DOI: 10.4274/anatoljmed.2023.40799
Anatol J Gen Med Res 2023;33(3):349-56

CLINICAL RESEARCH / KLİNİK ARAŞTIRMA

ANATOLIAN JOURNAL of GENERAL MEDICAL RESEARCH

Risk Factors and Morbidity in Late-preterm Infants: A Comparison with Early-term and Full-term Infants

Geç Preterm Bebeklerde Risk Faktörleri ve Morbidite: Erken Dönem ve Tam Dönem Bebeklerle ile Karşılaştırılması

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Cite as: Eşki A, Ceylan G, Zenciroğlu A. Risk Factors and Morbidity in Late-Preterm Infants: A Comparison with Early-Term and Full-Term Infants
Anatol J Gen Med Res 2023;33(3):349-56

Abstract

Objective: Although late-preterm infants tend to be considered term infants, they are at risk for postnatal morbidities and mortality. We aimed to identify prenatal and obstetric risk factors with postnatal morbidity and mortality in late-preterm infants.

Methods: We conducted a retrospective study on late-preterm infants ($34^{0/7}$-$36^{6/7}$ weeks) and term infants ($37^{0/7}$-$41^{6/7}$) born in a tertiary hospital between January and December 2012. Term infants were classified as early- ($37^{0/7}$-$38^{6/7}$ weeks) and full-term infants ($39^{0/7}$-$41^{6/7}$ weeks). Data on demographic characteristics, risk factors, morbidity, and mortality were collected from medical records.

Results: There were 468 babies in the study, and 156 (33.3%) were late-preterm infants. Rates of maternal smoking, premature rupture of membranes, in vitro fertilization, and caesarian section were significantly higher in late-preterm infants than in full-term infants. Compared to full-term infants, admission to the intensive care unit was more common in late-preterm and early-term infants (11.9 and 1.6 times, respectively). Transient tachypnea of the newborn, pneumonia, hypocalcemia, hypoglycemia, feeding problems, sepsis, and indirect hyperbilirubinemia was statistically more frequent in late-preterm than early-term and full-term infants. Late-preterm infants (12.2%) had a higher rehospitalization rate after discharge than full-term infants (2.9%). While two late-preterm infants died, no death in early-and full-term infants.

Conclusion: Late-preterm infants have an increased risk of respiratory, metabolic, gastrointestinal, and infectious problems, as well as higher rates of hospital readmissions and mortality. This study emphasizes the importance of obstetric decision-making when considering late-preterm delivery and the need to establish better strategies to improve the outcomes of these newborns.

Keywords: Cesarean section, indirect hyperbilirubinemia, premature rupture of membrane, respiratory distress syndrome, transient tachypnea of the newborn

***This article was presented at the 2nd International Behçet Uz Congress on March 4-7, 2020.**

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Received/Geliş tarihi: 06.12.2022
Accepted/Kabul tarihi: 14.05.2023

Öz

Amaç: Geç preterm bebekler, term bebekler gibi kabul edilme eğilimi olmakla birlikte, doğum sonrası morbidite ve mortalite açısından risk altındadırlar. Geç preterm bebeklerde doğum sonrası morbidite ve mortalite ile prenatal ve obstetrik risk faktörlerini belirlemeyi amaçladık.

Yöntem: Ocak ve Aralık 2012 tarihleri arasında üçüncü basamak bir hastanede doğan geç preterm bebekleri ($34^{0/7}$-$36^{6/7}$ hafta) ve term bebekleri ($37^{0/7}$-$41^{6/7}$) içeren retrospektif bir çalışma yaptık. Term bebekler, erken term ($37^{0/7}$-$38^{6/7}$ hafta) ve tam term bebekler ($39^{0/7}$-$41^{6/7}$ hafta) olarak sınıflandırıldı. Demografik özellikler, risk faktörleri, morbidite ve mortalite ile ilgili veriler tıbbi kayıtlardan toplandı.

