Journal of Cardiovascular Disease Research
ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 7, 2024

NON-SHOCK SEPTIC SUBJECT: ANALYSING THE RELATIONSHIP BETWEEN MORTALITY AND RESULTANT SEPTIC SHOCK

Dr Harjot Singh Arora,[1] Dr Dhruv Sethi,[2] Dr Kaushiki Saha,[3] Dr Arpan Muniyal[4*]

[1]PG Student, Department of General Medicine, RKDF Medical College, Bhopal, Madhya Pradesh
[2]MD, SR, ICU and Critical Care, ESIC Medical College, Faridabad, Hariyana
[3]MD, SR, ICU and Critical Care, ESIC Medical College, Faridabad, Hariyana
[4*]MD, SR, ICU and Critical Care, ESIC Medical College, Faridabad, Hariyana

Corresponding author

Dr Arpan Muniyal

Email id: Singharpan35@gmail.com

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ABSTRACT

Background: Since blood lactate can result in tissue hypoxia and hypoperfusion and has been related to mortality, blood lactate levels should be closely monitored in all patients with septic shock and severe sepsis.

Objective: In non-shock septic people, the current study aimed to explore the association between early blood lactate levels and death and eventual septic shock.

Methods: Initial serum lactate levels in the emergency ward and 224 sepsis patients admitted to a non-critical department were assessed in this retrospective analysis. The experiment was not open to subjects with hyperlactatemia of any other aetiology.

Results: Pneumonia was the most common cause of sepsis, accounting for 44.5% (n=213) of the cases. More intravenous fluid was given to Group II with high lactate levels compared to the group with low lactate levels. Six patients from Group I and 24 participants from Group II received IV fluid (>1500 ml). Compared to Group I (consisting of 13 people), Group II (30 participants) had a greater frequency of initial positive hemoculture. Compared to 23 people in Group II, only 5 individuals in Group I went through 3 days of septic shock. Ten people in Group I died after 28 days, whereas 40 people in Group II did.

Conclusion, early blood lactate levels of ≥2 mmol/L in patients with non-shock sepsis are associated with significant mortality rates and septic shock. Blood lactate level composites and other prediction scores can be used to predict participant mortality more precisely

Keywords: mortality, nonshock, sepsis, shock, serum lactate.

INTRODUCTION

Sepsis is a syndromic disease that results in either early sepsis or more severe septic shock. It is caused by a dysregulation in the host's response to a severe infection, which puts life in danger for that involved.1. The Sepsis-3 task force recommended in 2016 that the sepsis-related SOFA score be used as diagnostic criteria for sepsis since it has a high degree of accuracy and minimal errors in predicting mortality rates. Nevertheless, there are several disadvantages to the SOFA score, including the need

for multiple lab assessments, which may not be suitable for patients who arrive with early sepsis, especially when they first visit the ER.2.

In the beginning, the SOFA score was offered as a screening tool for patients who weren't admitted to the intensive care unit (ICU). The process for calculating the SOFA score is rather simple. Even yet, prior literature study has shown that, when used on sepsis patients who are not admitted to the intensive care unit or emergency room, it has low sensitivity.3. In patients with early sepsis in the emergency room, initial blood lactate levels can be a reliable predictor of poor prognosis. Elevations in blood lactate are associated with adverse outcomes, such as mortality.4

Given that blood lactate can result in tissue hypoxia and hypoperfusion, the sepsis bundle advises testing blood lactate levels in all patients with septic shock and severe sepsis.

Hemodynamic resuscitation is considered required when the initial blood lactate concentrations are more than 2 mmol/L.5. The existence of septic shock and severe sepsis in the previously examined literature data raises doubts about the validity of lactate levels, even if they have been mentioned in prior study.Six The goal of the current study was to find out how early blood lactate levels in non-shock septic patients related to death and eventual septic shock.

The objective of the ongoing retrospective clinical study is to evaluate the association between early blood lactate levels and death as well as septic shock that follows in non-shock septic patients. The individuals who were admitted to the institute comprised the study population. To identify the source of the infection, each participant underwent an initial evaluation at the emergency department, which was followed by a thorough history and clinical examination.

