

Early Developmental Outcomes Among Infants Born Early Term

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Abstract

Background: The length of gestation has a strong impact on the child's developmental outcomes. Early childhood development (during the first year of life) is crucial for life-long learning. We aimed at investigating the possible influence of early term birth on early child development by recording the age of attainment of early developmental milestones. **Subjects and Methods:** This prospective cohort study was conducted in a tertiary care teaching hospital in South India between Feb and Dec 2020. It included 70 full term and 50 early term neonates, born between 39-40 weeks and 37-38 weeks respectively, who were followed up till 4 months of age. Clinical condition during the hospital stay was recorded. Attainment of social smile was collected by phone call. Head control grading was done at 4 months of age. **Results:** Neonatal morbidities were found to be higher among early term babies. The mean age of attainment of social smile was 31.38 days and 48.26 days among infants born at early term and full term respectively. Head control grading was normal in all full term born infants whereas 11% of early term infants did not achieve appropriate head control grading at the end of 4 months. These results were statistically significant. **Conclusion:** Our observations suggest that there is increased risk for adverse respiratory consequences and hyperbilirubinemia among infants born early-term. There is obvious relationship between gestation length and developmental outcomes of the child and hence early-term neonates have to be enrolled as high risk neonates to start early intervention for preventing neurodevelopmental impairment.

Keywords: Development, Milestones, Infants, Early term

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Introduction

Fetal growth and development is a continuum, with accelerated growth in the later stages of pregnancy from 32 weeks of gestation. The optimal time of birth is considered as 39 to 40 weeks gestation.^[1] But decisions regarding timing of delivery always should be individualized to the needs of the patient considering relative maternal and newborn risks, practice environment, and patient preferences.^[2] Previously, babies born between 34 and 36 weeks of gestation were called as "near term" assuming that they are developmentally similar to term infants. In 2005, "late preterm" replaced the phrase "near term" for these babies to emphasize their previously underestimated vulnerability.^[3,4] In the recent years, elective deliveries are being conducted in early term gestation for non medical reasons, contributing to the shift of length of gestation for singleton births from 40 to 38 weeks.^[5] The latest jargon coined by "Defining Term Pregnancy Workgroup" is "early term" for infants born between 37 and 38 weeks on the basis of emerging

evidences that this group of babies are at increased risk for poor neonatal and neuro-developmental disabilities (NDDs).^[6-12] Currently the recommendations by different organization for caesarean sections (CS) on maternal request, without clinical indication, should be performed only at 39 weeks of gestation at the earliest which is based on studies that have demonstrated a clear benefit in allowing the pregnancy to reach full term.^[13,14] Revision of the committee's opinion happened to include frequent obstetric conditions since the neonatal risks of early term births are well established.^[15] Considering the above literature search, we ought to include early term babies are under high risk for NDD and the present study was conducted to assess whether early-term delivery impacts the age of attainment of early developmental milestones (social smile and head control) till 4 months of age so as to facilitate early identification and intervention for NDDs.

Subjects and Methods

In this prospective cohort study, we included all singleton newborns delivered at term (37 to 42 weeks of gestation) between February 2020 and December 2020 at a tertiary care teaching hospital in South India. Gestational age calculation was based on first trimester ultrasound estimates. Neonates with congenital malformations and who are born to mothers < 18 and > 30 years of age were excluded. Cases were recruited during the first 6 months of study period to facilitate the follow-up until 4 months of age. Eligible neonates were categorized into early term babies (37 weeks and 38 weeks +6 days gestation) and full term babies (39 weeks and 41 weeks +6 days gestation). Birth weight was measured with a calibrated digital weighing scale (PHOENIX digital baby scale, NITIRAJ engineers Pvt Ltd, India) to the nearest 10 grams and plotted on intrauterine growth charts defined by Lubchenco for categorizing infants as appropriate/small/large for gestational age (AGA/SGA/LGA).^[16] The hospital outcome measures analyzed were need for resuscitation in delivery room (positive pressure ventilation for more than one minute), oxygen therapy during hospitalization (oxygen prongs/hood, continuous positive airway pressure [CPAP] or mechanical ventilation), neonatal intensive care unit admission for more than 24 hours, hypoglycemia (defined by blood glucose less than 45 mg/dl) within first 48 hours of life, hyperbilirubinemia requiring phototherapy within first 72 hours of life, and respiratory distress (respiratory rate more than 60/min with or without retractions / grunting). Follow-up outcome measures were attainment of social smile and head control. Mothers were contacted by telephone from fifth to seventh week after delivery to collect data on age of attainment of social smile (defined by recognize facial expressions and begins to smile at people). The following precautionary measures were taken to minimize the errors in telephonic interviewing: local number of the hospital was provided to the parents and crosschecked for storing in their phones; phone numbers of the deputed private phone of the investigator and both the parents were exchanged and stored; calls were made during daytime; script consisting of the definition of social smile in the parents' comprehensible language was used to have uniformity in conversation. Head control was assessed during follow up visit at completed 4 months of age. Grading of head control was done with the help of grading for major motor milestones developed by Child development centre, Thiruvananthapuram.^[17] Motor tasks for head control assessment were done in partnership with the mother. Precautions were taken to comfort the infant during examination. The trained investigator performed the grading of head control which was confirmed by the corresponding author. For head control, grades 0, 1, 2 were considered delay whereas grades 3, 4, 5 were considered normal. For those infants with delay, appropriate intervention was started. Collected data were entered into Microsoft excel sheet and appropriate sta-

