e-ISSN: 0976-822X, p-ISSN:2961-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2023; 15(12); 166-170

Original Research Article

A Study on Absolute Eosinophil Count as a Prognostic Marker in Sepsis & Septic Shock in ICU

Nitin Kumar[1], Ranjeet Rana De[2], Akhileshwar[3], Akrity Singh[4], Saurav Shekhar[5], Rajbahadur Singh[6]

[1]Assistant Professor, Department of Trauma and Emergency, IGIMS, Patna, Bihar, India
[2]Assistant Professor, Department of Trauma and Emergency, IGIMS, Patna, Bihar, India
[3]Assistant Professor, Department of Trauma and Emergency, IGIMS, Patna, Bihar, India
[4]Assistant Professor, Department of Trauma and Emergency, IGIMS, Patna, Bihar, India
[5]Assistant Professor, Department of Trauma and Emergency, IGIMS, Patna, Bihar, India
[6]Assistant Professor, Department of Trauma and Emergency, IGIMS, Patna, Bihar, India

Received: 15-08-2023 Revised: 21-09-2023 / Accepted: 17-10-2023
Corresponding author: Dr Akhileshwar
Conflict of interest: Nil

Abstract

Aim: The aim of the present study was to find out the usefulness of absolute eosinophil count as a biomarker for sepsis and septic Shock In ICU.

Material & Methods: A prospective cohort study was conducted in the ICU of Subjects were recruited consecutively. 50 subjects were included in the study. The recruitment criteria were patients age ≥18 years admitted to the ICU.

Results: 74% were males and 26% were females. 78% had infection on admission. 48% had sepsis on admission. These findings contrasted when compared with the CRP levels, which did not differ significantly among the study groups.

Conclusion: In conclusion, the present study found an association between eosinopenia with the diagnosis of sepsis. However, considering the low sensitivity and specificity, our study did not recommend the use of absolute eosinophil count as single diagnostic tool.

Keywords: Eosinopenia, Absolute eosinophil count, Sepsis, Marker, Diagnosis.

Introduction

Sepsis, a syndrome of physiologic, pathologic and biochemical abnormalities induced by infection, is a major public health concern. [1] Sepsis exists on a continuum of severity, ranging from infection and bacteremia to sepsis and septic shock, which can lead to multiple organ dysfunction syndrome (MODS) and death. The clinical and biologic phenotype of sepsis is modified by pre-existing illness, co morbid conditions, medications and interventions.[1] Septic shock remains a leading cause of death worldwide, with a mortality rate greater than 40% despite substantial efforts to improve early identification and management. [2]

Mortality from sepsis is much higher than that from acute coronary syndrome or stroke. Roughly the mortality was 30% in sepsis and 80% in septic shock. The incidence of sepsis from the study was around 22 to 240 cases per 100,000 population, severe sepsis was 13 to 300 cases per 100,000 population and 11 septic shock cases per 100,000 population. [3] It is noted that diagnosis and treatment delay contribute to the high mortality of sepsis. Sepsis mortality was around similar, it was 61%. [4] It is noted that diagnosis and treatment delay contribute to the high mortality of sepsis. The clinical expression varies, and several factors influence the severity like infectious aetiology, site of infection, genetic background, comorbidities, immune status, age, time to initiation of treatment and appropriate treatment. [5]

The diagnosis of sepsis constantly encounters some important issues. Diagnosis of sepsis based on clinical findings leads to high false positive rate. Forty three percent of the patients diagnosed with sepsis on admission – using systemic inflammatory response syndrome (SIRS) criteria with suspected infection – later turned to be non-infection cases. [6] Various biological marker including procalcitonin, adrenomodulin, C-reactive protein (CRP), procalcitonin and interleukin (IL)-6 were examined to support the diagnosis and stratify the risk in sepsis. [7]

