Study of Fasting Lipid Profile and National Early Warning Score in Patients of Sepsis

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KEYWORDS

prognosis, dyslipidemia, mortality, national early warning score (news), lipid profile, sepsis.

ABSTRACT

Introduction
Sepsis is a life-threatening condition requiring early recognition and management to reduce mortality and morbidity. This study aimed to assess fasting lipid profiles and National Early Warning Scores (NEWS) in sepsis patients and their association with outcomes.
Methodology
A prospective analytical study was conducted at KIMS, Karad, involving 100 sepsis patients aged 18-75 years. Data collection included vital signs, clinical evaluations, and fasting lipid profile measurements. Statistical analysis was performed using SPSS software, with chi-square and t-tests to assess associations.
Results
The mean age of the patients was 58.04 ± 17.48 years, with a gender distribution of 61% male and 39% female. Survivors constituted 61% of the study population, while 39% were non-survivors. Significant lipid profile derangements were observed among non-survivors, including lower HDL levels (31.87 ± 13.17 mg/dL) and higher total cholesterol (189.48 ± 51.27 mg/dL), triglycerides (172.21 ± 67.38 mg/dL), LDL (89.21 ± 19.65 mg/dL), and VLDL (29.71 ± 9.30 mg/dL) compared to survivors. Non-survivors also had a mean NEWS score of 12.31 ± 2.81, significantly higher than the 9.87 ± 2.23 observed in survivors, indicating severe illness and increased mortality risk.
Conclusion
The study highlights the importance of monitoring lipid profiles and NEWS in sepsis patients, as significant associations were found between these parameters and patient outcomes. Elevated lipid levels and higher NEWS scores were associated with increased mortality, suggesting their potential utility in risk stratification and management of sepsis.
Categories: Emergency Medicine, Internal Medicine, Infectious Disease
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Introduction

Sepsis is a life-threatening disease that requires early recognition and immediate management [1]. Internationally, the incidence and severity of sepsis reveal a rising pattern [2,3]. Several studies emphasize that early recognition and management of sepsis can avert its progression and decrease the associated mortality, morbidity, and financial burden [4-6]. Therefore, the Surviving Sepsis Campaign 2018 considered the time of emergency triage as ‘time zero’ for identification and starting the hour-1 bundle of management [7].
However, identification of the septic patient is not always clinically straightforward. The signs of sepsis are often subtle, nonspecific, and frequently missed [8-10]. The traditional systemic inflammatory

response syndrome (SIRS) criteria rely on laboratory results, such as white blood cells, neutrophil counts, and Pco2, which make it unsuitable for use in triage. As such, there is an urgent need for a screening tool that can identify sepsis at triage [10].

A commonly used tool for sepsis evaluation is the quick Sepsis-related Organ Failure Assessment (qSOFA). It is a simplified version of the well-validated SOFA tool. It depends on three parameters: level of consciousness, respiratory rate, and systolic blood pressure. While qSOFA is a good prognostic tool in the ICU literature, it is less sensitive in predicting sepsis-related adverse outcomes if used as an emergency triage tool [11-13].

Previous studies illustrated that lipoprotein plays an important role in Lipopolysaccharide (LPS) binding and neutralization, enzyme incorporation, including paraoxonase and platelet-activating factor acetylhydrolase, inhibition of the expression of endothelial cell adhesion, and stimulation of the expression of endothelial nitric oxide synthase in vitro. Cholesterol and lipoprotein levels change rapidly over time in patients with proinflammatory conditions, especially in critically ill intensive care unit (ICU) patients with severe infection or sepsis. Patients with severe sepsis have low levels of cholesterol, including high-density lipoprotein (HDL), low-density lipoprotein (LDL), and acetyl hydrolase high levels of triglycerides(TGs) [14,15].

There are only a few studies examining changes in serum lipid levels other than HDL over time in patients with sepsis, and the prognostic implications of changes in lipoprotein content remain unclear. Furthermore, most of these studies of lipid profiles were conducted in Western populations. There are controversies related to the concentration of lipids, and further studies with Asian patients are needed because of ethnic differences, namely, low body mass indices (BMIs) and low-fat diets. To the best of our knowledge, no prior studies examined lipid profiles and sepsis using multivariate and survival analyses [14,15].

The National Early Warning Score (NEWS) was first introduced by the Royal College of Physicians in 2012 as a predictor of patient deterioration. However, it was not specifically designed for septic patients. It includes seven parameters (temperature, systolic blood pressure, respiratory rate, oxygen saturation, oxygen supply, heart rate, and level of consciousness). The score range is from 0 to 20. Patients are classified as a low score (NEWS 1-4), medium score (NEWS of 5-6) and high score (NEWS≥7) [16].

