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Original Article

# Gestational Age Matters: Dissecting Outcomes in Late Preterm Births

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**ABSTRACT**

**Aim:** The proportion of late preterm babies, defined as neonates born between 34+0/7 and 36+6/7 weeks of gestation, among the total number of babies born is increasing due to increasing technological possibilities and changing maternal factors in modern life. While attention is paid to preterm babies, ignoring these babies as term babies results in increased morbidity and mortality. This causes a significant burden on the health system, especially in places like our country where the number of births is high. However, this burden can be reduced with more care and less cost in late preterm babies as opposed to preterm babies.

**Materials and Methods:** In this retrospective cohort study, all late preterm infants admitted within the first 28 days of life over a five-year period were evaluated. Maternal and neonatal data were collected from patient records. Infants were classified into 3 groups to emphasize differences between gestational ages (34, 35 and 36 gestational weeks).

**Results:** Four hundred twenty-one infants were analyzed, and hyperbilirubinemia was the most frequent complication (47.5%), followed by respiratory difficulties (33.7%) and sepsis (24.2%). Infants delivered at 34 weeks showed a higher incidence of respiratory complications and required longer hospital stays than those born at 35 and 36 weeks. Moreover, differences in the occurrence of hypoglycemia and feeding intolerance further emphasized the unique vulnerability of the youngest subgroup.

**Conclusion:** Even within the late preterm category, distinct morbidity patterns exist based on gestational age. The findings underscore the necessity for tailored clinical management strategies to address the specific risks faced by the younger late preterm infants. Future studies should focus on refining care approaches and examining long-term outcomes in this population.

**Keywords:** Late preterm, maternal morbidity, neonatal morbidity, neonatal mortality

## Introduction

Prematurity, traditionally defined as birth before 37 weeks of gestation, encompasses a wide range of neonatal outcomes and risks (1,2). Within this broad categorization, infants are further classified into early and late preterms, acknowledging the significant clinical and prognostic differences across this spectrum (3). The designation of "late preterm" specifically refers to infants born between 34+0/7 and 36+6/7 weeks of gestation. Despite their apparent maturity compared to earlier preterms, late preterm infants face considerable risks, including respiratory, metabolic, and neurological complications. While differences between

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34, 35, and 36-week infants exist and may influence management strategies, these distinctions are often overlooked in clinical practice.

The increasing incidence of late preterm births is a global concern, linked to heightened risks of neonatal morbidity and mortality. In the United States, the proportion of late preterm births has seen a notable rise, from 9.68% in 1990 to 12.81% in 2006, eventually reaching 20% by 2009 (4). Developing countries such as India have also reported rising preterm birth rates, largely due to limited access to maternal healthcare and high rates of infections during pregnancy (5). These trends reflect broader shifts in obstetric practices, including more frequent use of induction and cesarean delivery before full term, alongside demographic changes such as older maternal age and an increase in multiple gestations.

In Türkiye, it is estimated that out of approximately 1.3 million annual births, around 100,000 are late preterm. Despite the variability in reported rates across different healthcare settings, the prevalence generally falls between 9% and 15%, highlighting a significant public health issue (5,6). The morbidity and mortality associated with late preterm births, although lower than those for extremely preterm infants, are nevertheless substantially higher than for those born at term. Studies from various countries, including the UK, the US, and Canada, have consistently demonstrated increased risks for these infants (1-3).

Recent epidemiological data indicate notable shifts in preterm birth rates during and following the Coronavirus disease 2019 pandemic. Although some studies reported a temporary reduction in overall preterm births linked to lockdown measures and altered healthcare utilization, more nuanced patterns emerged for late preterm births, defined as infants born between 34+0/7 and 36+6/7 weeks of gestation. Specifically, Yalçın et al. (7) observed variable trends in Türkiye, where pandemic-related changes in prenatal care, maternal stress, and healthcare-seeking behaviors influenced birth outcomes differently across gestational ages, highlighting an increased vulnerability among late preterm infants. Similarly, a nationwide analysis from South Korea and a study from Germany demonstrated shifts in neonatal outcomes, emphasizing the importance of understanding regional and gestational-specific trends (8,9). Given these complex dynamics, close monitoring and tailored clinical management of late preterm infants have become increasingly crucial to mitigate morbidity and mortality risks exacerbated by pandemic-related disruptions.

