

Clinical and laboratory characteristics according to the onset of neonatal sepsis: a retrospective cohort study

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ABSTRACT

Aims: Neonatal sepsis remains a major cause of neonatal morbidity and mortality despite advances in neonatal intensive care. Although early-onset sepsis (EOS) and late-onset sepsis (LOS) differ in their pathophysiology and clinical presentation, comparative data including neonates who experience both EOS and LOS remain limited. This study aimed to compare the clinical and laboratory characteristics of neonates with EOS, LOS, and combined EOS+LOS.

Methods: This retrospective cohort study included 289 neonates with sepsis admitted to a tertiary neonatal intensive care unit between January 2020 and January 2022. Patients were classified into three groups: EOS (n=207), LOS (n=32), and EOS+LOS (n=50). Demographic characteristics, clinical findings, microbiological results, and laboratory parameters were compared among the groups.

Results: Neonates with EOS+LOS had lower gestational age, birth weight, and Apgar scores and longer hospitalization than neonates with EOS or LOS alone. Platelet count and plateletcrit (P-LCT) were lowest in the EOS+LOS group, while mean platelet volume was higher in EOS+LOS than in EOS. Neonates with EOS had higher white blood cell count, hemoglobin, absolute neutrophil count, and neutrophil-to-lymphocyte ratio (NLR) than both the LOS and EOS+LOS groups; red cell distribution width and C-reactive protein were higher in EOS than in LOS. Hematocrit was lower in EOS+LOS than in both EOS and LOS, and absolute lymphocyte count was higher in LOS than in both EOS and EOS+LOS.

Conclusion: Clinical and laboratory characteristics differ according to the onset of neonatal sepsis. Routinely available hematological parameters may complement clinical assessment and support the early evaluation of neonatal sepsis. Larger prospective multicenter studies are needed to validate these findings.

Keywords: Early-onset sepsis, late-onset sepsis, newborn, biomarkers, hematological parameters

INTRODUCTION

Neonatal sepsis remains a major cause of neonatal morbidity and mortality worldwide despite advances in neonatal intensive care and antimicrobial therapy. The burden of disease is greatest among preterm and low-birth-weight infants because of their immature immune system and increased exposure to invasive procedures. Although improvements in perinatal care have reduced its incidence in developed countries, neonatal sepsis continues to be associated with substantial mortality and prolonged hospitalization.¹⁻⁴

Neonatal sepsis is classified as early-onset sepsis (EOS) or late-onset sepsis (LOS) according to the timing of disease onset. EOS is primarily associated with vertical maternal transmission, whereas LOS is commonly related to nosocomial or community-acquired infections. Because these conditions differ in microbiological etiology, risk

factors, and host immune response, differences in their clinical presentation and laboratory findings are expected.^{3,4}

Early diagnosis remains challenging because the clinical manifestations of neonatal sepsis are nonspecific and often overlap with those of noninfectious neonatal disorders. Although blood culture is considered the diagnostic gold standard, its sensitivity is limited and results require 48–72 hours, making early clinical decision-making difficult. Consequently, readily available laboratory markers, including white blood cell count, platelet indices, C-reactive protein, neutrophil-to-lymphocyte ratio, and nucleated red blood cell count, have been increasingly investigated as adjunctive diagnostic tools.⁵⁻⁷

Most previous studies have evaluated EOS and LOS separately, whereas comparative data including neonates



who experienced both EOS and LOS are scarce. Therefore, this study aimed to compare the clinical characteristics and routinely available hematological and biochemical parameters among neonates with EOS, LOS, and combined EOS+LOS to identify potential diagnostic differences according to the timing of sepsis onset.

METHODS

Ethics

This study was approved by the Ethics Committee of Ankara Training and Research Hospital, University of Health Sciences (Date: 05.10.2022, Decision No: E-22-1099). All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki. Because of the retrospective study design, the requirement for informed consent was waived.

Study Design and Participants

This retrospective single-center cohort study was conducted in the tertiary Neonatal Intensive Care Unit of Ankara Training and Research Hospital, Türkiye, between January 2020 and January 2022. Medical records of neonates aged ≤ 30 days who were diagnosed with neonatal sepsis were retrospectively reviewed. Demographic characteristics, maternal and perinatal data, clinical findings, microbiological results, treatment information, and laboratory parameters were extracted from the hospital's electronic medical record system.