Bulgular: Çalışmada 468 bebek vardı ve 156'sı (%33,3) geç preterm bebekti. Annede sigara içme, erken membran rüptürü, in vitro fertilizasyon ve sezaryen oranları geç preterm bebeklerde tam term bebeklere göre anlamlı derecede daha yüksekti. Geç preterm ve erken term bebeklerde yoğun bakıma yatış, tam term bebeklere göre daha sıktı (sırasıyla; 11,9 ve 1,6 kat). Yenidoğanın geçici takipnesi, pnömoni, hipokalsemi, hipoglisemi, beslenme sorunları, sepsis ve indirekt hiperbiluribinemi, geç pretermlerde erken term ve tam term bebeklere göre istatistiksel olarak daha sıktı. Geç preterm bebeklerde (%12,2) taburcu olduktan sonra yeniden hastaneye yatış tam term bebeklere göre (%2,9) daha yüksekti. İki geç preterm bebek ölürken, erken ve tam term bebeklerde ölüm olmadı.

Sonuç: Geç preterm bebeklerde solunum, metabolik, gastrointestinal ve enfeksiyon problemleri açısından risk ve ayrıca hastaneye yeniden yatış ve ölüm oranları daha yüksektir. Bu çalışma, geç preterm doğum düşünüldüğünde obstetrik karar vermenin önemini ve bu yenidoğanların sonuçlarını iyileştirmek için daha iyi stratejiler oluşturma ihtiyacını vurgulamaktadır.

Anahtar Kelimeler: Sezaryen, indirekt hiperbilirubinemi, erken membran rüptürü, solunum sıkıntısı sendromu, yenidoğanın geçici takipnesi

Introduction

Preterm birth is one of the most critical determinants in neonatal morbidity and mortality. The American Academy of Pediatrics, the American College of Obstetricians and Gynecologists, and the National Institute of Child Health and Human Development define preterm infants as those born before 37 weeks (259 days) of pregnancy since the first day of the last menstrual period[1,2]. The late-preterm delivery rate (born between $34^{0/7}$-$36^{6/7}$ weeks) has increased worldwide and made up more than 70.0% of all preterm babies, while the early-term delivery rate (born between $37^{0/7}$-$38^{6/7}$ weeks) delivery has represented 17.5% of all births[3].

Preterm labor occurs spontaneously or secondary to obstetric intervention, associated with preexisting maternal medical conditions[4]. Furthermore, increasing rates of elective cesarean delivery (C/S) and multiple gestations contribute to the increase in late-preterm and early-term births[4]. Late-preterm infants are generally considered functionally and developmentally as mature as term newborns[5-8]. However, a broad range of respiratory, metabolic, infectious, and gastrointestinal (GIS) problems more likely arise in newborns, accounting for a substantial share of healthcare utilization. The prevalence of these morbidities may be different among countries. Moreover, late-preterm infants with a potentially higher risk for morbidity and hospitalization need closer follow-up and monitoring. Therefore, identifying the risk factors of these infants results in comprehensive preventive and treatment strategies[3-5]. To understand their needs better, we aimed to investigate prenatal risk factors and postnatal outcomes between late-preterm and term infants.

Materials and Methods

We conducted a retrospective observational study that included late-preterm infants and term infants (with a 1=2 ratio) born at a tertiary hospital between January and December 2012. Ethics Committee approval was obtained from University of Health Sciences Turkey, Ankara Dr. Sami Ulus Gynecology, Child Health and Diseases Training and Research Hospital (date: 25.04.2011, approval no: 2011/799).

Late-preterm infants were defined as those born between $34^{0/7}$-$36^{6/7}$ weeks. Term infants were classified as early-term infants ($37^{0/7}$-$38^{6/7}$ weeks) and full-term infants ($39^{0/7}$-$41^{6/7}$ weeks). We included newborns with non-critical congenital heart anomalies (e.g., atrioventricular septal defect). Those with congenital and genetic anomalies, incomplete maternal or newborn medical records, and stillbirths were excluded[6-8].

The following data were collected and evaluated: gestational age, gender, maternal age, parity, mode of delivery, birth weight, height, head circumference, body weight according to gestational age[9], obstetric complications, and prenatal conditions [in vitro fertilization (IVF) and maternal smoking]. Among the obstetric complications, spontaneous ruptured membranes included women with premature rupture of membranes (PROM); spontaneous labor included those with no other complications except for preterm uterine contractions that resulted in progressive cervical dilation

leading to delivery; and women with pregnancy-related hypertensive disorders, such as gestational hypertension or preeclampsia, who were classified as having maternal hypertensive disorders of pregnancy.