MATERIALS AND METHODS

Patients diagnosed with sepsis who were admitted to the non-critical department and aged 18 years or older were included in the research. Excluded from the study were those who were in cardiac arrest or shock, used metformin simultaneously, had a seizure during the presentation, or had their blood lactate levels not checked.

The patient had an abnormal mental state (Glasgow coma scale score of 14 or less), a systolic blood pressure of 100 mm Hg or less, and a respiratory rate of 22 breaths per minute or more. The patient's qSOFA values varied from 0 to 3. Prolonged hypotension requiring vasopressors to maintain serum lactate levels over 2 mmol/L and mean arterial pressure of ≥65 mm Hg was characterised as septic shock.

The surviving sepsis campaign conventional methodologies were used to analyse the qSOFA and Systemic inflammatory response syndrome criteria 7. For those who underwent laboratory tests and arterial blood gas measurements, the overall SOFA score was computed. The first treatment and laboratory testing included intravenous fluids, empiric broad-spectrum antibiotics, venous blood lactate levels, and hemoculture. Each patient had a review to confirm the diagnosis prior to admission.

The study's data came from the institute's earlier archives. Three days of septic shock, twenty-eight days of mortality, the first effective antibiotic based on microbiological results, the time it took to start an antibiotic at the emergency department, the amount of IV fluid given during the stay, microbiologic

data, the site and source of the infection, and blood lactate levels were among the components evaluated for the SOFA score, qSOFA, and SIRS criteria.

A blood lactate level of greater than 2 mmol/L at baseline was considered to be in the high blood lactate group. The "hour-1 bundle" of the surviving sepsis campaign bundle, which was 2 mmol/L, served as the cut-off mark. According to suggested guidelines, the cut-point value for qSOFA and SIRS was determined at ≥2.8.

The study focused on 28-day mortality as the major outcome and 3-day in-hospital septic shock as the secondary endpoint. The Mann-Whitney U test and SPSS software version 21.0 were used to statistically analyze the collected data. A significance threshold of $p<0.05$ was used.

RESULTS

Two groups of 224 participants—100 with blood lactate <2 mmol/L and 124 with blood lactate ≥2 mmol/L—were included in the retrospective research.

Group I's mean age was 71.7±3.12 years, whereas Group II's mean age was 70.2±2.48 years. This difference was not statistically significant (p=094). Group II had a significantly higher proportion of males than Group I, with 39 and 61 men in Group II, respectively (p=0.02). The oxygen saturation levels of both groups were 94.2% and an 8 on the Glasgow coma scale. Eight patients in Group I and fifteen participants in Group II were hypotensive. The two groups did not significantly differ in mean arterial pressure, diastolic blood pressure, systolic blood pressure, or respiratory rates (p-values of 0.64, 0.75, 0.22, and 0.26). However, Group II had a significantly higher heart rate (p=0.001), and Group I had a higher temperature (p=0.01).

While immunocompromised condition, renal disease, diabetes, CVA, CHF, and CAD were similar in both groups (p=0.09, 0.07, 0.43, 0.920.95, 0.74, and 0.46, respectively), cancer and cirrhosis were significantly higher in Group II (p=0.007 and 0.03, respectively) (Table 1).

Group II (15 people) had a higher prevalence of intraabdominal infection than Group I (6 subjects) had in terms of infection site (p=0.01). Between the two groups, the other places, unknown sites, UTI, and pneumonia were similar (p=0.72, 0.34, 0.26, and 0.16, respectively).

42 individuals in Group I and 59 people in Group II both contracted the infection in the hospital (p=024). Groups I and II had SIRS≥2 ratings of 95 and 118, respectively (p=0.95), qSOFA≥2 scores of 25 and 42 (p=0.03), and SOFA scores of 2 and 3 (p=0.002).

In terms of laboratory parameters, 63 individuals from Group I and 79 people from Group II underwent arterial blood gas testing (p=074).WBC counts and total bilirubin were significantly higher in Group II ($p < 0.001$ and 0.006, respectively). Haemoglobin levels and platelet counts were similar in the two groups (p=0.05 and 0.23). Group I had lactate levels of 1.35 mmol/L and Group II had 3.05 mmol/L ($p < 0.001$).

