

Original research:

A prospective study on early neonatal morbidities in early term neonates.

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Abstract

Aims & Objective : The objectives of this study were to examine how the neonatal morbidities, related to prematurity, persist into early term gestation in our set up. Aim was also to know the early neonatal (within first 7 days of life) morbidities, in early term infants in comparison to their full term counterparts.

Materials and Methods : It was a prospective, observational & comparative study. Consecutively born, 1000 intramural newborns were examined and only term babies were included in the study. They were observed for any morbidity for first 7 days of life. Multiple birth, congenital malformations, genetic disorders, inborn metabolic disorders and pre and post term infants were excluded.

Results : 761 term babies were included in the study, out of which 244 were early term & 517 were full term. NICU/SNCU admission rates were higher for babies born at an earlier gestational age (14.69% v/s 8.53%) than babies born later. Incidence of morbidities like jaundice requiring phototherapy (4.9% v/s 1.6%), need for resuscitation (6.9% v/s 3.3%), hypoglycemia on admission (4.9% v/s 1.6%), respiratory morbidities (2.9% v/s 1.6%), need for mechanical ventilation (1.2% v/s 0.4%), clinical sepsis (6.9% v/s 3.4%), confirmed sepsis (4.5% v/s 1.7%), need for intravenous antibiotics (10.6% v/s 6.0%), need for intravenous fluid (12.7% v/s 6.8%) were significantly higher in early terms than full terms during the first one week of life.

Conclusion : Neonatal morbidity decreases with delivery at later gestational ages and that infants delivered at 37 and 38

weeks' gestation, are at increased risk for morbidity compared to infants delivered at 39 weeks or later. So, to reduce early term deliveries and its influence on health care system we should carefully consider the optimal timing and route of delivery.

Keywords : Neonatal, Early term, Late term, Morbidity.

Introduction :

There has been extensive research in the field of pediatrics describing the morbidity and mortality related to prematurity. It is well established that full term neonates are at lower risk for morbidity and mortality than their preterm counterparts. However, to restrict neonatal health to this dichotomy is an oversimplification. Originally thought to have similar risks as full term neonates, late preterm (LPT) neonates (formally referred as near term neonates) born between 34^[0/7] weeks and 36^[6/7] weeks have been shown to manifest morbidities often times similar to premature neonates.¹

Early term neonates are defined as those infants delivered at a gestation age (GA) between 37^[0/7] weeks and 37^[6/7] weeks. This group accounts for approximately 27% of all deliveries, a value at least three times that of LPT infants.² This proportion has increased since 1990, when the prevalence was 19%, and is correlated with a general decrease in GA

among live births.^[3] There are likely many factors that led to these changes, which includes a rise in elective cesarean sections.^[4] Compared to their full term counterparts, there is growing evidence that early term neonates are predisposed to increased rates of mortality, risk of NICU admissions, and metabolic, neurologic, and respiratory morbidities.^[5,6]

As stated, there is previous literature investigating issues associated with being born during the first two weeks of the classically defined term period. In order to add to the knowledge base and determine if this principle can be applied to many different populations, we planned an analysis of our own experience with this age group of infants.

Aims and Objective :

1. To know the early neonatal morbidities (within first 7 days of life) in early terms infants.
2. To compare early neonatal morbidity in early term infants with full term infants.

Materials and Methods :

This was a prospective, observational & comparative study. A consecutive 1000 intramural newborns were examined and all the early term (37^[0/7] to 38^[6/7] weeks) and the full-term (39^[0/7] to 41^[6/7] weeks) babies were enrolled for the study. After obtaining ethical clearance from the Institutional Ethics Committee, study was conducted among the study population after taking written informed consent from the guardian /parents.