Postnatal outcome measures including respiratory morbidity [respiratory distress syndrome, transient tachypnea of the newborn (TTN), meconium aspiration syndrome, pneumonia, need for oxygen and respiratory support], indirect hyperbilirubinemia requiring phototherapy (IHB)[10], hypoglycemia[11], hypothermia[12], hypocalcemia[13], apnea[14], anemia[15], sepsis[16], necrotizing enterocolitis (NEC)[17], feeding problems (defined as poor sucking, abdominal distention, or recurrent vomiting), total parental nutrition (TPN) need, admission to neonatal intensive care unit (NICU), indications for admission to NICU, and mortality were recorded. Rehospitalization rates and diagnoses for the three months after discharge were evaluated.

Statistical Analysis

Quantitative data were reported as mean ± SD or median with an interquartile range, whereas qualitative data were reported as observed frequencies and percentages. The Shapiro-Wilk test was used to check normality, and according to the results, suitable parametric or nonparametric statistical tests were performed. An independent sample t-test or a nonparametric alternative of its Mann-Whitney U test was used to compare two groups for a quantitative variable. In the case of more than two groups, the analysis of variance or the Kruskal-Wallis test was selected. Follow-up the significant result of these tests, Bonferroni correction was applied for multiple comparisons to control the type one error rate. χ^2 test or Fisher exact test was used for relationships between qualitative variables. Univariate logistic regression analysis was used to calculate the odds ratio (OR) and confidence interval (CI). All statistical analyses were performed with the statistical package (Version 22.0; SPSS Inc., Chicago, IL), and the significance level was established at 0.05.

Results

Between January and December 2012, the study population consisted of 156 (33.3%) late-preterm infants, 140 (30.0%) early-term infants, and 172 (36.7%) full-term infants. Six late-preterm infants were excluded due to congenital syndrome and stillbirths. Demographic characteristics of the newborns are presented in Table 1.

The most common indications of preterm labor in late-preterm infants were spontaneous labor (71; 45.5%), PROM (40; 25.6%), and maternal smoking (24; 15.4%). Compared to full-term infants, maternal smoking, IVF pregnancy, and PROM were statistically more frequent in late-preterm infants (p=0.008, p=0.02, and p=0.01, respectively). Caesarean section delivery was identified more often in late-preterm

Table 1. Demographic characteristics of infants

	Total infants (n=468)	Late-preterm (n=156)	Early-term (n=140)	Full-term (n=172)	p-value
GA (weeks)*	38 (34-41)	35 (34-36)	38 (37-38)	39 (39-41)	<0.001
Gender, n (%)					0.87
Male	227 (48.5)	73 (46.7)	69 (49.2)	85 (49.4)	
Female	241 (51.5)	83 (43.3)	71 (50.8)	87 (50.6)	
Maternal age*	25 (16-42)	25 (16-42)	26 (16-41)	25 (16-41)	0.40
Parity*	2 (1-10)	2 (1-10)	2 (1-8)	2 (1-7)	0.16
BW (kg)*	2.9 (1.3-4.6)	2.4 (1.3-4.2)	3.2 (2.2-4.3)	3.3 (2.2-4.6)	0.18
BL (cm)*	48 (38-54)	46 (38-52)	49 (44-53)	50 (46-54)	0.08
HC (cm)*	35 (30-38)	34 (30-38)	35 (33-38)	35 (34-37)	0.06
BW-GA, n (%)					0.03
SGA	12 (2.6)	8 (5.1)	1 (0.7)	3 (1.7)	0.02
AGA	394 (84.2)	132 (84.6)	112 (80.0)	150 (87.2)	0.85
LGA	62 (13.2)	16 (10.3)	27 (19.3)	19 (11.1)	0.17

*Data are presented as median with range.

GA: Gestational age, BW: Birth weight, BL: Birth length, HC: Head circumference, kg: Kilogram, cm: Centimeter, BW-GA: Birth weight according to gestational age, SGA: Small for gestational age, AGA: Appropriate for gestational age, LGA: Large for gestational age

infants (104; 66.7%) and early-term infants (82; 58.6%) than in full-term infants (79; 45.9%). The neonatal problems observed in the study population are shown in Table 2.

