Research Article

Outcomes of Preterm Labor and Preterm Births: A Retrospective Cross-Sectional Analytical Study in a Nigerian Single Center Population

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Abstract

Background: Genuine preterm labor precedes almost half of preterm births and preterm birth is the leading cause of high prematurity and neonatal mortality indices in the world. In Nigeria, there is a paucity of recent data on the pattern of preterm labor and preterm births, including its prevalence and neonatal outcome.

Objective: To determine the prevalence, patterns and immediate neonatal outcomes of preterm labor and preterm births in a single center population.

Methods: This was a retrospective cross-sectional analytical study of all pregnant women who had preterm

labor and/or preterm births at Nnamdi Azikiwe University Teaching Hospital, Nnewi, Nigeria from January 1, 2014 to December 31, 2015. Women who delivered outside the study hospital were excluded. Data was manually collected from the patients' case files using a proforma and analyzed using a Statistical Package for Social Sciences (SPSS) version 20. P < 0.05 was considered statistically significant.

Results: A total of 1573 deliveries were recorded of which 139 had preterm births, giving a prevalence of 8.8%. Thirty-five women had spontaneous, genuine preterm labor, giving a prevalence of 2.2%. The mean age of the women was 30.2 ± 2.3 years. Forty seven (33.8%) women were nulliparous, while 12 (8.6%) were grand multiparous. Majority, 103 (74.1%) were unbooked. Sixty five (46.8%) of the preterm births were iatrogenic while 35 (25.2%) were due to spontaneous preterm labor. Of the 139 women, 81 (58.3%) delivered via cesarean section and 125 (89.9%) had singleton births. Fifty four (38.8%) of the preterm babies had a birth weight of 1500-2499 grams, while the 14 (10.1%) had a birth-weight in <1000 grams. Seventy seven (55.4%) of the babies were males. One hundred and four (74.8%) babies were non-asphyxiated, 18.0% had a stillbirth, although 12 (8.6%) had immediate neonatal deaths while 102 (73.4%) were live births. Ninety one (65.5%) preterm babies did not require immediate resuscitation while 87 (62.6%) babies required admission into the Special Care Baby Unit. Sixty three (45.3%) preterm babies were moderate to late preterm (32 to <37 weeks), 58 (41.7%) were very preterm babies (28 to <32 weeks) and 18 (12.9%) were extremely preterm babies. There was statistical significance, association between the gestational age at birth and some neonatal outcomes such as birth weight (p-value=<0.001), Apgar scores (p-value=0.002), and the need for immediate neonatal resuscitation (p-value=0.010)

Conclusion: The prevalence of preterm birth and spontaneous, genuine preterm labor was high in Nnewi, Nigeria and iatrogenic preterm births predominate. There were significance association between gestational age at preterm birth and route of delivery, birth weight, Apgar scores, and need for immediate neonatal resuscitation. Women and neonates at greater risk of preterm births need optimal care to improve survival.

Keywords: Preterm Labor; Preterm Birth; Iatrogenic; Stillbirth

1. Introduction

The World Health Organization (WHO) defined "preterm birth" as any birth before 37 completed weeks of gestation, or fewer than 259 days since the first day of the woman's last menstrual period [1]. The WHO definition makes the distinction between being born early and being born too small. Preterm labor is defined as the presence of uterine contractions of sufficient frequency and intensity to effect progressive effacement and dilation of the cervix prior to term gestation. Genuine preterm labor precedes almost half of preterm births and preterm birth occurs in approximately 12% of pregnancies and is the leading cause of neonatal mortality in the United States [2]. In addition, preterm birth accounts for 70% of neonatal morbidity and mortality [3, 4]. Preterm birth is heterogeneous in numerous ways. It is heterogeneous in terms of the extent to which the birth is preterm (20-27 weeks, 28-31 weeks or 32-36 weeks of gestation); in whether the birth was elective (induction of labor or elective cesarean section) or spontaneous (spontaneous preterm labor or preterm premature rupture of the membranes) [3]. In the

