IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 22, Issue 12 Ser.1 (December. 2023), PP 65-71
www.iosrjournals.org

Comparison of the Absolute Eosinophil Count and Blood Culture in Patients with Sepsis

[1]Dr. Suraiya Begum, *Medical Officer, Department of Pathology and Microbiology, National Institute of Disease of the Chest and Hospital, Dhaka, Bangladesh.*
[2]Professor Dr. Debatosh Paul, *Professor and Chairman, Department of Laboratory Medicine, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh.*
[3]Dr. Sheuly Ferdousi, *Associate Professor, Department of Laboratory Medicine, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh.*
[4]Dr. Al Aharama, *Associate Professor, Department of biochemistry, Medical College for women and Hospital, Dhaka, Bangladesh.*
Corresponding Author: *Dr. Suraiya Begum, Medical Officer, Department of Pathology and Microbiology, National Institute of Disease of Chest and Hospital, Dhaka, Bangladesh.*

ABSTRACT
Background: *Sepsis is one of the leading causes of mortality and morbidity in intensive care units. Despite ongoing breakthroughs in detection and treatment, sepsis continues to be one of the leading causes of mortality and morbidity. Sepsis has a greater fatality rate since the diseases progress more quickly. Early detection of sepsis reduces morbidity and mortality in patients hospitalized to the intensive care unit.*
Objectives: *The aim of the study was to Comparison of the Absolute Eosinophil Count and Blood Culture in Patients with Sepsis.*
Methods: *This cross-sectional study was carried out in the Department of Clinical Pathology, in collaboration with Department of Anaesthesia, Analgesia and Intensive Care Medicine and Department of Microbiology and Immunology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka. In this study, 74 suspected cases of sepsis were enrolled from intensive care unit, BSMMU, Dhaka. Among 74 patients, 34 patients were considered as proven sepsis by blood culture as infection group. The rest 40 were in non-infection group by blood culture. This cross-sectional study evaluated absolute eosinophil count for early diagnosis of sepsis compared with gold standard blood culture.*
Results: *In this study 74 suspected case of sepsis were enrolled from intensive care unit, BSMMU, Dhaka. Out of these patients 34 were included in the infection group and 40 in the non-infection group depending on blood culture report. Gender distribution of the study patient's male was predominant in both groups, which was 27(79.4%) in infection group and 27(67.5%) in non-infection group. And here, blood culture was positive in 34 patients (46%) which indicate infection group and negative in 40 patients (54%) which indicate no infection group*
Conclusion: *Sepsis was associated with a drop in absolute eosinophil count. As a result, eosinopenia may be a reliable marker for early detection of sepsis. Eosinopenia provides an effective guideline for making decisions regarding the judicious use of antibiotic therapy, which will save lives and reduce the risk of the establishment of resistant organisms owing to antibiotic overuse.*
Keywords: *Sepsis, Mortality, Morbidity, Eosinopenia, Antibiotics.*

I. INTRODUCTION

Sepsis is a leading cause of mortality and morbidity in the intensive care unit (ICU). [1] Despite ongoing breakthroughs in detection and treatment, sepsis continues to be one of the leading causes of mortality and morbidity. Sepsis has a greater fatality rate because the diseases progress more quickly. As a result, early detection of sepsis is crucial. Rapid development is critical since the condition continues to be lethal in terms of mortality, resource consumption, and frequency. Because it ensures the early provision of antibiotic medication, early diagnosis of sepsis plays an important role in lowering morbidity and mortality in ICU patients. [2] Sepsis is defined as a systemic inflammatory response to infection by the American College of Chest Physicians and the Society of Critical Care Medicine. [3] Sepsis is often characterized by nonspecific clinical and laboratory indicators that can mislead since parameters frequently vary in severely ill patients with systemic inflammatory response syndrome (SIRS) related to various non-infectious causes. [2] This is significant because treatment and

outcome varies substantially between people with and without sepsis. Furthermore, widespread antibiotic usage for all of these individuals is expected to increase antibiotic resistance and toxicity. [4]