The admission rate to the NICU was statistically higher in late-preterm infants (44.9%) than in early-and full-term infants (10.0% and 6.4%, respectively; p<0.001; Table 3). Regarding respiratory morbidities, TTN (16%; p<0.001), pneumonia (5.1%; p=0.02), and respiratory support requirement (27.6%; p<0.001) were more common in late-preterm infants compared to early- and full-term infants. NEC was present in 7 (4.5%) late-preterm infants, but no patients were

Table 2. Prenatal and obstetric indications/risk factors of preterm labor

	Total infants (n=468)	Late-preterm (n=156)	Early-term (n=140)	Full-term (n=172)	P_1	P_2	P_3
Spontaneous labor	251 (53.6)	71 (45.5)	78 (55.7)	102 (59.3)	0.08	0.01	0.52
HDP	27 (5.8)	10 (6.4)	2 (1.4)	15 (8.7)	0.06	0.56	0.01
PROM	93 (19.9)	40 (25.6)	28 (20.0)	25 (14.5)	0.24	0.01	0.26
Maternal smoking	51 (10.9)	24 (15.4)	17 (12.1)	10 (5.8)	0.52	0.008	0.07
IVF	6 (1.3)	5 (3.2)	1 (0.7)	0 (0.0)	0.21	0.02	0.44
C/S	265 (56.7)	104 (66.7)	82 (58.6)	79 (45.9)	0.15	<0.001	0.02
Others	40 (8.5)	6 (3.8)	14 (10.0)	20 (11.6)	0.06	0.01	0.78

Data were given as number and percentage.

P_1 represents the statistical significance between late-preterm and early-term infants.

P_2 represents the statistical significance between late-preterm and full-term infants.

P_3 represents the statistical significance between early- and full-term infants.

HDP: Hypertensive disorders of pregnancy, PROM: Premature rupture of membrane, IVF: In vitro fertilization, C/S: Cesarean section.

Others: Fetal complication, placental accidents, and mothers with medical problems

Table 3. Comparison of late-preterm postnatal outcomes with early- and full-term infants

				Late preterm vs. Early-term		Late preterm vs. Full-term	
Postnatal Morbidities	**Late-preterm (n=156)**	**Early-term (n=140)**	**Full-term (n=172)**	**OR (95% CI)**	**p-value**	**OR (95% CI)**	**p-value**
Respiratory, n (%)							
TTN	25 (16.0)	5 (3.6)	2 (1.2)	5.15 (1.91-13.86)	0.001	16.22 (3.77-69.72)	<0.001
Pneumonia	8 (5.1)	0 (0.0)	1 (0.6)	-	0.008	9.24 (1.14-44.76)	0.01
Apnea	5 (3.2)	0 (0.0)	0 (0.0)	-	0.06	-	0.02
RDS	2 (1.3)	0 (0.0)	0 (0.0)	-	0.50	-	0.22
MAS	1 (0.6)	1 (0.7)	2 (1.2)	0.89 (0.05-14.47)	1	0.54 (0.04-6.10)	1
Respiratory support	43 (27.6)	4 (2.9)	3 (1.7)	12.93 (4.50-37.13)	<0.001	21.43 (6.49-70.77)	<0.001
Gastrointestinal, n (%)							
Feeding problems	33 (21.2)	7 (5.0)	4 (2.3)	5.09 (2.17-11.94)	<0.001	11.26 (3.89-32.63)	<0.001
NEC	7 (4.5)	0 (0.0)	0 (0.0)	-	0.01	-	0.005
TPN need	16 (10.3)	1 (0.7)	1 (0.6)	15.88 (2.07-42.54)	<0.001	19.54 (2.56-59.18)	<0.001
Hematological, n (%)							
Anemia	6 (3.8)	0 (0.0)	1 (0.6)	-	0.03	6.84 (0.81-57.46)	0.05
IHB	31 (19.9)	11 (7.9)	5 (2.9)	2.90 (1.40-6.03)	0.005	8.28 (3.13-21.90)	<0.001
Metabolic, n (%)							
Hypothermia	7 (4.5)	0 (0.0)	1 (0.6)	-	0.01	8.03 (1.97-66.04)	0.03
Hypoglycemia	25 (16.0)	3 (2.1)	1 (0.6)	8.71 (2.57-29.55)	<0.001	32.63 (4.36-63.96)	<0.001
Hypocalcemia	14 (9.0)	0 (0.0)	0 (0.0)	-	<0.001	-	<0.001