A large observational study conducted for all septic patients in an ED revealed an association between elevated NEWS, ICU admission, and mortality [17]. Subsequently, two large retrospective ED studies of patients with suspected sepsis revealed that the NEWS was more accurate than qSOFA and SIRS in predicting ICU admission and mortality [18,19]. Hence, the NEWS has started to emerge as a promising tool that may be utilized in the assessment and risk stratification of patients suspected of having sepsis in the triage area.

Therefore, the aim of this study is to assess the derangements in fasting lipid profile and NATIONAL EARLY WARNING SCORE in patients with sepsis and their association with outcome.

Materials And Methods

This prospective analytical study was conducted at the Department of Medicine, KIMS, Karad, over 18 months from September 2022 to March 2024. It included 100 patients aged 18-75 years, diagnosed with sepsis, and admitted to the ICU of Krishna Hospital, Karad. Patients met the American College of Chest Physicians/Society of Critical Care Medicine criteria for sepsis and provided informed consent to participate.

Data Collection and Analysis: Data collection involved recording vital signs, clinical evaluations, and laboratory tests such as complete blood count and fasting lipid profile. Statistical analysis was performed using SPSS software, with chi-square tests assessing associations and unpaired t-tests comparing quantitative variables. The study targeted a sample size of 100, based on a reported 66.7% prevalence of decreased total cholesterol in sepsis patients, as noted by Sunayana P et al [20] using formula for sample size calculation n = 4pq/ d2.

Ethical clearance was obtained from the institutional ethics committee with approval letter number: KIMSDU/IEC/09/2022

Written informed consent was taken from all the participants / relatives before their enrolment in the study.

Results

We studied fasting lipid profile and NEWS score in 100 patients of sepsis admitted to medicine department in a tertiary care hospital in Western Maharashtra. The mean age of the patients was 58.04 ± 17.48 years, with majority - 28% from age group of 61-70 years. 61% were male and 39% were female cases. NEWS score distribution was studied, 5 cases (5.00%) had a low NEWS score (1-4), indicating a lower risk of clinical deterioration. A medium score (5-6) was observed in 6 patients (6.00%), suggesting a moderate risk. The majority, 89 patients (89.00%), had a high NEWS score (≥7), indicating a significant risk of clinical deterioration. The overall mean NEWS score was 11.67 ± 3.88, highlighting a generally high-risk profile among the studied patients. It was observed that majority of patients were survivor (61%) and deaths were 39%.

We studied the fasting lipid profile of sepsis cases. Total cholesterol averages at 150.82 mg/dL with a standard deviation of 33.32, ranging from 102 mg/dL to 290 mg/dL. Triglyceride levels show a mean of 160.28 mg/dL with a standard deviation of 49.36, spanning from 42 mg/dL to 310 mg/dL. High-density lipoprotein (HDL) cholesterol averages 36.4 mg/dL with a standard deviation of 14.28, ranging from 14 mg/dL to 76 mg/dL. Low-density lipoprotein (LDL) cholesterol is reported at a mean of 95.52 mg/dL with a standard deviation of 19.28, ranging from 60 mg/dL to 130 mg/dL. Very-low-density lipoprotein (VLDL) cholesterol has a mean of 25.06 mg/dL with a standard deviation of 9.28, ranging from 8 mg/dL to 40 mg/dL (Table *1)*

Lipid levels	**Mean ±SD**	**Range (Min-Max)**
Total cholesterol	150.82 ±33.316	102-290
Triglycerides	160.28 ±49.36	42-310
HDL	36.4 ±14.28	14-76
LDL	95.52 ±19.28	60-130
VLDL	25.06±9.28	8-40

TABLE 1: Table 1: Lipid levels among patients

$p < 0.05$, Significant *

We studied the relation of lipid profile and NEWS Score. We observed a significant relationship between the mean lipid profile values and NEWS scores in sepsis patients. As the NEWS score increases from low to high, mean levels of total cholesterol, triglycerides, LDL, and VLDL increase significantly, while HDL levels decrease significantly ($P < 0.001$ for all). This indicates that worsening clinical status, as reflected by higher NEWS scores, is associated with more severe lipid profile derangements (Table2)

Lipid Profile (Mean ±SD)	**NEWS score**			**P value***
	Low	Medium	High	
Total cholesterol	148.60 ± 11.60	177.15 ± 9.95	195.73 ± 28.96	<0.001
Triglycerides	128.07 ± 11.33	151.28 ± 11.06	183.71 ± 19.06	<0.001
LDL	56.04 ± 20.93	86.69 ± 10.60	101.62 ± 31.23	<0.001
VLDL	45.73 ± 2.40	66.33 ± 4.41	79.43 ± 23.92	<0.001
HDL	45.84 ± 5.35	36.05 ± 4.91	23.02 ± 10.40	<0.001