Morbidities of the early term and full-term babies within the first seven days of life were observed. All the babies included in the study were examined at birth, after 24 hours, after 48 hours and daily up to seven days. For babies who were discharged early, the parents were advised to attend Sick Newborn Care Unit if any form of illness develops within seven days. Exclusion criteria were multiple birth, congenital malformations, genetic disorders inborn metabolic disorders, pre terms & post terms.

Results :

Consecutive 1000 live births were included in the study during the study period. Of them 149 (14.9%) were preterm and 62 (6.2%) were post-term. Among the term 25 babies were born out of multiple pregnancy and 3 had major congenital anomalies. Therefore 761 term babies constituted in the final study population.

Out of the total 761 population included in the study, 245 were early term (32.2%) and 516 were full terms (67.8%). The distribution of study population according to gestational age is shown in table 1. Among the study population most of the babies were 39 weeks of gestational age and the least being 37 weeks. The mean gestational age of the population was 39.17 ± 1.35 weeks.

Table 1. Distribution of study population according to gestational age.

Gestational age	Frequency	Percent
37 weeks	114	14.98%
38 weeks	131	17.21%
39 weeks	193	25.36%
40 weeks	155	20.37%
41 weeks	168	22.08%

Among the population 386 were boys (50.7%) and 375 were girls (49.3%). Among the early term babies 120 were boys (48.98%) and 125 are girls (51.02%). Among full term babies 266 were boys (51.55%) and 250 were girls (48.45%).

Distribution of weight for gestation among study population is shown in table 2.

Table 2. Weight for gestation among the population.

Weight for gestation	Frequency	Percent
AGA	596	78.3%
LGA	30	3.9%
SGA	135	17.7%
Total	761	100.0%

Among the total population 210 were delivered by cesarean section (27.6%) and 551 had vaginal (72.4%) birth (table 3). Among the early term deliveries 69 were delivered by cesarean section (28.2%) and 176 by vaginal delivery (71.8%). Out of total full term deliveries 141 were by cesarean section (27.3%) and 375 by vaginal delivery (72.7%). P-value is 0.809.

Table 3. Difference in mode of delivery between early and full term babies.

Mode of delivery	TERM		Total	P value (Chi square test)	OR (95% CI)
	Early Term	Full Term			
CEASEREAN	69	141	210		
VAGINAL	176	375	551	0.809	1.043
Total	245	516	761		(0.743 – 1.464)

Out of 210 cesarean newborn 32 (15.2%) needed NICU admission. Out of 551 vaginally born babies 48 (8.7%) needed NICU admission. P value is <0.05.

Table 4 is showing the incidence of different types of morbidities in early term and full term neonates and their NICU/SNCU admission rates. NICU/SNCU admission rates were higher for babies born at an earlier gestational age (14.69% v/s 8.53%) than babies born later. Incidence of morbidities like jaundice requiring phototherapy (4.9% v/s 1.6%), need for resuscitation (6.9% v/s 3.3%), hypoglycemia on admission (4.9% v/s 1.6%), respiratory morbidities (2.9% v/s 1.6%), need for mechanical ventilation (1.2% v/s 0.4%), clinical sepsis (6.9% v/s 3.4%), confirmed sepsis (4.5% v/s 1.7%), need for intravenous antibiotics (10.6% v/s 6.0%), need for intravenous fluid (12.7% v/s 6.8%) were significantly higher in early terms than full terms during the first one week of life. Significantly higher number of babies delivered by cesarean section needed intervention and NICU admission (15.2% v/s 8.7%) than vaginally born babies. Moreover, among the cesarean deliveries the early term babies had significantly more morbidities or NICU/SNCU admission than their counterparts.

Table 4. Comparison of morbidities between early & full term babies.

