EGYPTIAN JOURNAL OF ANAESTHESIA
2024, VOL. 40, NO. 1, 317–324
https://doi.org/10.1080/11101849.2024.2354610

Comparison between platelets to lymphocytes ratio, procalcitonin serum level, and SOFA score for outcome prediction in patients with sepsis

Mohamed Malah, Motaz Amr Abusaba, Ahmed Said-Gebaly, Ghada Fouad El Baradey and Naglaa Khalil Yousef

Anesthesiology, Surgical ICU and Pain Management, Faculty of Medicine, Tanta University, Tanta, Egypt

ABSTRACT

Background: Sepsis is a fatal condition with high treatment costs, early identification of sepsis is mandatory to avoid lethal complications. The objective of this study was to compare the predictive capabilities of platelets to lymphocytes ratio (PLR) and procalcitonin (PCT) in determining the outcome of sepsis.

Methods: This study was a prospective cross-sectional study and fifty-four individuals diagnosed with sepsis were involved. The participants were between the ages of twenty-one and sixty-five and had been admitted to ICU for more than twenty-four hours. The measurement of whole blood count and PCT serum levels was conducted at time of diagnosis, as well as on days three, seven, and fourteen following the onset of sepsis while SOFA score was conducted at time of admission.

Results: There was important elevation in platelet to lymphocytes ratio value and PCT in non survivors group compared to survivors group at day one, three, and seven of diagnosis of sepsis (p value ≤ 0.05), and day fourteen there were no data in non survivors group. The Sequential Organ Failure Assessment (SOFA) score was found to be the most effective in mortality prediction [area under the curve (AUC) = 0.982] second effective was PCT (AUC = 0.977) and PLR was third (AUC = 0.945).

Conclusions: In adult patients diagnosed with sepsis PLR with cutoff value > 228.89 demonstrates efficacy as a reliable prognostic indicator for predicting outcomes in sepsis. Although PLR may have a lower predictive power compared to PCT and SOFA score, it possesses the advantage of being a readily available and cost-effective technology.

ARTICLE HISTORY
Received 3 February 2024
Revised 14 March 2024
Accepted 2 May 2024

KEYWORDS
Platelets to lymphocytes ratio; procalcitonin; sepsis; outcome

1. Introduction

Sepsis is an expeditiously advancing, potentially fatal condition. The precise evaluation of sepsis holds significant importance in facilitating prompt administration of medicines and the elimination of the infection's origin [1]. The 2016 iteration of the sepsis guidelines, known as Sepsis-3, has eliminated the inclusion of the systemic inflammatory response syndrome (SIRS) concept According to a scholarly source [2]. Despite the implementation of intensive management strategies, such as early goal directed therapy (EGDT), in emergency department (ED) settings, the death rate associated with sepsis has been documented to exceed twenty percent to thirty percent [3,4].

A number of physicians have conducted research on the importance of blood biomarkers, including C-reactive protein, procalcitonin (PCT), and lactate, in the early evaluation of sepsis and in predicting patient outcomes [5,6].

Multiple studies have elucidated the benefits associated with the precursor molecule of calcitonin, specifically PCT, as a biomarker for sepsis [7].

In recent years, there has been a growing body of research indicating that platelets (PLT) and lymphocytes are significant contributors to the inflammatory process. The platelet-to-lymphocyte ratio (PLR) has attracted study interest as a potential biomarker of inflammation in various disorders, including myocardial infarction and acute kidney injury (AKI) [8–10]. Previous research suggests a possible association between PLR and sepsis mortality. Platelet-to-lymphocyte ratio (PLR) is defined as the ratio of absolute platelets count to absolute lymphocytes count.

The aim of this prospective cross-sectional study was to compare the PLR, the PCT level and the SOFA score for Outcome prediction in patients with Sepsis.

CONTACT Mohamed Malah horslessknight2015@outlook.com Anesthesiology, Surgical ICU and Pain Management, Faculty of Medicine, Tanta University, Tanta 11113, Egypt

Supplemental data for this article can be accessed online at https://doi.org/10.1080/11101849.2024.2354610

2. Patients and methods

A total of fifty-four individuals with septic disease who required a twenty four-hour or longer stay in the ICU participated in this prospective cross-sectional study. After receiving clearance from the Ethical Committee of Tanta University Hospitals (clearance code: 34587/3/21), the study ran from April 2021 to April 2022 under the guise of NCT05399225 on clinical trials gov. The patient or patient's family member provided written informed consent.

Patients who met the following exclusion criteria were not eligible to participate: those who were pregnant, those who were actively bleeding, those who had hematological diseases (including bone marrow diseases) or collagen diseases, those who were taking corticosteroids or immunosuppressive drugs, those who required emergency surgery, those with acute cerebrovascular or coronary syndrome, and those who had received a blood or platelet transfusion.