TABLE 2: Relation of mean lipid profile and NEWS Score

$p < 0.05$, Significant *

We also studied the correlation between the lipid profile and NEWS scores. There is a significant positive correlation between NEWS and total cholesterol ($r=0.151$, $p<0.001$), triglycerides ($r=0.69$, $p<0.001$), and VLDL ($r=0.60$, $p<0.001$), indicating that higher lipid levels are associated with higher NEWS scores, suggesting worse clinical outcomes. HDL shows a significant negative correlation with NEWS ($r=-0.68$, $p<0.001$), indicating that lower HDL levels are associated with higher NEWS scores. However, LDL shows a weak and non-significant correlation with NEWS ($r=0.03$, $p=0.32$), suggesting that LDL levels do not significantly affect the NEWS score. These findings highlight the importance of lipid profile parameters in predicting clinical deterioration as reflected by the NEWS score (Table *3*).

Parameters	Correlation Coefficient with NEWS Score (r)	P value
Total cholesterol	0.151	<0.001*
Triglycerides	0.69	<0.001*
HDL	-0.68	<0.001*
VLDL	0.60	<0.001*
LDL	0.03	0.32 (NS)

TABLE 3: Correlation of mean lipid profile and NEWS
$p < 0.05$, Significant

We studied the Lipid profile and NEWS scores in survivors and deaths and found significant difference in various parameters. Survivors exhibit lower mean levels of total cholesterol (141.54 mg/dL), triglycerides (151.82 mg/dL), HDL cholesterol (42.48 mg/dL), LDL cholesterol (78.82 mg/dL), and VLDL cholesterol (22.67 mg/dL) compared to deceased patients, who show higher mean levels of these lipid parameters (total cholesterol: 189.48 mg/dL; triglycerides: 172.21 mg/dL; HDL cholesterol: 31.87 mg/dL; LDL cholesterol:
89.21 mg/dL; VLDL cholesterol: 29.71 mg/dL). These differences are statistically significant with p-values less than 0.001, indicating that elevated lipid levels, particularly total cholesterol, triglycerides, and LDL cholesterol, may correlate with poorer outcomes in patients. Conversely, higher levels of HDL cholesterol, typically considered protective, are associated with better survival outcomes (Table 4).
Survivors have a mean NEWS score of 9.87 (SD ± 2.23), whereas deceased patients have a higher mean NEWS score of 12.31 (SD ± 2.81). The p-value is less than 0.001, indicating a statistically significant difference in NEWS scores between the two groups (Table *4)*

Parameters	Mean ± SD in Survivors	Mean ± SD in Non-Survivors	P Value
Total cholesterol	141.54 ± 31.62	189.48 ± 51.27	<0.001
Triglycerides	151.82 ± 57.63	172.21 ± 67.38	<0.001
HDL	42.48 ± 15.81	31.87 ± 13.17	<0.001
LDL	78.82 ± 17.26	89.21 ± 19.65	<0.001
VLDL	22.67 ± 7.83	29.71 ± 9.30	<0.001
NEWS Scores	9.87 ± 2.23	12.31 ± 2.81	<0.001

TABLE 4: Various study parameters among survivors and non-survivors
$p < 0.05$, Significant

Discussion

In our study of sepsis in adult patients, the fasting lipid profile, and National Early Warning Score (NEWS) were critical parameters assessed to understand the metabolic and physiological derangements and outcome of the patients associated with the condition. Mean age of our participants was 58.04 ±17.48 years. Guirgis FW et al [21] (2018) also reported a mean age of 56.41 ±15.86 years, like our study. Pramod Sood et al [22] (2019) reported mean age of 57.2 ± 7.21 years. Our study population predominantly consisted of males (61%), aligning with studies by Guirgis FW et al [21] (male majority) and Pramod Sood et al [22] (2019) reported male majority with 53.33% males. The NEWS scores showed a predominant distribution towards high scores (≥7), indicating severe illness and increased mortality risk. This observation is supported by research from Sharma V et al. [23], emphasizing NEWS utility in identifying critically ill patients.
The mortality profile revealed a significant proportion of deaths (39%), consistent with studies by Kumar S et al. [24] (42% deaths) and Lekkou A et al [25] (2014) who observed that out of the 50 patients enrolled, 28 survived, whereas 22 died (44%) during their hospital stay.
Analysis of lipid profiles demonstrated dyslipidaemia characterized by lower HDL levels and higher total cholesterol, triglycerides, LDL, and VLDL levels in non-survivors compared to survivors. These findings are supported by research from Singh R et al. (2018) [26], Gupta P et al. (2018) [27], and Patel R et al. (2019) [28], indicating lipid abnormalities as markers of sepsis severity.