In the United States, 3 per thousand people are diagnosed with sepsis each year, with the mortality rate of over 30%. Sepsis will grow by 1.5 percent per year. [2] It affects people of all ages and occurs in the community, long-term care settings, and among hospitalized patients under the care of any medical specialization. [5] During their ICU stay, more than 35% of patients were diagnosed with sepsis. [6] Hospital mortality rates ranged from 16.9% for non-infected patients to 53.6% for ICU patients infected. When sepsis is accompanied with shock, the mortality rate rises to 70%. Early detection of sepsis remains difficult. A perfect sepsis marker would be highly specific, sensitive, easy to measure, quick, and inexpensive. A positive blood culture, which must be obtained within 48-72 hours, is the gold standard for diagnosing sepsis. Because the culture method is costly and time-consuming, other tests are required in the diagnosis of sepsis. [7] Blood cultures are frequently negative. This result may reflect prior antibiotic administration, the presence of slow growing or fastidious organisms, an insufficient volume of blood, a single set of culture, blood not collected early in a febrile episode, an inappropriate ratio of blood to broth, a faulty blood collection technique, iodine contamination of a blood sample, blood collection without appropriate skin preparation, and an insufficient incubation temperature. [8] Two or three cultures should be acquired for each septic episode.

Sepsis and non-infectious SIRS have extremely similar clinical manifestations. It is critical that clinicians have the tools they need to quickly recognize and diagnose sepsis. [9] Unfortunately, the need for a highly specific sensitive marker of sepsis remains unsatisfied. To diagnose sepsis quickly, a simple, sensitive, straightforward, less expensive, and reliable approach is required. [10]

II. METHODOLOGY

This cross-sectional study was carried out in the Department of Clinical Pathology, in collaboration with Department of Anaesthesia, Analgesia and Intensive Care Medicine and Department of Microbiology and Immunology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka. Suspected sepsis patients who were admitted in the Intensive Care Unit, BSMMU, Dhaka. Study population was divided into infection and non-infection group depending on blood culture reports. Among 74 patients, 34 patients were positive for culture who were included in infection group and 40 patients were negative for culture who were included in the non-infection group. Criteria for selection of the infection and non-infection group are described here. Statistical analyses of the results were be obtained by using window-based Microsoft Excel and Statistical Packages for Social Sciences (SPSS-24).

RESULTS

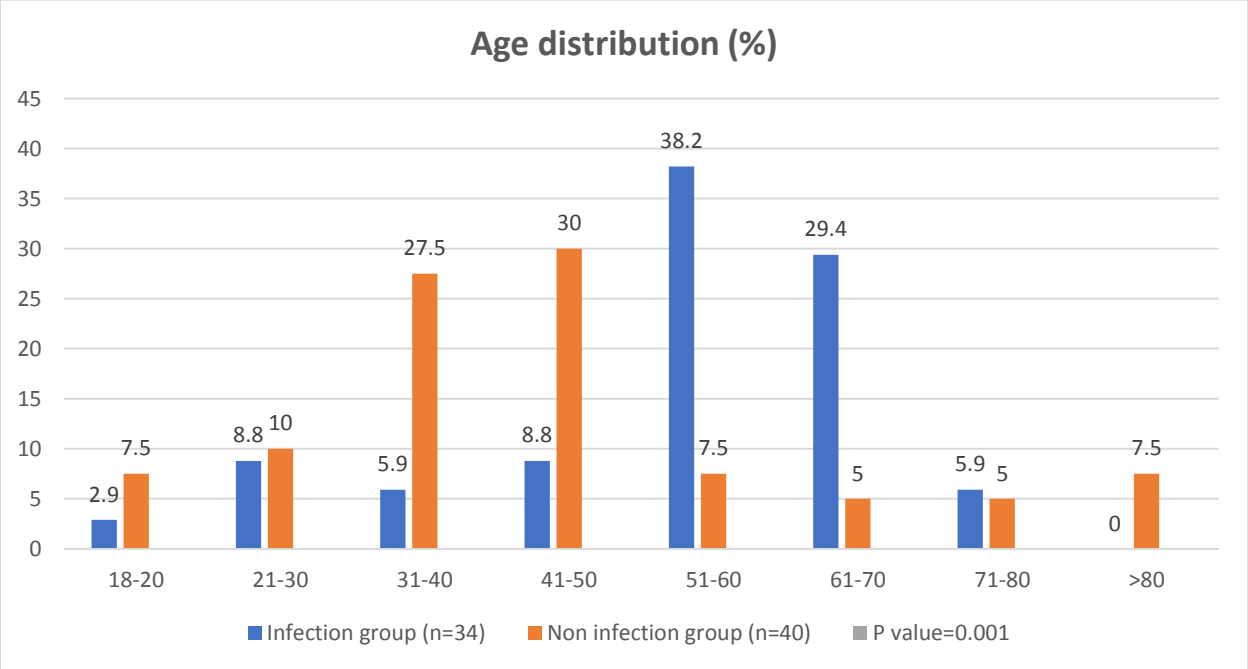

Figure I: Age distribution of the study populations (n=74)