This study aims to bridge the gap in understanding the unique characteristics and outcomes of late preterm infants, specifically examining differences between 34, 35, and 36 weeks of gestation. By evaluating local birth rates, neonatal intensive care needs, and morbidity and mortality patterns, it seeks to provide valuable insights for improving care strategies and advancing outcomes for this vulnerable group.

## Materials and Methods

### Study Design and Population

The retrospective cohort study, conducted between 2014 and 2019 in a tertiary neonatal intensive care unit (NICU), included all infants born between 34+0/7 and 36+6/7 weeks of gestation and admitted during the neonatal period (0-28 days). Its primary objective was to evaluate morbidity and mortality rates in late preterm infants, assess maternal and neonatal risk factors, and investigate differences among the subgroups of 34, 35, and 36 weeks to highlight their distinct clinical characteristics and outcomes.

The clinical data for this study were collected retrospectively from the hospital's electronic medical records. Eligible infants were identified based on gestational age at birth, and maternal data were obtained from both obstetric and neonatal records. All data were anonymized to protect patient confidentiality.

This study was approved by the Non-Interventional Research Ethics Committee of Dokuz Eylül University (approval no.: 2020/08-26, date: 27.04.2020).

### Definitions and Interventions

Maternal risk factors such as chorioamnionitis (both clinical and histologic), premature rupture of membranes (PROM), preeclampsia, gestational diabetes mellitus (GDM), oligohydramnios, polyhydramnios, and thrombophilia were evaluated for their potential effects on neonatal outcomes.

**Neonatal morbidities were classified system by system in this study**

**Respiratory system:** Respiratory morbidities included conditions such as respiratory distress syndrome (RDS), pneumonia, transient tachypnea of the newborn (TTN), and air leak syndromes. These were managed with respiratory support, mechanical ventilation, and oxygen therapy.

**Gastrointestinal system:** Necrotizing enterocolitis (NEC) was identified using modified Bell's criteria, with management focusing on preventing further intestinal damage and controlling infection. In addition, infants

who presented with feeding intolerance or experienced significant weight loss were classified under gastrointestinal morbidities.

Hypoglycemia was defined with specific glucose thresholds: ≤40 mg/dL for symptomatic infants on the first day, and ≤50 mg/dL for subsequent days.

Hyperbilirubinemia was another key metabolic issue, managed using the Turkish Neonatology Society's 2014 guidelines for phototherapy thresholds, depending on gestational age and associated risk factors.

**Neurological system:** Neurological morbidity was defined as the presence of clinical seizures, the need for antiepileptic therapy, intraventricular hemorrhage (IVH), hypoxic-ischemic encephalopathy (HIE), or periventricular leukomalacia (PVL). In cases of suspected clinical seizures, standard 30-60 minute video electroencephalography recordings were performed using the international 10-20 electrode placement system (with 20 electrodes) to confirm electrographic seizure activity. HIE diagnosis and management-including the use of therapeutic hypothermia-were guided by the Turkish Neonatal Society's national recommendations (10). IVH was graded according to Papile's classification, and PVL was assessed via cranial ultrasonography using the de Vries criteria.

**Infectious diseases:** Infections, particularly sepsis, were a significant concern among late preterm infants. Sepsis was classified into early-onset sepsis, defined as infection occurring within the first 72 hours of life, and late-onset sepsis, which was diagnosed after 72 hours. Diagnosis of sepsis was confirmed through positive blood cultures, with treatment initiated based on systemic signs of infection.

Neonatal morbidity and mortality management adhered to the most up-to-date recommendations from the Turkish Neonatology Society and other contemporary publications during the study period (10-16).