Eosinopenia is proposed as one potential biomarker in sepsis by different studies which have showed that eosinophil counts are low in infection and sepsis. [8,9] As the eosinophil count is already measured in routine clinical investigations, it would entail no additional costs. If comparable sensitivity and specificity could be demonstrated with established markers like Procalcitonin and CRP to diagnose and prognosticate sepsis, eosinophil count could be a very useful tool for clinician's at least in the group of patients with low socioeconomic status. [10]

The use of eosinopenia as a prognostic factor at ICU admission is attractive due to its availability, low cost, and minimum delay between taking blood samples and obtaining results. Its ease of application contrasts with complexity of various scales and algorithms currently used. While the scales with more clinical variables tend to show better performance compared to the simple ones, [11] different biomarkers have shown robust prognostic power even when they are used individually. [12-15]

Hence, this study was undertaken to find out the usefulness of Absolute eosinophil count as a biomarker for sepsis &Septic Shock In ICU.

Material & Methods

A prospective cohort study was conducted in the ICU of IGIMS, Patna, Bihar, India for one year. Subjects were recruited consecutively. 50 subjects were included in the study. The recruitment criteria were patients age ≥18 years admitted to the ICU. Subjects were excluded if died or discharged within 24 hours after admitted, had parasitic infection, asthma, atopic dermatitis, leukemia, lymphoma, autoimmune disease, Cushing syndrome or on long term steroid use.

Independent variable in this study was eosinopenia and the dependent variable was the diagnosis of sepsis. Eosinopenia was defined as absolute eosinophil count <50 cells/µL on admission. It was sampled from subjects' peripheral blood. Sepsis was diagnosed using Surviving Sepsis Campaign Criteria 2012, that is suspected or proven infection with minimum two of the following criteria: body temperature >38.3oC or <36.0oC, heart rate >90 beats/minute, respiratory rate >20 breaths/minute, altered mental status, significant edema or positive fluid balance (>20 mL/kg over 24 hour), plasma glucose >140 mg/dL in the absence of diabetes, leukocyte count >12,000/µL or <4,000/µL or immature forms >10%, CRP level >2 standard deviation (SD) and procalcitonin level >2 SD.13

Leukocyte and differential counting, collected from peripheral blood, were performed with Advia 2021i (Siemens) using flow cytometry technique. Absolute eosinophil count was calculated by multiplying the percentage of eosinophil retrieved from the machine counting with the total leukocyte count.

Along with the blood cell counting, we also measured procalcitonin level, hs-CRP (high-sensitivity C-reactive protein) level and blood culture. Procalcitonin was measured with VIDAS PC (Biomerieux) using sandwich immunoassay technique and fluorescent detection; hs-CRP was measured with Dimension XL 200 using turbidimetry technique; and blood culture was analyzed using Vitex 2 Compact.

According to the absolute eosinophil count level, subjects were grouped into eosinopenic and non-eosinopenic. Subjects without infection or with focal infection were grouped into non-septic while subjects with sepsis, severe sepsis and septic shock were grouped into sepsis. Statistical analysis was performed using SPSS version 23.0.

Results

Table 1: Subjects characteristics

Characteristics	N (%)
Sex	
• Male (%)	37 (74)
• Female (%)	13 (26)
Infection on admission (%)	39 (78)
Source of infection on admission	
• Respiratory tract (%)	40 (80)
• Skin and soft tissue (%)	6 (12)
• Urinary tract (%)	4 (8)
Sepsis on admission (%)	24 (48)
Positive blood culture in sepsis (%)	21(42)
Length of hospital stay (days)	12 (3-43)
Length of ICU stay (days)	6 (1-31)
Died	
• In-hospital (%)	7 (14)
• Within the first 3 day (%)	10 (20)

74% were males and 26% were females. 78% had infection on admission. 48% had sepsis on admission.

