ORIGINAL RESEARCH

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Clinical and Demographic Risk Profiles in the Early Neonatal Period: A Comparative Study of Turkish and Refugee Newborns

Yenidoğan Döneminde Klinik ve Demografik Risk Profili: Türk ve Mülteci Bebeklerin Karşılaştırmalı Değerlendirmesi

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Abstract

Objective: This study explores how basic clinical and demographic factors relate to early neonatal sepsis in term newborns, with a focus on differences between Turkish and refugee populations.

Method: We conducted a retrospective analysis of 1,637 term newborns delivered at a tertiary public hospital in İstanbul between May 2023 and May 2025. Collected data included birth weight, Apgar scores, cord blood lactate levels, maternal nationality, and antenatal care status. Suspected early-onset sepsis was defined using clinical signs observed within the first 72 hours. We applied chi-square tests, correlation analysis, and multivariate logistic regression for statistical evaluation.

Results: Fewer refugee mothers received adequate antenatal care than Turkish mothers (58.4% vs. 74.9%, p<0.01). Suspected sepsis was also more common in refugee newborns (22.5% vs. 11.1%, p=0.03). Lower Apgar scores at one minute and elevated cord lactate levels emerged as independent predictors of early-onset sepsis. A moderate inverse relationship was also found between birth weight and lactate (r=-0.42, p<0.01).

Conclusion: Easily measurable clinical parameters, such as Apgar scores and cord blood lactate, can provide early indicators of sepsis risk. Differences in antenatal care rates may contribute to this risk, particularly among refugee populations. Tailored follow-up strategies could help bridge this gap.

Keywords: Apgar score, lactate, newborn, prenatal care, refugee health, sepsis

Öz

Amaç: Bu çalışma, term yenidoğanlarda erken neonatal sepsis ile ilişkili temel klinik ve demografik faktörleri incelemeyi ve Türk ile mülteci popülasyonlar arasındaki farkları ortaya koymayı amaçlamaktadır.

Yöntem: Mayıs 2023 ile Mayıs 2025 tarihleri arasında İstanbul'daki üçüncü basamak bir kamu hastanesinde doğan 1.637 term yenidoğan retrospektif olarak analiz edildi. Toplanan veriler arasında doğum ağırlığı, Apgar skorları, göbek kordonu laktat düzeyi, annenin milliyeti ve antenatal bakım durumu yer aldı. İlk 72 saat içinde gözlenen klinik bulgulara göre erken sepsis şüphesi tanımlandı. İstatistiksel analizde ki-kare testi, korelasyon analizi ve çok değişkenli lojistik regresyon kullanıldı.

Bulgular: Mülteci annelerin yeterli antenatal bakım alma oranı Türk annelere göre daha düşüktü (%58,4 vs. %74,9, p<0,01). Sepsis şüphesi mülteci yenidoğanlarda daha yüksekti (%22,5 vs. %11,1, p=0,03). Düşük 1. dakika Apgar skoru ve yüksek kordon laktat düzeyleri, erken sepsis için bağımsız belirleyiciler olarak öne çıktı. Ayrıca doğum ağırlığı ile laktat düzeyi arasında orta derecede negatif bir ilişki bulundu (r=-0,42, p<0,01).

Sonuç: Apgar skoru ve göbek kordonu laktat düzeyi gibi kolay ölçülebilen parametreler, erken sepsis riski hakkında önemli ipuçları sağlayabilir. Antenatal bakım farkları özellikle mülteci gruplarda bu riski artırabilir. Bu nedenle bireyselleştirilmiş takip stratejileri geliştirilmesi faydalı olacaktır.

Anahtar kelimeler: Apgar skoru, göçmen sağlığı, laktat, prenatal bakım, sepsis, yenidoğan

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Introduction

Neonatal sepsis, particularly when it arises within the first 72 hours after birth, continues to be a leading cause of illness and death in newborns across the globe (1). One of the main challenges with early-onset sepsis (EOS) is its vague, non-specific symptoms. Newborns often present with subtle signs, such as breathing difficulties, temperature instability, or feeding problems, which can hinder timely diagnosis (1).

Because there are no definitive early diagnostic tools, clinicians rely on simple and widely available indicators to assess risk. Parameters such as Apgar scores, birth weight, and umbilical cord blood gas values have long been used to evaluate a newborn's initial adaptation to life and physiological stress (2,3). In particular, cord blood lactate has received increasing attention as a potential marker of perinatal hypoxia and overall systemic strain. Elevated lactate levels, especially among infants with lower birth weights, have been linked to higher risks of early complications, including sepsis (4).