Figure I shows a total of 74 patients were included in this study. Majority of patients were aged belonged to 31-50 years in non-infection group and 51-70 years in infection group. The mean age was found 54.7±13.4 years in infection group and 44.9±18.4 years in non-infection group. The difference was statistically significant (P<0.05) between two groups.

Table I: Sex distribution of the study patients (n=74)

Sex	Infection group (n=34)		Non infection group (n=40)		P value
	n	%	n	%	
Male	27	79.4	27	67.5	0.25
Female	7	20.6	13	32.5	

P value reached from chi-square test

Table I shows regarding sex distribution of the study patient's male were predominant in both groups, which was 27(79.4%) in infection group and 27(67.5%) in non-infection group. The difference was not statistically significant (P>0.05) between two groups.

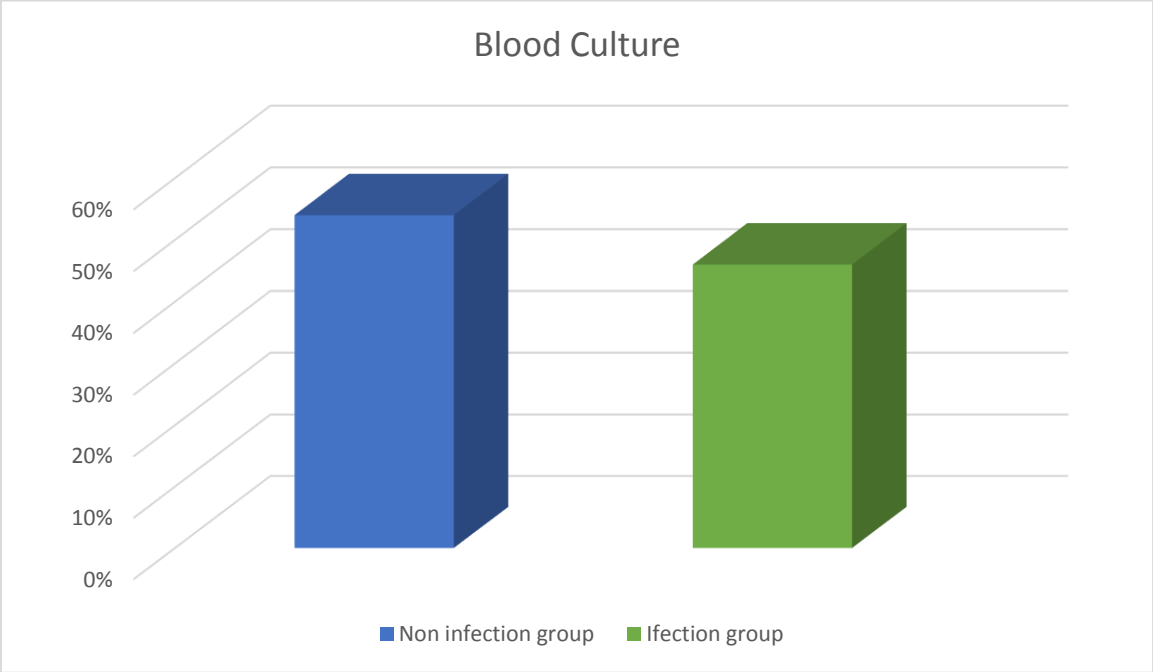

Figure II: Bar diagram distribution of bacterial growth in study patient (n=74)

Figure II show blood culture was positive in 34 patients (46%) which indicate infection group and negative in 40 patients (54%) which indicate no infection group.

Table II: Distribution of the study populations according to Absolute Eosinophil Count (AEC) (n=74).

AEC (cell/cumm)	Infection group (n=34)		Non infection group (n=40)		P Value
	n	%	n	%	
<40	25	73.5	13	32.5	0.001
>40	9	26.5	27	67.7	
Mean± SD	18.3±11.4		145.0±57.7		

P value reached from unpaired t-test.

