Razi Med J. 2025;1(2):60-63
https://doi.org/10.69667/rmj.25206
Razi Medical Journal
https://razi.edu.ly/rmj/index.php/hm

Original article

Prevalence and Outcomes of Coagulase-Negative Staphylococci in Newborns Admitted to the NICU in a Tertiary Hospital in Libya

Mufeedah Mansour*, Khoulah Alaribi

Department of Pediatrics, Faculty of Medicine, University of Zawia, Zawia, Libya
Corresponding Email. *mansourmofida2@gmail.com*

Abstract
Neonatal sepsis caused by coagulase-negative Staphylococcus (CoNS) poses significant challenges in NICUs, particularly in preterm infants, with diagnostic uncertainty and antimicrobial resistance complicating care. This retrospective study of 411 neonates admitted to the NICU at Zawia Medical Center in the year 2012. The prevalence of CoNS was 10.5%. Cesarean section (C/S) was a key risk factor, with 79.1% of CoNS-positive neonates delivered via C/S versus 52.9% in CoNS-negative cases (p =0.001), suggesting disrupted maternal microbiome transmission and nosocomial exposure. While prematurity (55.8% vs. 51.4%) and low birth weight (60.5% vs. 50.8%) were more prevalent in CoNS-positive infants, these associations lacked significance. Notably, CRP positivity surged post-deterioration in CoNS cases (93% vs. 21.5%; p <0.001), supporting its role as a late biomarker, while clinical decline within 1–7 days of admission (p <0.001) implicated hospital-acquired transmission. CoNS-positive neonates required more blood transfusions (27.9% vs. 18%; p =0.005) and prolonged antibiotics (30.2% vs. 16.6%; p =0.001), though mortality remained comparable (18.6% vs. 16.3%; p = 0.70). These findings underscore C/S as a modifiable risk, advocate serial CRP monitoring post-deterioration, and emphasize stringent infection control to mitigate nosocomial spread. Despite comparable mortality, CoNS-associated morbidity highlights systemic burdens, urging targeted interventions—rationalizing C/S use, CRP-guided therapy, and enhanced NICU protocols—to reduce neonatal sepsis burden globally.
Keywords. *Neonatal Sepsis, Coagulase-Negative Staphylococcus, Cesarean Section, C-Reactive Protein, Nosocomial Infections.*

Received*: 11/03/25*
Accepted*: 16/05/25*
Published*: 22/05/25*

Introduction

Neonatal sepsis remains a leading cause of morbidity and mortality in newborns, particularly in low- and middle-income countries, where delayed diagnosis and limited resources exacerbate poor outcomes [1]. Among pathogens, coagulase-negative Staphylococcus (CoNS)—often dismissed as a contaminant—has emerged as a predominant cause of late-onset sepsis in neonatal intensive care units (NICUs), accounting for up to 60% of bloodstream infections in preterm infants [2]. Despite its prevalence, CoNS infections present a clinical conundrum: their indolent course and frequent colonization complicate differentiation between true pathogens and incidental findings, often leading to delayed or unnecessary antibiotic use [3]. This challenge is compounded by rising antimicrobial resistance, emphasizing the urgent need for targeted diagnostic and preventive strategies [4].

Current research identifies prematurity, low birth weight, and prolonged hospitalization as key risk factors for CoNS infections [3]. However, the role of mode of delivery—specifically, cesarean section (C/S)—remains contentious [5], [6]. While some studies associate C/S with disrupted vertical transmission of maternal microbiota and increased colonization by hospital-acquired pathogens like Staphylococcus [7]. Others argue this link is confounded by underlying maternal comorbidities or NICU practices [8]. Similarly, biomarkers such as C-reactive protein (CRP) are widely used to detect sepsis, yet their utility in CoNS-specific cases is debated due to inconsistent elevation during early infection [9]. These gaps hinder evidence-based protocols for managing CoNS, which straddle the line between overtreatment and missed diagnoses. This study aims to measure the prevalence and identify the outcomes associated with coagulase-negative staphylococcal infections in all newborns at the NICU of Zawia Medical Center, Libya.