### Statistical Analysis

Data analysis was conducted using Statistical Package for the Social Sciences software (version 24.0). Continuous variables were described either as mean ± standard deviation for normally distributed data or as median (minimum-maximum) for non-normally distributed data. Normality was assessed using the Shapiro-Wilk test. To compare two groups for parametric variables, Independent Samples t-tests were utilized, while the Kruskal-Wallis test was employed for non-parametric variables. Categorical variables were analyzed using the chi-square test, and when relevant, relative risk calculations were conducted. Statistical significance was set at a p-value <0.05, with all tests performed as two-tailed to account for potential confounding factors.

## Results

### Study Population

During the study period, from June 1, 2014, to May 31, 2019, there were 6,545 live births at the hospital. Of these, 11% (n=727) were classified as late preterm. A total of 38.9% (n=283) of these late preterm newborns were admitted to the NICU for specific reasons. Additionally, 149 late preterm infants born at other centers were transferred to our hospital, representing 34% of the total admitted late preterm population. Eleven infants were excluded due to missing data, bringing the total number of cases included in the study to 421.

### Maternal Demographic Results

Maternal demographic data were collected from obstetrics and gynecology clinic records. The average maternal age was 30±6 years, and no significant difference in maternal age was found when grouped by gestational weeks (p=0.53). Most pregnancies were second pregnancies, with no statistical difference in gestational age across different pregnancy orders (p=0.49). Multiple pregnancies comprised 12.1% of the sample, with 35-week gestations significantly more frequent than 34 or 36 weeks (p=0.019). Assisted reproductive technology was used in 4.4% of pregnancies, with no statistical difference among gestational age groups (p=0.83). Antenatal steroid administration occurred in 20 cases, with fewer cases at 36 weeks compared to 34 and 35 weeks (p=0.018) (Table I).

Regarding maternal morbidities, gestational hypertensive disorders were the most common (15.9%, n=62), with preeclampsia accounting for 81% of these cases, though no differences were observed among gestational ages (p=0.71). GDM was present in 12.6% of mothers, with no significant differences across gestational ages (p=0.42). Hypothyroidism was noted in 10% of mothers, and its prevalence was significantly higher in those who delivered at 36 weeks (p=0.024). Oligohydramnios was seen in 7.4% of pregnancies, with a lower frequency at 35 weeks (p=0.03). Prolonged PROM occurred in 8.2%, without significant variation by gestational age (p=0.29). Smoking during pregnancy was reported in 3.3% of cases, with no significant differences among groups (p=0.29).

### Neonatal Demographic Results

Among the 421 neonates in the study, 23.8% (n=100) were born at 34 weeks, 32.8% (n=138) at 35 weeks, and

**Table I.** Maternal and neonatal characteristics and outcomes across the gestational age groups in late preterm infants

| | 34 GW | 35 GW | 36 GW | p-value |
|---|---|---|---|---|
| Total number of mothers, n | 91 | 124 | 175 | - |
| Average maternal age (years) | 30.49±6.89 | 29.73±6.12 | 29.86±6.04 | 0.53 |
| Number of multiple pregnancies, n (%) | 12 (13.1) | 21 (16.9) | 14 (8) | **0.02** |
| Oligohydramnios, n (%) | 11 (12.1) | 6 (4.8) | 12 (6.8) | 0.03 |
| Antenatal steroid, n (%) | 8 (8.7) | 9 (7.2) | 3 (1.7) | 0.018 |
| Gestational hypertensive disorder, n (%) | 17 (18.6) | 18 (14.5) | 27 (15.4) | 0.71 |
| Gestational diabetes, n (%) | 15 (16.4) | 15 (12.1) | 19 (10.8) | 0.42 |
| Fetal growth restriction, n (%) | 4 (4.3) | 10 (8.1) | 14 (8) | 0.50 |
| PPROM, n (%) | 7 (7.6) | 14 (11.3) | 11 (6.3) | 0.29 |
| Mode of delivery (C/S), n (%) | 79 (86.8) | 106 (85.5) | 133 (76) | 0.21 |
| Total number of babies, n | 100 | 138 | 183 | - |
| Birth weight, g | 2.356±472 | 2.512±486 | 2.672±453 | **0.001** |
| SGA, n (%) | 9 (9) | 22 (15.9) | 32 (17.5) | 0.15 |
| LGA, n (%) | 15 (15) | 17 (12.3) | 14 (7.6) | 0.73 |
| Female gender, n (%) | 42 (42) | 62 (44.9) | 79 (43.1) | 0.94 |
| Apgar score<br>1st minute<br>5th minute | <br>9 (1-10)<br>9 (4-10) | <br>9 (1-10)<br>9 (7-10) | <br>9 (1-10)<br>9 (4-10) | <br>0.50<br>0.30 |
| PPV in the delivery room, n (%) | 32 (32) | 36 (26) | 34 (18.6) | 0.090 |

