ISSN: 0975-833X

Available online at http://www.journalcra.com

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

International Journal of Current Research
Vol. 13, Issue, 05, pp.17619-17622, May, 2021

DOI: https://doi.org/10.24941/ijcr.41541.05.2021

RESEARCH ARTICLE **OPEN ACCESS**

NEONATAL MORBIDITIES AND DEVELOPMENTAL OUTCOMES OF INFANTS BORN EARLY TERM

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ARTICLE INFO

Article History:
Received 20th February, 2021
Received in revised form
25th March, 2021
Accepted 18th April, 2021
Published online 30th May, 2021

Key Words:

Hemodynamics,
Intubation,
Lignocaine,
Nalbuphine.

ABSTRACT

Background: Term babies are those who are born between 37 weeks 0 days and 42 weeks. They are further subdivided into early term (between 37 weeks and 38 weeks) and full term (between 37 weeks and 38 weeks). The objectives of this review are to examine the effect of early-term birth on adverse neonatal outcomes and developmental disabilities. **Methods:** We searched PubMed, EMBASE, Scopus, and Google scholar from January 2007 to December 2020, for studies investigating the associations between early-term birth and neonatal mortality, morbidity and long term developmental outcomes. **Results: Twenty two** studies were included in the review, of which fourteen compared morbidity and mortality rates and eight assessed any adverse developmental outcomes among the subgroups of term babies. Reviewed studies found that early-term birth was associated with increased neonatal mortality, poor neonatal outcomes and short term and long term developmental disabilities. **Conclusion: T**he included trials in this review involved a sizeable population, with good quality with limited reporting for adjusting the outcomes for obstetric, social and regional factors. We recommend to assess the benefits or harms before planning early birth and to carefully follow infants born early term for neurodevelopmental disabilities.

Citation: Karthikeyan Kadirvel, Sumathisri Ramachandran, Ragasivamalini Sivapregassam, Anu Rakesh Chellathurai. "Neonatal morbidities and developmental outcomes of infants born early term*", 2021. International Journal of Current Research, 13, (05), 17619-17622.*

INTRODUCTION

The growth and development of the fetus are continuous processes, with accelerated rate in the later stages of pregnancy from 32 weeks of gestation. Hence the optimal time of birth is considered as 39 to 40 weeks gestation[1]. This phase of brain growth is very vulnerable to damage from various factors important being shortened gestation [1]. Termination of pregnancy is decided based on the balance between the risk of continuing the pregnancy versus the risk of delivery the baby preterm. Specific conditions in the mother, fetus, or the placenta decide the times of interruption of pregnancy[2].Recent investigations have shown that infants born at 37 and 38 weeks' gestation (early-terms) are at increased risk of adverse outcomes such as respiratory morbidities, admission to Neonatal Intensive Care Units (NICU), prolonged hospitalisation, neonatal mortality, rehospitalisation, developmental delay and health complications during early infancy[3-5].The strong recommendation is for uncomplicated pregnancies different organizations have recommended that caesarean sections (CS) on maternal request, without clinical indication, be performed at 39 weeks of gestation at the earliest. This recommendation is based on studies that have demonstrated a clear benefit in allowing the pregnancy to reach full term[6]. This committee's opinion is being revised to include frequent obstetric conditions since the neonatal risks of early term births are well established. There is a clear association between gestation length and developmental outcomes for the child[7]. Researchers in recent years have explored that risks of neurodevelopmental disabilities are not restricted to preterm birth (≤37 weeks gestation) alone but also for infants born early term (37–38 weeks) too[8,9]. Developmental milestones follow principles of predictable course and new milestones get piled up on the previous ones achieved. Development during the first year of life is crucial for life-long learning.

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Table 1. Summary of different studies on various morbidities among infants born early term

Authors	Reference group	Design	N	Outcomes significant associated	Outcomes not significantly associated
Parikh (2008)	39 – 41 weeks	Retrospective study	188,809	NICU admission and respiratory morbidity.	Other neonatal morbidities
Maya Menon (2017)	Babies born after 39 weeks	Prospective design	660	Respiratory distress, hypoglycemia , hyperbilirubinemia requiring phototherapy and feeding problems.	Hospital stay, Neonatal sepsis
Xun zhang (2001)	39 to 40 weeks, low risk singleton live births	Retrospective design	12,762,098	Neonatal mortality, birth asphyxia, need for mechanical ventilation	Birth injury and meconium aspiration syndrome
Chetan Kumar (2014)	39 – 41 weeks	Editorial		Respiratory distress, hypoglycemia , hyperbilirubinemia requiring phototherapy, hospital readmission	
Luis C. Machado (2010)	term babies	retrospective cohort study	17,988	Neonatal mortality, Pneumonia, Convulsions, Jaundice, Hypocalcemia Hypothermia	Meconium aspiration syndrome, Central nervous system hemorrhage
Shaon Sengupta (2008)	term (39(0/7)-41(0/7) weeks)	Retrospective population-based 3-year birth cohort study	33,488	hypoglycemia, NICU admission, need for respiratory support, requirement for intravenous fluids treatment with intravenous antibiotics and mechanical ventilation or intubation	-
Roberta De Luca (2004)	39 – 41 weeks	cohort study including prospectively recorded late-preterm and term deliveries	56 549	Respiratory distress, hypoglycemia , hyperbilirubinemia requiring phototherapy	mortality and respiratory morbidity
Subinay Mandal (2017)	Term babies	prospective, observational & comparative study	761	NICU/SNCU admission rates, jaundice requiring phototherapy, need for resuscitation, hypoglycemia on admission, respiratory morbidities, need for mechanical ventilation, clinical sepsis, confirmed sepsis, need for intravenous antibiotics, need for intravenous fluid	