All patients were categorized into two groups: non survivors' group included twenty-two patients and survivors' group included thirty-two patients.

Blood samples were taken from the arterial, peripheral vein or a central catheter for complete blood count (CBC) evaluation, and PCT serum levels. This procedure was done at diagnosis, three, seven and fourteen days of sepsis. No storage was performed on CBC samples, and results were reported within 1.5 hours. The Dirui BCC-3600 cell counter was used for obtaining rough cell count estimates. All samples were subjected to a concomitant smear examination as well. Hemoglobin (Hb), total leukocytic count (TLC), including platelet count and lymphocytes percent were followed up till discharge from hospital or death.

SOFA score values and PCT and their correlation with changes in PLR, Delta changes of Procalcitonin and platelet-to-lymphocyte ratio (PLR) and their effect on patient mortality, Length of ICU and hospital stay were recorded.

The primary outcome was twenty-eight days' prediction mortality. The secondary outcomes were length of ICU stay, SOFA score and hospital day

2.1. Sample size

G*Power 3.1.9.2 (Universitat Kiel, Germany) was used to determine the optimal sample size for the present prospective cross-sectional study. The selection of fifty participants as the research's sample size was based on the following factors: eighty percent research power, 0.05 alpha error, as reported in a previous investigation [11].

2.2. Statistical analysis

SPSS v26 (IBM Corp., Chicago, IL, USA) was used for the statistical analysis. To determine if the data followed a normal distribution, we utilized the Shapiro-Wilks test using histograms. The unpaired Student t-test was used to compare the two groups on the quantitative parametric variables provided as standard deviations (SDs) and averages. The Mann Whitney test was used to analyze the non-parametric quantitative data reported as a median and IQR. When applicable, the Chi-square test or Fisher's exact test was used to analyze qualitative variables provided as percentages and frequencies. Survival curves were compared between patients with ROCs and atypical and normal PLR were calculated to see how well PLR may predict mortality. The time amount spent in the overall hospitalization time, PLR and ICU were all shown to be correlated using the Spearman coefficient. To be statistically significant, the p value has to be less than 0.05 with two tails.

3. Results

Seventy-nine patients were evaluated for eligibility; seventeen did not match the criteria, and eight families declined to take part. The remaining fifty-four patients were split into two groups (thirty-two individuals in the survivors' group and twenty-two out patients in the non-survivors' group). The data from all fifty-four individuals that were tracked and analysed statistically is presented in Figure 1.

Gender, causes of infection and BMI showed no statistically significant differences between the two groups. The age and SOFA score were higher in the non-survivors group compared to survivors' group and the difference was statistically significant ($p < 0.001$). There was statistically significant increase in hospital stay and ICU stay in survivors group compared to non-survivors' group. Table 1

There was statistically significant increase in lymphocytes and platelets count in survivors group compared to non-survivors' group at day one, three, and seven of diagnosis of sepsis (p value ≤ 0.05), and day fourteen there were no data in non-survivors' group. There was statistically significant increase in PLR and PCT value in non survivors group compared to survivors' group at day one, three, and seven of diagnosis of sepsis (p value ≤ 0.05), and day fourteen there were no data in non-survivors' group. Table 2

Regarding delta changes, there was a significant elevation of lymphocytes and PLT in survivors group in days three, seven and fourteen but there was significant decline of lymphocytes and PLT in non survivors group in days three and seven. There was significant decrease of PLR and PCT in survivors group in days three, seven and fourteen, but there was a significant elevation of PCT in non survivors group in days three and seven. There was non-significant increase of PLR in non survivors group in days three and seven (Table 3).

