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**Original Research Article**

# Timing of elective term deliveries and its association with adverse neonatal outcomes

**Varsha Advani[1], Sidrah Nausheen[1]*, Muhammad Sajid[2], Tooba Jawed Khan[3]**

[1]Department of Obstetrics and Gynaecology, [2]Department of Paediatrics and Child Health-Medical College, [3]Centre of Excellence in Women and Child Health, The Aga Khan University Hospital, Karachi

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***Correspondence:**
Dr. Sidrah Nausheen,
E-mail: sidrah.nausheen@aku.edu



## ABSTRACT

**Background:** Pre and early term birth are one of the major causes of neonatal mortality and morbidity as compared to term infants. The risk of neonatal morbidity and mortality decreases with gestational age. Thus, this study aimed to determine the association of neonatal outcomes among early term and full-term elective deliveries.
**Methods:** A prospective cohort study was conducted at the department of obstetrics and gynecology, Aga Khan University Hospital, Pakistan. A total of 390 women, 195 in each study group were selected using a non-probability consecutive sampling. Demographic was presented as simple descriptive statistics giving mean and standard-deviation. Pearson's chi-square and Fisher-Freeman-Halton exact test were used to compare qualitative data. Risk-ratios (RR) and confidence-intervals (CI) were calculated by using binary logistic regression. STATA V.17 SE software was used for data analysis.
**Results:** A total of 390 participants were recruited, including 195 patients in each group. The high prevalence of low Apgar score 5.6%, low birth weight 5.6% was found among early term when compared with full term. The respiratory distress was also reportedly high in early term neonates with 7.2%. Likewise, the prolonged hospital stays and NICU admissions were also more evident in early term elective deliveries i.e. 8.7% and 5.6%.
**Conclusions:** Early-term births are associated with adverse neonatal outcome of low APGAR score, low birth weight, hospital stay, NICU admission and respiratory distress when compared with neonates born as full term through elective deliveries. Similarly, the risk of prolonged hospital stay and NICU admissions were higher among the early term neonates.

**Keywords:** APGAR score, Early term, Elective Delivery, Full term, Low birth weight, Neonate outcome

## INTRODUCTION

The 2030 Agenda for sustainable development provides a shared blueprint for peace and prosperity for people and the planet through 17 Sustainable Development Goals (SDGs), which are an urgent call for action by all developed and developing countries in a global partnership.[1] SDG3 is to ensure healthy lives and promote wellbeing for all at all ages.[1] It aims to reduce the ratio of global maternal mortality to less than 70 per 100,000 live births and neonatal mortality to at least as low as 12 per 1,000 live births by 2030.[2,3] According to WHO report, the number of neonatal deaths declined from 5 million in 1990 to 2.4 million in 2020 globally and still approximately 6700 newborn deaths occurred every day.[4]

In low middle income countries (LMICs), the prevalence of major or minor illness related to pregnancy and childbirth is much higher especially in Pakistan due to lack of facilities which is consequently responsible for poor feto-maternal outcomes.[5] Recent data showed that

Pakistan is 3rd highest country with high maternal and child mortality and one of the major contributors of such neonatal incidents is preterm and early term births.[6,7]

In singleton pregnancies, gestation lasts an average of 40 weeks 0/7 (280 days) from the first day of the last menstrual period.[8] The infant delivered between 39 and 40 weeks, 6/7 days of pregnancy are considered as full term or term. Infants born between 37 and 38 weeks, 6/7 days are considered as early term.[9] "Late terms" referred to the infants born between 41 0/7 days and 41 6/7 weeks: (i.e. on or after the first day of the 42nd week through the end of the 42nd week). Whereas the infants born between 42 0/7 weeks and beyond are considered as post term.[9,10]

The risk of adverse neonatal outcomes has been studied among the women who underwent elective cesarean delivery at term (i.e., at 37 weeks or later), and found various adverse neonatal outcomes with early term deliveries that mainly includes respiratory distress syndrome (RDS) and sepsis.[11] A composite outcome including admission to the NICU, prolonged hospitalization, need for respiratory support and treatment with intravenous antibiotics were increased.[12,13] The early term neonates are also at a higher risk of low birth weight, low Apgar score at 5-minutes (<7) when compared with full or post term.[14,15]