However, clinical markers alone do not provide a complete assessment. Broader social and environmental factors also shape neonatal health outcomes. In middle-income countries such as Turkey, refugee and migrant mothers often encounter significant barriers to accessing routine prenatal care. These gaps in care have been associated with increased rates of neonatal infections and poorer early health outcomes for newborns in these communities (5-7). To address such disparities, the World Health Organization (WHO) recommends a minimum of four antenatal visits during pregnancy to support maternal and newborn well-being (8).

This study was conducted at a large public hospital in İstanbul where both Turkish and refugee mothers receive care under shared institutional protocols. The main objective was to explore whether maternal demographic characteristics [such as nationality and antenatal care (ANC) attendance] and clinical indicators (such as the Apgar score and cord blood lactate) are associated with the risk of EOS in term neonates.

Materials and Methods

This retrospective analysis was conducted at University of Health Sciences Turkey, İstanbul Bağcılar Training and Research Hospital, a public tertiary-referral center in İstanbul, Turkey. The study population included term neonates (gestational age ≥37 weeks) who were born between May 1, 2023, and May 31, 2025. Ethical approval for the study was obtained from the Institutional Review Board of University of Health Sciences Turkey, İstanbul Bağcılar Training and Research Hospital (approval no: 2025/08/19/082, date: 02.06.2025).

Eligible participants were singleton live births who had complete perinatal records and available umbilical cord blood gas data. Newborns with congenital anomalies, with incomplete data, or those transferred from other healthcare facilities were excluded from the analysis.

Data were extracted from the hospital's electronic medical system and included both maternal and neonatal variables. These variables included maternal age, nationality (classified as Turkish or refugee), number of ANC visits, mode of delivery, gestational age, birth weight, 1- and 5-minute Apgar scores, cord blood pH and lactate levels, and early neonatal outcomes. According to WHO guidelines, adequate ANC was defined as attending at least four prenatal visits (8). Maternal infection was standardized as a binary variable, defined as a physician-diagnosed bacterial or viral illness that required pharmacologic treatment during the current pregnancy, ensuring that subjective symptoms alone were not classified as infection.

The primary outcome was the incidence of suspected EOS within the first 72 hours. Sepsis was classified into two categories: Culture-proven sepsis, defined as a positive blood culture with clinical signs; and clinical sepsis, defined as the presence of at least two clinical signs (e.g., respiratory distress or temperature instability) accompanied by abnormal laboratory markers, such as elevated CRP or leukocytosis, necessitating empirical antibiotic treatment. In line with standard neonatal practice, empirical antibiotic treatment initiated within the first three days of life was also considered part of the diagnostic criteria (1).

Statistical Analysis

All statistical analyses were performed using SPSS version 28. Descriptive statistics were presented as means with standard deviations for continuous variables and as frequencies and percentages for categorical ones. Comparisons between groups were made using independent t-tests for continuous variables and chi-square tests for categorical variables. Pearson correlation coefficient was used to assess the relationship between birth weight and cord blood lactate levels. Variables with p-values under 0.10 in univariate analyses were included in a multivariate logistic regression model to determine independent predictors of suspected EOS. While the sample size (n=1.637) provided robust statistical power, interpretation of the multivariate model is limited by the retrospective single-center design

and reliance on clinical sepsis diagnoses, for which culture confirmation was not always available. A p-value less than 0.05 was considered statistically significant.

Results

Demographic Characteristics

A total of 1.637 term neonates were included in the final analysis. Of these, 1.026 (62.7%) were born to Turkish mothers, while 611 (37.3%) were born to refugee mothers. The average maternal age was 29.7±5.8 years in the Turkish group and 27.2±6.5 years in the refugee group, showing a statistically significant difference (p=0.01).

Turkish mothers were also significantly more likely to have received adequate ANC, with 74.9% meeting the threshold of four or more visits, compared to 58.4% among refugee mothers (χ^2=12.8, p<0.01; see Table 1). There were no statistically significant differences between the two groups regarding mode of delivery (χ^2=1.9, p=0.17) or sex distribution of the neonates (χ^2=0.8, p=0.36).

Sepsis Prevalence

Overall, 251 neonates (14.9%) were classified as having suspected EOS. The prevalence of suspected sepsis was notably higher among refugee newborns (22.5%) compared to Turkish newborns (11.1%), a difference that reached statistical significance (χ^2=9.1, p=0.03; see Figure 1 and Table 1).