Morbidities	Early term (n=245)	Full term (n=516)	P value (Chi square test)
NICU/SNCU admission	14.7%	8.5%	0.01
Phototherapy for jaundice	4.9%	1.6%	0.007
Need for resuscitation	6.9%	3.3%	0.023
Hypoglycemia	4.9%	1.6%	0.007
Respiratory morbidities	2.9%	1.6%	0.226
Ventilation support	1.2%	0.4%	0.335
Clinical sepsis	6.9%	3.4%	0.034
Confirmed sepsis	4.5%	1.7%	0.027
Need for antibiotics	10.6%	6.0%	0.024
Need for IV fluid therapy	12.7%	6.8%	0.007

Discussion :

Human pregnancy is considered to be full-term when it lasts between 37-42 weeks. Anything shorter is considered to be a pre-term birth and anything longer is considered post-term. Longer pregnancies can be a risk to both the mother and infant and so labour tends to be induced if a pregnancy goes on past 42 weeks. On the other hand, it is well-documented that pre-term babies can have a variety of health problems.^[1,4,5] However, considering all babies born between 37 - 42 weeks as a single group ignores the variability of developmental outcomes of these children. A child born at 41 weeks is likely to be more physically and mentally developed and weigh substantially more than a child born at 37 weeks. The designation of early-term infants (37^[0/7] - 38^[6/7] weeks' PMA) was more recently coined to focus attention on the risk for morbidity and mortality in such infants compared with other term infants born at 39^[0-7] to 41^[6/7] weeks' gestational age. Some research suggesting that the short-term outcomes of children born between 37-38 weeks are worse than those born after 39 weeks, including a greater risk of not surviving infancy.

In our study we have tried to find the early neonatal morbidities of babies born early term (n = 245) and compared it with babies born at full term gestation (n = 516) in a population of peripheral medical college in West Bengal. The distribution of study population in our study consists of 32.2% early term and 67.8% full term with highest cluster in 39 week age and lowest in 37 weeks with mean gestational age of 39.17 ± 1.35 weeks. It is in line with the study of Parikh LI et al.^[5] and Sengupta S et al.^[7] where the full term population is twice the early term, whereas the study conducted by Ramprakash MA et al.^[8], has nearly equal distribution of early and full term population.

In contrast to the previous studies our study shows 28.2% cesarean section in early term and 27.3% in full term population. Thus rate of cesarean section is almost equal in both the population and there is no statistically significant difference between

them. This may be because this study was conducted in a government medical college and hospital where incidence of non-medically indicated elective early term cesarean section deliveries are very less in contrast to the previous studies conducted in private hospitals and mostly in western countries.

The information reported here demonstrates that early term infants make up a significant proportion of NICU admissions and supports previous research that shows that this group of infants is at some increased health risks when compared to full term infants. Our findings illustrate that 14.69% of early term infants needed NICU/SNCU admission compared to 8.53 % of their full term (P value < 0.01) counterparts signifying that babies born during term gestation are not a homogenous risk group and early term infants may look as healthy as full-term babies, but are physiologically and metabolically less mature than full term babies. Our study is supported by Fang et al.^[9] as they found increased neonatal morbidities requiring NICU admission for early term (8.4 %) compared to full term (3.3%) despite fetal pulmonary maturity. In their study Tita et al.^[10] reported that 12.8% of 37-week and 8.1% of 38-week infants were admitted to the NICU, compared to 5.9% and 4.8% of 39-week and 40-week infants, respectively. After adjusting for potential confounders, infants born at 37 weeks had a 2.3 times higher risk of an NICU admission, compared to infants born at 39 weeks.

NICU admission decreases as gestational age increases from 37 to 39 weeks as reported by Gharvey et al.^[6] Ramprakash MA et al.^[8] also found that odds of NICU admission were 2.61 times in early term pregnancies, compared to full term pregnancies. Poets CF et al.^[11] found singletons born by elective cesarean section at 37 (i.e. 37^[0/7] to 37^[6/7]) weeks' gestation showed twice the risk of dying or becoming acutely ill after birth compared to children born at 39^[0/7] to 39^[6/7] weeks' gestation. Sengupta S et al.^[7] also found that even among vaginal deliveries, early-term neonates (6.8%) had a significantly higher rate of NICU or neonatology service admission

compared with full term neonates (4.4%). There is also an additive effect of cesarean section delivery on the need for admission to NICU/SNCU which was highest at a younger gestational age.