Table 3. Continued

				Late preterm vs. Early-term		Late preterm vs. Full-term	
Postnatal morbidities	**Late-preterm (n=156)**	**Early-term (n=140)**	**Full-term (n=172)**	**OR (95% CI)**	**p-value**	**OR (95% CI)**	**p-value**
Rehospitalization, n (%)	19 (12.2)	9 (6.4)	5 (2.9)	2.01 (0.88-4.62)	0.13	4.63 (1.68-12.72)	0.003
NICU admission, n (%)	70 (44.9)	14 (10.0)	11 (6.4)	7.32 (3.87-13.83)	<0.001	11.91 (5.99-23.69)	<0.001
Mortality, n (%)	2 (1.3)	0 (0.0)	0 (0.0)	-	0.50	-	0.22

TTN: Transient tachypnea of newborn, RDS: Respiratory distress syndrome, MAS: Meconium aspiration syndrome, NEC: necrotising enterocolitis, TPN: Total parenteral nutrition, IHB: Indirect hyperbilirubinemia, NICU: Neonatal intensive care unit.

detected in early-and full-term infants. In late-preterm infants, feeding problems and TPN needs (21.2% and 10.3%, respectively; p<0.001) were statistically detected more often than in early- and full-term infants. Hypoglycemia (OR: 32.63, 95% CI 4.36 to 63.96; p<0.001) and hypothermia (OR: 8.03, 95% CI 1.97 to 66.04; p=0.03) occurred more frequently in late-preterm infants than in full-term infants (Table 3). We observed that late-preterm infants (19.9%) had a higher rate of phototherapy treatment for IHB compared to early-term (7.9%; p=0.005) and full-term infants (2.9%; p<0.001; Table 3). Late-preterm infants underwent sepsis evaluations 6.8 and 8.3 times more often than early- and full-term infants, respectively. The mortality rate was 1.3% in late-preterm infants, and no death occurred in early- and full-term infants (Table 3). Compared to full-term infants (2.9%), the rehospitalization rate was statistically higher in late-preterm infants (12.2%; p=0.003; Table 3). The most common indication for rehospitalization was IHB (47.5%), followed by infections (31.5%) and feeding problems (10.5%; Figure 1).

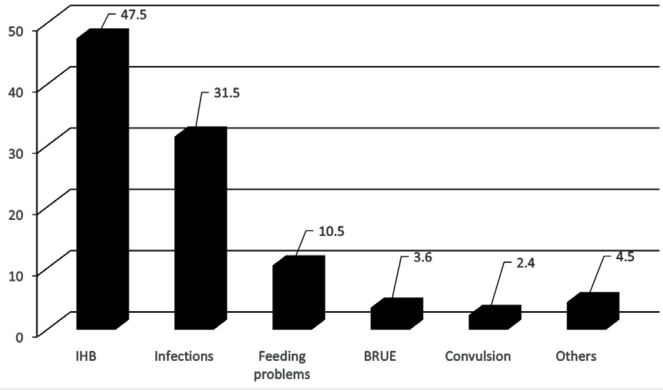

Figure 1. Distribution of rehospitalization diagnosis

IHB: Indirect hyperbilirubinemia, BRUE: Brief resolved unexplained event.

Others: Skin eruption, failure to thrive, autoimmune and hematological disorders

Discussion

Late-preterm and early-term deliveries represent a significant and growing public health concern. There is increasing awareness of the clinical risks of these infants during birth, hospitalization, and after discharge. Babies delivered at these gestational ages are at an increased risk of mortality, respiratory and non-respiratory morbidity[18].

Consistent with previous studies[19,20], our data showed that SGA birth is more common in late-preterm infants than in early- and full-term infants. Although SGA delivery increases postnatal morbidity and mortality, it is not clear whether SGA delivery increases the preterm birth rate. There is a lack of extensive population-based studies, which is a significant barrier to understanding the impact of birth weight on preterm birth. Maternal smoking during pregnancy is associated with an increased risk of late-preterm birth. Many factors, such as the vasoconstrictive effects of nicotine and the increase in circulating levels of carbon monoxide, may trigger preterm labor[21]. Although smoke-free legislation reduces smoking rates in Turkey, smoking rates in women are still as high as 19.7%[22]. Therefore, developing psychosocial and pharmacological interventions to prevent smoking during pregnancy is essential. IVF has increased the risk of preterm birth compared to natural conception. During oocyte pick-up and embryo-transfer procedures, pelvic and cervical injury may play an essential role in the pathogenesis of preterm birth in IVF pregnancies[23]. Cervical screening may be performed in this high-risk group to take preventive precautions. Almost 80% of preterm birth occurs with spontaneous idiopathic preterm labor or PROM, and only 20% of them are associated with no recorded medical or obstetric indication[24]. According to the guidelines, mothers with PROM should be treated; antenatal prophylactic antibiotics and maternal steroids may reduce neonatal morbidity. The C/S delivery rate is higher in Turkey than in the US and Europe. There was a gradual increase, from 21.0%