Continuous variables are displayed as mean ± standard deviation or as median (minimum-maximum) where appropriate, while categorical variables are expressed as frequencies (n) and percentages (%). Statistical significance was assessed with a p-value <0.05 (bold values)
PPROM: Preterm premature rupture of membranes, LGA: Large for gestational age, SGA: Small for gestational PPV: Positive pressure ventilation

43.5% (n=183) at 36 weeks, with an average gestational age of 35.2±0.8 weeks. Males accounted for 56.5% (n=238) of the cohort. The average birth weight was 2544±484 grams, varying across gestational ages, with 36-week neonates being heavier. Apgar scores at 1 and 5 minutes showed no significant differences. Median hospital stay was 5 days, with 36-week neonates having shorter durations (p=0.001).

**Neonatal morbidities:** Among neonatal morbidities, respiratory morbidities were the most frequently observed, while hyperbilirubinemia was the most common specific condition documented, as presented in Figure 1.

**Respiratory morbidities:** Respiratory morbidities were observed in 33.7% (n=142) of the infants, with the highest frequency at 34 and 35 weeks. Infants born at 36 weeks had significantly fewer respiratory issues (p=0.014). TTN was the most common condition, seen in 18.1% of the cohort and 53.5% of those with respiratory morbidities. RDS and congenital pneumonia were also prevalent. Non-invasive ventilation was required in 32% of cases, while 12.8% required invasive ventilation, with no significant differences in ventilation duration across gestational weeks (Table II).

**C/S:** Caesarean section Gastrointestinal morbidities were observed in 15.4% (n=65) of the infants (Table III). The majority (58 cases) presented with isolated feeding intolerance, while other causes included intestinal atresia (4 cases), direct hyperbilirubinemia (2 cases), and NEC (1 case). Feeding intolerance was consistent across gestational weeks, but neonates born at 36 weeks required significantly shorter intravenous therapy (p=0.039). Total parenteral nutrition (TPN) was needed by 30.2% of infants, with 36-week infants requiring less TPN compared to younger gestational ages (p=0.001).

**Metabolic morbidities:** In this study, 23.9 (n=101) of infants were monitored for hypoglycemia, with the highest incidence observed in those born at 35 weeks (p=0.003). Intravenous dextrose was required for an average of 4 days, with no significant differences between gestational ages. Hyperbilirubinemia, requiring treatment in 47.5% (n=200) of infants, was the most common morbidity. Phototherapy was administered most frequently to 34-week infants, and 36-week infants had significantly shorter hospital stays (p=0.001). Risk factors included ABO and Rh incompatibility, though no significant differences were found between groups (Table III).

