

Prevalence of preterm birth and perinatal outcome: A rural tertiary teaching hospital-based study

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ABSTRACT

Context: Preterm birth is defined as births before 37 weeks of gestational age. Preterm birth is a major challenge in obstetric health care and leading cause of perinatal mortality and long-term morbidity. Complications arising from preterm births are the leading cause of deaths among children less than 5 years of age. Seventy-five percent of them could be saved with current, cost-effective interventions. The rate of preterm births worldwide is 5–18% with the developing countries accounting for the maximum deaths.

Aims: This study was undertaken to evaluate the prevalence of preterm births and risk factors associated with it among women delivered at a rural tertiary teaching hospital in Telangana and further assess its impact on perinatal outcome. **Settings and design:** This was a retrospective case control study conducted at Medciti Institute of Medical Sciences from January 2019 to December 2019.

Methods and material: Of the 1243 deliveries during the study period, 135 births that occurred at <37 weeks were taken as cases and 248 term neonates were taken as control group. Data were collected retrospectively through review of prenatal and hospital delivery records.

Statistical analysis used: Data were collected and tabulated as shown in the results. Statistical analysis was done using Microsoft Excel. Frequency and percentage of each parameter were calculated and analyzed. The risk estimates were analyzed between the cases and controls by calculating the odds ratio, 95% confidence interval, and *P* value. *P* Value of <0.05 was considered significant.

Results: The prevalence rate of preterm birth was 10.86%. History of previous preterm birth (OR = 4.88, C.I: 1.50–15.87, *P* = 0.0084), previous LSCS (OR = 2.16, C.I: 1.36–3.44, *P* = 0.001), inter-pregnancy interval <12 months (OR = 2.78, C.I: 1.13–6.84, *P* = 0.026), hypertension (OR = 3.10, C.I: 1.78–5.42, *P* = 0.0001), PROM (OR = 0.73, C.I: 2.36–9.49, *P* < 0.0001), Oligohydramnios (OR = 3.58, C.I: 1.29–9.9, *P* = 0.01), and multiple pregnancy (OR = 24.09, C.I: 3.09–187.46, *P* = 0.0024) were found to be significant risk factors for preterm birth. Though the NICU admission rate was high (52%), neonatal outcome was found to be satisfactory. **Conclusions:** Some of the risk factors that contributed to preterm birth were modifiable. Preventive strategies addressing the risk factors such as hypertension, oligohydramnios, and also improving health care quality to pregnant women will reduce the prevalence of preterm births and outcomes.

Keywords: Perinatal outcome, preterm birth, prevalence, risk factors

Introduction

Preterm labor is defined by WHO as “The onset of labor prior to completion of 37 weeks of gestation, in pregnancy beyond

20 weeks of gestation.”^[1] Preterm labor complicates 5–10% of pregnancies and a leading cause of perinatal morbidity and mortality in both developed and developing countries. WHO estimates that there are 15 million preterm births every year.^[2] It can affect physical health, cognitive and behavioral dimensions, making it one of the significant challenges for modern public health.^[3] Preterm infants face higher risk of several disabilities including neurodevelopmental impairments, gastrointestinal complications, cerebral palsy, sensory deficits, learning disabilities, and respiratory illness.^[4] According to Copper *et al.*^[5] preterm

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birth occurs in 7–11% of pregnancies but is responsible for 85% of neonatal deaths in normally formed infants who do not have any congenital anomalies.

A greater increase in the survival of preterm infants is seen in recent decades, mostly by timely interventions, antenatal administration of corticosteroids, better NICU care, and exogenous surfactant therapy but still prematurity is the leading cause of neonatal morbidity and mortality.

Earlier is the preterm birth, greater is the risk of adverse outcomes; however, infants born late preterm still have considerable higher morbidity and mortality compared to infants born at term.