Neonates with culture-proven sepsis or clinically diagnosed sepsis requiring antibiotic treatment were eligible for inclusion. Patients with incomplete medical records, isolated urinary tract infection without systemic involvement, or noninfectious conditions that could mimic neonatal sepsis, including perinatal asphyxia, transient tachypnea of the newborn, respiratory distress syndrome, pulmonary hypoplasia, congenital diaphragmatic hernia, congenital or acquired heart disease, adrenal disorders, intraventricular hemorrhage, hypoxic-ischemic encephalopathy, inherited metabolic diseases, and neonatal abstinence syndrome, were excluded. Transient tachypnea of the newborn and respiratory distress syndrome were considered exclusionary only when they provided a noninfectious explanation for the clinical presentation; respiratory failure itself was not used as an exclusion criterion in neonates who otherwise fulfilled the study definition of sepsis.

A total of 289 neonates met the eligibility criteria and were classified into three groups according to the onset of sepsis: EOS; $n=207$, LOS; $n=32$, and combined EOS+LOS ($n=50$). The EOS+LOS group comprised neonates who experienced two distinct sepsis episodes during the same hospitalization, with an initial EOS episode followed by a subsequent LOS episode. For the EOS+LOS group, the laboratory values used in the between-group analyses were those obtained during the initial EOS episode; laboratory data from the subsequent LOS episode were not consistently available and were therefore not included in these comparisons.

Data Collection

The collected variables included gestational age, birth weight, gender, mode of delivery, Apgar scores, maternal

infection history, premature rupture of membranes, duration of hospitalization, timing of antibiotic initiation, clinical manifestations of sepsis, complete blood count parameters including plateletcrit (P-LCT), C-reactive protein, procalcitonin (PCT), interleukin-6, blood gas analysis, lactate level, and blood, urine, and cerebrospinal fluid culture results. To avoid abbreviation ambiguity, PCT is used exclusively for procalcitonin in the text, whereas plateletcrit is abbreviated as P-LCT. Patients with positive blood cultures were classified as having culture-proven sepsis, whereas those with negative blood cultures but compatible clinical and laboratory findings were classified as having clinical sepsis. Blood cultures were obtained before initiation of empirical antibiotic therapy in all patients.

Statistical Analysis

Continuous variables were expressed as mean $\pm$ standard deviation or median (minimum–maximum), according to data distribution, whereas categorical variables were presented as numbers and percentages. Comparisons among the three groups were performed using one-way ANOVA or the Kruskal–Wallis test for continuous variables and the Chi-square test for categorical variables. When an overall group comparison was statistically significant, pairwise post-hoc comparisons were evaluated with Bonferroni adjustment. In **Tables 1** and **2**, superscript letters identify the significant pairwise contrasts (a: EOS vs LOS; b: EOS vs EOS+LOS; c: LOS vs EOS+LOS). Statistical significance was defined as $p<0.05$. Statistical analyses were performed using IBM SPSS Statistics version 23.0 (IBM Corp., Armonk, NY, USA).

RESULTS

A total of 289 neonates with sepsis were included in the study. Of these, 207 (71.6%) were classified as having EOS, 32 (11.1%) as LOS, and 50 (17.3%) experienced two distinct episodes, with EOS followed by LOS during the same hospitalization (EOS+LOS).

The baseline demographic and perinatal characteristics of the study population are summarized in **Table 1**. Significant differences were observed among the three groups with respect to gestational age, birth weight, Apgar scores, hospitalization duration, timing of antibiotic initiation, sex distribution, small-for-gestational-age status, and prematurity (all $p<0.05$). Infants in the EOS+LOS group were generally more premature, had lower birth weights and Apgar scores, and required longer hospitalization than those in the other groups.

The clinical manifestations observed at the time of diagnosis are presented in **Table 3**. Respiratory manifestations were the most frequent presenting feature, followed by metabolic and gastrointestinal manifestations.

Blood cultures were positive in 17 neonates (5.9%), yielding 20 bacterial isolates. The most frequently isolated organism was *Staphylococcus epidermidis*, followed by *Staphylococcus haemolyticus* and *Escherichia coli*. Only one patient had a positive cerebrospinal fluid culture, which yielded *Listeria monocytogenes*. The most commonly prescribed empirical antibiotic regimen was ampicillin plus gentamicin.