normal human fetus, several organ systems mature between 34 and 37 weeks, and the fetus reaches adequate maturity by the end of this period. One of the main organs greatly affected by preterm birth is the lungs. The lungs are one of the last organs to mature in-utero; and this predisposes many premature babies to spend their first few days/weeks of life on a ventilator. Therefore, a significant overlap exists between preterm birth and prematurity. Preterm babies born near 37 weeks often have no problems relating to prematurity if their lungs have developed adequate surfactant, which allows the lungs to remain expanded between breaths [5]. Premature infants can be classified based on their gestational age into: extremely preterm (<28 weeks), very preterm (28 to <32 weeks) and moderate to late preterm (32 to <37 weeks), and based on their birth weight into low birth weight (<2.5 kg), very low birth weight (<1.5 kg) and extremely low birth weight (<1 kg) [6]. Often, the specific cause of preterm birth is not clear, however, many factors may increase the risk [7]. For unidentified reasons, black women are more likely to experience premature birth than are women of other races. Indeed, majority of women who have preterm births have no known risk factors [7]. Prematurity remains a major determinant of neonatal morbidity and mortality and has both immediate and long-term adverse consequences on health [8-11]. In Nigeria, there is a paucity of recent data on the pattern of preterm labor and preterm deliveries (including its prevalence and neonatal outcome), which would serve as an indication of the trend and help in evaluation of intervention programs. The current study was conducted to determine the prevalence, patterns and immediate neonatal outcomes of preterm labor and preterm births at Nnamdi Azikiwe University Teaching Hospital, Nnewi, south-east Nigeria.

2. Methods

This study was a retrospective cross-sectional analytical study. The study population comprised all pregnant women presenting for labor and delivery in the Obstetrics and gynecology complex of Nnamdi Azikiwe University Teaching Hospital (NAUTH), Nnewi, Nigeria from January 1, 2014, to December 31, 2015. The study included all pregnant women who presented with preterm labor and/or had preterm births and delivered in NAUTH Nnewi during the study period. We excluded pregnant women who did not have their delivery in study hospital. Since it is a retrospective study, the sample size comprised all cases that met the inclusion criteria for the study within the given time period. Ethical approval for the study was obtained from the NAUTH ethics committee. The names and folder numbers of the women were obtained from the delivery register in the maternity unit. Subsequently, the case notes were retrieved from the medical records department of the hospital. The information needed for this study was retrieved from the records of all pregnant women who presented in labor during time period. Data were collected using a proforma containing the socio-demographic characteristics of the patients (age, marital status, occupation, highest educational qualification, religion), parity, booking status, gestational age at onset of labor (which were used to determine whether labor is preterm or not), gestational age at delivery (which were used to determine whether the delivery was preterm or not), course of labor (spontaneous or induced), route of delivery (vaginal or cesarean section) and immediate neonatal outcome of the delivery (such as sex of baby, birth weight, Apgar score, live healthy baby with no complications, immediate resuscitation, admission into special care baby unit, perinatal death). The prevalence of preterm labor and preterm birth was expressed in percentage (%). Iatrogenic preterm births were

identified when the onset of labor was induced (without spontaneous labor), when there was an elective or emergency cesarean section with delivery of preterm infant. Genuine preterm labor was identified when there is onset of labor before 37 weeks of gestation with intact membranes, effaced cervix with os at least 3cm dilated, contractions increasing in intensity and frequency, and evidence of increasing cervical os dilatation between two consecutive vaginal examinations. Data were analyzed electronically using the statistical package for social sciences (SPSS) version 20 and results presented using frequency tables. Chi-square test was used for categorical data and $P < 0.05$ was considered to be statistically significant.