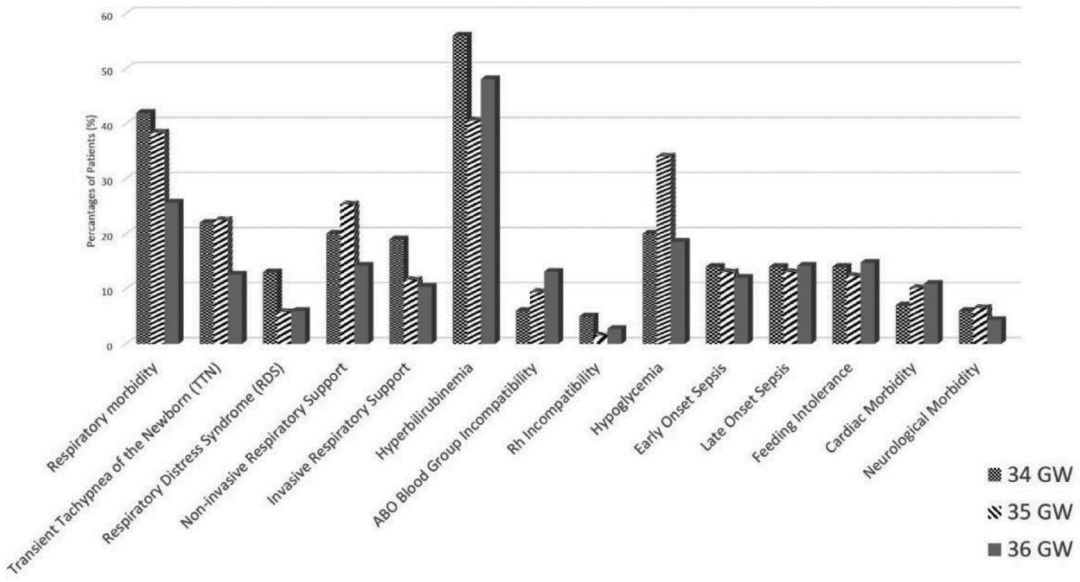


**Figure 1.** Distribution of respiratory, metabolic, infectious, and interventional outcomes among hospitalized late preterm infants by gestational week. This figure illustrates the percentage of hospitalized late preterm infants (34, 35, and 36 weeks) affected by various morbidities, metabolic disturbances, infections, and the need for respiratory interventions. Parameters include both clinical diagnoses (e.g., TTN, RDS, sepsis) and treatment indicators (e.g., non-invasive/invasive support), as well as underlying etiologies (e.g., ABO/Rh incompatibility)
*TTN: Transient tachypnea of the newborn, RDS: Respiratory distress syndrome*

**Table II.** Respiratory morbidities and ventilation support in late preterm infants across the gestational weeks

| | 34 GW | 35 GW | 36 GW | p-value |
|---|---|---|---|---|
| Respiratory morbidity, n (%) | 42 (42) | 53 (38.4) | 47 (25.6) | **0.014** |
| TTN, n (%) | 22 (22) | 31 (22.4) | 23 (12.6) | **0.035** |
| RDS, n (%) | 13 (13) | 8 (5.8) | 11 (6.1) | **0.034** |
| Pneumonia, n (%) | 6 (6) | 8 (5.8) | 6 (3.2) | 0.46 |
| Apnea, n (%) | 4 (4) | 7 (5.1) | 7 (3.8) | 0.84 |
| Pneumothorax, n (%) | 2 (2) | 1 (0.7) | 2 (1.1) | 0.67 |
| Non-invasive ventilation support, n (%) | 20 (20) | 35 (25.3) | 26 (14.2) | **0.024** |
| Intubation, n (%) | 19 (19) | 16 (11.6) | 19 (10.4) | 0.10 |
| Ventilation time, days (total) | 7 (1-37) | 7 (1-55) | 5 (2-21) | 0.46 |
| Ventilation time, days (intubated) | 2 (1-20) | 2.5 (1-55) | 5 (1-21) | 0.29 |

Continuous variables are displayed as mean ± standard deviation or as median (minimum-maximum) where appropriate, while categorical variables are expressed as frequencies (n) and percentages (%). Statistical significance was assessed with a p-value <0.05 (bold values)
TTN: Transient tachypnea of the newborn, RDS: Respiratory distress syndrome

**Neurological morbidities:** Neurological complications were observed in 5.2% (n=22) of the cohort. Seizures requiring antiepileptic treatment occurred in 3.6% (n=15) of infants, without significant differences between gestational ages. IVH was detected in 1.7% (n=7), with 71% occurring in 34-week infants, a statistically significant finding (p=0.008) (Table III). HIE was seen in 1.7% (n=7) of patients, and 57.1% of these cases required antiepileptic treatment. The median hospital stay for these infants was 17 days, significantly longer compared to other patients (p=0.001). Mortality was recorded in 21.8% (n=5) of neurologically affected infants.

**Congenital anomalies:** The most common congenital anomaly observed was cardiac anomalies, present in 9.7% (n=41) of the infants. Atrial septal defect (ASD) was the most frequent cardiac anomaly, followed by patent ductus arteriosus (PDA) and critical congenital heart disease. Congenital anomalies of the kidneys and urinary tract (CAKUT) were identified in 1.9% (n=8) of the infants.