Table 1. Demographic and perinatal characteristics according to the onset of neonatal sepsis

	EOS (n=207)	LOS (n=32)	EOS+LOS (n=50)	p value
Maternal age*	27.38±6.56	27.56±6.96	27.34±6.62	0.66
Gravidity**	2 (1–9)	3 (1–8)	3 (1–12)	0.28
Parity**	2 (1–9)	2 (1–6)	3 (1–9)	0.55
Gestational age (weeks)**	39 (28.4–41.5)	38.5 (34–41)	35.6 (28–41)	<0.001 ^{bc}
Birth weight (g)*	3179.65±573.79	3003±548.14	2379.2±962.72	<0.001 ^{bc}
Apgar score at 1 min**	8 (2–9)	8 (5–9)	7 (1–9)	<0.001 ^{bc}
Apgar score at 5 min**	9 (5–10)	9 (7–10)	8 (3–10)	<0.001 ^{bc}
Day of hospital admission**	1 (1–3)	3 (1–29)	1 (1–1)	<0.001 ^{abc}
Day of antibiotic initiation**	2 (1–4)	7 (4–29)	1 (1–3)	<0.001 ^{abc}
Length of hospital stay (days)**	9 (2–27)	12 (7–31)	25 (7–250)	<0.001 ^{abc}
Mode of delivery, n (%)				
Vaginal	117 (57.9%)	18 (60.0%)	22 (44.0%)	0.18
Cesarean delivery	85 (42.1%)	12 (40.0%)	28 (56.0%)	
Male gender, n (%)	126 (60.9%)	11 (34.4%)	27 (54.0%)	0.02 ^a
SGA, n (%)	2 (1.0%)	3 (9.4%)	1 (2.0%)	0.01 ^a
Preterm birth, n (%)	34 (16.4%)	4 (12.5%)	28 (56.0%)	<0.001 ^{bc}
Maternal infection/risk factor, n (%)				
None	119 (58.9%)	24 (80%)	31 (62%)	0.08
Maternal infection	35 (17.3%)	2 (6.7%)	4 (8%)	
PROM/PPROM	19 (9.4%)	0 (0.0%)	3 (6%)	
Other maternal diseases, n (%)	29 (14.4%)	4 (13.3%)	12 (24.0%)	0.19

*Mean (±SD); **Median (minimum–maximum). SGA: Small for gestational age. PROM: Premature rupture of membranes. PPROM: Preterm premature rupture of membranes. For mode of delivery, percentages correspond to the records included in the original subgroup extraction (EOS, n=202; LOS, n=30; EOS+LOS, n=50), while the overall study-group sizes remained EOS n=207, LOS n=32, and EOS+LOS n=50. Superscripts denote significant Bonferroni-adjusted pairwise comparisons: a, EOS vs LOS; b, EOS vs EOS+LOS; c, LOS vs EOS+LOS. Significant pairwise p values: Gestational age b<0.001, c=0.002; birth weight b<0.001, c<0.001; Apgar 1 min b<0.001, c=0.002; Apgar 5 min b<0.001, c<0.001; day of admission a<0.001, b=0.011, c<0.001; antibiotic initiation day a<0.001, b=0.047, c<0.001; hospitalization duration a=0.004, b<0.001, c<0.001; male gender a=0.023; SGA a=0.005; prematurity b<0.001, c<0.001. EOS: Early-onset sepsis, LOS: Late-onset sepsis

Table 2. Comparison of laboratory parameters according to the onset of neonatal sepsis