Methods

A Retrospective case series study department in Al-Zawia Medical Center /Libya from 1st January to -31 December 2012. The study included 411 neonates admitted to the Neonatal Intensive Care Unit (NICU) in the pediatric department were selected from the hospital files.

Razi Med J. 2025;1(2):60-63
https://doi.org/10.69667/rmj.25206
Razi Medical Journal
https://razi.edu.ly/rmj/index.php/hm

The following data obtained from the files included: gestational age, sex, birth weight, mode of delivery, time of admission (Season), address, blood culture, maternal history, platelet transfusion, CRP for risk patent, CRP on deterioration, duration of treatment, association problem as mechanical ventilator, blood exchange, umbilical vein Cather, resuscitation needs in delivery respiratory distress syndrome, birth asphyxia. The study was conducted after obtaining ethical approval from the ethical committee in the hospital.

Data was analyzed using the Statistical Program for Social Sciences (SPSS version 24) for Windows. Descriptive statistics were calculated for all variables and presented as frequencies and percentages for categorical data, and the mean ± standard deviation was provided for numerical data. Analytical methods used in this study included Student's test and Chi-square test, and Fisher's exact test if appropriate. A P-value < 0.05 was considered statistically significant.

Results

The study included 411 neonates, with a slight predominance of males (54.7%, n=225) over females (45.3%, n=186). Geographically, the majority of participants resided in Al-Zawia (85.2%, n=350), while 14.8% (n=61) were from outside this region. Gestational age distribution was nearly equivalent, with 51.8% (n=213) classified as preterm (PT) and 48.2% (n=198) as full-term (FT). Maternal age analysis revealed that 32.8% (n=135) of mothers were aged 26–30 years, followed by 27.3% (n=112) aged 31–35 years. Younger maternal age groups (≤20 years and 21–25 years) accounted for 3.4% (n=14) and 13.4% (n=55), respectively, while older mothers (36–40 years and >40 years) comprised 19.0% (n=78) and 4.1% (n=17) of the cohort. Birth weight distribution showed a marginal majority of neonates (51.8%, n=213) weighing ≤2.5 kg. Mode of delivery was predominantly cesarean section (C/S; 55.5%, n=228), compared to normal vaginal delivery (NVD; 44.3%, n=182), with one case (0.2%) lacking data. C-reactive protein (CRP) testing indicated that 5.6% (n=23) of at-risk patients had positive results, whereas 94.4% (n=388) were negative. Upon clinical deterioration, CRP positivity increased to 29.0% (n=119), with 71.0% (n=292) remaining negative. Regarding outcomes, 83.5% (n=343) of neonates survived, while 16.5% (n=68) succumbed to mortality. These findings underscore key demographic and clinical characteristics of the studied population. The results are summarized in Table 1.

Table 1. Characteristics of the included neonates

Characteristic		Frequency	%
Sex	Male	225	54.7%
	Female	186	45.3%
GA	PT	213	51.8%
	FT	198	48.2%
Maternal Age	<=20 yrs	14	3.4%
	21-25 yrs	55	13.4%
	26-30 yrs	135	32.8%
	31-35 yrs	112	27.3%
	36-40 yrs	78	19.0%
	>40 yrs	17	4.1%
Birth Weight	<2.500 kg	213	51.8%
	>=2.500 kg	198	48.2%
Mode of Delivery	C/S	228	55.5%
	NVD	182	44.3%
	No Data	1	0.2%
CRP Risk	Positive	23	5.6%
	Negative	388	94.4%
CRP on Deterioration	Positive	119	29.0%
	Negative	292	71.0%
Outcome	Alive	343	83.5%
	Dead	68	16.5%

CoNS was identified in 10.5% (n=43) of neonates. Among these, 81.3% (n=343) had negative blood cultures overall.