3. Results

Table 1 describes the sociodemographic data of pregnant women, showing the distribution of patients who had delivered preterm at NAUTH, Nnewi, Nigeria according to their age, marital status, occupation, highest educational qualification, religion, and parity. A total of 1573 deliveries were recorded of which 139 were of preterm giving a prevalence of 8.8%. Thirty-five had spontaneous preterm labor, giving a prevalence of 2.2%. All cases of spontaneous preterm labor resulted in preterm births. The mean age of the patients was 30.2 ±2.3 years (range: 19-45 years) of which 30.2% (n=42) were between 30-34 years and 1.4% (n=2) were ≤19 years. There was no statistical significance association between the age groups of pregnant women with the gestational age at the time of delivery (x^2=9.740, p-value=0.639). There was also no association between the maternal age group and the cause of the preterm birth (x^2=11.752, p-value=0.466). The majority of them were married (n=138; 99.3%) and had at least a primary school education (n=138; 99.3%). Fifty three (38.1%) were unemployed including students, corps members, and housewives, while 16 (11.5%) were artisans. Forty seven (33.8%) of the women were nulliparous (Para 0), while 12 (8.6%) were grand multipara (≥P5). There was no statistical significance association between the parity of the women and the gestation age of women at the time of delivery (x^2=6.985, p-value=0.935). There was also no statistical significance association between parity and the cause of delivery (x^2=10.147, p-value=0.751). Table 2 gives the distribution of the various delivery characteristics of pregnant women. More than half of the women, 103 (74.1%), were unbooked. Sixty five (46.8%) of the preterm deliveries were iatrogenic or induced while 35 (25.2%) had spontaneous genuine preterm labor. Of these 139 women, 81 (58.3%) delivered via cesarean section and 125 (89.9%) had singleton births. Table 3 describes the various neonatal outcomes including the sex distribution, the birth weight distribution of the preterm infants, various perinatal outcome of the preterm delivery, the percentage of the preterm infants that had need for immediate resuscitation after delivery, the percentage of the preterm infants that were admitted into the Special Care Baby Unit (SCBU) for further monitoring and management, and the gestational ages at delivery. Seventy seven (55.4%) of the babies were males, while 62 (44.6%) were females. Fifty four (38.8%) of the preterm babies had a birth weight of 1500-2499 grams (low birth weight) while 14 (10.1%) had a weight <1000 grams (extremely low birth weight). One hundred and four (74.8%) were non-asphyxiated while 25 (18%) had stillbirth. While 12 (8.6%) died within 24 hours of birth, 102 (73.4%) were alive. Ninety one (65.5%) of the preterm babies did not require immediate resuscitation. Eighty seven (62.6%) of the preterm neonates required admission into the Special Care Baby Unit (SCBU). Sixty three (45.3%) of the preterm babies were moderate to late preterm (32 to

<37 weeks), 58 (41.7%) were very preterm babies (28 to <32 weeks) and 18 (13.0%) were extremely preterm babies (24-27 week). Table 4 shows the relationship between the gestational ages at birth and some neonatal outcomes and delivery characteristics of the mother. There was statistical significance, association between the gestation age at birth and some neonatal outcomes such as birth weight (x^2=94.894, p-value=<0.001), Apgar scores (x^2=12.151, p-value=0.002), and the need for immediate neonatal resuscitation (x^2=14.277, p-value=0.010). One hundred and four (74.8%) babies did not require resuscitation and this relationship was statistically significant (p>0.05). There was also statistically significant association between the gestational age at birth and route of delivery (x^2=16.285, p-value=<0.001), and also with the booking status of the women (x^2=9.199, p-value=0.01). There was also a statistically significant association between the gestational age and the iatrogenic preterm delivery (x^2=11.473, p-value=0.020). But there was no statistical significance, association between the gestational age and stillbirth (x^2=2.652, p-value=0.266) and that of immediate neonatal death (x^2=5.41, p-value=0.067).

Characteristics	Frequency	Percentage
Age		
<=19 Years	2	1.4
20-24 Years	17	12.2
25-29 Years	41	29.5
30-34 Years	42	30.2
35-39 Years	29	20.9
40-44 Years	5	3.6
>=45 Years	3	2.2
Marital Status		
Married	138	99.3
Single	1	0.7
Occupation		
Unemployed	53	38.1
Civil Servant	33	23.7
Trader	37	26.6
Artisans	16	11.5
Highest Educational Qualification		
NO Formal Education	1	0.7
Primary	20	14.4
Secondary	51	36.7
Tertiary	67	48.2
Religion		

Christianity	138	99.3
Islamic	1	0.7
Parity		
Nulliparous(P0)	47	33.8
Primipara(P1)	31	25.2
Multipara(P2-P4)	45	32.4
Grandmultipara(>P4)	12	8.6
Total	139	100

Table 1: Socio-demographic characteristics of pregnant women.