Laboratory	EOS (n=207)	LOS (n=32)	EOS+LOS (n=50)	p value
WBC (/mm ³)**	19010 (3800–127960)	13095 (2370–45260)	12480 (4820–37340)	<0.001 ^{ab}
Platelet count (/mm ³)**	285500 (75000–734000)	292000 (59000–680000)	240000 (21000–510000)	0.04 ^c
Hemoglobin (g/dl)*	17.82±2.59	15.85±3.35	15.53±4.21	<0.001 ^{ab}
Hematocrit (%)*	52.51±7.94	52.51±9.89	45.79±12.15	<0.001 ^{bc}
RDW (%)**	17.5 (14.4–51.5)	16.65 (14.1–21.2)	16.95 (14.1–24.3)	0.004 ^a
Neutrophil (%)**	65.75 (22.9–89)	40.25 (8.3–77.5)	51.05 (11–85)	<0.001 ^{ab}
Lymphocyte (%)**	23.8 (2.6–50)	41.8 (14–75)	31 (8.4–64)	<0.001 ^{ab}
NRBC (%)**	1.3 (0–91.1)	0.2 (0–32.3)	2.1 (0–167.9)	0.006 ^{ac}
NRBC (10 ³ /mm ³)**	0.26 (0–13.69)	0.04 (0–15.2)	0.19 (0–14.8)	0.01 ^a
ANC (/mm ³)**	11750 (1540–102750)	4925 (820–32070)	5690 (940–28120)	<0.001 ^{ab}
ALC (/mm ³)**	4435 (1190–18600)	5100 (710–9000)	4100 (970–12260)	0.01 ^{ac}
MPV (fL)*	9.77±0.84	9.90±1	10.2±1.1	0.01 ^b
Plateletcrit (P-LCT, %)**	0.28 (0.08–3)	0.30 (0.06–0.69)	0.25 (0.06–0.60)	0.04 ^c
NLR**	2.6 (0.4–19.2)	0.9 (0.1–5.46)	1.41 (0.31–9.85)	<0.001 ^{ab}
CRP (mg/dl)**	10.9 (0.1–143)	3.89 (0.3–44)	8.15 (0.2–165)	0.002 ^a
pH**	7.33 (6.98–7.49)	7.36 (7.26–7.42)	7.34 (7.11–7.47)	0.12
HCO ₃ ⁻ (mmol/L)**	19.4 (8.2–26)	20.2 (14.6–25.6)	19.8 (9.7–24.2)	0.2
Lactate (mmol/L)**	3.6 (1.1–19.0)	3 (1.7–5)	3.2 (1.03–14.7)	0.08

*Mean (±SD); **Median (minimum–maximum). WBC: White blood cell count, RDW: Red cell distribution width, NRBC: Nucleated red blood cells, ANC: Absolute neutrophil count, ALC: Absolute lymphocyte count, MPV: Mean platelet volume, P-LCT: Plateletcrit, NLR: Neutrophil-to-lymphocyte ratio, CRP: C-reactive protein, HCO₃⁻: Bicarbonate. Superscripts denote significant Bonferroni-adjusted pairwise comparisons: a, EOS vs LOS; b, EOS vs EOS+LOS; c, LOS vs EOS+LOS. Significant pairwise p values: WBC a=0.002, b<0.001; platelet count c=0.042; hemoglobin a=0.003, b<0.001; hematocrit b<0.001, c=0.014; RDW a=0.014; neutrophil percentage a<0.001, b<0.001; lymphocyte percentage a<0.001, b=0.003; NRBC percentage a=0.005, c=0.012; absolute NRBC a=0.009; ANC a<0.001, b<0.001; ALC a=0.027, c=0.013; MPV b=0.008; P-LCT c=0.037; NLR a<0.001, b=0.001; CRP a=0.001. The extreme WBC and NRBC values were rechecked against the original patient-level dataset and confirmed as recorded values rather than transcription or data-entry errors. EOS: Early-onset sepsis, LOS: Late-onset sepsis

Laboratory findings according to the onset of sepsis are presented in **Table 3**. Bonferroni-adjusted pairwise comparisons showed that white blood cell count, hemoglobin, absolute neutrophil count, and neutrophil-to-lymphocyte ratio (NLR) were higher in EOS than in both LOS and

EOS+LOS, whereas red cell distribution width and C-reactive protein were higher in EOS than in LOS. Hematocrit was lower in EOS+LOS than in both EOS and LOS. Platelet count and P-LCT were lower in EOS+LOS than in LOS, while mean platelet volume was higher in EOS+LOS than in EOS.

Absolute lymphocyte count was higher in LOS than in both EOS and EOS+LOS. NRBC percentage was higher in EOS than in LOS and in EOS+LOS than in LOS, while absolute NRBC count was higher in EOS than in LOS. No significant differences were observed among the groups in blood pH, bicarbonate, or lactate levels.