Table 2: Eosinophils count and CRP levels in patients with sepsis and septic shock

Eosinophils (cells/mm^3)	(IQR)	*P-Value*
Median on admission	5 (0-90)	.577
Median after 24 h	20 (0-160)	.01
Median after 48 h	95 (0-200)	.01
Median after 72 h	40 (0-200)	.012
Median after 96 h	100 (0-250)	01
CRP (mg/dL)		
Median on admission	18.7 (5.1-28)	.392
Median after 24 h	18.4 (11.8-30)	.397
Median after 48 h	19.5 (13.8-25)	.559
Median after 72 h	14 (5.5-21)	.398
Median after 96 h	15.9 (6.6-22)	.328

These findings contrasted when compared with the CRP levels, which did not differ significantly among the study groups.

Discussion

Sepsis is a highly heterogeneous syndrome which is the net result of interactions between the host and the pathogen involving various biochemical mediators and cascades of inflammation. Sepsis Definitions Task Force in 2016 proposed the Third International Consensus Definitions specifying that sepsis is a dysregulated host response to infection that leads to acute organ dysfunction.1 In 1991 the American College of Chest Physicians (ACCP) and Society of Critical Care Medicine (SCCM) Consensus Conference defined sepsis as a Systemic Inflammatory Response Syndrome (SIRS) that has a proven or suspected microbial aetiology. The clinical expression varies, and several factors influence the severity like infectious aetiology, site of infection, genetic background, comorbidities, immune status, age, time to initiation of treatment and appropriate treatment.2

74% were males and 26% were females. 78% had infection on admission. 48% had sepsis on admission. These findings contrasted when compared with the CRP levels, which did not differ significantly among the study groups. Several studies did not suggest eosinopenia as marker of sepsis. Those studies compared the eosinophil count with the other sepsis markers, those were procalcitonin, CRP and circulating-free DNA (cf-DNA). The studies summarized that the absolute eosinophil count could not differentiate infection from non-infection and sepsis from non-sepsis. [16-18] Eosinophils normally account for only 1 to 3% of peripheral blood leucocytes, and the upper limit of the normal range is 350 cells/mm^3. [19] Mechanisms that control eosinopenia in acute infection, also considered as an acute stress, involve mediation by adrenal glucocorticosteroids and epinephrine. [20] As a cheap test to diagnose sepsis on ICU admission, eosinopenia offers a higher degree of certainty than other currently available tests or markers. [21]

The precocity and precision with which the eosinophil trend follows the phases of the infection underline the value of the assay as a reliable parameter for monitoring acute infection. [22] Many recent studies have concluded eosinopenia as an accurate marker in blood strea infections in critically ill patients. Abidi et al, found eosinopenia as an early marker of mortality in critically ill patient. Also, they found that eosinopenia is a better marker of blood stream infections in critically ill patients than CRP and procalcitonin. [23-26] Different microbes might induce distinct responses, resulting in a variable up/do down regulation of circulating biomarkers and mediators. [27] Sepsis related markers research in developing countries are mainly focusing on Procalcitonin and CRP and it is widely accepted as a potential biomarker in sepsis. [28] Only few studies are available in this setting of eosinopenia as a marker of survival in peritonitis. [29]

Conclusion

In conclusion, the present study found an association between eosinopenia with the diagnosis of sepsis. However, considering the low sensitivity and specificity, our study did not recommend the use of absolute eosinophil count as single diagnostic tool.

References

1. Mervyn Singer etal. The third consensus definitions for sepsis and septic shock. JAMA. 2016;315(8):801-810.
2. Singer M, Deutschman CS, Seymour CW, et al. The Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3). JAMA 2016; 315: 801-10.
3. Jawad, I, Luksic, I and Rafnsson, SB. Assessing available information on the burden of sepsis: global estimates of incidence,