Razi Med J. 2025;1(2):60-63
https://doi.org/10.69667/rmj.25206
Razi Medical Journal
https://razi.edu.ly/rmj/index.php/hm

Gestational Age and Birth Weight CoNS-positive neonates were predominantly preterm (55.8% vs. 51.4% in CoNS-negative), though this association was non-significant (p=0.5). Similarly, low birth weight was more frequent in CoNS-positive neonates (60.5% vs. 50.8%), but this difference lacked statistical significance (p=0.23). Males comprised 65.1% of CoNS cases (male-to-female ratio: 1.8:1), though sex was not significantly associated with infection (p=0.12). Conversely, delivery via C/S showed a strong association with CoNS (79.1% of CoNS-positive vs. 52.9% of CoNS-negative neonates; p=0.001). (Table 2)

Initial CRP positivity was similar between groups (11.6% CoNS-positive vs. 4.9% CoNS-negative; p=0.06). However, CRP positivity post-deterioration was markedly higher in CoNS-positive neonates (93% vs. 21.5%; p<0.001). Deterioration occurring 1–7 days after admission was significantly associated with CoNS (60.5% vs. 16% in CoNS-negative; p<0.001). CoNS-positive neonates more frequently required blood transfusions (27.9% vs. 18%; p=0.005) and prolonged antibiotic therapy (30.2% received 8–15 days of treatment vs. 16.6% in CoNS-negative; p=0.001). Mortality did not differ significantly between CoNS-positive (18.6%) and CoNS-negative neonates (16.3%; p=0.70) (Table 2).

Table 2. Comparative analysis of CoNS-positive vs. CoNS-negative neonates

Variable	CoNS-Positive (%)	CoNS-Negative (%)	p-value
Preterm Gestation	55.8%	51.4%	0.50
Low Birth Weight (≤2.5 kg)	60.5%	50.8%	0.23
Male Sex	65.1%	53.2%	0.12
Cesarean Delivery	79.1%	52.9%	**0.001**
CRP+ post-deterioration	93.0%	21.5%	**<0.001**
Mortality	18.6%	16.3%	0.70

Discussion

This study provides initial insights into the epidemiology, risk factors, and clinical trajectory of coagulase-negative *Staphylococcus* (CoNS) infections in neonates, a leading cause of late-onset sepsis in neonatal intensive care units (NICUs) worldwide. By systematically comparing CoNS-positive and CoNS-negative neonates, we identified modifiable risk factors, diagnostic clues, and therapeutic challenges that carry direct implications for clinical practice and infection control protocols.

The strong association between cesarean delivery (C/S) and CoNS infection aligns with emerging evidence linking surgical births to neonatal dysbiosis and delayed immune priming [6]. C/S deprives neonates of exposure to the maternal vaginal microbiome, which may impair colonization resistance against opportunistic pathogens like CoNS [10]. This finding underscores the need for stringent sterile techniques during C/S and supports global efforts to reduce non-medically indicated cesarean deliveries.

While initial CRP positivity did not differ significantly between groups, the dramatic rise in CRP positivity post-deterioration highlights CRP's utility as a late biomarker for CoNS sepsis. The use of CRP as a marker for neonatal sepsis is discussed in multiple publications, however, it is not commonly used because of its relatively short half-life [11]. However, these differences in CRP levels following deterioration can be explained by the indolent course of CoNS infections, which often evade early detection due to subtle initial symptoms. Our results advocate for serial CRP monitoring in neonates with clinical deterioration, particularly those born via C/S or requiring prolonged hospitalization [9].

The predominance of clinical deterioration 1–7 days after admission strongly suggests nosocomial transmission. CoNS thrives on indwelling devices and healthcare worker hands, and this temporal association reinforces the need for rigorous adherence to catheter care bundles and hand hygiene in NICUs.

Despite comparable mortality rates between groups, CoNS-positive neonates required significantly more blood transfusions and prolonged antibiotic courses. This underscores the hidden morbidity and resource strain of CoNS infections, which prolong hospitalization and escalate healthcare costs—a critical [12].