Table 3. Clinical manifestations observed at presentation

Clinical manifestation	EOS (n=207), n (%)	LOS (n=32), n (%)	EOS+LOS (n=50), n (%)	Overall (n=289), n (%)
Respiratory manifestations	183 (88.4%)	23 (71.9%)	43 (86.0%)	249 (86.2%)
Metabolic disturbances	56 (27.1%)	7 (21.9%)	18 (36.0%)	81 (28.0%)
Gastrointestinal manifestations	25 (12.1%)	12 (37.5%)	2 (4.0%)	39 (13.5%)
Circulatory manifestations	19 (9.2%)	7 (21.9%)	7 (14.0%)	33 (11.4%)
Neuromotor manifestations	14 (6.8%)	1 (3.1%)	9 (18.0%)	24 (8.3%)
Skin manifestations	3 (1.4%)	3 (9.4%)	0 (0.0%)	6 (2.1%)
Genitourinary manifestations	2 (1.0%)	0 (0.0%)	0 (0.0%)	2 (0.7%)
Hematological manifestations	0 (0.0%)	0 (0.0%)	1 (2.0%)	1 (0.3%)

Values are presented as n (%). More than one clinical manifestation could be present in the same patient; therefore, the cumulative number of manifestations may exceed the total number of patients. EOS: Early-onset sepsis, LOS: Late-onset sepsis

DISCUSSION

In this retrospective cohort study, we compared the clinical and laboratory characteristics of neonates with EOS, LOS, and combined EOS+LOS. The principal findings were that neonates with combined EOS+LOS had lower gestational age, lower birth weight, lower platelet indices, and longer hospitalization, whereas EOS was associated with higher inflammatory and hematological parameters, including white blood cell count, absolute neutrophil count, nucleated red blood cell count, red cell distribution width, and neutrophil-to-lymphocyte ratio. These findings suggest that the onset of neonatal sepsis is associated with distinct clinical and hematological profiles.

Prematurity and low birth weight are well-established risk factors for neonatal sepsis because of immune immaturity, impaired epithelial barriers, and the frequent need for invasive procedures. Consistent with previous reports, infants in the EOS+LOS group had significantly lower gestational age and birth weight and experienced longer hospitalization than those with EOS or LOS alone. Lower Apgar scores observed in this group may also reflect greater perinatal vulnerability. Collectively, these findings suggest that infants who develop both EOS and LOS represent a particularly high-risk subgroup requiring prolonged hospitalization and closer clinical surveillance.^{3,8}

Among the laboratory findings, inflammatory markers were more pronounced in the EOS group. White blood cell count, absolute neutrophil count, and (NLR) were significantly higher in EOS than in both LOS and EOS+LOS, whereas C-reactive protein was significantly higher in EOS than in

LOS. These observations are consistent with previous studies demonstrating that routinely available hematological and inflammatory markers may differ according to the timing and phase of neonatal infection. Although none of these biomarkers alone has sufficient diagnostic accuracy, their combined interpretation together with clinical findings may improve the early recognition of neonatal sepsis.⁹⁻¹¹

Platelet and erythrocyte indices also differed according to the timing of sepsis onset. The EOS+LOS group showed the lowest platelet count and P-LCT, whereas mean platelet volume differed significantly among the groups. Thrombocytopenia is a well-recognized hematological manifestation of neonatal sepsis and may reflect platelet consumption during systemic inflammation.⁸ Mean platelet volume has also been investigated as an adjunctive marker in neonatal sepsis.¹² Red cell distribution width and nucleated red blood cell measures also differed by sepsis-onset group.^{13,14} These changes may reflect platelet consumption, systemic inflammation, tissue hypoxia, and bone marrow activation during sepsis. Because these indices are inexpensive and routinely available as part of a complete blood count, they may provide additional diagnostic information when interpreted alongside conventional inflammatory markers rather than being used individually.

Blood culture positivity was relatively low in our cohort, with only 17 of 289 neonates (5.9%) having culture-confirmed infection. Importantly, blood cultures were obtained before the initiation of empirical antibiotic therapy in all patients; therefore, prior neonatal antimicrobial exposure does not explain the low culture positivity rate observed in our cohort. The low rate should primarily be interpreted in the context of our inclusion criteria, which permitted enrollment of neonates with clinically diagnosed sepsis despite negative blood cultures. In addition, the limited sensitivity of blood culture in neonates, particularly when small blood volumes are inoculated, may have contributed to the low microbiological yield. Because the exact blood volume inoculated into culture bottles was not consistently documented in this retrospective dataset, its potential effect could not be quantified. Accordingly, the low proportion of culture-confirmed cases should be considered when interpreting our findings. Gram-positive organisms predominated among culture-positive cases, with *Staphylococcus epidermidis* being the most frequently isolated pathogen.^{15,16}

The mortality rate in our cohort was relatively low compared with previous reports. Although the retrospective nature of the study precludes identification of the underlying reasons, early diagnosis, prompt initiation of empirical antimicrobial therapy, and management in a tertiary neonatal intensive care unit may have contributed to this favorable outcome.