Characteristics	**Frequency**	**Percentage**
Booking Status		
Booked	36	25.9
Unbooked	103	74.1
Cause of Delivery		
Iatrogenic	65	46.8
Spontaneous labor	35	25.2
PPROM	39	28.1
Route of Delivery		
Vaginal	58	41.7
Cesarean section	81	58.3
Outcome of Delivery		
Singleton	125	89.9
Multiple gestation	14	10.1
Total	139	100.0

Table 2: Delivery characteristics of pregnant women.

Characteristics	**Frequency**	**Percentage**
Sex		
Male	77	55.4
Female	62	44.6
Birth Weight		
<1KG (extreme LBW)	14	10.1

<1.5KG (Very LBW)	50	36.0
<2.5KG (LBW)	54	38.8
>2.5KG (Normal BW)	21	15.1
APGAR Scores in 5 Minutes		
0 (Stillbirth)	25	18.0
1-5 (Asphyxia)	10	7.2
6-10 (Non-asphyxia)	104	74.8
Outcome within the first 24 hours of birth		
Dead	12	8.6
Alive	102	73.4
Need for Immediate Resuscitation Post-Delivery		
Yes	48	65.5
No	91	34.5
Admission into SCBU		
Yes	87	62.6
No	52	37.4
Gestational Age at Delivery		
24-27 weeks (Extremely Preterm)	18	13
28-31 weeks (Very Preterm)	58	41.7
32-36 weeks (Moderate to late Preterm)	63	45.3
Total	139	100

Table 3: Neonatal and perinatal outcome.

Characteristics	**Gestational Ages**		
	24-27 Weeks	**28-31 Weeks**	**32-36 Weeks**
Birth Weight			
<1.0 KG	10	2	2
<1.5 KG	8	36	6
<2.5 KG	0	17	37
>2.5 KG	0	3	18 (p-value=<0.001)
Apgar score			
0-5 (Asphyxia)	9	18	8
≥6(No asphyxia)	9	40	55 (p-value=0.002)
Immediate Resuscitation			

Yes	12	23	13
No	6	35	50 (p-value=0. 010)
Stillbirth			
Yes	5	12	8
No	13	46	55 (p-value<0.001)
Immediate Death			
Yes	4	5	3
No	14	53	60 (p-value>0.05)
Booking Status			
Booked	2	10	24
Unbooked	16	48	39 (p-value=0. 010)
Cause of Delivery			
Iatrogenic	4	23	38
SPTB	5	17	13
PPROM	9	18	12 (p-value=0.020)
Route of Delivery			
Vaginal	15	24	19
C/S	3	34	44 (p-value=<0.001)
Total	18	58	63

Table 4: Relationship between the gestational ages at birth, neonatal outcome and the delivery characteristics of the women.

4. Discussion

The preterm birth rate in this study was found to be 8.8%. This is higher than 6.7% reported in the secondary data analysis conducted by the WHO in 359 health facilities from 29 countries in Africa, Asia, Latin America, and Middle East [12]. It is also higher than 6.1% reported by a very recent study in Iceland [13]. This is far less than the 21.7% gotten from a Brazilian study, but more than the 5.1% reported by a study done in Ardabil [14, 15]. The prevalence of preterm delivery in this study was also found to be higher than the 4.7% reported in a study done at National Ribat University Teaching Hospital, North Sudan [16]. This is less than 16.4% reported by McGil Ugwu at the Delta State University Teaching Hospital in Southern Nigeria [17], and also less than the 31.3% reported by Onwuanaku *et al* in Jos University Teaching Hospital, North Central Nigeria [18]. The reason for these differences is not clear, but may be due to differences in the incidence of preterm births in the various parts of Nigeria as a result of geographical and ethnic differences in these study populations. Thus, individual ethnicity, socioeconomic disadvantage and living in ethnically dense areas have been potentially linked to the risk of preterm births [13-15]. As 46.5% of preterm births were iatrogenic, 28.1% were preterm premature rupture of membrane (PPROM), while 25.2% followed spontaneous preterm labor. This is different from that reported by