Fang et al.^[9] and Bates et al.^[12] conducted the study on population with documented fetal pulmonary maturity and found that despite lung maturity, delivery before 39 weeks is associated with significantly increased neonatal morbidity when compared to scheduled deliveries at 39 weeks or greater and significant increases in neonatal morbidity were noted prior to 39 weeks regardless of the mode of delivery.

We found in our study that infants admitted in NICU/SNCU with neonatal hyperbilirubinemia requiring phototherapy are significantly higher in early term (4.9 %) than full term (1.6 %) population. Our study is analogous with the findings of Ramprakash MA et al.^[8] that the odds of neonatal jaundice were 3.59 times in early term pregnancies, compared to full term pregnancies. Jensen, JR et al.^[13] (9.2% v/s 1.2%), and Ruth CA et al.^[14] also found similar observations in their study between early and full term. Jaundice and hyperbilirubinemia occur more commonly in early term infants than in full term because of developmental immaturity in the liver i.e. decreased capacity to handle unconjugated bilirubin, decreased hepatic uptake, decreased Uridinediphosphoglucuronate Glucuronosyl Transferase (UGT) activity, and increased enterohepatic circulation, delayed postnatal maturation of hepatic bilirubin uptake and bilirubin conjugation and feeding difficulties.^[15] The life span of red blood cells are also shortened in early term and enterohepatic circulation is specially increased in sick early term babies due to some other comorbid conditions which common in this group. Bilirubin neurotoxicity may also occur at an earlier postnatal age and the margin of safety may be narrower.

In our study, among the early term 7.5% babies required resuscitation of some sort, as compared to only 3.3% of full term babies. The need for resuscitation including Initial steps of resuscitation,

positive pressure ventilation at birth and intubation were significantly higher in early term when compared to full term born [P value <0.05]. None of the babies in the study period required medications for resuscitation. Parikh et al.⁵ found rates of HIE, asphyxia, or seizures tended to be lowest at 38 and 39 weeks of gestation, but were not significantly different between early and full term birth for any precursor. Study conducted by Heimstad R et al.^[16] shows there is a U shaped distribution, of need for resuscitation with lowest rates at 39 weeks of gestation. However, that study lacked information on the specific indications for induction.^[16]

Hypoglycemia (Symptomatic or Asymptomatic) defined as blood sugar below 40mg/dl was seen in 4.9% babies in the early term group as compared to 1.6% in full term babies (P value <0.05) in our study population. Only sick term babies had glucose estimation during admission in NICU/SNCU. Our findings are also similar to the study done by Ramprakash MA et al.^[8] where odds of hypoglycemia were 3.42 times more in early term pregnancies, compared to full term. Sengupta S et al.^[7] also found incidence of hypoglycemia twice more in early term (4.9%) than full term (2.5%). The risk of hypoglycemia is also increased when there are increased energy demands (eg, sepsis, hypoxia, and cold stress) and when enteral intake is inadequate (eg, abnormal suck and swallow or feeding intolerance). So screening for asymptomatic hypoglycemia is recommended in this group of newborns after an initial feeding.

In our study the babies admitted with any sort of respiratory morbidities are significantly higher in early term (2.9%) than full term (1.6%) population. Among the respiratory morbidities transient tachypnea of newborn (TTN) was most common. Need for neonatal ventilation either in form of CPAP or Mechanical ventilation was also higher in early (1.2%) than full (0.4%) term. Our study is supported by the findings of Madar et al.^[17], that ventilation for severe RDS was significantly higher for infants born at 37 weeks (18.0 per 10,000