Table II shows the AEC of the study patients. AEC <40 cells/cumm was found 25(73.5%) in infection group and 13(32.5%) in non-infection group. AEC >40 cells/Cumm was found 9(26.5%) in infection group and 27(67.5%) in non-infection group. The mean AEC was found 18.3±11.4 cells/cum in infection group and 145.0±57.7 cells/cumm in non-infection group. The difference was statistically significant(P<0.05) between two groups.

Table III: Diagnosis of sepsis by AEC, ANC, TLC, PLT and immature PMN in infection group (n=34)

Sepsis	Number of cases	Percentage	Z value	P value
AEC				
<40 cells/cumm	25	73.5	4.390	0.001
>40 cells/cumm	9	26.5		
ANC				
>7,500/cumm	23	67.6	3.101	0.001
<7,500/cumm	11	32.4		
TLC				
>11,000/cumm	21	61.8	2.002	<0.05
<11,000/cumm	13	38.2		
PLT				
<150 x 10"/L	19	55.9	0.979	>0.05
>150 x 109 /L	15	44.1		
Immature PMN				
>10 %	21	61.8	2.00	<0.05
<10 %	13	38.2		

Table III shows regarding the diagnosis of the study patients, AEC <40 cells/ cumm was found in 25(73.5%) cases and >40 cells/cumm was found in 9(26.5%) cases. ANC >7.500/cumm was found in 23(67.6%) cases and <7.500/cu mm was found in 11(32.4%) cases. TLC >11.000/cumm was found in 21(61.8%) cases and <11.000 /cu mm was found in 13(38.2%) cases. PLT <150x 10^9 /L was found in 19(55.9%) cases and >150 x 10^9 /L) was found in 15(44.1%) cases. Immature PMN >10% was found in 21(61.8%) cases and <10% were found in 10(29.4%) cases. All these parameters were statistically significant (P< 0.05) except PLT which was non-significant (P>0.05).

Table IV: Sensitivity, specificity, positive and negative predictive values of the Immature PMN and platelet count (PLT)

Validity test	Immature PMN	PLT
Sensitivity	70.6	55.9
Specificity	65.0	55.0
PPV	63.2	51.4
NPV	72.2	59.5

Table IV shows the validity of Immature PMN evaluation for infection were correlated by calculating sensitivity, specificity, positive and negative predictive values. Sensitivity, specificity, positive and negative predictive values of immature PMN for detecting infection were 70.6%, 65%, 63.2% and 72.2% respectively. The validity of PLT evaluation for infection were correlated by calculating sensitivity, specificity, positive and negative predictive values.