The American College of Obstetricians and Gynecologists recommends that no elective delivery should be conducted before 39 weeks of gestation as these newborns are at an increased risk of neonatal adverse respiratory outcome, e.g., transient tachypnea of newborn and risk of neonatal intensive care unit admission.[12]

In addition to apparent health concerns, there is also a growing recognition that this neonatal population may have more subtle neurodevelopmental issues such as inferior academic performance or behavioral problems when they grow-up. Though, the data is limited but it is supported by literature that the neonates born between 34 and 37 or 38 weeks account for most admissions to the NICU and for large proportion of health care expenditures.[16,17]

Whereas, the late or post term infants have a higher rate of behavioral and neurodevelopmental problems than infants born at full term.[18-20]

Addressing the issues of late preterm and early term birth requires balancing the risks of continuing the pregnancy versus the risk of delivery before term. While there is clear benefit to allowing uncomplicated pregnancies to reach full term, continuing pregnancy in the face of medical or obstetrical complications can potentially increase the risk to mother and/or fetus.[16,17]

The growing public health awareness of prematurity and its complications has prompted careful evaluation of the timing of deliveries by clinicians and hospitals. Preterm birth is associated with significant morbidity and mortality and affects over millions of births across the globe. In some situations, however, a late-preterm birth or early-term birth is the optimal outcome for the mother, baby, or both, due to conditions that can result in worse outcomes if pregnancy is allowed to continue.[16,17] Thus, this study focused on to determine the variability in neonatal outcomes among early term and full-term elective deliveries. Yet, limited literature in Pakistan on this topic mark it as a first study of its kind that will also aid in deciding optimal time of elective delivery which has its substantial public health significance.

## METHODS

A prospective cohort study was conducted at the department of obstetrics and gynecology of Aga Khan University Hospital, Karachi, Pakistan in the duration of 6 months (i.e. September 2016, March 2017) after ERC approval.

The sample size was calculated by using WHO software with 95% significance level (1-alpha), 80% power; 12.8% (NICU admission in early term delivery) and 4.8% (NICU admission in full term delivery). A total 390 participants were enrolled in the study with 195 participants in each group with maternal age of 15-35 years. The term singleton pregnancies confirmed through dating ultrasound were included in the study. Both primigravida and multigravida were added in the inclusion criteria. However, neonates with congenital anomalies were excluded from the study.

Non-probability consecutive sampling technique was used for selecting the study participants. The pregnant women who were admitted electively for delivery at 37-40 weeks, six days were included in the study. The gestational age was confirmed by dating scan. The study included 2 groups i.e., exposed, and unexposed group. The women with pregnancy of 37 and 38 weeks, six days of gestation were included in the exposed groups whereas, the women with pregnancy of 39 to 40 weeks, six days of gestation were categorized in the unexposed group.

The data was collected on a standard performa and the maternal characteristics (age, parity, pregnancy induced hypertension, gestational diabetes mellitus and obstetric cholestasis) and neonatal outcome were included (i.e., low APGAR score, low birth weight, prolonged hospital stay and admission to NICU). The information was retrieved from files of women who were admitted in labour room or labour ward at 37-40 weeks, six days of gestation and delivered electively. Neonates were followed till their 4th day of life.

All statistical analysis were performed using STATA v17 SE (Stata Corp LLC, College Station, Texas, USA). Mean and standard deviation were expressed for

continuous variables like age, parity, and gestational week at delivery. Frequency and percentages were calculated for categorical variables such as neonatal outcome (low APGAR score, low birth weight, prolonged hospital stay, NICU admission and respiratory distress), parity, pregnancy induced hypertension, gestational diabetes mellitus, obstetric cholestasis. Pearson's chi-square test and the Fisher-Freeman-Halton exact test were used to compare qualitative variable as appropriate. Binary logistic regression analysis was used to calculate the risk ratios (RR) and 95% confidence intervals (CI). The factors adjusted for included maternal age, parity, pregnancy induced hypertension, gestational diabetes mellitus and obstetric cholestasis, expressed as adjusted RR (ARR) and 95% CI. P values <0.05 were considered to indicate statistical significance.