Table 2. Summary of different studies on various developmental outcomes among infants born early term

Authors	Reference group	Design	N	Adjusted estimates	Outcomes significant associated	Outcomes not significantly associated
Noble (2012)	41 weeks	Retrospective cohort (U.S. 1988 - 1992)	1,28,050	Yes	Poor reading scores, poor maths scores	
Paulsen (2013)	39 – 41 weeks	Retrospective cohort (U.K. 2000 - 2002)	14,027	Yes		School readiness, poor reading scores, poor maths scores
Quigley (2012)	39 – 41 weeks	Prospective cohort (U.K. 2000 - 2002)	9,523	Yes	Poor language scores, Social developmental delay	Poor maths scores, Motor developmental delay
Shapiro – Mendoza (2013)	39 – 41 weeks	Retrospective cohort (U.S. 1998 - 2005)	5,54,947	Yes	General developmental delay	
Yang (2010)	39 – 41 weeks	Randomised trial (B.Y. 1996 - 1997)	13,643	Yes	Overall IQ (37), Non-verbal IQ (37)	Poor reading scores, poor maths scores

Hence this literature search was planned to assess whether early-term delivery has adverse neonatal outcomes and impacts the child development. This report could help us formulate guidelines regarding optimal timing of delivery for infants.

Review report: This review report was prepared from the articles search done using the key words "neonatal morbidity", "neonates, infants", "term babies", "early term infants" and "neurodevelopmental disabilities" in PubMed, EMBASE, Scopus, and Google scholar. The criteria for inclusion of the articles for review were original articles, committee reports and guidelines. We selected 22 articles published between January 2007 to December 2020 for the predefined criteria. Preterm delivery is strongly associated with short term and long-term adverse outcomes for the babies, the relationship is well established. Traditionally, infants born closer to term were treated as developmentally similar to term infants. A U.S. National Institute of Child Health and Human Development panel replaced the term "near-term" with "late preterm" for infants born between 34 and 36 weeks to emphasize their previously underappreciated vulnerability for various morbidities in the neonatal period and poor developmental outcomes in the later life[10]. "Defining Term Pregnancy Workgroup" has introduced a new terminology "early term" for infants born between 37 and 38 weeks on the basis of emerging evidences that these babies are at increased risk for poor neonatal and neuro-developmental disabilities (NDDs) [11]

Neonatal Outcomes of Early Term Birth: In many studies comparing the neonatal morbidities, the comparison groups were babies born late preterm (34 to 36 weeks) and term (37 to 41 weeks). Since the subgroup "early term" among term infants are at increased risk for poor outcomes compared to full term peers, this comparison is inappropriate. Few studies have compared the subgroups among term infants. The following neonatal morbidities are discussed below.

Need for Neonatal Intensive care (NICU) admission: Three retrospective cohorts have dealt with NICU admission among infants born earlyterm[12,13,14]. All these analyses revealed that infants born early term are at increased risk for NICU admission. One study has restricted the study population to singleton elective caesarean sections[12] and another for both assisted and unassisted vaginal deliveries, for caesarean sections before and after labor[13]. The latter has observed statistically insignificant results for assisted deliveries at 38 weeks in primiparas and multiparas and the same for caesarean sections after labor in primiparas.

Neonatal Mortality: Some studies have documented increased mortality rate among infants born early term compared to their full-term peers, however confounding factors were controlled only in one study. The differences in mortality rate among early term infants observed by Zhang *et al* were small and this might be due to the extremely large sample size (7 million births)[15]. Confounders were not controlled by the three additional studies included for the present review[16-18]. Young *et al* in their Utah study, found increased risk for neonatal mortality at 37 weeks but not 38 weeks[18].

Neonatal Morbidities: The results from various other studies[19-26] which observed the neonatal morbidities have been depicted in table 1.