to 53.1%, between 2002 and 2016[25]. A considerable number of C/S deliveries are avoidable, as most preterm babies are born by C/S with no record of any medical or obstetric indication. Cesarean section delivery is not without risks to the mother and baby, so health workers should carry out strategies to decrease the rate of C/S delivery and increase the probability of spontaneous vaginal birth.

Late-preterm infants are more likely to require admission to NICU secondary to postnatal morbidities than full-term infants. The prevalence of these problems may differ between countries. Like our results, Tsai et al.[26] reported higher admission rates to the NICU for late-preterm than full-term infants (36% vs. 7%). Determining risk factors for morbidity and hospitalization is essential for developing prevention and treatment strategies. Close monitoring and follow-up are required in late-preterm infants with a potential higher risk. Many studies indicate high rates of TTN in late-preterm infants[7,9,27]. Although activation of spontaneous preterm labor facilitates fetal lung maturation and improves pulmonary fluid clearance, factors related to lung immaturities, such as underdeveloped surfactant and defective fetal alveolar fluid resorption, can contribute to an increased rate of respiratory distress. Late-preterm babies are relatively more susceptible to lower respiratory tract infections due to the cessation of maternal antibody transmission and immature immune cells[28]. Besides, secondary to physiological and metabolic immaturity, late-preterm babies require more respiratory support than full-term babies. Decreasing the rate of late-preterm birth and appropriate prenatal management, such as antenatal steroids, may prevent respiratory problems and reduce costs. Early and effective treatment of infections can further decrease the need for respiratory support in these infants. Apnea of prematurity is present in 4-12% of late-preterm infants. It is associated with immature control of breathing and future neurodevelopmental impairments[6]. Early diagnosis and treatment of apnea are important because late-preterm infants are already at a higher risk of unfavorable neurodevelopmental outcomes[29].

Compared to early- and full-term infants, our results showed that late-preterm infants faced more common GIS morbidities (for example, feeding problems, NEC, and need for TPN), hypoglycemia, hypocalcemia, and hypothermia. Late-preterm infants have poor peristaltic functions and sphincter controls with difficulty learning to suckle and swallow, resulting in inadequate weight gain[30,31]. Additionally, they have an immature GIS function that continues to develop with increasing gestational age. Consequently, more mature infants have relatively fewer GIS problems[32]. Glucose and calcium are transferred in the second trimester of pregnancy[33]. Late-preterm infants have lower glycogen and lipid storage, insufficient ketogenesis and lipolysis enzymes, relatively lower subcutaneous lipid tissues, and a higher body surface[26,31,32]. Early enteral feeding is associated with better weight gain, and shorter hospital stays, reducing GIS and metabolic morbidities. Therefore, full enteral feeding should be achieved as soon as infants tolerate it. In late-preterms, low bilirubin intake to hepatocytes and conjugation of bilirubin cause increased IHB that requires phototherapy. In addition, coexisting diseases such as sepsis contribute to IHB.

Prematurity is a major cause of perinatal and neonatal mortality. Some studies showed higher mortality rates in late-preterm infants (0.3-1.3%) than in term infants (0.0-0.08%)[5,26], in agreement with our finding (1.4% vs. 0.0%). Beyond postnatal morbidities and mortality, the rehospitalization rate in late-preterm infants is 2-3 times that in term infants[4,34,35]. Previous reports determined that jaundice was the most common etiologies for readmission, followed by infections and feeding problems[34-36]. Home healthcare organizations play an essential role in facilitating the transition period of premature infants from the NICU to home and reducing the risk of postnatal morbidity after discharge. There is a developing home healthcare system in Turkey, although, at present, it seems to be insufficient to provide excellent care. However, we did not show marked differences between early- and full-term infants, possibly due to the similarity of the median gestational weeks of these infants (38 vs. 39 weeks). Another explanation might be that the small number of early-term infants in our study affected the outcome.