Newborns with suspected sepsis had significantly lower 1-minute Apgar scores and higher average cord blood lactate levels than those without sepsis (both p<0.01).

The mean birth weight across the sample was 3.160±340 grams, and the mean cord blood lactate concentration was 2.9±1.2 mmol/L. There was a moderate but significant inverse correlation between birth weight and lactate level (r=-0.42, p<0.01; see Figure 2). Neonates with 1-minute Apgar scores below 7 had higher lactate levels and were more frequently diagnosed with suspected sepsis (p<0.01).

In multivariate logistic regression (Table 2), two factors emerged as independent predictors of suspected EOS: a low 1-minute Apgar score [odds ratio (OR) =2.9; 95% confidence interval (CI): 1.6-5.3; p<0.01] and an elevated cord blood lactate level above 3.0 mmol/L (OR=2.2; 95% CI: 1.1-4.4; p=0.02). Although maternal nationality and ANC were associated with sepsis risk in univariate analysis, they were not retained as significant in the final model.

All neonates included in the study survived to hospital discharge. No in-hospital mortality was observed during the study period.

Discussion

In this study, we explored both clinical and demographic factors that may predict EOS in term infants born at a public tertiary hospital. Our findings show that low 1-minute Apgar scores and elevated cord blood lactate levels are strongly associated with an increased likelihood of suspected sepsis. Additionally, refugee status and insufficient ANC were linked to higher rates of suspected sepsis in the univariate analysis.

EOS continues to be a leading cause of illness and death among newborns, particularly within the first 72 hours of life. However, diagnosing it early remains difficult due to the non-specific nature of its clinical signs and the limitations of rapid confirmatory testing. As a result, healthcare providers often turn to readily available indicators to guide early intervention strategies (1).

Among these indicators, the 1-minute Apgar score is one of the most universally used measures of a newborn's condition. Previous research has associated low Apgar scores with adverse outcomes, including sepsis, particularly when scores are below 7 (2,3). Our results are consistent with that pattern: newborns with lower Apgar scores had nearly threefold higher odds of being treated for suspected EOS.

Cord blood lactate has emerged as another valuable marker in recent years. In our dataset, we observed that higher lactate levels were more common in neonates with lower birth weight. This supports the idea that smaller neonates may have reduced oxygen reserves or greater metabolic

Table 1. Demographic and clinical characteristics by maternal nationality

Characteristic	Turkish	Refugee	p-value
Maternal age (years)	29.7±5.8	27.2±6.5	0.01
Adequate antenatal care (%)	74.9	58.4	<0.01
Sepsis suspicion (%)	11.1	22.5	0.03
Birth weight (g)	3160±340	3080±360	0.06
Lactate (mmol/L)	2.7±1.1	3.1±1.2	0.04

stress at birth (4). Notably, elevated lactate levels remained a significant predictor of suspected sepsis in our multivariate model, consistent with earlier studies (5).

Although maternal nationality did not show a significant independent effect in the multivariate analysis, refugee newborns had notably higher rates of suspected sepsis. These infants were also more likely to have been born to mothers who did not receive adequate prenatal care. This finding echoes national data from Turkey, which indicate that refugee women often encounter systemic barriers to accessing antenatal services, including language challenges, limited health literacy, and unfamiliarity with the healthcare system (6,7).

The World Health Organization recommends at least four antenatal visits to support maternal and neonatal well-being (8). In our cohort, fewer than 60% of refugee mothers reached this benchmark, compared to nearly 75% of Turkish mothers.

This gap is significant. Recent studies from Turkey have highlighted that limited prenatal care among refugee populations is associated with a higher incidence of neonatal complications, including infections and preterm births (9,10). These disparities persist even when medical protocols are standardized, which underscores the importance of culturally responsive care models and targeted support at both community and system levels.

One limitation of our analysis is that detailed maternal health data, such as anemia, infections during pregnancy, hypertensive disorders, or premature rupture of membranes, were not consistently recorded in the hospital's retrospective dataset. As a result, we could not fully adjust for these potential confounders, which may have influenced the associations observed.

Study Limitations

This study has several important limitations. First, as a retrospective analysis, it is inherently subject to documentation bias and cannot establish causal relationships. Second, the identification of EOS was based on clinical judgment and laboratory findings rather than on confirmed blood cultures in every case. While this approach reflects routine clinical practice in many public hospitals, it could have led to an overestimation of the incidence of sepsis.