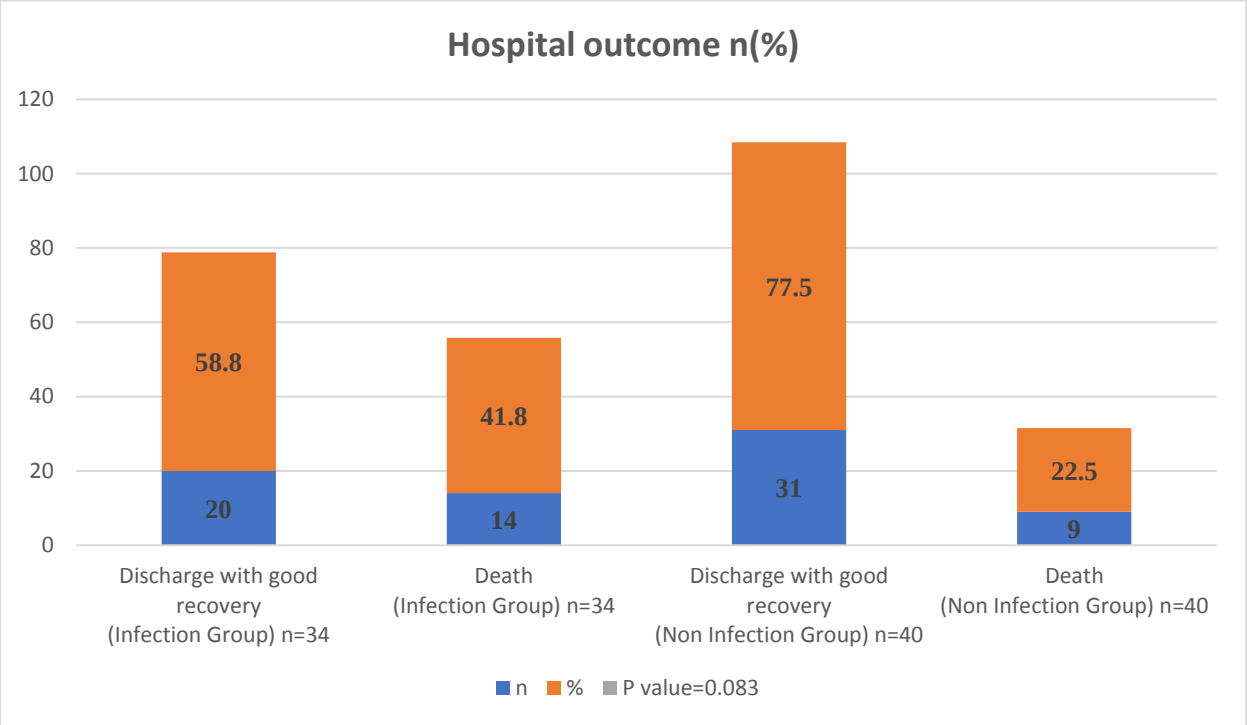

Figure III: Distribution of the study subjects according to hospital outcome (n=74)

Figure III shows the hospital outcome of the study patients. Good (Discharge) outcome was found 20(58.8%) in infection group and 31(77.5%) in non-infection group. Bad (death) outcome was 14(41.2%) in infection group and 9(22.5%) in non-infection group. The difference was not statistically significant (P>0.05) between two groups.

Table V: Relation of AEC with mortality in infection group

Variable	AEC (cell/cumm)	
	Mean±SD	(Min-max)
Mortality	23.1± 19.21	(0-60)

Table V shows the relation of AEC with mortality in infection group. 42 1% patients died in infection group. AEC decreased in patients who died due to infection. Mean AEC was found 23.1±19.2 1 cells/cumm with range from 0 to 60 cells/cumm in patients died due to infection.

III. DISCUSSION

Sepsis is primarily diagnosed clinically, although laboratory diagnosis requires a microbiologic-clinical correlation. Many patients were treated empirically with antibiotics for several days while they awaited bacteriologic culture for a suspected infection. Because clinical indications alone are not always useful for detecting sepsis early, it is critical to use a simple and speedy laboratory test.

In our study, the average age was 54.7 ± 13.4 years in the infection group and 44.9 ± 18.4 years in the non-infected group. In an unpaired t-test, the mean age difference between two groups was statistically significant (p<0.001), indicating that sepsis was related with increased age. The majority of patients were between the ages of 31 and 50 in the non-infected group and 51 and 70 in the infection group. Wibrow et al (2011), Shaban et al (2010), and Moura et al (2011) discovered similar results. [11, 12, 13] Their investigation found that the average age was 62 years, 68 years, and 58 years. They all discovered that sepsis was positively associated to age. These findings were consistent with the outcomes of our investigation. According to the sex distribution analysis, 27 (79.4%) of the 34 sepsis patients were male and 7 (20.6%) were female. Abidi et al (2008) discovered a male predominance in sepsis patients in another research. [1] According to Abidi et al. (2008), 58% of sepsis patients were male and 42% were female. According to Ho et al. (2009), 59% of sepsis patients were male and 41% were female. These findings were remarkably identical to those of our investigation. Though the specific explanation

for this male predominance is unknown, it is most likely owing to the fact that the factors governing gamma globulin synthesis are located on the X chromosome. Males have only one X chromosome and are therefore less immunologically protected than females. [14]

Blood cultures were positive in 34 (46%) of the 74 patients and negative in 40 (54%). This corresponded to the findings of earlier research conducted by Bayram et al (2012). [15] The comparatively limited number of cultures proved sepsis in their study may be owing to delayed patient arrival, collection of samples after having antibiotics, insufficient blood, and improper collection technique. The mean absolute eosinophil count in this study was 18 ± 11.4 cells/cu mm in the infection group and 145 ± 57.4 cells/cu mm in the non-infection group. In an unpaired t test, the difference in mean absolute eosinophil count between two groups was statistically significant ($p<0.001$), indicating that sepsis was linked with lower eosinophil count. Similar outcomes were found in studies conducted by Abidi et al (2008) and Gil et al (2003). [1, 16] According to Kadir et al (2012), the mean absolute eosinophil count in sepsis was 23 ± 46 cells/cu mm and 143 ± 101 9ells/cu mm in patients without sepsis. This finding was comparable to what we discovered. [14]