**Table III.** Different morbidities and mortality in late preterm infants across the gestational weeks

| | 34 GW | 35 GW | 36 GW | p-value |
|---|---|---|---|---|
| Feeding intolerance, n (%) | 14 (14) | 17 (12.3) | 27 (14.8) | 0.82 |
| TPN requirement, n (%) | 42 (42) | 49 (35.5) | 36 (19.7) | **0.001** |
| TPN duration, (days) | 5 (1-28) | 6 (1-57) | 5 (1-33) | 0.62 |
| Hypoglycemia, n (%) | 20 (20) | 47 (34.1) | 34 (18.6) | **0.003** |
| Hyperbilirubinemia, n (%) | 56 (56) | 56 (40.5) | 88 (48.1) | 0.06 |
| ABO group incompatibility, n (%) | 6 (6) | 13 (9.4) | 24 (13.1) | 0.07 |
| Rh incompatibility, n (%) | 5 (5) | 2 (1.4) | 5 (2.7) | 0.51 |
| Exchange transfusion, n (%) | 1 (1) | 1 (0.7) | 0 | 0.45 |
| Neurological morbidity, n (%) | 6 (6) | 9 (6.5) | 8 (4.3) | 0.68 |
| Intraventricular hemorrhage, n (%) | 5 (5) | 0 | 2 (1.1) | **0.008** |
| HIE, n (%) | 0 | 3 (2.1) | 4 (2.1) | 0.32 |
| Congenital metabolic diseases, n (%) | 3 (0.7) | 1 (1) | 0 | - |
| Sepsis, n (%) | 28 (28) | 36 (26.1) | 38 (20.7) | 0.33 |
| Early sepsis, n (%) | 14 (14) | 18 (13.1) | 22 (12.1) | 0.89 |
| Late sepsis, n (%) | 14 (14) | 18 (13.1) | 16 (8.7) | 0.32 |
| Early sepsis duration of antibiotic use, (days) | 7 (5-7) | 7 (5-14) | 7 (5-10) | 0.06 |
| Late sepsis duration of antibiotic use, (days) | 10 (3-14) | 10 (5-30) | 6 (3-21) | 0.09 |
| Length of hospital stay, (days) | 8 (1-53) | 7 (1-67) | 4 (1-42) | **0.001** |
| Mortality, n (%) | 3 (3) | 2 (1.4) | 5 (2.7) | 0.99 |

Continuous variables are displayed as mean ± standard deviation or as median (minimum–maximum) where appropriate, while categorical variables are expressed as frequencies (n) and percentages (%). Statistical significance was assessed with a p-value < 0.05 (bold values)
TPN: Total parenteral nutrition, HIE: Hypoxic-ischemic encephalopathy

Additionally, 0.7% (n=3) had congenital metabolic diseases. Infants with critical congenital heart disease had longer hospital stays and later transitions to full enteral feeding.

**Infectious morbidities:** Sepsis was identified in 24.2% (n=102) of the infants, with early-onset sepsis occurring in 53% of cases and late-onset sepsis in 47% (Table III). Culture-positive sepsis was found in 15.2% of cases, with coagulase-negative staphylococci being the most frequent pathogen. The median length of hospital stay for septic infants was 12.5 days, significantly longer than for non-septic infants (p=0.001). IV therapy duration was longer in septic cases (p=0.04). Mortality was observed in 4.9% of the sepsis cases, with one death related to *Candida parapsilosis* infection.

**Neonatal mortality:** In this study, mortality was observed in 2.4% (n=10) of late preterm infants, with no significant difference between gestational weeks (p=0.99). Among the deaths, three occurred in 34-week infants, two in 35-week, and five in 36-week infants. The most common cause of death was cardiac-related, followed by sepsis and disseminated intravascular coagulation. Other causes included respiratory failure, hydrops fetalis, and severe neurological anomalies. The average time to mortality was 13 days (range: 2-55 days).