Preterm labor can be spontaneous or iatrogenic where labor is induced due to medical, fetal, or obstetric indications. The etiology of preterm birth is multifactorial and it is affected by social, psychological, biological, and genetic factors. Several factors that contribute to preterm birth include maternal factors (prepregnancy BMI, inter-pregnancy interval, psychosocial factors), pregnancy history (previous preterm delivery, medical disorders), and pregnancy characteristics (infections, multiple gestation, shortened cervix, tobacco, antepartum hemorrhage, hydramnios, etc.).^[6] There is a strong association between infections and preterm birth.^[7] The etiology still remains unknown in a large number of cases. Wherever feasible it is important to screen and identify the mothers with risk factors for preterm delivery at the primary care level and provide timely corrective interventions such as smoking cessation, counseling, use of progestational agents, cervical cerclage, etc.

Better understanding of the causes and mechanisms of preterm birth will help in developing solutions to prevent preterm birth. Reliable information on the predictors of preterm birth is critical to design effective preventive intervention strategies in India and globally. Early identification of at-risk pregnancies with timely referral for specialized obstetric care may help to identify women at risk for preterm labor and reduce the extreme prematurity thereby decreasing the morbidity and mortality rate. Though several studies have been conducted worldwide to assess the prevalence of preterm birth and its risk factors, studies on the risk factors for preterm birth in low-middle-income countries are sparse.

We analyzed a range of prenatal risk factors on preterm birth in a prospective observational cross-sectional study in India.

As the prevalence of preterm birth also depends on geographical and demographic features and risk factors might differ, this study will help in implementing necessary interventions in a rural area.

Materials and Methods

A retrospective study was carried out at Medciti Institute of Medical Sciences (MIMS), a rural tertiary teaching hospital in the Medchal district in Telangana State, India. It is an observational cross-sectional study. The protocol was approved by the

SHARE INDIA/Medciti Institute of Medical Sciences Ethics Committee. Preterm births that occurred from January 19 to December 19 at MIMS were taken as cases. All term births that were considered controls were randomly taken.

Among 1243 births that occurred during the study period, 135 were born preterm. Control group ($N = 248$) was randomly selected from births that occurred at 37 or more completed weeks of gestation. All deliveries in the hospital and the pregnancy outcomes were recorded in the birth register. Using the parturient inpatient numbers, case files were obtained from the medical records department. Data on demographic variables, obstetric history, risk factors contributing to the preterm delivery such as pre-eclampsia, FGR, previous history of preterm births, etc., were noted. Information regarding the onset of labor, mode of delivery, weight of the baby, NICU admissions, and complications was recorded on a predesigned proforma.

Gestational age was ascertained by the last menstrual period (LMP) and confirmed by dating scan. Wherever the LMP was not known, first trimester dating ultrasound was used and if not available, clinical estimate of gestational age was considered. Pre-eclampsia is defined as hypertension after 20 weeks of pregnancy, combined with proteinuria and/edema.^[8] Proteinuria in pregnancy is defined as the new appearance of protein in the urine equal to or greater than 300 mg of protein in 24-hour collection, protein/creatinine ratio equal to or greater than 0.3 mg/mg or + 2 or more on urine dipstick testing.^[9] Oligohydramnios is defined as decreased amniotic fluid volume for gestational age. For oligohydramnios AFI <5 cm is taken as a cutoff value. Polyhydramnios is defined as deepest vertical pool (DP) more or equal than 8 cm or amniotic fluid index (AFI) of equal or more than 24 cm or AFI above the 95th percentile for gestational age.^[10]

Fetal growth restriction is defined as fetal weight less than the 10th percentile for gestational age as determined with an ultrasound.^[11] Low birth weight (LBW) is defined by the World Health Organization as birth weight of an infant of 2499 g or less, regardless of gestational age.^[12]

Statistical analysis

Data were collected and tabulated as shown in the results. Statistical analysis was done using Microsoft Excel. Frequency and percentage of each parameter were calculated and analyzed. The risk estimates were analyzed between the cases and controls by calculating the odds ratio, 95% confidence interval, and *P* value. *P* Value of <0.05 was considered significant.

Results

Out of the 1,243 deliveries that occurred at Medciti Institute of Medical Sciences from January 2019 to December 2019, 135 (10.86%) were born preterm.

Table 1 shows the gestational age at the time of delivery among preterm births. Out of 135 preterm births, 7 (5%) were

early (<28 weeks), 10 (7%) were moderate (28–32 weeks), and 118 (88%) were late (32–37 weeks) preterm deliveries.