In our investigation, we discovered eosinopenia (40 cells/cu mm) in 25 patients with infection and 13 patients without infection. AEC > 40 cells/cu mm were identified in 9 of the infection groups and 27 of the non-infection groups. Previous research found that the sensitivity of eosinopenia in sepsis patients varied within a tolerable range. The sensitivity in our investigation was 72.5%, which was similar with the study of Abidi et al (2008). Sensitivity was 71%, 61.4%, 64.8%, and 64% in studies by Abidi et al (2008), Bayram at al (2012), and Gil et al (2003), respectively. These findings were remarkably identical to those of our investigation. [1, 15, 16] The total leukocyte count (TLC) has limited clinical utility in the diagnosis of sepsis. This is the least effective index because hematology auto analyzers can confound it by include nucleated red blood cells in cell counts, although this limitation can be solved if this parameter is rechecked manually microscopically. Total leukocyte count can be 30-40% lower in central catheter blood than in capillary or venous blood. Furthermore, numerous non-infectious diseases might cause an increase in the total WBC count. Total leukocyte count did not increase in all patients, most likely due to early collection, counting problems in the lab, and a previous low level. TLC sensitivity was 61.8% and specificity was 72.5% in our investigation, which was consistent with the findings of Cavallazzi et al (2010). [17] Cavallazzi et al. (2010) discovered that sensitivity and specificity were 62% and 69%, respectively. As a result of this study's findings, total leucocyte count can also be used to predict sepsis. [17] This study investigation found that mortality was 41% in the infection group and 22.5% in the non-infected group. In our investigation, the mortality rate appears to be significant and connected to infection. Lower eosinophil count, on the other hand, had a worse prognosis than normal eosinophil level. This result is similar with the findings of Abidi et al (2008). According to the findings, ICU mortality was higher in the infection group (42%) than in the non-infected group (25%). [1]

Sepsis is a potentially fatal but treatable condition. Non-infection illnesses can cause hematological changes similar to those seen with infection. The treatment of non-infected patients is unavoidable, but using absolute eosinophil count to diagnose the patient will result in more judicious antibiotic use, earlier cure, lower mortality, shorter hospital stays, and reduced risk of the emergence of resistant bacteria due to inappropriate antibiotic use.

Limitations of the study

The present study was conducted in a very short period due to time constraints and funding limitations. The small sample size was also a limitation of the present study.

IV. CONCLUSION

Sepsis has a high mortality and morbidity rate, especially when antibiotic therapy is delayed. Early detection of sepsis prior to receiving the results of microbial culture facilitates antibiotic medication selection and reduces patient mortality. The absolute eosinophil count, which can be obtained from a regular laboratory test in a complete blood count, is used to make an early diagnosis of sepsis. As a result of being able to analyze the change in eosinophil count that happens in sepsis, it can be concluded that a lower absolute eosinophil count may be a useful marker for distinguishing infected patients from non-infected individuals. This is a simple, rapid, cost-effective, and easily accessible technique with high sensitivity and specificity for the early detection of sepsis. In our study, eosinopenia served as a useful guideline for making decisions about the judicious use of antibiotic medication, which saved lives while also reducing the danger of the establishment of resistant organisms due to antibiotic overuse.

V. RECOMMENDATION

This study can serve as a pilot to much larger research involving multiple centers that can provide a nationwide picture, validate regression models proposed in this study for future use and emphasize points to ensure better management and adherence.

ACKNOWLEDGEMENTS

The wide range of disciplines involved in comparison of the Absolute Eosinophil Count and Blood Culture in Patients with Sepsis research means that editors need much assistance from referees in the evaluation of papers submitted for publication. I would also like to be grateful to my colleagues and family who supported me and offered deep insight into the study.