Significantly more IV fluid was administered to Group II with high lactate levels compared to the group with low lactate levels ($p<0.001$). Additionally, 24 individuals from Group II and 6 persons from Group I received IV fluid that weighed more than 1500 ml ($p<0.001$). Compared to Group I,

Group II got more antibiotics more often. But the difference (p = 0.25) was not statistically significant. Within 60 minutes, 58 Group I participants and 74 Group II people received antibiotics (p=0.76).

Table 2 demonstrates that there was a significant (p=0.003) difference in the frequency of first positive hemoculture between the 30 participants in Group II and the 13 patients in Group I. The research revealed that 5 individuals in Group I encountered 3 days of septic shock, a significantly less number than the 23 cases noted in Group II (p<0.001). Out of the 10 patients in Group I, 40 patients from Group II had a 28-day death rate. A statistically significant difference (p < 0.001) is displayed in Table 3.

Characteristic	**Blood lactate <2 mmol/L (n=100)**	**Blood lactate ≥2 mmol/L (n=124)**	**p-value**
Mean age (years)	71.7±3.12	70.2±2.48	0.94
Gender (Male)	39	61	**0.02**
Glasgow coma scale	8	8	**0.01**
Oxygen saturation percentage	94.2	94.2	0.54
Presenting with hypotension	8	15	0.1
Vitals			
Mean arterial pressure (mm Hg)	90.2	90.9	0.64
Diastolic BP (mm Hg)	70.2	71.2	0.75
Systolic BP (mm Hg)	126.2	125.2	0.22
Respiratory rates (breath/min)	24.2	24.2	0.26
Heart rate (beats/min)	104.7	110.2	**0.001**
Temperature (C)	38.4	38.2	**0.01**
Comorbidity			
Immunocompromised	10	7	0.09
Cancer	24	43	**0.007**
Cirrhosis	3	8	**0.03**
Renal disease	15	11	0.07
Diabetes	20	22	0.43
Cerebrovascular accident	20	24	0.92
Congestive heart failure	13	16	0.95
Coronary artery disease	8	9	0.74
COPD	11	17	0.46
Infection site			
Unknown	22	23	0.34
Other	6	7	0.72
Intraabdominal infection	6	15	**0.01**
UTI	15	24	0.26
Pneumonia	51	56	0.16
Source (hospital-acquired)	42	59	0.24
Clinical predictive scores			
SOFA score	2	3	**0.002**
qSOFA ≥2	25	42	**0.03**
SIRS ≥2	95	118	0.95
Laboratory parameters			
Arterial blood gas	63	79	0.74
Lactate level mmol/L	1.35	3.05	**<0.001**
Total bilirubin (mg/dl)	0.55	0.85	**<0.001**
Creatinine (mg/dl)	1.04	1.04	-
Platelet count (X 10^3/mm3)	238.3	225.2	0.23
WBC count (cells/mm3)	10,310	12,745	**0.006**
Hemoglobin (gm/dl)	10.6	11.2	0.05

Table 1: Demographic and disease characteristics of the study subjects

Parameter	Blood lactate <2 mmol/L (n=100)	Blood lactate ≥2 mmol/L (n=124)	p-value
Initial antibiotic effectiveness	29	45	0.57
Initial positive hemoculture	13	30	**0.003**
Antibiotics within 1st hour	58	74	0.76
Antibiotic receiving time (minutes)	48.2	46.7	0.74
Initial antibiotic administration	93	119	0.25
IV fluid ≥1500ml	6	24	**<0.001**
IV fluid volume (ml)	150	250	**<0.001**

Table 2: Initial management of study subjects in the emergency department

Outcomes	Blood lactate <2 mmol/L (n=100)	Blood lactate ≥2 mmol/L (n=124)	p-value
3 days of septic shock	5	23	**<0.001**
28 days mortality	10	40	**<0.001**

Table 3: Primary and secondary outcomes of the study subjects

DISCUSSION

The purpose of the current retrospective study is to evaluate the relationship between early blood lactate levels and death in non-shock septic patients, as well as the following septic shock.