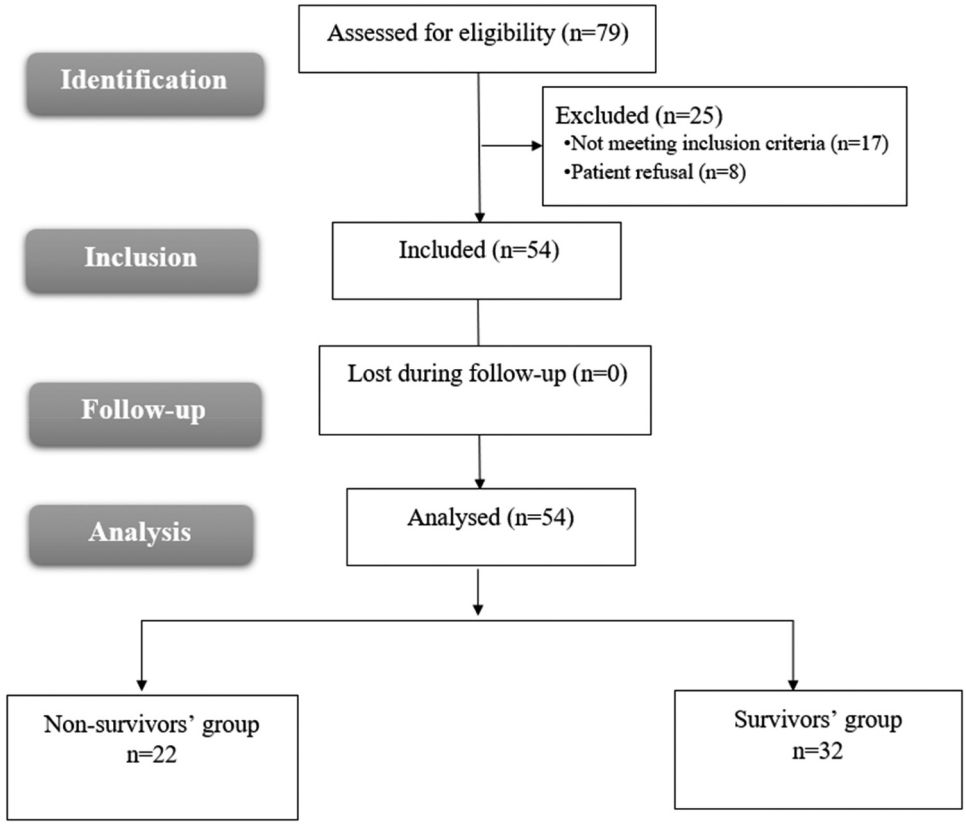

Figure 1. The enrolled patients flowchart.

Table 1. Comparison between the two studied groups according to causes of infection,ICU stay, hospital stay, SOFA score and demographic data in the studied groups.

		Finding		
	Total (n = 54)	Survivors (n = 32)	Non survivors (n = 22)	P- value
Gender				
Male	25 (46%)	14 (44%)	11 (50%)	0.651
Female	29 (54%)	18 (56%)	11 (50%)	
Age (years)	50± 9	7± 47	54 ± 10	0.003**
BMI (kg/m^2)	30 ± 6	29 ± 6	30 ± 6	0.653
Hospital stay	2–31	7–31	2–12	<0.001**
Intra-abdominal infection	9 (12)	5 (13)	4 (14)	FEp=1.0
Chest infection	12 (15)	7 (15)	5 (15)	0.990
C.N. S	8 (16)	5 (13)	3 (17)	FEp=1.0
Surgical wound	18 (33)	10 (31)	8 (36)	0.695
Urinary tract infection(UTI)	4 (7)	4 (18)	0 (0.0)	FEp=0.137
Bed sores central line infection	3 (6)	1 (3)	2 (9)	FEp=0.560
SOFA score	8 ± 2	6 ± 1	10 ± 2	<0.001**
ICU stay	9 ± 5	11 ± 5	6 ± 4	0.003**

Data are presented as number (%) or mean ± SD. BMI. Sofa score. ICU, C.N.S, P: p value for comparing between the two studied groups, *statistically significant at $p \leq 0.05$**: Statistically significant at $p \leq 0.001$.

PLR at cut-off value > 229 can predict mortality with sensitivity 86%, specificity 88%, and PPV 83% [area under the curve (AUC) = 0.945] (95% C.I: 0.890–0.999) with p value < 0.001. PCT at cut-off value >9 ng/mL can predict mortality with sensitivity 95%, specificity 91%, PPV 88% and NPV 100% with area under the curve 0.977 and (95% C.I: 0.946–1.0) with p value < 0.001. SOFA score at cut-off value > 7 can predict mortality with sensitivity 100%, specificity 84%, PPV 82% and NPV 100% with area under the curve 0.982and (95% C.I: 0.957–1.007) with p value < 0.001. Delta change of PLR at day 7 cut-off value is > 68 can predict mortality with sensitivity 80%, specificity 91%, PPV 73% and NPV 94% (AUC = 0.841) and (95% C.I: 0.642–1.039) with p value < 0.001. Delta change of PCT at day 7 cut-off value is >3.6 ng/mL can predict mortality with sensitivity 90%, specificity 97%, PPV 90% and NPV 97% (AUC = 0.978) and (95% C.I: 0.934–1.022) with p value < 0.001. Figure 2

There is significant correlation between ICU and PLR stay and hospital stay in survivor's patients. Higher PLR is associated with longer ICU stay and hospital stay at diagnosis (p value < 0.001). Also, important correlation between delta changes in ICU stay length and PLR and hospital stay in survivor's patients. More elevate in delta change in PLR is associated with lower ICU and

Table 2. Values of PLT, PCT, PLR and lymphocytes in the studied groups.