Goldenberg et al, of which about 30-35% of preterm births were induced while 40-45% and 25-30% follow spontaneous preterm labor and preterm premature rupture of membranes (PPROM) respectively [10]. This finding also differ from a previous study in Iceland, that reported an iatrogenic preterm birth rate of 2.40% [13]. Spontaneous preterm birth was most commonly caused by preterm labor in Caucasians, and PPROM in black women indicating the existence of potentially different causative mechanisms [12]. But in this study, it showed that the iatrogenic causes accounted for most of the preterm delivery. In these studies [12, 13], the increase in iatrogenic preterm births even remained significant after adjusting for medical indications, suggesting that other factors might be affecting the rising trend. This study, showed that age groups of 30-39 years were found to have a higher occurrence of preterm birth. Other studies had shown that advanced maternal age and being unmarried were associated with prematurity but this was not demonstrated in our study [19, 20]. This is also not corroborated with the findings done in a retrospective study by Tai-Ho et al of which extreme maternal age was associated with early preterm birth and being unmarried [21]. A Denmark and Quebec study on the role of maternal age to the rates of preterm birth revealed that preterm birth rates increased the most in women aged 20 to 29 years, whereas rates decreased or remained stable in women aged 35 years and older [22]. The overall increase over time was driven by age-specific preterm birth rates, although the contribution of younger women was countered by fewer births at this age in the Denmark and Quebec study [22]. The higher occurrence of preterm birth among women aged between 30-39 in this study is similar to the study done in Pakistan by Irshad et al [23] of which about 25% of the mothers were aged 35 years and above but different from that done by Shrestha et al [24] of which about 35% of mothers were teenagers. This is also similar to the study done at Ilorin Teaching Hospital, Nigeria in which about 52% of preterm births were early preterm (<34 weeks gestation), and the maternal age of greater than 35 years were significantly associated with preterm birth [25]. The current study demonstrated that nulliparous women were more likely to deliver prematurely. This finding is different from that of previous studies which had shown that multiparous women were more likely to deliver preterm [23-25]. High parity is likely to increase the risk of preterm delivery due to uterine changes such as myometrial stretching from previous pregnancies. This point, however appears to clearly contradict biological plausibility. Some of the mothers with high parity may also have had a bad obstetric history which may be due to unidentified factors that may persist in subsequent pregnancies. There are no clear explanations as to why nulliparous women would be at greater risk of preterm birth. A study in Nigeria showed that parity (0 or ≥1) was not associated with preterm delivery [26]. However, another study done in Nigeria had shown that high parity was a significant determinant of preterm birth [23, 27]. This study showed a higher probability of preterm delivery via caesarean section. This may be due to obstetric complications such as pregnancy-induced hypertension and antepartum hemorrhage. There were more preterm males than females in the present study compared to the study by McGil Ugwu in Warri and Zeleke *et al* in Ethiopia who reported more preterm females [28, 29]. It has long been noted that male infants are at increased risk of being born prematurely of which was similar to that observed from this study with male to female ratio was 1.2:1. There were more babies who were of low birth weight and few who were extremely low birth weight. Although the majority (74.8%) was not asphyxiated, some babies required

admission into the SCBU for further resuscitation and management. These results, when compared to the study done at Niger Delta University Teaching Hospital by McGil Ugwu and at Usmanu Danfodiyo University Teaching Hospital, Sokoto, Nigeria by Onankpa and Isezuo showed that prematurity constituted a significant percentage of neonatal admissions [17, 30]. There are several limitations to our study. The small sample size is a limitation. This might explain some of the non-significant associations observed in this study. Other potential limitations include the heterogeneity in the factors evaluated as causes of preterm labor. There is also limitations of retrospective studies. The strength of the study is that this is an updated data on the patterns of preterm births in a Nigerian tertiary hospital. We conclude that the prevalence of preterm birth and spontaneous genuine preterm labor is high in Nnewi, Nigeria and iatrogenic preterm births predominate. There were significance association between gestational age at preterm birth and route of delivery, birth weight, Apgar scores, and need for immediate neonatal resuscitation. Women and neonates at greater risk of preterm births need optimal care so as to improve survival outcomes.

Author's Contribution

BCU and IAM contributed to the study conceptualization and methodology; BCU conducted the clinic study, ensured completion of the participants data and extracted the required data; BCU, and GUE analysed the data and drafted the original manuscript; ICI, CUE, CCO, OSU and EAE worked with BCU on formal analysis; IAM, ICI, GUE, CCO, OSU and EAE contributed to the project administration, writing (review and editing), data visualization, and supervision. All authors have seen and approved their contributions and the final version of the manuscript.

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Conflict of Interest

Authors declare no conflict of interest.

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