Developmental Outcomes of Early Term Birth: There are few studies comparing children born early term to those born "full" term showing conflicting findings regarding risks for poor developmental outcomes particularly cognitive domain, school performance and ability for good score in mathematics. A summary of these studies[27-31] can be found in Table 2. A well-designed questionnaire-based study was conducted by Hugo Peyre at al[32]. These authors had a research question of how well developmental milestones at different ages within two years of life predict IQ at 6 years of life. At 4, 8, 12 and 24 months, developmental milestones were collected through self-administered questionnaires rated by parents and combined with detailed medical examination at 12 months. They concluded that early language skills more strongly predict later IQ than the other cognitive domains[32]. One of the major predictors of later attainment of motor milestones includes earlier gestational age. Earlier gestational age includes both preterm and early term babies. There are many studies on neurodevelopmental outcomes among preterm babies. Observations by Noble et al revealed with respect to mathematics scores and reading in third grade, the achievement scores for early term infants were significantly lower than those for children born between 39 and 41 weeks. The uniqueness is this result was independent of birth weight, obstetric, social, and economic factors[27]. Similar study extended the observation till 7 years of age. There was a progressive decline in scoring for the tests as the gestational age at birth decreases. Also, they concluded that cognitive ability was adversely related to the decreasing gestational age at birth[28].

Seungmi Yang et al classified the study population according to the health status at birth and observed that cognitive ability at age 6.5 years was lower in those healthy children born early term[31]. There was a higher prevalence enrollment for early intervention program services among late preterm and early term infants as documented by Carrie Shapiro-Mendoza et al. They suggested that these group of children may benefit from more frequent monitoring for developmental delays or disabilities[30]. In the recent years, there is evolving evidence that all babies born term (37 to 41 weeks) do not behave similar with respect to neonatal, growth and developmental outcomes. These opinions from the various investigators from different geographical areas made the policy makers to further classify term infants into "early term" (infants born between 37 and 38 weeks) and "full term" (those born from 39 to 41weeks). The adverse neonatal and developmental outcomes among infants born late preterm and early term can be attributed to factors like physiological immaturity, biological and social factors. The extent to which the combination of these factors contribute to the immediate and late morbidities among early term are unclear and need more research in this aspect.

Conclusion

There is a clear association between gestation length and developmental outcomes for the child and hence early-term neonates have to be followed up for neuro-developmental impairment. Early-term deliveries appear to be associated with adverse neonatal consequences which are converting this population into high-risk newborn category with mild to moderate risk for neuro-developmental disorders. The present review adds an important perspective to be considered when balancing the fetal, maternal, and neonatal risks associated with delivery timing. Our report serves as an important reminder that policies to avoid non-medically indicated delivery before 39 weeks of gestation.

The use of "term" as a stand-alone designation should be discouraged and emphasize on using "early-term" in the diagnosis.

REFERENCES

Spong CY, Mercer BM, D'alton M, Kilpatrick S, Blackwell S, Saade G. 2011. Timing of indicated late-preterm and early-term birth. *Obstet Gynecol*. 118:323-333.

Consortium on Safe Labor, Hibbard JU, Wilkins I, Sun L, Gregory K, Haberman S, Hoffman M, et al. 2010. Respiratory morbidity in late preterm births. JAMA. Jul 28;304(4):419-25.

De Luca R, Boulvain M, Irion O, Berner M, Pfister RE. 2009. Incidence of early neonatal mortality and morbidity after late-preterm and term cesarean delivery. Pediatrics. 123(6):e1064-1071.

Hansen AK, Wisborg K, Uldbjerg N, et al., 2008. Risk of respiratory morbidity in term infants delivered by elective caesarean section:cohort study. BMJ 336: 85–7.

Brown HK, Speechley KN, Macnab J, et al., 2014. Neonatal morbidity associated with late preterm and early term birth: the roles of gestational age and biological determinants of preterm birth. *Int J Epidemiol.,* 43: 802–14.

Medically indicated late preterm and early term deliveries. ACOG Committee Opinion, Number 764. Obstetrics &Gynecology2019; 133: e151 – e155 (replaces Committee Opinion number 560, April 2013)

Davis EP, Buss C, Muftuler LT, et al. 2011. Children's brain development benefits from longer gestation. Front Psychol. 2:1–7

Zivanit Ergaz and Asher Ornoy. Perinatal and early postnatal factors underlying developmental delay and disabilities. Developmental Disabilities Research reviews. 2011; 17: 59–70

Daniel F. MacKay, Gordon C. S. Smith, Richard Dobbie, Jill P. Pell. 2010. Gestational Age at Delivery and Special Educational Need: Retrospective Cohort Study of 407, 503 School children. PLoS Medicine. 7(6): e1000289

Huff K, Rose RS, Engle WA. 2019. Late Preterm Infants: Morbidities, Mortality, and Management Recommendations. *Pediatr Clin North Am.,* Apr;66(2):387-402.