		Finding		
	Total	Survivors	Non survivors	P-value
PLT count(*10^3/μL)				
	(*n* = 54)	(*n* = 32)	(*n* = 22)	
1st day	146 ± 44	166 ± 25	117 ± 49	<0.001**
	(*n* = 47)	(*n* = 32)	(*n* = 15)	
3 days	156 ± 45	179 ± 22	107 ± 41	<0.001**
	(*n* = 42)	(*n* = 32)	(*n* = 10)	
7 days	174 ± 58	200 ± 33	90 ± 36	<0.001**
	(*n* = 32)	(*n* = 32)	(*n* = 0)	
14 days	204± 31	204 ± 31	–	
Lymph count (μL)				
	(*n* = 54)	(*n* = 32)	(*n* = 22)	
1st day	676 ± 294	863 ± 112	404 ± 262	<0.001**
	(*n* = 47)	(*n* = 32)	(*n* = 15)	
3 days	1411 ± 815	1926 ± 374	346 ± 175	<0.001**
	(*n* = 42)	(*n* = 32)	(*n* = 10)	
7 days	2089 ± 1140	2644 ± 615	312 ± 119	<0.001**
	(*n* = 32)	(*n* = 32)	(*n* = 0)	
14 days	2798 ± 436	2798 ± 436	–	
PCT (ng/mL)				
	(*n* = 54)	(*n* = 32)	(*n* =22)	
1st day	11 ± 10	4 ± 3	21 ± 8	<0.001**
	(*n* = 47)	(*n* = 32)	(*n* = 15)	
3 days	8 ± 9	2 ± 1	21 ± 6	<0.001**
	(*n* = 42)	(*n* = 32)	(*n* = 10)	
7 days	6 ± 11	0.4 ± 0.4	25 ± 5	<0.001**
	(*n* = 32)	(*n* = 32)	(*n* = 0)	
14 days	0.3 ± 0.2	0.3 ± 0.2	–	–
PLR				
	(*n* = 54)	(*n* = 32)	(*n* = 22)	
1st day	258 ± 131	194 ± 31	351 ± 164	<0.001**
	(*n* = 47)	(*n* = 32)	(*n* = 15)	
3 days	177 ± 143	97 ± 22	343 ± 144	<0.001**
	(*n* = 42)	(*n* = 32)	(*n* = 10)	
7 days	142 ± 133	80 ± 23	341 ± 146	<0.001**
	(*n* = 32)	(*n* = 32)	(*n* = 0)	
14 days	75 ± 17	75 ± 17	–	

Data are demonstrated as mean ± SD. PLT, PCT. PLR *statistically significant at $p \leq 0.05$**: Statistically significant at $p \leq 0.001$.: *p* value for comparing between the two studied groups.

hospital stay at day three, seven and day fourteen (*p* value < 0.001) (Table 4).

There is significant correlation between PLR and SOFA score between the two groups in prediction of mortality (*p* value < 0.001) but no significant correlation between PLR and PCT in prediction of mortality in the studied groups. There is a significant correlation between delta change in PLR and in PCT at day 7 (*p* value < 0.001) (Table 5).

3.1. Discussion

Sepsis is well recognized as a pervasive worldwide health issue that exerts substantial economic ramifications.

The PLR is a quantitative measure that is determined by dividing the absolute platelet count by the absolute lymphocyte count. The utilization of PCT has been subject to comprehensive investigation with regards to its application in the diagnosis, prognostication of outcomes, and facilitation of antibiotic treatment in cases of sepsis [18,19].

In the present study the PLT count showed a statistically significant decline in non-survivors group compared to survivors' group at day one, three, and seven after diagnosis of sepsis and in day fourteen there were no data in non survivors group, and PLT delta change which is the variance of values of PLT count in days three, seven and fourteen and 1st day showed significant elevation in survivors and significant decrease in non survivors group. Wang D et al. [17] reported similar findings in the large retrospective cohort study on 16,401 participants and found that decline in PLT count was significantly associated with a 28-day risk of death from sepsis.

In this study lymphocytes count demonstrated statistically significant decline in non-survivors group compared to survivors group at day one, three, and seven of sepsis diagnosis and in day fourteen there were no data in non survivors group, and delta change of lymphocytes count which is the variance of values of lymphocytes count in days three, seven and fourteen and 1st day showed significant elevation in survivors and significant decrease in non survivors group. Our findings are in the line with Li Q et al. [16] who carried a research in a general ICU on 1245 patients with septic shock and found that increased lymphocyte counts were associated with lower 28day mortality.

In this research PLR showed statistically significant increase in non-survivors group compared to the

Table 3. Delta change in lymphocytes, platelets (*10^3/μL), PCT in the studied groups.