***Operational definitions used***

*Apgar scores*

This is the scoring system that provides an accepted and convenient method for assessing the status of the newborn immediately after birth. APGAR score less than 7 at 5 minutes is considered poor and more than 7 at 5 minutes is taken as good APGAR scores.

*Birth weight*

Weight of baby at birth (in kg). Birth weight less than 2.5 kg is labeled as low birth weight and between 2.5 to 4.0 kg is considered as appropriate birth weight.

*Hospital stay*

Stay in hospital (in days). If it is more than 7 days, it is considered as prolonged hospital stay.

*Admission To NICU*

Baby shifted to NICU within 4 days of life.

*Respiratory distress*

The presence of one or more of the following signs: an abnormal respiratory rate (tachypnea >60 breaths/minute, bradypnea <30 breaths/minute, respiratory pauses, or apnea) or signs of labored breathing (expiratory grunting, nasal flaring, intercostal recessions, xyphoid recessions, or thoraco-abdominal asynchrony), with or without cyanosis.

## RESULTS

In this study, a total of 390 participants were recruited, including 195 women in each of the study group i.e., early term and full-term group who visited department of obstetrics and gynecology of Aga Khan University Hospital, Karachi.

**Table 1: Maternal characteristics of the participants (n=390).**

| Maternal characteristics | N (%) |
|---|---|
| **Maternal age (years)** | 28.5±5.4 |
| 15-25 years | 83 (21.3) |
| 26-35 years | 307 (78.7) |
| Mean±SD | 28.5±5.4 |
| **Parity** | |
| <3 | 12 (3.1) |
| >3 | 378 (96.9) |
| Mean±SD | 2.2±0.4 |
| **Term baby** | |
| Early term | 195 (50.0) |
| Full term | 195 (50.0) |
| **Pregnancy induced hypertension** | 16 (4.1) |
| **Gestational diabetes mellitus** | 53 (13.6) |
| **Obstetric cholestasis** | 13 (3.3) |

Out of total, 78.7% of the women were from the age group 26-35 years and less than a quarter were in the age group 15-25 years. The mean age of the study participants was reported to be 28.5 years with the standard deviation of ±5.4. Around 96.9% women had >3 parities. However, the mean parity was found to be 2.2±0.4 as shown in Table 1.

Majority of the women were healthy we found pregnancy induced hypertension in 4.1%, gestational diabetes mellitus 13.6%%, and obstetric cholestasis in 3.3% of participants.

**Table 2: Neonatal outcomes (n=390).**

| Neonatal outcomes | N (%) |
|---|---|
| **Low Apgar scores** | 16 (4.1) |
| **Low birth weight** | 24 (6.2) |
| **Prolonged hospital stay** | 22 (5.6) |
| **NICU admission** | 14 (3.6) |
| **Respiratory distress** | 23 (5.9) |

Table 2 reflected to the neonatal outcomes of the infants born to the study participants. Majority of neonates were in good health with high Apgar score 96% but about 4% of the neonates were found with low Apgar score. Similarly, the prevalence of low birth weight was also low with 6%. Whereas the neonates reported with respiratory distress were around 5.9%. Nearly 6% of the neonates were reported with prolonged hospital stay. However, the neonates admitted in NICU were 4%.

The Table 3 showed the association between neonatal outcomes with early and full-term elective deliveries. Analysis revealed the high prevalence of low Apgar score among early term neonates 5.6% when compared with full term. The prevalence of low birth weight was also high in early term with 5.6% and low in neonates born as

full term. The respiratory distress was also reportedly high with 7.2% in early term neonates than full term.