Limitations

This study has several limitations. First, its retrospective single-center design may limit the generalizability of the findings. Second, in the EOS+LOS group, the laboratory values used for the between-group analyses were obtained during the initial EOS episode. Laboratory data from the subsequent LOS episode were not consistently available; therefore, within-patient longitudinal comparison

between the EOS and subsequent LOS episodes could not be performed. Finally, some biomarkers, including interleukin-6, procalcitonin, and the immature-to-total neutrophil ratio, were not available for all patients. In addition, the low blood culture positivity rate and the inclusion of a substantial proportion of clinically diagnosed, culture-negative sepsis cases may have introduced diagnostic heterogeneity. Although blood cultures were obtained before empirical antibiotic treatment in all patients, the exact blood volume inoculated for culture was not consistently available in the retrospective records. In addition, although clinical manifestations were retrospectively collected from medical records, group-specific distributions were successfully extracted and evaluated for all cohorts. For all patients from the archived retrospective dataset, and only verified overall frequencies are therefore reported.

Despite these limitations, our study has several strengths. To our knowledge, relatively few studies have simultaneously compared demographic characteristics, clinical findings, and routinely available hematological parameters among neonates with EOS, LOS, and combined EOS+LOS within the same cohort. The inclusion of the EOS+LOS group provides additional insight into a subgroup of neonates who may represent a more vulnerable population and who are infrequently evaluated separately in the existing literature. Our findings suggest that simple hematological indices derived from routine complete blood counts may complement clinical assessment but should not replace microbiological confirmation.

CONCLUSION

The present study demonstrated that the clinical presentation and routinely available laboratory parameters differ according to the onset of neonatal sepsis. Neonates with combined EOS+LOS were characterized by greater prematurity, lower birth weight, longer hospitalization, and more pronounced platelet abnormalities, whereas EOS was associated with a stronger inflammatory and hematological response, including higher white blood cell count, absolute neutrophil count, neutrophil-to-lymphocyte ratio, nucleated red blood cell count, and C-reactive protein levels.

These findings suggest that readily available hematological indices obtained from routine complete blood counts may complement clinical assessment and assist in the early evaluation of neonatal sepsis according to disease onset. Although none of these biomarkers should be interpreted in isolation, their combined use may improve diagnostic accuracy and support timely clinical decision-making.

Further prospective, multicenter studies with larger cohorts are warranted to validate these findings and determine the clinical utility of these hematological parameters in the diagnosis and risk stratification of neonatal sepsis.

ETHICAL DECLARATIONS

Ethics Committee Approval

This study was approved by the Ethics Committee of Ankara Training and Research Hospital, University of Health Sciences (Date: 05.10.2022, Decision No: E-22-1099).

Informed Consent

This retrospective study used pre-existing anonymized patient data. No additional intervention was performed, and there was no direct patient contact. The study was approved by the Ethics Committee, and the requirement for written informed consent was waived by the ethics committee.

Peer Review Process

This manuscript was subject to external peer review.

Conflict of Interest

The authors declare no conflicts of interest related to this study.

Financial Disclosure

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Author Contributions

Concept: FS, DK; Design: FS, DK; Control: DK, MTG; Data Collection and/or Processing: FS; Analysis and/or Interpretation: FS, DK, CG; Literature Review: FS, CG, MTG; Writing the Article: FS, DK; Critical Review: FS, DK, CG, MTG.