	1st day	3 days	7 days	14 days
	PLT count(*10^3/μL)			
	(*n* = 32)	(*n* = 32)	(*n* = 32)	(*n* = 32)
Survivors	166 ± 25	179 ± 22	200 ± 33	204 ± 31
t (p)	–	*t*=3.625, *p*=0.001**	*t*=5.433, *p*<0.001**	*t*=6.147, *p*<0.001**
Delta change	–	↑ 13 ± 20	↑ 34 ± 35	↑ 37 ± 34
	(*n* = 22)	(*n* = 15)	(*n* = 10)	(*n* = 0)
Non survivors	116 ± 49	107 ± 41	90 ± 36	–
t (p)	–	*t*=4.648, *p*<0.001**	*t*= 3.067, *p*=0.013**	–
Delta change	–	↓ 21 ± 18	↓ 38 ± 39	–
Lymph count(μL)				
	(*n* = 32)	(*n* = 32)	(*n* = 32)	(*n* = 32)
Survivors	863 ± 112	1926 ± 374	2644 ± 615	2798 ± 436
Z (p)		Z=4.861, *p*<0.001**	Z=4.937, *p*<0.001**	Z=4.938, *p*<0.001**
Delta change		↑ 1063 ± 381	↑ 1781 ± 627	↑ 1935 ± 444
	(*n* =22)	(*n* = 15)	(*n* = 10)	(*n* = 0)
Non survivors	404 ± 262	346 ± 175	287 ± 125	–
Z (p)	–	Z=2.613, *p*=0.009**	Z=2.293, *p*=0.022*	–
Delta change	–	↓ 138 ± 170	↓ 209 ± 231	–
PCT (ng/mL)				
	(*n* = 32)	(*n* = 32)	(*n* = 32)	(*n* = 32)
Survivors	4 ± 3	2 ± 1.5	0.4 ± 0.4	0.3 ± 0.2
Z (p)	–	Z=4.939, *p*<0.001**	Z=4.937, *p*<0.001**	Z=4.937, *p*<0.001**
Delta change	–	↓ 2 ± 2	↓ 4 ± 3	↓ 4 ± 3
	(*n* = 22)	(*n* = 15)	(*n* = 10)	(*n* = 10)
Non survivors	21 ± 8	21 ± 6	25 ± 5	–
Z (p)	–	Z=2.726, *p*=0.006*	Z=2.803, *p*=0.005*	–
Delta change	–	↑ 3 ± 4	↑ 9 ± 4	–
PLR				
	(*n* = 32)	(*n* = 32)	(*n* = 32)	(*n* = 32)
Survivors	194 ± 31	97 ± 22	80 ± 23	75 ± 17
Z (p)	–	Z=4.860, *p*<0.001**	Z=4.937, *p*<0.001**	Z=4.937*, *p*<0.001**
Delta change	–	↓ 98 ± 39	↓ 114 ± 43	↓ 120 ± 37
	(*n* = 22)	(*n* = 15)	(*n* = 10)	(*n* = 0)
Non survivors	351 ± 164	343 ± 144	341 ± 146	–
Z (p)	–	Z=1.761, *p*=0.078	Z=0.561, *p*=0.575	–
Delta change	–	↑ 25 ± 218	↑ 17 ± 137	–

Data are demonstrated as mean ± SD. PLT. PCT. PLR.: *p* value for comparing between at 1st day and each other periods, Z: Wilcoxon signed ranks test: *p* value for comparing between at diagnosis and each other periods, *statistically significant at $p \leq 0.05$**: Statistically significant at $p \leq 0.001$.

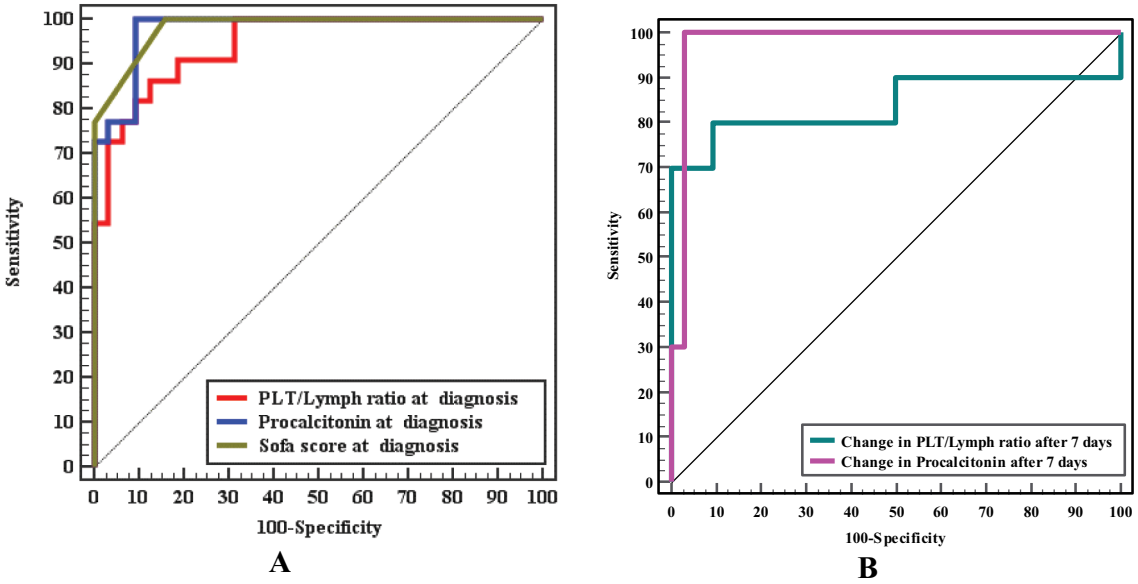

Figure 2. ROC curve to predict mortality of A): PLR, PCT and SOFA score at diagnosis and B): change in PCT and PLR after 7 days.

survivors' group at day one, three, and seven of sepsis diagnosis and in day fourteen there were no data in non survivors group. Our findings were in accordance with Wang G et al. [13] who found that there is a important elevate in PLR values in non survivors groups compared to survivors group.