tistical analysis were done. The Institutional Human Ethical Committee clearance was obtained. A written informed consent was obtained from parents of all participants.

Results

A total of 723 deliveries happened during study period, 585 (81 %) were term deliveries. 243 (41.6%) deliveries happened during early term (37 and 38 weeks) gestation. Early trimester ultrasonography was not available for 413 mothers and 52 babies excluded by defined criteria. The study included 120 eligible neonates of which 50 were early term and 70 were full term. The descriptive characteristics of all neonates according to gestational age are shown in [Table 1]. The mean USG-GA was 38.6 ± 1.53 (37.6; 39) weeks with lowest of 37 weeks and highest of 41.0 weeks. The mean birth weight of study population was 2731 ± 1.02 grams, constituting with a range of 1580 grams and 4000 grams as the lowest and highest respectively. Neonatal morbidities of early term consist of 26% as compared to 16% among infants born full term which was statistically insignificant. The morbidities and their distribution with the statistical interpretation are depicted in [Table 2]. Social smile attained at a mean age of 31.38 days among term babies and 48.26 days among early term infants. The difference was statistically significant [Table 3]. The mean age of assessment of head control was 4.04 months (range of 4.1 to 4.3 months). At 4 months of age, all infants born at term gestation had head control. In the early term group 22% of children were classified as delayed in attaining head control [Table 4]. The summary statistics with respect to demographic and morbidity parameters reflect the less diversity of the study population, with a high proportion of babies in low risk group. Some of the morbidities varied according to gestational age, but there was no strong dose-response effect across gestational age.

Discussion

Attainment of developmental milestones is a continuous process and has uniformity. However age of attainment of milestones is highly influenced by biology and environment. One of the major predictors of later attainment of motor milestones includes earlier gestational age. Our aim was to investigate the variations in achievement of social smile and control of head posture among the infants born at term gestation. In the hypothetical outline of the present prospective observational study, the milestones which were planned to be observed are considered essential for the active participation of the infant in social interactions and for the successful emergence of further developmental milestones. When the baby is placed in a semi-upright position in a particular age he starts to have sustained looking, smiling and pleasure vocalizations towards the mother. These acts are associated

Table 1: Demographic characteristics of the study population

Parameter		Early term [n=50] n (%)	Full term [n=70] n (%)	p value [£]
Sex	Male	27 (54)	33 (46)	0.45
	Female	33 (47)	37 (53)	
Birth weight (in)	1500 – 2500	4 (8)	6 (9)	0.72
	2500 – 3500	43 (86)	57 (81)	
	>3500	3 (6)	7 (10)	
Birth weight	SGA	5 (10)	7 (10)	0.60
	AGA	44 (88)	59 (84)	
	LGA	1 (2)	4 (6)	

£ – Pearson chi square test

Table 2: Morbidity status among the study population

Morbidity parameter	Early term	Full term	p value
NICU stay	6 (12)	4 (6)	0.21 [£]
Need for resuscitation	2 (4)	0	0.09 [≠]
Perinatal asphyxia	1 (2)	0	0.23 [≠]
Respiratory distress	8 (16)	4 (6)	0.67 [£]
Hypoglycemia	1 (2)	0	0.24 [≠]
Hyperbilirubinemia	9 (18)	4 (6)	0.03 [£]