Table 2 shows the various risk factors associated with preterm birth. Preterm delivery was found to be commonly associated with pregnancy-induced hypertension (32%), PROM (21%), hypothyroidism (15%), and previous LSCS (37%). Among the 135 cases, univariate analysis [Table 3] showed factors like pregnancy-induced hypertension (OR 3.1, $P = 0.001$), APH (OR 3.94, $P = 0.0075$), oligohydramnios (OR 3.58, $P = 0.01$), PROM (OR 4.73, $P < 0.0001$), and multiple pregnancy (OR 24.09, $P = 0.002$) as significant associated risk factors.

Table 4 shows the regression analysis of past obstetric history variables. Previous LSCS (OR 2.16, $P = 0.001$), previous preterm labor (OR 4.88, $P = 0.0084$), and inter-pregnancy interval less than 12 months (OR 2.78, $P = 0.025$) were found to be significantly associated with risk of preterm delivery. Emergency cesarean section rate was significantly higher in the cases group [Table 5]. Perinatal outcomes and preterm birth are shown in Table 6. Overall, 47% of preterm births weighed between 2 and 2.5 kg. More than half of preterm births required NICU admissions.

Discussion

Preterm birth is a major challenge in health care and is associated with most of the perinatal deaths. In the present study, 1,243 deliveries took place during the study period, out of which 135

were preterm births. The prevalence of PTB was 10.86% which was similar to a study by Yamini V. Pusdekar *et al.*^[13] (12.6%). This may be explained by the fact that these women were from rural background with low socioeconomic status and were relatively young at the time of conception. In contrast Jida Ali Hassen *et al.*^[14] study showed incidence of preterm birth to be 25%.

There are multiple factors associated with the etiology of preterm labor that includes maternal risk factors, pregnancy-related complications, the social and environmental factors. Parity is a risk factor for preterm birth. Sonia Arogya *et al.*^[15] study showed that multiparous women had higher chances of preterm delivery (72.92%) compared to primigravida (27.08%). We observed that preterm births were high in multiparous women (60.74%). One of the factors that may contribute to PTB in multiparous women is a damaged cervix. The cervix plays a very important role in maintaining pregnancy.

A significant risk of PPRM is that preterm birth happens within few days after membrane rupture. In our analysis of risk factors, it was one of the significant factors that contributed to PTB ($p < 0.0001$). Sureshbabu *et al.*^[16] study found that 25.1% of the cases had PPRM. We found preterm rupture of membrane to be associated with 22% of preterm births. Chauhan N *et al.*^[17] also reported PROM as a risk factor in 31.8% of cases.

Previous preterm delivery increases the risk of a subsequent preterm delivery 2.5-fold, with those women with a previous preterm delivery at the lowest gestations being at highest risk. History of previous preterm birth had an odds of 4.88 of having preterm birth in the present study. A statistically significant relationship was observed between previous preterm delivery and the occurrence of preterm delivery in present pregnancy. Satija A *et al.*^[18] observed a positive history of previous preterm births in 12% cases of preterm labor. Carr-Hill and Hall^[19] state that there is 15% chance of preterm delivery with history of one previous preterm delivery and 32% chance after two preterm deliveries.

APH accounted for 9% of preterm births in the present study, whereas in Satija *et al.*^[18] study, 11% of PTB were secondary to APH. Abruptio and bleeding at the choriodecidual interface lead to thrombin generation which enhances protease and prostaglandin production and cause myometrial contractions.