In contrary to our findings Biyikli E et al. [12] who found that there were no important variances of PLR

Table 4. Correlation between hospital stay, length ICU stay and PLR in survivors group.

	ICU stay		Hospital stay	
PLT/Lymph ratio (*n*=32)	rs	p	rs	p
At diagnosis	0.618	<0.001**	0.525	0.002**
Delta change (reduction) from diagnosis				
After three days	0.531	0.002**	0.507	0.004**
After seven days	0.447	0.010*	0.420	0.017*
After fourteen days	0.444	0.011*	0.417	0.018*

PLR, ICU. r_s: Spearman coefficient, *statistically significant at $p \leq 0.05$**: Statistically significant at $p \leq 0.001$.

Table 5. Correlation between PLR with SOFA score and PCT as a predictor of mortality and between delta change of PCT and delta change of PLR at day 7 as a predictor of mortality.

	rs PLR (At diagnosis)	p
SOFA score	0.504	0.017*
PCT	0.184	0.413
Delta change (After 7 days) PCT		
Survivors	−0.437	0.012*
Non survivors	−0.685	0.029*

Sofa score. PCT. PLR. r_s: Spearman coefficient, *statistically significant at $p \leq 0.05$**: Statistically significant at $p \leq 0.001$.

between non survivors and survivors and this can be explained by different age group between our research and this research as in his research included patients aged more than sixty five years old.

In the present study demonstrated that the PLR can predict mortality at a cutoff value > 228.89 with 86.36% sensitivity, 87.50% specificity, 82.6% PPV, and 90.3% NPV with AUC of 0.945 (95% C.I: 0.890–0.999). Our findings were in agreement with Zhai G et al. [19] who reported that elevation in PLR quartile positively associated with mortality as PLR ≥ 271.0 (OR, 95% CI: 1.77, 1.39–2.25, $p < 0.001$) more than PLR < 271.0 (OR, 95% CI: 1.51 (1.18–1.94), $p < 0.001$).

our results were in line with Rizal TS et al., 2020 [14] who carried retrospective cross-sectional study on 91 patients with sepsis diagnosis and found that the PLR cut off point value as a predictor of 28-day mortality in septic patients was > 272.22 with a sensitivity of 84%, specificity of 80.49% and an area under the ROC curve (AUC) 89.1%.

As regards PCT, there was statistically significant elevation in non-survivors group compared to survivors' group at day one, three, and seven of sepsis diagnosis and in day fourteen there were no data in non survivors group. Our findings are similar to Li X et al. [20], who reported that the PCT concentration over time was significantly decreased in survivors compared to non-survivors groups.

In contrary to our findings Effendi B et al. [21] who found that PCT has a poor performance in predicting mortality in patients with sepsis due to Gram-negative bacteria.

PCT can significantly predict mortality at cut-off value >9.2 ng/mL with sensitivity 95.45%, specificity 90.6%, PPV 88.0% and NPV 100% with area under the curve 0.977 and (95% C.I: 0.946–1.0) with p value < 0.001. Similar to our results Jain S et al. [22] constructed ROC curves to evaluate PCT in predicting mortality, and recorded that PCT can predict mortality with a cut-off ≥7 ng/mL on day one.

We found a significant increase in non-survivors' group and significant decline in delta changes of PCT in survivors. Our findings were in accordance with, Liu D et al. [15] who found that PCT non-clearance are strongly associated with all-cause of mortality in septic patients.

In contrary to our results Mangalesh S et al. [23] who found that delta change of PCT values over 72 hours were positive in non-survivors and negative in survivors.

Furthermore, our research revealed that SOFA score ranged from four to eight with a mean value of 6.13 ± 1.1 In survivors' group and ranged from eight to twelve with an average value of 9.73 ± 1.52 in non-survivors' group. In comparison between both groups, there was statistically significant increase in non-survivors group compared to survivors' group (p value < 0.001)

This result is similar to Tang Y et al. [24] who found that SOFA score was 10.9 ± 0.41 in non survivors which was significantly higher than that of survivors group 2.75 ± 0.05.