**Table 3: Association between neonatal outcomes among early and full-term elective deliveries (n=390).**

| Neonatal outcomes | Early term | Full term | P value |
|---|---|---|---|
| | N (%) | N (%) | |
| **Low Apgar scores** | 11 (5.6) | 5 (2.6) | 0.130 |
| **Low birth weight** | 11 (5.6) | 4 (2.1) | 0.065 |
| **Hospital stay** | 17 (8.7) | 5 (2.6) | 0.008* |
| **NICU admission** | 11 (5.6) | 3 (1.5) | 0.029* |
| **Respiratory distress** | 14 (7.2) | 9 (4.6) | 0.280 |

*Significant at 0.05.

Prolonged hospital stays were recorded more in the early term neonates with around 8.7%. Likewise, the NICU admissions were comparatively higher among early term neonates with 5.6%.

For binary logistic regression analysis, full term is taken as reference to predict about early term. After adjusting for maternal characteristics (i.e. maternal age, parity, pregnancy induced hypertension, gestational diabetes mellitus and obstetric cholestasis) and neonatal outcomes, it was found that the maternal age, parity, pregnancy induced hypertension, gestational diabetes mellitus and obstetric cholestasis was associated with 3.18-fold (adjusted RR 3.18, 95% CI 1.17-8.65) increased risk of neonate's prolonged hospital stay. Similarly, maternal age, parity, pregnancy induced hypertension, gestational diabetes mellitus and obstetric cholestasis is also associated with 3.64-fold (adjusted RR 3.64, 95% CI, 1.03-12.93) reflected towards the increased risk of NICU admission of a neonates born as early term (Table 4).

**Table 4: Risks of neonatal outcomes.**

| Neonatal outcomes | RR (95% confidence interval) early term versus full term[1 (ref)] | | | |
|---|---|---|---|---|
| | Unadjusted | P values | Adjusted[1] | P values |
| **low Apgar scores** | 2.2 (0.78-6.21) | 0.137 | 1.73 (0.59-5.08) | 0.315 |
| **Low birth weight** | 2.75 (0.89-8.49) | 0.079 | 2.18 (0.66-7.14) | 0.199 |
| **Hospital stay** | 3.4 (1.28-9.03) | 0.014* | 3.18 (1.17-8.65) | 0.023* |
| **NICU admission** | 3.67 (1.04-12.94) | 0.043* | 3.64 (1.03-12.93) | 0.045* |
| **Respiratory distress** | 1.56 (0.69-3.51) | 0.287 | 1.63 (0.71-3.71) | 0.249 |

*Significant at 0.05 and 95% CI, 1Adjusted for maternal age, parity, pregnancy induced hypertension, gestational diabetes mellitus and obstetric cholestasis.

## DISCUSSION

Infants born between 37 and 41 weeks of gestation have been considered to be a homogeneous and low-risk group. Babies born at 37-38 weeks might appear to be as healthy as those born at 39-41 weeks; however, recent studies have revealed that it is not the case. Neonatal morbidities such as respiratory distress, feeding difficulties, hypothermia, sepsis, low APGAR score, low birth weight and neonatal mortality are increased in infants born at 37-38 weeks of gestation compared with infants born after 38 weeks 6/7 days.[21] The risks and benefits of early term generally are similar regardless of obstetrical or medical condition. However, the newborn risks include gestational age dependent morbidities (e.g. respiratory distress syndrome, intraventricular hemorrhage, necrotizing enterocolitis, hyperbilirubinemia, feeding difficulties, temperature instability, among others).[16,17] Furthermore, the increased risk of several long-term childhood morbidities, including cerebral palsy and mental retardation, problems at school, hospital admission up to 5 years of age, asthma, and wheezing has also been reported.[21,22]

As accentuated by literature that the early term neonates were significantly at higher risk of NICU admission, need for respiratory support, and treatment with intravenous antibiotics.[13] Another study showed the incidence of respiratory distress was found to be more in early term as compared to full term neonates (37% versus 0.9%).[15] Correspondingly, the risk of 5-minute Apgar score (<7) decreased from 1.01% at 37 weeks of gestation to 0.69% at 39 weeks of gestation. However, the risk of birth weight greater than 4,000 gm increased from 2.0% at 37 weeks of gestation to 7.9% at 39 weeks of gestation.[14]