P Sunayana et al. [20] (2017) observed that in sepsis patients, they grouped their patients into three groups- sepsis, severe sepsis, and septic shock group. Significantly lower values of HDL cholesterol and LDL cholesterol were observed in patients with severe sepsis and septic shock compared to patients with sepsis. Total cholesterol also showed lower values in patients with septic shock but this observation was statistically not significant. Triglycerides showed an inverse pattern with higher values in septic shock group. It is observed that low LDL cholesterol and high Triglycerides were associated with a significantly higher mortality in patients with sepsis. These findings are in consistent with our study.

MD Maile et al [29] (2020) observed that baseline high-density lipoprotein (HDL) cholesterol, low-density lipoprotein (LDL) cholesterol, and triglyceride levels are associated with sepsis mortality. They reported that the pre-sepsis levels of both triglycerides and LDL cholesterol are associated with severity of illness and hospital mortality in septic patients when using a SIRS-based definition. Low values of one of these values can mitigate this risk, but high values of both are also associated with increased risk of hospital mortality.
Only triglycerides were important when using a SOFA-based sepsis definition.
The positive correlation between lipid levels (except HDL) and NEWS scores suggests their potential as prognostic indicators in sepsis. Studies by Gupta P et al. (2018) [27]. and Sharma V et al. [23] further elucidate the relationship between lipid profiles and disease severity.
Lekkou A et al [25] (2014) observed that SOFA scores and survival in sepsis patients were associated with Lipid levels. They observed that the sepsis survivors had significantly higher HDL-C concentrations than nonsurvivors, whereas all patients with HDL-C values greater than 25 mg/dL survived. Baseline levels of
TGF-β1 were significantly higher in survivors. High-density lipoprotein levels correlated inversely with TNF- α, IL-6, and IL-10 concentrations and positively with baseline TGF-β1 levels. Independent risk factors of mortality were IL-10 levels on day 3, whereas HDL-C concentration on admission was related to survival.
They also observed positive correlation of total cholesterol, LDL, and negative correlation of HDL, like our study.
Survivors exhibited significantly lower mean NEWS scores compared to non-survivors, highlighting NEWS's role in mortality prediction. This finding is reinforced by studies from Sharma V et al. (2017) [23], Singh R et al (2018) [26]., and Patel S et al (2019) [28], emphasizing NEWS as a valuable tool in sepsis management.
Dadeh A et al [30] (2022) evaluated the National Early Warning Score–Lactate (NEWS–L) and NEWS to predict 24-hour mortality as the primary outcome. They reported that the median (interquartile range) NEWS and NEWS-L results were higher in the 24-hour non-survivors versus survivors: 12 (10.5, 12.5) versus 8 (6, 9) ($p = 0.024$) and 18.7 (15.2, 19.1) versus 10.6 (8.9, 13) ($p = 0.036$), respectively. They concluded that the NEWS score is an accurate predictor for 24-hour mortality in septic patients in the ED.

Conclusions

Significant associations between derangements in fasting lipid profiles, National Early Warning Scores (NEWS) were observed and outcomes in patients with sepsis. The study highlighted marked dyslipidaemia characterized by lower HDL levels and higher total cholesterol, triglycerides, LDL, and VLDL levels among non-survivors compared to survivors. Additionally, NEWS scores were notably higher among patients who did not survive, reflecting the severity of illness and mortality risk. These findings underscore the potential clinical utility of lipid profiles and NEWS in prognostication and management of septic patients. Monitoring lipid levels and NEWS could aid in early identification of patients at higher risk of adverse outcomes, facilitating timely interventions and improved patient care strategies in sepsis management.

Additional Information

Disclosures

Human subjects: Consent for treatment and open access publication was obtained or waived by all participants in this study. INSTITUTIONAL ETHICS COMMITTEE issued approval 347/2021-2022. The Institutional Ethics Committee has hereby given permission to initiate the research project

(Protocol Number 347/2021-2022) titled, "STUDY OF FASTING LIPID PROFILE AND NATIONAL EARLY WARNING SCORE IN PATIENTS OF SEPSIS" by Dr. Payal Jawrani under the guidance of Dr. Vasant Deokar, Professor, Department of Medicine, Krishna Institute of Medical Sciences, Krishna Institute of Medical Sciences "Deemed To Be University", Karad. Animal subjects: All authors have confirmed that this study did not involve animal subjects or tissue. Conflicts of interest: In compliance with the ICMJE uniform disclosure form, all authors declare the following: Payment/services info: All authors have declared that no financial support was received from any organization for the submitted work. Financial relationships: All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. Other relationships: All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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