Moreover, in our study SOFA score at cut-off value > 7 can predict mortality with sensitivity 100%, specificity 84%, PPV 81.5% and NPV 100% with area under the curve 0.982and (95% C.I: 0.957–1.007) with p value < 0.001. This finding is similar to Efat A et al. [25] who found that the SOFA score had a sensitivity of 91%, specificity of 88%, and accuracy of 0.90 at a cutoff value of ≥ 8.5 for predicting mortality.

In the present study demonstrated that there was no statistically significant variance between non survivors and survivors groups regarding the infection causes. The present findings are in the same line with Mangalesh S et al. [23] who found that there was no statistically significant difference between non survivors and non survivors groups regarding the infection causes.

On the other hand, our findings are against Orak M et al. [26] who found that there is a significant difference between non survivors and survivors groups regarding the infection causes.

In our results PCT was more effective than Platelet to lymphocytes ratio with area under the curve 0.977 compared with area under the curve 0.945 for PLR. In accordance to our results Matsumura Y et al., (2014) [27] reported a similar result in his prospective, observational study as

SOFA score area under the curve was 0.861 (0.796–0.927) more than procalcitonin 0.830 (0.771–0.890). In the present study demonstrated that there is important link between PLR and ICU stay and hospital stay in survivors patients. Higher PLR is associated with longer ICU stay and hospital stay at diagnosis. Similarly Zhai G et al. [19] who found that increased PLR quartiles were associated with prolonged the ICU stay length and hospital stay. In contrast with our findings Tang Y et al. [23] who found that there was a negative correlation between PLR with length of hospital stay and ICU stay this can be explained by including patients other than septic patients in his research.

In the present study it is demonstrated that there is important correlation between SOFA score and PLR between the two groups in mortality prediction (p value < 0.001), but no important correlation between PCT and PLR in prediction of mortality in non survivors group.

In accordance to our findings George AA et al. [28] who reported that there is a positive correlation between SOFA score and PLR as PLR > 200 showed an important association with patients with SOFA score > 10.

Limitations: It was a single-centric study. Individual therapeutic decisions for each patient have implications on outcomes that could not be investigated. The research lacked bacterial culture data, such as the positive culture percentage or the most common bacteria and their resistance profile.

4. Conclusions

PLR demonstrates efficacy as a reliable prognostic indicator for predicting outcomes in sepsis with cutoff value > 228.89. Although PLR may have a lower predictive power compared to PCT and SOFA score, it possesses the advantage of being a readily available and cost-effective technology.

Disclosure statement

No potential conflict of interest was reported by the author(s).

ORCID

Mohamed Malah http://orcid.org/0009-0001-4132-5050

References

[1] Dellinger RP, Levy MM, Rhodes A, et al. Surviving sepsis campaign: international guidelines for management of severe sepsis and septic shock, 2012. Inten care Med. 2013;39:165–228. doi: 10.1007/s00134-012-2769-8

[2] Singer M, Deutschman CS, Seymour CW, et al. The third international consensus definitions for sepsis and septic shock (sepsis-3). JAMA. 2016;315(8):801–810. doi: 10.1001/jama.2016.0287

[3] Angus DC, Van der Poll T. Severe sepsis and septic shock. N Engl J Med. 2013;369(9):840–851. doi: 10.1056/NEJMra1208623

[4] Coen D, Cortellaro F, Pasini S, et al. Towards a less invasive approach to the early goal-directed treatment of septic shock in the ED. Am J Emerg Med. 2014;32(6):563–568. doi: 10.1016/j.ajem.2014.02.011

[5] Kim H, Kim Y, Lee HK, et al. Comparison of the delta neutrophil index with procalcitonin and C-reactive protein in sepsis. Clin Lab. 2014;60(12/2014):2015–2021. doi: 10.7754/Clin.Lab.2014.140528

[6] Vassiliou AG, Mastora Z, Orfanos SE, et al. Elevated biomarkers of endothelial dysfunction/activation at ICU admission are associated with sepsis development. Cytokine. 2014;69(2):240–247. doi: 10.1016/j.cyto.2014.06.010

[7] Standage SW, Wong HR. Biomarkers for pediatric sepsis and septic shock. Expert Rev Anti Infect. 2011;9(1):71–79. doi: 10.1586/eri.10.154

[8] Kutlucan L, Kutlucan A, Basaran B, et al. The predictive effect of initial complete blood count of intensive care unit patients on mortality, length of hospitalization, and nosocomial infections. Eur Rev Med Pharmacol Sci. 2016;20(8):1467–1473.