Spong CY. 2013. Defining "term" pregnancy: recommendations from the Defining "Term" Pregnancy Workgroup. JAMA. Jun 19;309(23):2445–6.

Ruth CA, Roos N, Hildes-Ripstein E, Brownell M. 2012. The influence of gestational age and socioeconomic status on neonatal outcomes in late preterm and early term gestation: A population-based study. *BMC Pregnancy Childbirth.,* 12(62).

Tita ATN, Landon MB, Spong CY, Lai Y, Leveno KJ, Varner MW. et al., 2009. Timing of elective repeat cesarean delivery at term and neonatal outcomes. *N Engl J Med.,* 360(2):111-20.

Tracy SK, Tracy MB, Sullivan E. 2007. Admission of term infants to neonatal intensive care: A population-based study. Birth. 34(4):301-7.

Zhang X, Kramer MS. 2009. Variations in mortality and morbidity by gestational age among infants born at term. *J Pediatr.,* 154(3):358-62.

Reddy UM, Ko CW, Raju TNK, Willinger M. Delivery indications at late-preterm gestations and infant mortality rates in the United States. Pediatrics. 2009;124:234-40.

Reddy UM, Bettegowda VR, Dias T, Yamada-Kushnir T, Ko CW, Willinger M. Term pregnancy: A period of heterogeneous risk for infant mortality. Obstet Gynecol. 2011;117(6):1279-87.

Young PC, Glasgow TS, Li X, Guest-Warnick G, Stoddard G. Mortality of late preterm (near-term) newborns in Utah. Pediatrics. 2007;119:e659-65.

Parikh LI, Reddy UM, Männistö T, et al. Neonatal outcomes in early term birth. American Journal of Obstetrics and Gynecology. 2014;211(3):265.e1-265.e11.

Menon M, G. S, K. R. Neonatal morbidity pattern in early term births. Int J Contemp Pediatr. 2018;6(1):93.

Zhang X, Kramer MS. Variations in Mortality and Morbidity by Gestational Age among Infants Born at Term. The Journal of Pediatrics. 2009;154(3):358-362.

Kumar C, Sharma D, Pandita A. Late Preterm and Early Term Neonates: A New Group of High Risk Newborn in Neonatology with Varied Complications. 2014;3(5):3.

Machado Jr. LC, Passini Jr. R, Rosa IR, Carvalho HB. Neonatal outcomes of late preterm and early term birth. European Journal of Obstetrics & Gynecology and Reproductive Biology. 2014;179:204-208.

Sengupta S, Carrion V, Shelton J, et al. Adverse Neonatal Outcomes Associated With Early-Term Birth. JAMA Pediatr. 2013;167(11):1053.

De Luca R, Boulvain M, Irion O, Berner M, Pfister RE. Incidence of early neonatal mortality and morbidity after late-preterm and term cesarean delivery. Pediatrics. 2009 Jun;123(6):e1064-71.

Subinay Mandal, Satyaki Dey, Meghdeep Mukhopadhyay :A prospective study on early neonatal morbidities in early term neonates NIJP 2018: 7(3)

Noble KG, Fifer WP, Rauh VA, Nomura Y, Andrews HF. Academic achievement varies with gestational age among children born at term. Pediatrics. 2012 Aug;130(2):e257-64.

Poulsen G, Wolke D, Kurinczuk JJ, Boyle EM, Field D, Alfirevic Z, Quigley MA. Gestational age and cognitive ability in early childhood: a population-based cohort study. Paediatr Perinat Epidemiol. 2013 Jul;27(4):371-9.

Quigley MA, Poulsen G, Boyle E, Wolke D, Field D, Alfirevic Z, Kurinczuk JJ. Early term and late preterm birth are associated with poorer school performance at age 5 years: a cohort study. Arch Dis Child Fetal Neonatal Ed. 2012 May;97(3):F167-73.

Shapiro-Mendoza C, Kotelchuck M, Barfield W, Davin CA, Diop H, Silver M, Manning SE. Enrollment in early intervention programs among infants born late preterm, early term, and term. Pediatrics. 2013 Jul;132(1):e61-9.

Yang S, Platt RW, Kramer MS. Variation in child cognitive ability by week of gestation among healthy term births. Am J Epidemiol. 2010 Feb 15;171(4):399-406.

Peyre H, Charkaluk ML, Forhan A, Heude B, Ramus F; EDEN Mother–Child Cohort Study Group. Do developmental milestones at 4, 8, 12 and 24 months predict IQ at 5-6 years old? Results of the EDEN mother-child cohort. Eur J Paediatr Neurol. 2017 Mar;21(2):272-279.

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