Mothers i.e (19%), majority between the gestational ages of 24 weeks and 32 weeks neonates were diagnosed with hyaline membrane disease /RDS. In this study we observed the use of steroids in PPROM between 26 weeks and 33 weeks had improved neonatal outcomes with a lesser incidence of RDS, NEC and IVH.

Antenatal antibiotics are a cornerstone in the management of PPROM, aimed at preventing neonatal and maternal infections. Of the 447 patients, 38 mothers did not receive antibiotics. 21 (5,1%) of mothers were diagnosed with chorioamnionitis. In this study, we observed that the risk of maternal infection was inversely proportional to the latency period. PPROM exposes the amniotic cavity to vaginal flora leading to chorioamnionitis, endometritis and sepsis in the mother. Antibiotic therapy is crucial in preventing and treating these infections, thus reducing maternal morbidity and mortality[50]. PPROM poses risks of fetal infection and inflammation which can lead to neonatal sepsis, pneumonia and neonatal death. Antibiotics help mitigate these risks by reducing bacterial colonization in the amniotic cavity and preventing fetal infection[51]. In my study I observed that the use of antibiotics increased the latency period, thus preventing fetal/amniotic fluid infections resulting in improved neonatal outcomes and apgar scores (>7).

Future research should focus on prospective studies to better understand the mechanisms and factors influencing perinatal and maternal outcomes associated with PPROM, before 34 weeks in a regional hospital setting. Additionally, investigating interventions to improve outcomes in this population is warranted.

Conclusion

Infections decreased the latency period resulting in premature deliveries. Spontaneous PPROM carried a higher incidence of neonatal morbidity than iatrogenic PPROM. The incidence of PPROM increased with untreated UTIs and vaginitis. The risk of neonatal morbidity has been correlated with the residual amount of amniotic fluid between 22 and 24 weeks. The group with an amniotic Fluid Index (AFI)>=5cm had a greater neonatal survival rate compared to those with an AFI<5cm. Those with AFI=<5cm were more susceptible to chorioamnionitis resulting in increased cesarean section rates. An AFI<5 cm at 24 weeks were associated with limb deformities, pulmonary hypoplasia and craniofacial defects. The risk of maternal infection is inversely proportional to the latency period. The use of steroids in PPROM between 26 and 33 weeks had improved neonatal outcomes with lesser incidence of Respiratory Distress Syndrome (RDS), necrotising enterocolitis (NEC) and Intraventricular Hemorrhage (IVH). There was no difference in the outcome of HIV positive patients as compared to HIV negative patients with regard to the incidence PPROM. Patients with a previous history of

PPROM had a higher incidence of PPROM in the current pregnancy. There was an association with a previous history of abortions and PPROM at GJGMRH hospital.

Contribution of authors

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