## Discussion

Late preterm births, defined as deliveries occurring between 34+0/7 and 36+6/7 weeks of gestation, account for a significant proportion of neonatal admissions globally. These infants face increased risks of morbidity and mortality compared to term counterparts, primarily due to physiological immaturity. This study evaluated the outcomes of late preterm infants admitted to a tertiary care center, emphasizing the differences among gestational age subgroups (34, 35, and 36 weeks). The findings highlight distinct patterns of morbidity and neonatal care requirements, underlining the importance of tailored management strategies for each gestational subgroup.

In our study, late preterm births accounted for 11% of live deliveries over a five-year period, a finding consistent with reported rates of 7%-12% in developed countries and 9%-20% in developing nations (1,2). Factors contributing

to this increasing prevalence include advanced maternal age, widespread use of assisted reproductive technologies, and improvements in obstetric care. Notably, 39% of these infants required hospitalization, underlining the burden of morbidity in this population.

Maternal factors significantly influenced late preterm births in this study. The average maternal age was 30 years, and multiple pregnancies accounted for 12% of the cases. Hypertensive disorders (15.9%), gestational diabetes (12.6%), and hypothyroidism (10%) emerged as the most common maternal morbidities, consistent with prior studies. For example, Helvacı et al. (17) reported preeclampsia at 9.3% and gestational diabetes at 6.7%. The higher prevalence observed in this study may reflect the tertiary referral nature of the hospital, which manages a greater proportion of high-risk pregnancies.

In terms of neonatal outcomes, the most frequent morbidities observed in our cohort were hyperbilirubinemia (47.5%), respiratory morbidities (33.7%), and sepsis (24.2%). The high rate of hyperbilirubinemia is consistent with the literature, where studies have shown that late preterm infants are more susceptible to jaundice due to immaturity in bilirubin metabolism delayed feeding, and hemolytic conditions such as ABO and Rh incompatibilities (17,18). Although phototherapy remained the primary treatment modality, its duration was uniform across gestational ages, suggesting standardized care practices.

Respiratory morbidities, particularly TTN and RDS, were observed in 33.7% of the infants, with a significantly lower incidence in those born at 36 weeks compared to those born at 34 and 35 weeks reflecting incomplete alveolar development and surfactant deficiency (p=0.014). The most common respiratory complication was TTN, accounting for 53% of the respiratory cases. RDS was observed in 22.5% of the respiratory cases, while congenital pneumonia was identified in 14%. These findings align with studies showing a gradual reduction in respiratory complications as gestational maturity increases (19). For example, Kitsommart et al. (20) reported a TTN rate of 47% and an RDS rate of 37.3% in late preterm infants.

Our study also found that sepsis was a major contributor to morbidity, affecting 24.2% of the infants, with early-onset sepsis accounting for 53% of cases and late-onset sepsis for 47%. Culture-positive sepsis was identified in 15% of the cases, with coagulase-negative staphylococci being the most frequently isolated pathogen. Similar findings have been reported in other studies, with rates of sepsis in late preterm infants ranging from 15% to 28% (20,21). Notably, no significant differences were observed in sepsis rates among the gestational age subgroups. The prolonged length of hospital stay and the need for extended intravenous therapy underscore the importance of early identification and prompt treatment of infections in this vulnerable population.

Metabolic and gastrointestinal complications were also prominent. Hypoglycemia, another common metabolic issue in late preterm infants, was observed in 24% of the infants in our study, with 46.5% of the cases occurring in infants born at 35 weeks. This aligns with the literature, where hypoglycemia is frequently reported in late preterm infants due to immature glucose regulatory mechanisms (22,23). In our unit, infants born at 34 weeks are typically admitted to the NICU for close observation during the early days of life, unless both their clinical condition and birth weight are clearly adequate. On the other hand, 35-week infants are more often followed in the postnatal ward with their mothers unless specific concerns are noted. This variation in early monitoring practices may help explain the higher hypoglycemia rate observed among the 35-week group. While NICU-admitted infants undergo more frequent glucose checks, allowing for early detection and treatment of hypoglycemia, those monitored in the postnatal setting may not be screened as consistently. As a result, hypoglycemia in these infants might go unrecognized initially and only come to attention when symptoms emerge, potentially leading to later NICU admission. Even when 34-week infants are kept with their mothers, they are generally monitored more closely and early interventions are more likely to be initiated. In light of these findings, and in alignment with recent guideline updates, our unit has begun working on revising its protocols to ensure more uniform and proactive monitoring strategies across the late preterm population. The median duration of intravenous dextrose therapy was four days, with no significant differences between gestational age groups.