births) and 38 weeks (5.9 per 10,000 live births), versus 39-41 weeks, in which only 1 of 133,277 had RDS. Morrison et al.^[18] also found rate of respiratory morbidities are 14 and 8 times higher respectively in 37 and 38 weeks than their full terms counterparts. A smaller study conducted by Gharney et al.^[6] shows a 2-fold increased risk of RDS, oxygen use, continuous positive airway pressure (CPAP) in early term than full term babies. Eagle WA et al.^[4] found that infants born at 37 weeks' gestation have a 3-fold greater rate of respiratory distress syndrome than those born at 38 weeks' gestation, who in turn, have a 7.5-fold greater rate than infants born at 39 to 41 weeks' gestation.^[4] Thus pulmonary disorders such as transient tachypnea of the newborn (TTN), respiratory distress syndrome (RDS), pneumonia are more common, and incur a greater risk of respiratory failure, in early term than in full-term infants.^[19]

More babies were evaluated for sepsis and received empirical antibiotics in early term (6.9 %) as compared to full term (3.5%) [P value <0.05]. We also found that 4.5% of early term babies had blood culture positive sepsis compared to 1.7% of full term. Bates et al.^[12] found a nearly two-fold higher risk of suspected/proven sepsis in early term population compared to full term. Parikh LI et al.^[5] said there is decrease in sepsis morbidity occurred between 37 and 38 weeks with the nadir between 38 and 39 weeks for spontaneous labor and indicated deliveries as compared to full term. The findings of Jensen JR et al.^[13] (5.3% v/s 3.5% after 39 weeks) and Sengupta S et al.^[7] are also in line with us. Apart from immature defense mechanism of infants born at an earlier gestational age leading to an increased susceptibility to infectious agents, early term infants are also at an increased risk because of invasive monitoring required for them due to some other morbidities are much more than full term infants.

In our study between early and full term infants we found that the need for intravenous antibiotics (10.6% v/s 6.0%; P value <0.05) and need for intravenous fluid (12.7% v/s 6.8%; P value <0.05) was significantly higher in the former group. Our

findings are analogous with the findings of Sengupta S et al.^[7] [intravenous fluid (7.5% v/s 4.4%), antibiotics (2.6% v/s 1.6%)] proving that early term infants are relatively immature and more prone to infections.

Conclusion :

Much has been written regarding potential adverse newborn outcomes of preterm and post-term birth, but little attention has been given to differential neonatal morbidities of infants delivered within the 37-41 week interval. This research demonstrates that infants born during the first two weeks of what has traditionally been considered the term period (GA: 37^[0/7]- 41^[6/7] weeks) may actually have not achieved full maturity and are likely to still be at risk of morbidities that can affect premature babies. There is a continuous relationship between gestational age and neonatal morbidity and increased risk is more profound with cesarean section deliveries but risk exists for vaginal deliveries as well.

Our study supports the view that the use of the designations "term" to refer to a gestation that has reached 37 weeks 0 days is vague. Such a designation has no basis in maternal or fetal physiology and potentially leads to inappropriate care by suggesting to the clinician and patient those 37 weeks 0 days represents a valid physiologic threshold. Targeted obstetric practices and maternal education aimed at reducing early-term deliveries will have a significant influence on health care system. It seems apparent that more research looking at this population is required to determine the efficacy and safety of strategies to optimize these outcomes, and to develop interventions that affect physiologic maturation of the fetus when delivery is necessary.

The risks and benefits for spontaneous vaginal delivery, planned induction of labor, or elective cesarean section and also the differential neonatal morbidities of infants delivered within the 37-41 week interval should be carefully considered by mothers, families, and physicians when determining

the optimal timing and route of delivery.

Contribution of author: Dr. Satyaki dey has investigated all the cases and has prepared the manuscript. He will act as guarantor. Dr Subinay Mandal has planned and guided the study and has helped in analyzing the data and preparing the manuscript. Dr Meghdeep Mukhopadhyay has helped in the clinical examination and management.

Conflicts of interest : nil

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