Study Limitations

This study has some limitations. First, it was a retrospective study based on a chart review. Nonetheless, we used a standardized study form to collect data, only included newborns with complete medical records and data, and the same clinician performed the data collection. Second, no data related to the administration of antenatal steroids were available, and we could not include this information in our analysis as a confounder.

Conclusion

Even though late-preterm infants are near-term, they are at a high risk of admission to the NICU, respiratory, metabolic,

and GIS problems, IHB, readmission after discharge, and death. Further comprehensive population studies should be conducted comparing postnatal morbidity and mortality in early- and full-term infants.

Ethics Committee Approval: The study was approved by Dr. Sami Ulus Children's and Maternity Hospital of Local Ethics Committee (protocol number: 799, date: 25.04.2011).

Informed Consent: Retrospective study.

Peer-review: Externally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: A.E., G.C., A.Z., Concept: A.E., G.C., A.Z., Design: A.E., G.C., A.Z., Supervision: A.E., G.C., A.Z., Materials: A.E., G.C., A.Z., Data Collection and/or Processing: A.E., G.C., Analysis and/or Interpretation: A.E., G.C., A.Z., Literature Review: A.E., G.C., A.Z., Writing: A.E., G.C., A.Z., Critical Review: A.E., G.C., A.Z.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study received no financial support.