Gastrointestinal morbidities were observed in 15.4% of the infants, with feeding intolerance being the most common issue, affecting 58 infants. Feeding intolerance is a well-recognized challenge in late preterm infants, as they often have difficulty with coordinated sucking and swallowing (24,25). Our study also identified four cases of congenital intestinal atresia and one case of NEC, consistent with the low incidence of NEC reported in recent years due to improved feeding practices and the promotion of breast milk feeding (26).

Neurological morbidities, including HIE, seizures and intracranial hemorrhages, were noted in 5% of infants. Intracranial hemorrhage was significantly more common among infants born at 34 weeks, likely due to the fragility of the germinal matrix at earlier gestations (16). HIE was identified in seven infants, and therapeutic hypothermia was required in four cases.

Congenital anomalies, particularly involving the cardiovascular and renal systems, are prominent concerns in late preterm infants. ASD and PDA frequently emerge as significant cardiac anomalies in this population. This is in line with findings from studies such as that of Swenson et al. (27), where major cardiac anomalies were identified in late preterm infants at similar rates. While ASDs often remain asymptomatic initially, PDAs can exacerbate respiratory distress and feeding challenges, requiring timely medical or surgical management to mitigate complications. Similarly, CAKUT represent critical morbidities, with risks of infections and potential long-term renal impairment.

Mortality in our cohort was 2.4%, with no significant differences between gestational age groups. The leading causes of death were cardiac anomalies and sepsis. This mortality rate is lower than those reported in studies from the United States, where late preterm mortality rates of up to 10% have been documented (28). The relatively lower mortality rate in our study may reflect the high quality of neonatal care provided at our tertiary care center.

### Study Limitations

This study was designed to evaluate early morbidities and mortality specifically among hospitalized late preterm infants, with the goal of supporting protocol development and clinical decision-making in our unit. As such, infants who did not require NICU admission were not included, which may limit the generalizability of our findings to the broader late preterm population. While long-term outcomes such as neurodevelopment or later health status are undoubtedly important, they were beyond the scope of this retrospective study and were mentioned in the abstract only as a suggestion for future research. Additionally, because our aim was to describe the overall frequency of a wide range of neonatal morbidities rather than focus on specific associations, we did not perform multivariate regression analysis. Given the diversity of outcomes and relatively small subgroup sizes, we felt that such an analysis would not yield sufficiently reliable or meaningful results in this context.

## Conclusion

This study highlights the significant morbidity and mortality associated with late preterm births. These infants require close monitoring and specialized care to address common complications such as hyperbilirubinemia, respiratory distress, sepsis, hypoglycemia, and feeding intolerance. Particularly, smaller late preterm infants (e.g., 34-35 weeks) demand more attention for respiratory support and feeding challenges, whereas all late preterm infants share similar risks for issues like hyperbilirubinemia and sepsis. Our findings underscore the importance of adhering to evidence-based guidelines for the management of late preterm infants to improve their outcomes. Further research is needed to explore long-term outcomes in this population.

### Ethics

**Ethics Committee Approval:** Ethical approval for the study was obtained from the Non-Interventional Research Ethics Committee of Dokuz Eylül University Faculty of Medicine.

**Informed Consent:** Informant consent was obtained in accordance with ethical standards.

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### Footnotes

### Authorship Contributions

Surgical and Medical Practices: O.B., C.A., F.E., N.D., H.O., Concept: O.B., F.E., N.D., H.O., Design: O.B., F.E., N.D., H.O., Data Collection or Processing: O.B., K.A.C.B., Analysis or Interpretation: C.A., F.E., H.O., Literature Search: O.B., K.A.C.B., F.E., Writing: O.B., C.A., N.D.

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