REFERENCE

[1]. Abidi K, Khoudri I, Belayachi J, Madani N, Zekraoui A, Zeggwagh AA, Abouqal R. Eosinopenia is a reliable marker of sepsis on admission to medical intensive care units. Critical care. 2008 Apr;12(2):1-0.
[2]. Curtis NS, Wes S. New concepts in sepsis. Curr Opin Crit Care. 2002; 8:465-72.
[3]. Bone RC, Balk RA, Cerra FB, Dellinger RP, Fein AM, Knaus WA, Schein RM, Sibbald WJ. Definitions for sepsis and organ failure and guidelines for the use of innovative therapies in sepsis. Chest. 1992 Jun 1;101(6):1644-55.
[4]. Gibot S, Kolopp-Sarda MN, Béné MC, Cravoisy A, Levy B, Faure GC, Bollaert PE. Plasma level of a triggering receptor expressed on myeloid cells-1: its diagnostic accuracy in patients with suspected sepsis. Annals of internal medicine. 2004 Jul 6;141(1):9-15.
[5]. Lever A, Mackenzie I. Sepsis: definition, epidemiology, and diagnosis. Bmj. 2007 Oct 25;335(7625):879-83.
[6]. Vincent JL, Sakr Y, Sprung CL, Ranieri VM, Reinhart K, Gerlach H, Moreno R, Carlet J, Le Gall JR, Payen D, Sepsis Occurrence in Acutely Ill Patients Investigators. Sepsis in European intensive care units: results of the SOAP study. Critical care medicine. 2006 Feb 1;34(2):344-53.
[7]. Abidi K, Belayachi J, Derras Y, Khayari ME, Dendane T, Madani N, Khoudri I, Zeggwagh AA, Abouqal R. Eosinopenia, an early marker of increased mortality in critically ill medical patients. Intensive care medicine. 2011 Jul;37:1136-42.
[8]. Munford RS. Invited review: detoxifying endotoxin: time, place and person. Journal of endotoxin research. 2005 Apr;11(2):69-84.
[9]. Potjo M. Evaluation of circulating host-and pathogen-derived markers of infection and inflammation in the laboratory diagnosis of SEPSIS (Doctoral dissertation, University of Pretoria).
[10]. Aouifi A, Piriou V, Bastien O, Blanc P, Bouvier H, Evans R, Célard M, Vandenesch F, Rousson R, Lehot JJ. Usefulness of procalcitonin for diagnosis of infection in cardiac surgical patients. Critical care medicine. 2000 Sep 1;28(9):3171-6.
[11]. Wibrow BA, Ho KM, Flexman JP, Keil AD, Kohrs DL. Eosinopenia as a diagnostic marker of bloodstream infection in hospitalised paediatric and adult patients: a case-control study. Anaesthesia and intensive care. 2011 Mar;39(2):224-30.
[12]. Mohammed AJ, AlAwaidy S, Bawikar S, Kurup PJ, Elamir E, Shaban MM, Sharif SM, van der Avoort HG, Pallansch MA, Malankar P, Burton A. Fractional doses of inactivated poliovirus vaccine in Oman. New England Journal of Medicine. 2010 Jun 24;362(25):2351-9.
[13]. Varum S, Rodrigues AS, Moura MB, Momcilovic O, Easley IV CA, Ramalho-Santos J, Van Houten B, Schatten G. Energy metabolism in human pluripotent stem cells and their differentiated counterparts. PloS one. 2011 Jun 17;6(6):e20914.
[14]. Kadir NA, Arif M, Bahrun U. Eosinophil as a marker to distinguish sepsis from systemic inflammatory response syndrome (SIRS) patients in intensive care unit. International Journal of Infectious Diseases. 2012 Jun 1;16:e389.
[15]. Begum S, Ferdousi S, Chowdhury IH, Ahmed MU, Ahmed AN. Eosinopenia As a Marker of Sepsis in Intensive Care Unit Patients. Journal of Clinical and Laboratory Research. 2021;3(2):2768-0487.
[16]. Kibe S, Adams K, Barlow G. Diagnostic and prognostic biomarkers of sepsis in critical care. Journal of antimicrobial chemotherapy. 2011 Apr 1;66(suppl_2):ii33-40.
[17]. Cavallazzi R, Bennin CL, Hirani A, Gilbert C, Marik PE. Review of a large clinical series: is the band count useful in the diagnosis of infection? an accuracy study in critically ill patients. Journal of intensive care medicine. 2010 Nov;25(6):353-7.