Our findings align with studies identifying preterm birth and low birth weight as risk factors for CoNS colonization [5]. Though these associations lacked statistical significance here, possibly due to sample size limitations. The male predominance (65.1% of CoNS cases) echoes the report of sex-based immune differences in neonatal sepsis susceptibility, though this requires further investigation [13]. The lack of mortality disparity contrasts with studies linking CoNS to increased mortality in extremely low birth weight infants, suggesting our cohort's outcomes may reflect

improved CoNS management or differences in strain virulence. Notably, the robust link between C/S and CoNS adds nuance to prior work focused on prematurity and device use. This finding may partially explain rising CoNS rates in regions with high cesarean delivery rates, such as our study setting.

Conclusion

This study advances our understanding of CoNS infections by identifying cesarean delivery as a preventable risk factor, CRP trends as a diagnostic aid, and clinical deterioration timing as a marker of nosocomial transmission. While CoNS may not increase short-term mortality, its association with prolonged antibiotic use and transfusions demands heightened vigilance in at-risk neonates. These findings provide a roadmap for targeted interventions—from stricter C/S protocols to CRP-guided monitoring—that could reduce the global burden of neonatal CoNS sepsis.

Conflicts of Interest

The authors declare no conflicts of interest.

References

1. Dramowski A, Bolton L, Fitzgerald F, Bekker A. Neonatal sepsis in low- and middle-income countries – where are we now? Pediatr Infect Dis J. 2025 Apr. doi: 10.1097/INF.0000000000004815.
2. Cantey JB, Milstone AM. Bloodstream infections: epidemiology and resistance. Clin Perinatol. 2015 Mar;42(1):1-16. doi: 10.1016/j.clp.2014.10.002.
3. Marchant EA, Boyce GK, Sadarangani M, Lavoie PM. Neonatal sepsis due to coagulase-negative staphylococci. Clin Dev Immunol. 2013;2013:586076. doi: 10.1155/2013/586076.
4. Klingenberg C, et al. Coagulase-negative staphylococcal sepsis in neonates. Association between antibiotic resistance, biofilm formation and the host inflammatory response. Pediatr Infect Dis J. 2005 Sep;24(9):817-22. doi: 10.1097/01.inf.0000176735.20008.cd.
5. de Oliveira A, et al. Risk factors for infection with coagulase-negative staphylococci in newborns from the neonatal unit of a Brazilian university hospital. Clin Med Insights Pediatr. 2011 Dec;6:1-9. doi: 10.4137/CMPed.S7427.
6. Zhu B, et al. The association of maternal factors with the neonatal microbiota and health. Nat Commun. 2024 Jun;15(1):5260. doi: 10.1038/s41467-024-49160-w.
7. Madan JC, Farzan SF, Hibberd PL, Karagas MR. Normal neonatal microbiome variation in relation to environmental factors, infection and allergy. Curr Opin Pediatr. 2012 Dec;24(6):753-9. doi: 10.1097/MOP.0b013e32835a1ac8.
8. Wang S, et al. Maternal vertical transmission affecting early-life microbiota development. Trends Microbiol. 2020 Jan;28(1):28-45. doi: 10.1016/j.tim.2019.07.010.
9. Benitz WE, Han MY, Madan A, Ramachandra P. Serial serum C-reactive protein levels in the diagnosis of neonatal infection. Pediatrics. 1998 Oct;102(4):E41. doi: 10.1542/peds.102.4.e41.
10. Caballero-Flores G, Pickard JM, Núñez G. Microbiota-mediated colonization resistance: mechanisms and regulation. Nat Rev Microbiol. 2023 Jun;21(6):347-60. doi: 10.1038/s41579-022-00833-7.
11. Gude SS, et al. Biomarkers of neonatal sepsis: from being mere numbers to becoming guiding diagnostics. Cureus. 2022 Mar;14(3):e23215. doi: 10.7759/cureus.23215.
12. Nelson M, et al. The hidden economic and environmental costs of antimicrobial therapies: a call to action. Antimicrob Steward Healthc Epidemiol ASHE. 2025 Jan;5(1):e24. doi: 10.1017/ash.2024.496.
13. Ciesielski TH, et al. Late-onset neonatal sepsis: genetic differences by sex and involvement of the NOTCH pathway. Pediatr Res. 2023 Mar;93(4):1085-95. doi: 10.1038/s41390-022-02114-8.