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Original Research Article

Prospective Observational Assessment of Early Developmental Outcomes Among Infants Born Early Term

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Abstract

Aim: Early developmental outcomes among infants born early term.

Methods: This prospective observational study was carried out in the Department of Pediatrics, Saraswathi Institute of Medical Sciences, Hapur, India. For 3 months. We included all singleton newborns delivered at term (37 to 42 weeks of gestation). 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).

Results: The study included 100 eligible neonates of which 50 were early term and 50 were full term. The mean USG- GA was 38.7 ± 1.63 (37.7; 39.1) weeks with lowest of 37 weeks and highest of 41.1 weeks. The mean birth weight of study population was 2741±1.12 grams, constituting with a range of 1590 grams and 4010 grams as the lowest and highest respectively. Neonatal morbidities of early term consist of 46% as compared to 14% among infants born full term which was statistically insignificant. Social smile attained at a mean age of 32.38 days among term babies and 49.26 days among early term infants. The difference was statistically significant. The mean age of assessment of head control was 4.14 months (range of 4.2 to 4.4 months). At 4 months of age, all infants born at term gestation had head control. In the early term group 20% of children were classified as delayed in attaining head control.

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.

Keywords: Singleton Newborns, Term, Neonates.

Introduction:

It had been previously believed that children born between 37 and 41 weeks of gestational age share similar health outcomes, therefore including them in the same low-risk group[1]. In 2012, the American Academy of Pediatrics recommended that births occurring between 37 weeks 0 days and 38 weeks 6 days be defined as early term, while those from 39 weeks 0 days to 40 weeks 6 days as full term[2]. Approximately 27.6% of all births in the USA are early term[3,4], far exceeding the number of preterm births[4,5]. Many studies have reported that early-term births are associated with higher neonatal morbidity and higher probability of neonatal intensive care unit admission compared with their full-term counterparts (>38 gestational weeks)[6]. Early-term children also have increased susceptibility to various metabolic, neurological and respiratory diseases[7-9]. Recently, research into the effect of gestational age on developmental outcomes has directed attention to the investigation of early-term infants[10]. There have been increasing reports which show that early-term births resulted in worsened cognitive and academic outcomes compared with those born at 39 weeks or later[1,10-13]. A systematic review showed that full-term cohorts performed 3% of an SD higher in cognitive outcome than early-term cohorts.[10] The gestation period between 37 and 40 weeks was associated with neuromotor and cognitive development in infants aged 9–15 weeks and 12 months.[13,14] Early-term birth was associated with an increased risk of worsened academic achievements at ages 5-7 years[15,16].

However, on the basis of recent research[13,17-19], the exact boundary which separates early-term and full-term gestation periods should be carefully examined because of its implications for neonatal and developmental outcomes. The highest risk of mortality was observed for children born at 37 gestational weeks, but not for those born at 38 gestational weeks[19]. Furthermore, a prospective cohort study in Belarus showed that children born at 37 gestational weeks had a significantly lower full-scale IQ score compared with those born at 39–41 weeks, however, this difference was not observed in children born at 38 gestational weeks[20]. Moreover, in a large sample of healthy infants, there was a significant difference in the mental development index between infants born at 37 and 38 gestational weeks, but almost no difference between those born at 38 and 39 gestational weeks[13]. However, the degree to which earlier gestational age confers risk among infants born at term from 37 to 41 weeks of gestation remains unclear[7,12,20].

Material and methods

This prospective observational study was carried out in the Department of Pediatrics, Saraswathi Institute of Medical Sciences, Hapur, India for 3 months

Methodology

We included all singleton newborns delivered at term (37 to 42 weeks of gestation). 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 dig- ital 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)[21]. 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[22]. Motor tasks for head control assessment were done in partnership with the mother. Pre- cautions 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 statistical analysis were done.

Results

The study included 100 eligible neonates of which 50 were early term and 50 were full term. The descriptive characteristics of all neonates according to gestational age are shown in [Table 1]. The mean USG- GA was 38.7 ± 1.63 (37.7; 39.1) weeks with lowest of 37 weeks and highest of 41.1 weeks. The mean birth weight of study population was 2741±1.12 grams, constituting with a range of 1590 grams and 4010 grams as the lowest and highest respectively. Neonatal morbidities of early term consist of 46% as compared to 14% 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 32.38 days among term babies and 49.26 days among early term infants. The difference was statistically significant [Table 3]. The mean age of assessment of head control was 4.14 months (range of 4.2 to 4.4 months). At 4 months of age, all infants born at term gestation had head control. In the early term group 20% 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.

Table 1: Demographic characteristics of the study population

Parameter		Early term [n=50] n (%)	Full term (%)	p value£
Sex	Male	26 (52)	22 (44)	0.47
	Female	24 (48)	28 (56)	
Birth weight (in grams)	1500 – 2500	4 (8)	4 (8)	0.62
	2500 – 3500	42 (84)	40 (80)	
	>3500	4 (8)	6 (12)	
Birth weight	SGA	6 (12)	6 (12)	0.65
	AGA	43 (86)	40 (80)	
	LGA	1 (2)	4 (8)	

Table 2: Morbidity status among the study population

Morbidity parameter	Early term	Full term	p value
NICU stay	5 (10)	2 (4)	0.23£
Need for resuscitation	1 (2)	0	0.08≠
Perinatal asphyxia	1 (2)	0	0.25≠
Respiratory distress	7 (14)	2 (4)	0.68£
Hypoglycemia	1 (2)	0	0.26=
Hyperbilirubinemia	8 (16)	3 (6)	0.04£

£–Pearsonchisquaretest≠=Fischerexactttest

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)	49.26 + 5.3	-15.72 (-15.17- -18.72)	0.001
Full term (n=50)	32.38 + 4.31		

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=50)] n (%)
1	2 (4)	0 (0.0)
2	10 (20)	0 (0.0)
3	15 (30)	4 (8)
4	20 (40)	24 (48)
5	3 (6)	22(44)

Pearson Chi-Square=38.8; p=0.001

Discussion

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 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)[23]. 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[24]. 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[25]. 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[26]. 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[27]. 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[28]. 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[29]. 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[30]. 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.

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.

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