REFERENCES

1. Satar M, Arisoy AE, Çelik İH. Turkish Neonatal Society guideline on neonatal infections-diagnosis and treatment. *Turk Pediatri Ars.* 2018; 53(Suppl 1):S88-S100. doi:10.5152/TurkPediatriArs.2018.01809
2. Klein JO, Wilson CB, Nizet V, Maldonado YA, eds. Remington and Klein's Infectious Diseases of the Fetus and Newborn Infant. 8th ed. Elsevier; 2016.
3. Stoll BJ, Hansen NI, Sánchez PJ, et al. Early onset neonatal sepsis: the burden of group B Streptococcal and *E. coli* disease continues. *Pediatrics.* 2011;127(5):817-826. doi:10.1542/peds.2010-2217
4. Dong Y, Speer CP. Late-onset neonatal sepsis: recent developments. *Arch Dis Child Fetal Neonatal Ed.* 2015;100(3):F257-F263. doi:10.1136/archdischild-2014-306213
5. Edmond K, Zaidi A. New approaches to preventing, diagnosing, and treating neonatal sepsis. *PLoS Med.* 2010;7(3): e1000213. doi: 10.1371/journal.pmed.1000213
6. Odabasi IO, Bulbul A. Neonatal sepsis. *Sisli Etfal Hastan Tip Bul.* 2020; 54:142-158. doi:10.14744/SEMB.2020.00236
7. Hofer N, Zacharias E, Müller W, et al. An update on the use of C-reactive protein in early-onset neonatal sepsis: current insights and new tasks. *Neonatology.* 2012;102(1):25-36. doi: 10.1159/000336629
8. De Rose DU, Perri A, Auriti C, et al. Diagnosis and management of neonatal bacterial sepsis. *Trop Med Infect Dis.* 2024;9(9):199. doi:10.3390/tropicalmed9090199
9. Hornik CP, Benjamin DK, Becker KC, et al. Use of the complete blood cell count in early-onset neonatal sepsis. *Pediatr Infect Dis J.* 2012;31: 799-802. doi:10.1097/INF.0b013e318256905c
10. Wilr R. Diagnostic value of eosinopenia and neutrophil to lymphocyte ratio on early onset neonatal sepsis. *Korean J Pediatr.* 2019;62:217-223. doi.org/10.3345/kjp.2018.06723
11. Ganesan P, Shanmugam P, Sattar SBA, et al. Evaluation of IL-6, CRP and hs-CRP as early markers of neonatal sepsis. *J Clin Diagn Res.* 2016; JCDR10:DC13-DC17. doi:10.7860/JCDR/2016/19214.7764
12. Wang J, Wang Z, Zhang M, et al. Diagnostic value of mean platelet volume for neonatal sepsis: a systematic review and meta-analysis. *Medicine (Baltimore).* 2020;99: e21649. doi:10.1097/MD.00000000000021649
13. Ferber A, Fridel Z, Weissmann-Brenner A, et al. Are elevated fetal nucleated red blood cell counts an indirect reflection of enhanced erythropoietin activity? *Am J Obstet Gynecol.* 2004;190:1473-1475. doi: 10.1016/j.ajog.2004.02.033
14. Ellahony DM, El-Mekkawy MS, Farag MM. A study of red cell distribution width in neonatal sepsis. *Pediatr Emerg Care.* 2020;36:378-383. doi:10.1097/PEC.0000000000001319

15. Kariniotaki C, Tsakalidis C, Tsakris A, et al. Neonatal sepsis: a comprehensive review. *Children.* 2024;12(1):10. doi:10.3390/children12010010
16. Tunç T, Polat A, Özdemir R et al. Assessment of novel biomarkers: sTREM-1, pentraxin-3 and pro-adrenomedullin in the early diagnosis of neonatal early onset sepsis. *J Neonatal-Perinat Med.* 2020;13:47–54. doi:10.3233/NPM-180131

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I was born in 1982 and graduated from Karadeniz Technical University Faculty of Medicine in Trabzon, Türkiye, in 2008. I completed my compulsory medical service at Siirt Maternity and Children's Hospital between 2008 and 2010. From 2010 to 2019, I worked as a physician at Medical Park Hospital. I completed my residency training in Pediatrics at Ankara Training and Research Hospital between 2019 and 2023. After that, I fulfilled my compulsory specialist service at Dr. Sami Ulus Maternity and Children's Health and Diseases Training and Research Hospital from 2023 to 2025. Since 2025, I have been undertaking a fellowship in Neonatal Intensive Care at Ankara Training and Research Hospital. My main clinical and research interests include neonatal intensive care, neonatal sepsis, neonatal nutrition, respiratory support, and evidence-based neonatal medicine.