References

1. Raju TN, Higgins RD, Stark AR, Leveno KJ. Optimizing care and outcome for late-preterm (near-term) infants: a summary of the workshop sponsored by the National Institute of Child Health and Human Development. Pediatrics 2006;118:1207-14.
2. American Academy of Pediatrics and American College of Obstetricians and Gynecologists. Guidelines for Perinatal Care. Standard Terminology for Reporting of Reproductive Health Statistics in the United States Guidelines for Perinatal Care (Ed 5; Appendix F). Elk Grove, IL. 2002;617-21.
3. Engle WA, Kominiarek MA. Late preterm infants, early term infants, and timing of elective deliveries. Clin Perinatol 2008;35:325-41.
4. Shapiro-Mendoza CK, Tomashek KM, Kotelchuck M, et al. Effect of late-preterm birth and maternal medical conditions on newborn morbidity risk. Pediatrics 2008;121:e223-32.
5. Kalyoncu O, Aygün C, Cetinoğlu E, Küçüködük S. Neonatal morbidity and mortality of late-preterm babies. J Matern Fetal Neonatal Med 2010;23:607-12.
6. Engle WA, Tomashek KM, Wallman C; Committee on Fetus and Newborn, American Academy of Pediatrics. "Late-preterm" infants: a population at risk. Pediatrics 2007;120:1390-401.
7. Tan JH, Poon WB, Lian WB, Ho SK. A Comparison of the Short-term Morbidity and Mortality Between Late Preterm and Term Newborns. Ann Acad Med Singap 2014;43:346-54.
8. Shapiro-Mendoza CK, Tomashek KM, Kotelchuck M, Barfield W, Weiss J, Evans S. Risk factors for neonatal morbidity and mortality among "healthy," late preterm newborns. Semin Perinatol 2006;30:54-60.
9. Lubchenco LO, Hansman C, Dressler M, Boyd E. Intrauterine Growth As Estimated From Liveborn Birth-Weight Data At 24 To 42 Weeks Of Gestation. Pediatrics 1963;32:793-800.
10. American Academy of Pediatrics Subcommittee on Hyperbilirubinemia. Management of hyperbilirubinemia in the newborn infant 35 or more weeks of gestation. Pediatrics 2004;114:297-316.
11. Cornblath M, Hawdon JM, Williams AF, et al. Controversies regarding definition of neonatal hypoglycemia: suggested operational thresholds. Pediatrics 2000;105:1141-5.
12. World Health Organization. Thermal Control of the Newborn: A Practical Guide. Geneva, Switzerland: World Health Organization; 1997. https://www.who.int/reproductivehealth/publications/maternal_perinatal_health/MSM_97_2/en/
13. Jain A, Agarwal R, Sankar MJ, Deorari A, Paul VK. Hypocalcemia in the newborn. Indian J Pediatr 2010;77:1123-8.
14. Thompson M, Hunt C. Control of breathing: development, apnea of prematurity, apparent life-threatening events, SIDS. Avery's Neonatology: Pathophysiology and Management of the Newborn. 6th ed. Philadelphia, USA: Lippincott Williams & Wilkins. 2005. pp. 535-52.
15. Bizzarro MJ, Colson E, Ehrenkranz RA. Differential diagnosis and management of anemia in the newborn. Pediatr Clin North Am 2004;51:1087-107.
16. Sankar MJ, Agarwal R, Deorari AK, Paul VK. Sepsis in the newborn. Indian J Pediatr 2008;75:261-6.
17. Bell MJ, Ternberg JL, Feigin RD, et al. Neonatal necrotizing enterocolitis. Therapeutic decisions based upon clinical staging. Ann Surg 1978;187:1-7.
18. Melamed N, Klinger G, Tenenbaum-Gavish K, et al. Short-term neonatal outcome in low-risk, spontaneous, singleton, late preterm deliveries. Obstet Gynecol 2009;114:253-60.
19. Gouyon JB, Vintejoux A, Sagot P, et al. Neonatal outcome associated with singleton birth at 34-41 weeks of gestation. Int J Epidemiol 2010;39:769-76.
20. Correia C, Rocha G, Flor-de-Lima F, Guimarães H. Respiratory morbidity in late preterm infants. Minerva Pediatr 2018;70:345-54.
21. Smith LK, Draper ES, Evans TA, et al. Associations between late and moderately preterm birth and smoking, alcohol, drug use and diet: a population-based case-cohort study. Arch Dis Child Fetal Neonatal Ed 2015;100:486-91.
22. World Health Organization. WHO report on the global tobacco epidemic 2019. https://www.who.int/tobacco/global_report/en/
23. McDonald SD, Han Z, Mulla S, et al. Preterm birth and low birth weight among in vitro fertilization singletons: a systematic review and meta-analyses. Eur J Obstet Gynecol Reprod Biol 2009;146:138-48.
24. McIntire DD, Leveno KJ. Neonatal mortality and morbidity rates in late preterm births compared with births at term. Obstet Gynecol 2008;111:35-41.
25. Ministry of Health (Turkey). Turkey Health Statistics Yearbook 2016. Ankara, Turkey: General Directorate for Health Research. Turkey: SAGEM; 2017.
26. Tsai ML, Lien R, Chiang MC, et al. Prevalence and morbidity of late preterm infants: current status in a medical center of Northern Taiwan. Pediatr Neonatol 2012;53:171-7.
27. Visruthan NK, Agarwal P, Sriram B, Rajadurai VS. Neonatal Outcome of the Late Preterm Infant (34 to 36 Weeks): The Singapore Story. Ann Acad Med Singap 2015;44:235-43.
28. Holt PG, Jones CA. The development of the immune system during pregnancy and early life. Allergy 2000;55:688-97.
29. Olivier F, Nadeau S, Caouette G, Piedboeuf B. Association between Apnea of Prematurity and Respiratory Distress Syndrome in Late Preterm Infants: An Observational Study. Front Pediatr 2016;4:105.

30. Neu J. Gastrointestinal maturation and implications for infant feeding. Early Hum Dev 2007;83:767-75.
31. Adamkin DH. Feeding problems in the late preterm infant. Clin Perinatol 2006;33:831-7.
32. al Tawil Y, Berseth CL. Gestational and postnatal maturation of duodenal motor responses to intragastric feeding. J Pediatr 1996;129:374-81.
33. Bulut C, Gürsoy T, Ovalı F. Short-Term Outcomes and Mortality of Late Preterm Infants. Balkan Med J 2016;33:198-203.
34. Escobar GJ, Joffe S, Gardner MN, Armstrong MA, Folck BF, Carpenter DM. Rehospitalization in the first two weeks after discharge from the neonatal intensive care unit. Pediatrics 1999;104:e2.
35. Tomashek KM, Shapiro-Mendoza CK, Weiss J, et al. Early discharge among late preterm and term newborns and risk of neonatal morbidity. Semin Perinatol 2006;30:61-8.
36. Ananth CV, Friedman AM, Gyamfi-Bannerman C. Epidemiology of moderate preterm, late preterm and early term delivery. Clin Perinatol 2013;40:601-10.