£ – Pearson chi square test ≠ Fisher exact test

Table 3: Distribution of mean age at attainment of social smile among the study population

Gestational age	Mean + SD	Mean difference (C.I)	P value
Early term (n=50)	48.26 + 5.3	-16.72 (-15.07 - -18.62)	0.001
Full term (n=70)	31.38 + 4.31		

T-test

Table 4: Stage of head control at 4 months of age among the study population

Head control	Gestation age	
	Early term [n=50] n (%)	Full term [n=70] n (%)
1	2 (4.0)	0 (0.0)
2	9 (18.0)	0 (0.0)
3	16 (32.0)	6 (8.6)
4	19 (38.0)	33 (47.1)
5	4 (8.0)	31 (44.3)

Pearson Chi-Square=37.8; p=0.001

with simultaneous emergence of active postural control of the head. Hence the development in various dimensions like physical and mental are inter-related and inter-dependent. The decisive neurological prerequisite for achievement social behaviours is adequate postural control (neck holding).^[18] Van Wulfften Palthe et al emphasized that for a child to coordinate head and eye movements into a functional unit for looking around or change visual directions, he should have attained adequate postural control of the head along with maturation of the visual system. This is the first opportunity for the infant to control and organize social interaction.^[19] Hugo Peyre et al, by administering questionnaires to the parents on the details regarding developmental milestones at 4, 8, 12 and 24 months of age, aimed to investigate the predictability of IQ at 6 years of age. The authors concluded that early language skill more strongly predict later IQ than the other cognitive domains.^[20] The focus of the present study is on the early-term group, for whom the published evidence is limited. Studies with similar subjects had been conducted previously to assess the cognitive aspects and school performance. Lower achievement scores in third grade for reading and mathematics was observed among the children who are born early term gestation. The authors in this particular study had analysed whether children born within the term range of gestation (between 37 and 41 weeks) vary in terms of school achievement and concluded that babies born earlier normal term birth may be at risk for poorer school performance.^[21] Similar observations were made by Gry Poulsen et al using the UK Millennium Cohort Study who analyzed the relation between gestational age and cognitive ability in early childhood. Their findings suggested in early term group there was 20% increased risk of scoring less than 1 SD below the mean compared with the full-term group with the resultant opinion that cognitive ability is related to the entire range of gestational age, including children born at 37–38 weeks gestation.^[22] Findings by Seungmi Yang et al suggest that, even among healthy children born at term, cognitive ability at age 6.5 years is lower in those born at 37 or 38 weeks.^[23] In a population based cohort study by Maria A Quigley et al who compared school performance at age 5 years in children born at various gestational age revealed late preterm and early term birth were associated with an increased risk of poorer educational achievement at age 5 years.^[24] Carrie Shapiro-Mendoza et al suggested in their study that infants born late preterm and early term have higher prevalence of early intervention program services enrollment than infants born at term, and may benefit from more frequent monitoring for developmental delays or disabilities.^[25]

The major strength of the present study was gestational age was determined by the gold standard early trimester ultrasound dates. It should be noted that the association between gestational age at birth and attainment of milestones in the present study could be confounded by the underlying causes of earlier birth, fetal growth restriction, maternal or

neonatal complications.

Our study adds to the understanding of the relationship between gestational age at birth and the risk of being classified as ‘delayed’ development. It supports recent concerns that early term birth not only increases the risk of adverse short-term medical outcomes but may also have an adverse influence on child development. Physicians and parents who take care of early term infants need to be aware that this group may be at increased risk for developmental disabilities. Observed differences in the present study between early term and full term children are likely to be small, therefore large sample sizes will be required in order to assess such differences precisely and to address to what extent these differences are influenced by other confounding factors.

Conclusion

Our observations in addition to the existing data have important implications in considering the definition of “term”. Present analysis found evidence of delayed ability for early term group for attaining early developmental milestones when compared to full-term birth. The findings could help us formulate guidelines regarding optimal timing of delivery. Regular screening of infants born at early term gestation can facilitate early identification of developmental delay allowing for timely referral to early intervention centers to optimize the development.

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