The odds of delivering a preterm birth were significantly high among the women with oligohydramnios (OR 3.58; C.I: 1.29–9.9; $p: 0.01$). When oligohydramnios was detected management included early induction of labor or performing CS. Some reports have estimated the likelihood of preterm birth to be 3–10 times higher in women with oligohydramnios.^[20,21] Various factors like fetal abnormalities, hypertension, pre-eclampsia, blood transfusion between twins, and chronic leakage of amniotic fluid from ruptured areas of the membrane may lead to oligohydramnios.^[21]

Table 1: Gestational age at the time of delivery among preterm births

Gestational age in weeks	Number of deliveries	Percentage
<28 weeks	7	5
28-31 + 6 weeks	10	7
32-36 + 6 weeks	118	88

Table 2: Prevalence of risk factors associated with Preterm birth

Risk Factors	Number of cases (n)	Percentage
PPROM	28	21
Gestational hypertension	15	11
Pre-eclampsia	14	10.4
Imminent eclampsia/eclampsia	9	5.2
Abruptio	3	6.7
Placenta previa	4	2.2
Oligohydramnios	11	8.15
Polyhydramnios	2	1.48
GDM	11	8.15
Hypothyroidism	21	15.56
Anemia	6	4.44
UTI	3	2.22
Multiple pregnancy	12	9
Previous preterm birth	10	7
Miscarriage	13	10
Previous LSCS	50	37

Table 3: Comparison of demographic and clinical variables in present pregnancy between case and control groups and the results of univariate logistic regression

Risk Factors	Cases (n=135) n (%)	Controls (n=248) n (%)	Odds ratio	95% CI	P
Maternal age in years					
<20 yrs	23 (17.04)	36 (26.67)	1.21	0.68-2.74	0.51
20-30 yrs	105 (77.78)	201 (81.05)	0.82	0.49-1.37	0.45
>30 yrs	7 (5.19)	11 (4.44)	1.18	0.45-3.11	0.74
HTN during pregnancy	36 (26.6)	26 (10.5)	3.10	1.78-5.42	0.0001
APH	12 (8.89)	6 (2.42)	3.94	1.44-10.74	0.0075
GDM	11 (8.15)	11 (4.44)	1.91	0.81-4.53	0.14
Hypothyroidism	21 (15.56)	36 (14.52)	1.08	0.60-1.94	0.78
Polyhydramnios	2 (1.48)	3 (1.21)	1.23	0.20-7.44	0.82
Oligohydramnios	11 (8.15)	6 (2.42)	3.58	1.29-9.9	0.01
PROM	28 (21)	13 (5.24)	4.73	2.36-9.49	<0.0001
Anemia	6 (4.44)	6 (2.42)	1.88	0.59-5.93	0.28
UTI	3 (2.22)	0	—	—	—
Multiple pregnancy	12 (8.88)	1 (0.40)	24.09	3.1-187.46	0.002

Table 4: Risk estimates associated with preterm birth based on obstetric history

Risk factors	Cases (135) n (%)	Control (248) n (%)	Odds ratio	95% CI	P
Primigravida	53 (39.26)	106 (42.74)	0.87	0.56-1.33	0.51
Multigravida	82 (60.74)	142 (57.26)	1.15	0.75-1.77	0.51
Previous LSCS	50 (37.04)	53 (21.37)	2.16	1.36-3.44	0.001
Previous preterm birth	10 (7.41)	4 (1.61)	4.88	1.50-15.87	0.0084
Miscarriage	13 (9.63)	20 (8.06)	1.21	0.58-2.53	0.603
Inter-pregnancy interval $\leq$ 12 months	13 (9.63)	9 (3.63)	2.78	1.13-6.84	0.0255

Table 5: Mode of delivery in cases and control group

Mode of Delivery	Cases (135) n (%)	Control (248) n (%)	Odds ratio	95% C.I	P
Vaginal delivery	58 (43)	151 (61)			
Caesarean section	77 (57)	97 (39)	2.07	1.35-3.16	0.0008
Elective C.S	14 (18)	46 (47)			
Emergency C.S	63 (82)	51 (53)	3.38	2.14-5.34	<0.0001

Table 6: Perinatal outcomes and preterm Birth

Outcome	Frequency (n)	Percentage
Birth weight		
<1 kg	6	4.08
1-1.5 kg	20	14.81
1.6-2 kg	19	14.07
2-2.5 kg	64	47.41
>2.5 kg	26	19.26
Respiratory distress	34	23
NICU admissions	77	52
Gender		
Male	70	47.62
Female	77	52.38

The present study revealed a significant association between pregnancy-induced hypertension and preterm birth ($p = 0.0001$). Mothers who had pregnancy-induced hypertension had three times increased risk of having a preterm birth than those mothers without pregnancy-induced hypertension. Hypertension increases the

resistance of uterine vessels and reduces uteroplacental blood flow which in turn causes intrauterine growth restriction.^[22] High rate of disorders like placental abruption, pre-eclampsia, and intrauterine growth restriction among women with hypertension may result in surgical operations and preterm birth.^[21] Pregnancy-induced hypertension may cause vascular damage to the placenta and induce oxytocin receptors which result in preterm delivery. Renzo *et al.*^[23] reported the likelihood of preterm birth to be 2.6 times greater among women with chronic hypertension.