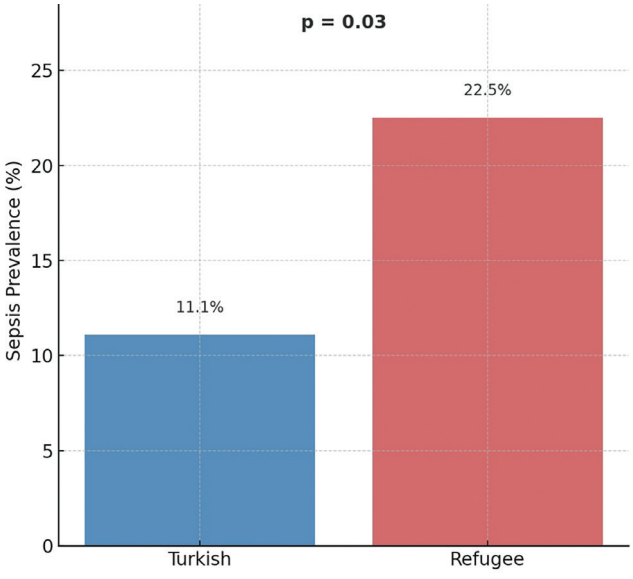

Figure 1. Sepsis prevalence by nationality (chi square test, χ^2=9.1, p=0.03, n=1.637)

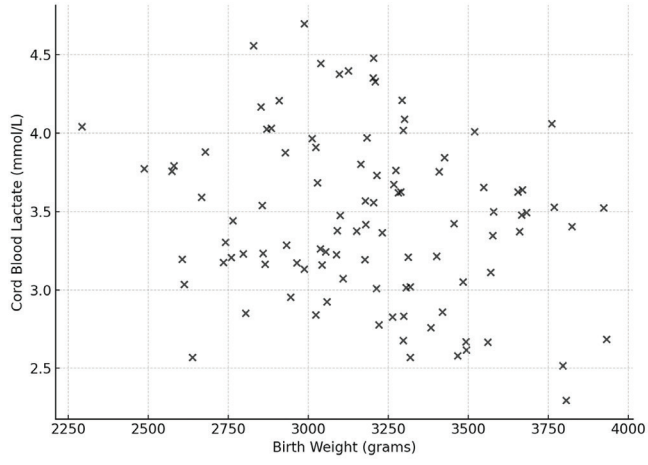

Figure 2. Relationship between birth weight and cord blood lactate (Pearson correlation, r=-0.42, p<0.01, n=1.637)

Table 2. Logistic regression analysis for predictors of sepsis

Variable	Adjusted OR	95% CI	p-value
Low 1-min Apgar score (<7)	2.9	1.6-5.3	<0.01
Elevated lactate (>3.0 mmol/L)	2.2	1.1-4.4	0.02
Maternal nationality (ref: Turkish)	1.5	0.9-2.6	0.09
Inadequate antenatal care	1.4	0.8-2.5	0.11

OR: Odds ratio, CI: Confidence interval

Third, although our sample size was relatively large, the data were collected from a single-center. This limits the generalizability of the findings, particularly to settings with different population dynamics or healthcare infrastructure.

Additionally, some potentially influential maternal health factors, such as anemia, infections during pregnancy, hypertensive disorders, and premature rupture of membranes were not consistently documented in the hospital records and were therefore excluded from the analysis. Prospective studies that include these variables could offer a more complete picture of the maternal contributions to neonatal sepsis risk.

Conclusion

Our results highlight the value of using simple, readily available indicators such as Apgar scores and cord blood lactate levels for early risk assessment in term newborns. When interpreted alongside maternal sociodemographic factors, these tools may help clinicians better identify infants at higher risk of EOS.

The higher rate of suspected sepsis among refugee newborns emphasizes the need for targeted prenatal interventions, particularly those that improve access to culturally sensitive and consistent ANC.

Importantly, all neonates in this study survived to discharge, suggesting that timely recognition and adherence to standardized management protocols may contribute to favorable short-term outcomes.

Going forward, public health strategies that account for both medical and social risk factors will be essential for improving neonatal outcomes, especially in busy public hospital settings serving diverse populations.

Ethics

Ethics Committee Approval: Ethical approval for the study was obtained from the Institutional Review Board of University of Health Sciences Turkey, İstanbul Bağcılar Training and Research Hospital (approval no: 2025/08/19/082, date: 02.06.2025).

Informed Consent: Retrospective study.

Footnotes

Authorship Contributions

Concept: Y.K., E.C., Design: Y.K., E.C., Data Collection or Processing: Y.K., E.C., Analysis or Interpretation: Y.K., E.C., Literature Search: Y.K., E.C., Writing: Y.K., E.C.

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

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