[9] Hudzik B, Szkodziński J, Korzonek-Szlacheta I, et al. Platelet-to-lymphocyte ratio predicts contrast-induced acute kidney injury in diabetic patients with ST-elevation myocardial infarction. Biomarker Med. 2017;11(10):847–856. doi: 10.2217/bmm-2017-0120

[10] Zheng C-F, Liu W-Y, Zeng F-F, et al. Prognostic value of platelet-to-lymphocyte ratios among critically ill patients with acute kidney injury. J Crit Care. 2017;21(1):1–11. doi: 10.1186/s13054-017-1821-z

[11] Taha RS, Afandy ME, Elbadawi AH. Abd El Ghafar MS. Platelet indices in critically ill septic patients as a predictor of mortality. Egypt J Anaesth. 2023;39(1):56–62. doi: 10.1080/11101849.2023.2168853

[12] Biyikli E, Kayipmaz AE, Kavalci C. Effect of platelet–lymphocyte ratio and lactate levels obtained on mortality with sepsis and septic shock. Am J Emerg Med. 2018;36(4):647–650. doi: 10.1016/j.ajem.2017.12.010

[13] Wang G, Mivefroshan A, Yaghoobpoor S, et al. Prognostic value of platelet to lymphocyte ratio in sepsis: a systematic review and meta-analysis. Bio Med Res Int. 2022;2022:314–328. doi: 10.1155/2022/9056363

[14] Rizal TS, Irwanto FH, Zainal R, et al. Correlation of platelet-lymphocyte ratio (PLR) as 28-days sepsis mortality predictor in intensive care unit of RSMH palembang. J Anesth Clin Res. 2020;1(2):43–62. doi: 10.37275/jacr.v1i2.137

[15] Liu D, Su L, Han G, et al. Prognostic value of procalcitonin in adult patients with sepsis: a systematic review and meta-analysis. PLoS One. 2015;10(6):145–160. doi: 10.1371/journal.pone.0129450

[16] Li Q, Xie J, Huang Y, et al. Leukocyte kinetics during the early stage acts as a prognostic marker in patients with septic shock in intensive care unit. Medicine. 2021;100(23):102–108. doi: 10.1097/MD.0000000000026288

[17] Wang D, Wang S, Wu H, et al. Association between platelet levels and 28-day mortality in patients with sepsis: a retrospective analysis of a large clinical database MIMIC-IV. Front Med. 2022;9:833–896. doi: 10.3389/fmed.2022.833996

[18] Rello J, Valenzuela-Sánchez F, Ruiz-Rodriguez M, et al. Sepsis: a review of advances in management. Adv Ther. 2017;34(11):2393–2411. doi: 10.1007/s12325-017-0622-8

[19] Zhai G, Wang J, Liu Y, et al. Platelet-lymphocyte ratio as a new predictor of in-hospital mortality in cardiac intensive care unit patients. Sci Rep. 2021;11(1):1–12. doi: 10.1038/s41598-021-02686-1

[20] Li X, Shen H, Zhou T, et al. Early elevation of thioredoxin-1 serum levels predicts 28-day mortality in patients with sepsis. J Inflamm Res. 2021;14:3837–3843. doi: 10.2147/JIR.S320419

[21] Effendi B, Pitoyo CW, Sinto R, et al. Procalcitonin prognostic value in predicting mortality among adult patients with sepsis due to Gram-negative bacteria. Med J Indones. 2022;31(1):50–55. doi: 10.13181/mji.oa.225864

[22] Jain S, Sinha S, Sharma SK, et al. Procalcitonin as a prognostic marker for sepsis: a prospective observational study. BMC Res Notes. 2014;7(1):1–7. doi: 10.1186/1756-0500-7-458

[23] Mangalesh S, Dudani S, Malik A. Platelet indices and their kinetics predict mortality in patients of sepsis. Indian J Hematol Blood Transfus. 2021;37(4):600–608. doi: 10.1007/s12288-021-01411-2

[24] Tang Y, Teng Y, Xu L, et al. Lower platelet-to-lymphocyte ratio was associated with poor prognosis for newborn patients in NICU. Medicina. 2022;58(10):1397–1406. doi: 10.3390/medicina58101397

[25] Efat A, Shoeib SA, Arafa AF, et al. Thrombo-inflammatory biomarkers to predict sepsis outcome. Int J Immunopathol. 2021;35:231–242. doi: 10.1177/20587384211048561

[26] Orak M, Karakoç Y, Üstündag M, et al. An investigation of the effects of the mean platelet volume, platelet distribution width, platelet/lymphocyte ratio, and platelet counts on mortality in patents with sepsis who applied to the emergency department. Niger J Clin Pract. 2018;21(5):667–671. doi: 10.4103/njcp.njcp_44_17

[27] Matsumura Y, Nakada T-A, Abe R, et al. Serum procalcitonin level and SOFA score at discharge from the intensive care unit predict post-intensive care unit mortality: a prospective study. PLoS One. 2014;9(12):114–127. doi: 10.1371/journal.pone.0114007

[28] George AA, Thomas TP, Praseeda I. The relevance of platelet count and platelet lymphocyte ratio in sepsis–A retrospective study. J Evol Med Dent Sci. 2021;10(4):199–203. doi: 10.14260/jemds/2021/43