The study data also underwent binary logistic regression analysis that indicated towards the association of maternal characteristics (i.e. maternal age, parity, pregnancy induced hypertension, gestational diabetes mellitus and obstetric cholestasis) with adverse neonatal outcomes specifically prolonged hospital stay and NICU admission, which was found to be statistically significant among the neonates who were early term. Analogous findings were seen in the study which as conducted with 180 neonates, which showed the odds of early term pregnancy were 2.44 (95% CI 1.04 to 5.7, p value 0.028) times higher in diabetic mothers, compared to mothers without diabetes. The odds of early term pregnancy were 4.08 times (95% CI 1.66 to 10.06, p value 0.001) for maternal hypertension and 11.81 times (95% CI 1.50 to 93.77, p value 0.004) high for maternal anemia. The proportion of cesarean delivery was quite high in early term pregnancy, compared to term pregnancy (52.2% versus 18.2%, p value <0.001). The proportion of small for gestational age (SGA) babies was 29.7% in early term pregnancies

(p value 0.011). The odds of hypoglycemia were 3.42 times more in early term pregnancies, compared to full term (OR 3.423, 95% CI 1.37 to 8.52, p value 0.006).[23]

A study from Pakistan compared neonatal outcomes among two groups of patients undergoing cesarean delivery at 38 and 39 weeks respectively. Both groups have same number of patients i.e. 122 in each group with mean age of 27.69±3.5 years and mean parity was 2.4±1.35. The study found that 19 (8.1%) neonates were admitted to intensive care unit in 38 weeks gestational age cesarean delivery group. Whereas in other group who underwent cesarean section at 39 weeks of gestation only 6 (2.6%) neonates were admitted to neonatal intensive care unit.[24] Thus there was a reduction in neonatal intensive care unit admission by three folds when neonates were born at 39 weeks of gestation. But there was not the complete absence of neonatal admission at 39 weeks of gestation. So, plan elective cesarean sections at 39 weeks of gestation in low-risk women in order to reduce complications at early term gestation, nursery admissions, their cost and many more procedures on neonate.

Another study which was conducted by Sebastian and colleagues comparing deliveries between 38 and 39 weeks of gestation and found that need for blood transfusion was slightly increased at 39 weeks. Although there was no significant difference in Apgar score, respiratory distress, NICU admission was seen when both groups were compared.[25]

Parikh et al study found that early term births (37 0/7- 38 6/7 weeks) accounted for 34.1% of term births. NICU admission and respiratory distress were lowest at or beyond 39 weeks compared to the early term period for most precursors, while indicated deliveries had the highest morbidity compared to other precursors. The greatest difference in morbidity was between 37 and 39 weeks for most precursors, while most differences in morbidities between 38 and 39 weeks were insignificant. Yet, the respiratory distress was higher at 37 than 39 weeks regardless of route of delivery.[26]

### *Limitations*

Our study has few limitations i.e. the sample size of our study was small and it was conducted over a period of six months only, therefore, for generalizability, we need more studies of same kind with a bigger sample size to be conducted at various geographical locations and at diverse facility levels in Pakistan. Secondly, this data is only taken from a private tertiary care hospital due to time and resources constraints, however, conducting such studies at public care facilities which are operating with a different logistic system to deal with emergencies, will allow us to visualize the picture from broader angle and scope.

## CONCLUSION

In reference to the literature and the findings of the present study, we conclude that the early-term births are associated with adverse neonatal outcome of low APGAR score, low birth weight, hospital stay, NICU admission and respiratory distress when compared with neonates born as full term through elective deliveries. Similarly, the risk of prolonged hospital stays and NICU admissions were higher among the early term neonates. Thus, the data of the present study will add up to the contextualize literature in determining the variability of neonatal outcomes among both early and full-term elective deliveries and will also help in the evaluation of local prevalence data which will assist in implementation of specific preventive measures and plans, as well as prioritize limited health care resources which has its substantial public health significance.

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