Two groups of 224 participants—100 with blood lactate <2 mmol/L and 124 with blood lactate ≥2 mmol/L—were involved in the research. Group I's mean age was 71.7±3.12 years, whereas Group II's mean age was 70.2±2.48 years. This difference was not statistically significant (p=094). Group II had a significantly higher proportion of males than Group I, with 39 and 61 men in Group II, respectively (p=0.02). The oxygen saturation levels of both groups were 94.2% and an 8 on the Glasgow coma scale.

Eight patients in Group I and fifteen participants in Group II were hypotensive. There was no discernible difference in the two groups' mean arterial pressure, diastolic blood pressure, systolic blood pressure, or respiratory rates. (p-values of 0.64, 0.75, 0.22, and 0.26), In contrast, Group I had a higher temperature (p=0.01) and Group II had a considerably greater heart rate (p=0.001).

Group II had significantly higher rates of cancer and cirrhosis (p=0.007 and 0.03), although the two groups did not differ in terms of immunocompromised status, renal disease, diabetes, CVA, CHF, or CAD (p=0.09, 0.07, 0.43, 0.920.95, 0.74, and 0.46, respectively). These results were contrasted with those of previous studies conducted by Maitra S et al. (2018) and Hwang SY et al. (2018), whereby the authors assessed patients whose demographics matched those of the earlier studies. It was shown that Group II (15 participants) had an intraabdominal infection at a higher rate than Group I (6 patients) (p=0.01).

Between the two groups, the other places, unknown sites, UTI, and pneumonia were similar (p=0.72, 0.34, 0.26, and 0.16, respectively). 42 individuals in Group I and 59 patients in Group II contracted the virus in the hospital (p=024). Groups I and II had SIRS≥2 ratings of 95 and 118, respectively (p=0.95), qSOFA≥2 scores of 25 and 42 (p=0.03), and SOFA scores of 2 and 3 (p=0.002).

In terms of laboratory parameters, 63 individuals from Group I and 79 people from Group II underwent arterial blood gas testing (p=074).WBC counts and total bilirubin were significantly higher in Group II ($p < 0.001$ and 0.006, respectively). Haemoglobin levels and platelet counts were similar in the two groups (p=0.05 and 0.23).

Group I had lactate levels of 1.35 mmol/L and Group II had 3.05 mmol/L ($p < 0.001$). These disease characteristics were similar to those reported by Nichol AD et al. (2010) and Filho RR et al. (2016), who presented data that was comparable to the current investigation's findings.

The study discovered that, compared to the low lactate group, Group II with high lactate levels got considerably more IV fluid ($p < 0.001$). Additionally, 24 individuals from Group II and 6 persons from Group I received IV fluid that weighed more than 1500 ml ($p<0.001$). Compared to Group I, Group II got more antibiotics more often. That being said, the difference ($p = 0.25$) was not statistically significant.

Within 60 minutes, 58 Group I participants and 74 Group II people received antibiotics (p=0.76). Thirty individuals in Group II had a greater frequency of first positive hemoculture than the thirteen subjects in Group I, a difference that was statistically significant (p=0.003).

These results were in line with those of recent research by Hwang TS et al.14 and Krishna U et al.13, which discovered that individuals with higher lactate levels needed more IV fluid administration and antibiotic consumption. Research revealed that 5 individuals in Group I went through 3 days of septic shock, which is significantly less than the 23 people in Group II ($p < 0.001$). Compared to 10 in Group I, a 28-day death rate was noted in 40 patients from Group II.

There was a statistically significant difference ($p < 0.001$). These results were in line with those of Baumann BM et al.15 in 2020 and Shetty A et al.16 in 2017, who, like in the present investigation, noted higher mortality rates and septic shock in individuals with elevated lactate levels.

CONCLUSION

The current study shows, with some limitations, that the evaluation of blood lactate levels and its cut-off at or above 2 mmol/L is a valid predictor factor of the 28-day mortality and progression to septic shock in participants with early sepsis. Additionally, determining the early blood lactate levels can improve the accuracy of qSOFA and SIRS prediction.

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