We observed a statistically significant increased risk of preterm birth in subsequent pregnancy in women with previous history of cesarean section (OR: 2.16, C.I: 1.36–3.44, p : 0.001). Gugusheff J *et al.*^[24] demonstrated that both first birth intrapartum and prelabor cesarean section increase the risk of subsequent preterm birth. Zhang Y.^[25] study also showed that, compared with primary vaginal birth, cesarean section in the first pregnancy increased the risk preterm birth in subsequent pregnancies. Cesarean section can be associated with subsequent preterm birth by different mechanisms. Injury to the cervix at the time of cesarean section, changed uterine microenvironment and disruption of tissue may predispose to spontaneous preterm labor.

Our study showed that women who conceived after a short inter-pregnancy interval of less than 12 months had a high risk of preterm birth (OR: 2.78, C.I: 1.13–6.84, p : 0.0255). Mothers with short inter-pregnancy interval cannot recover from the

biological stress imposed by the preceding pregnancy and also there is diminution of macronutrient supplementation in the body. Cervical insufficiency, anemia, and abnormal remodeling of endometrial vessels also may contribute to PTL.^[26] Given the high risk of recurrence and association between interpregnancy interval and preterm birth, interpregnancy interval remains a potentially modifiable risk factor in women with previous preterm birth.

Multiple gestations, accounting for only 2–3% of infants, carry a substantial risk of preterm delivery and resulted in 9% of all preterm births. Apart from the different mechanisms that cause preterm birth in multiple pregnancy like intrauterine infection, increased uterine stretch, and cervical insufficiency increased secretion of mediators like CRH from larger placental mass, surfactant protein A from the fetal lung stimulate uterine contractility and may contribute to preterm birth.^[27]

With respect to neonatal outcomes, RDS was diagnosed in 23% of these babies. A similar incidence of RDS was found in Chauhan *et al.*^[17] study (22.6%).

Conclusion

The study findings highlight previous LSCS, interpregnancy interval of less than a year, previous PTB, PROM, oligohydramnios, hypertensive disorders as significant risk factors associated with PTB. Investment in educating women, senior involvement in decision-making for deciding time and mode of delivery, identifying pregnant women at risk of PTB, and providing quality health care may decrease the prevalence of PTB and its global burden. Its association with prior cesarean deliveries and all of the studied maternal and fetal pathologies suggest that the reduction of prematurity may be possible by the postponement of intervention in cases without clear evidence of maternal–fetal benefit.

Addressing the burden of preterm birth is crucial to achieve Sustainable Development Goal 3 and for reducing preterm-related neonatal and child mortality.^[28] An active and integrated involvement of primary as well as tertiary health sectors can help in achieving this goal. Identifying the risk factors associated with preterm birth, focusing on preventable and modifiable factors, and providing appropriate risk-specific management can help in achieving the goal.

Key messages: Better understanding of the causes of preterm birth and their interrelationships will help in developing newer preventive and therapeutic measures to reduce preterm birth. Identifying at-risk women, implementing specific interventions and better management of obstetric complications are of utmost importance to reduce the burden of prematurity.

Key points

1. Previous cesarean section, short inter-pregnancy interval, previous preterm birth, premature rupture of membranes, oligohydramnios were significant risk factors for preterm

birth in rural population.

2. Measures to prevent primary cesarean section would bring down preterm births.
3. Women should be made aware of the consequences of short inter-pregnancy interval.
4. Obstetric complications like pregnancy-induced hypertension should be timely managed.

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Conflicts of interest

There are no conflicts of interest.

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