prevalence and mortality. 1, 2012, J Glob Health 2012;2(1):010404
4. Pangalila FJ, Herwanto V, Tjoa E, Hertanto M, Agustina Y, Haryanto S, Tang BM. Absolute Eosinophil Count as a Marker for Sepsis Diagnosis. In1st Tarumanagara International Conference on Medicine and Health (TICMIH 2021) 2021 Dec 1 (pp. 98-102). Atlantis Press.
5. Bone RC, Balk RA, Cerra FB, et al. Definitions for sepsis and organ failure and guidelines for the use of innovative therapies in sepsis. The ACCP/SCCM consensus conference committee. American College of chest physicians/society of critical care medicine. Chest. 1992;101(6):1644–1655.
6. Klouwenberg PMCK, Cremer OL, van Vught LA, Ong DSY, Frencken JF, Schultz MJ, dkk. Likelihood of infection in patients with presumed sepsis at the time of intensive care unit admission: a cohort study. Crit Care 2015; 19:319.
7. Pierrakos, C, Vincent, J-L. Sepsis biomarkers: a review. Crit Care 2010;14: R15.
8. Abidi Khalid, Khoudri Ibtissam, Belayachi Jihane, et al. Eosinopenia is a reliable marker of sepsis on admission to medical intensive care units. Crit Care. 2008;12: R59.
9. Shaaban H, Daniel S, Sison R, Slim J, Perez G. Eosinopenia is a good marker of sepsis in comparison to procalcitonin and C-reactive protein levels for patients admitted to a critical care unit in an urban hospital. J Crit Care. 2010;25(4):570–575.
10. Robert S. Munford. Harisson's Principles of Internal Medicine. Severe Sepsis and Septic Shock. vol 19. 2015; 2015:1751–1757.
11. Keegan MT, Gajic O, Afessa B. Comparison of APACHE III, APACHE IV, SAPS 3, and MPM0III and influence of resuscitation status on model performance. Chest. 2012;142(4): 851–8
12. Escobar-Valdivia EJ, González-Aguirre JE, Carrillo-Cisneros ER, Guerra-Leza KC, Mercado-Longoría R. Eosinophil count at intensive care unit admission was not predictor of hospital mortality: results of a case control study. Journal of intensive Care. 2015 Dec;3 (1):1-6.
13. Dellinger RP, Levy MM, Rhodes A, Annane D, Gerlach H, Opal SM, et al. Surviving sepsis campaign: international guidelines for management of severe sepsis and septic shock: 2012. Crit Care Med 2013;41(2):580-637.
14. Singer M, Deutschman CS, Seymour CW, Shankar-Hari M, Annane D, Bauer M, Bellomo R, Bernard GR, Chiche JD, Coopersmith CM, Hotchkiss RS. The third international consensus definitions for sepsis and septic shock (Sepsis-3). Jama. 2016 Feb 23;315(8):801-10.
15. 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.
16. Garnacho-Montero J, Huici-Moreno MJ, Gutiérrez-Pizarraya A, López I, Márquez-Vácaro JA, Macher H, Guerrero JM, Puppo-Moreno A. Prognostic and diagnostic value of eosinopenia, C-reactive protein, procalcitonin, and circulating cell-free DNA in critically ill patients admitted with suspicion of sepsis. Critical care. 2014 Jun;18(3):1-9.
17. Smithson A, Perelló R, Nicolas J-M. Is eosinopenia a reliable marker of sepsis? Critical Care 2009;13(3):409.
18. Anand D, Ray S, Bhargava S, Srivastava LM, Garg A, Gafoor I, dkk. Exploration of eosinopenia as a diagnostic parameter to differentiate sepsis from systemic inflammatory response syndrome: Results from an observational study. Indian J Crit Care Med 2016;20(5):285-90.
19. Rothenberg ME. Eosinophilia. N Engl J Med. 1998; 338:1592-600.
20. Bass DA, Gonwa TA, Szejda P, Cousart MS, DeChatelet LR, McCall CE. Eosinopenia of acute infection: Production of eosinopenia by chemotactic factors of acute inflammation. J Clin Invest. 1980; 65:1265-71.
21. 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.
22. Montesanti M, Testa G, Biagi C, Bartolini F. Trend of circulating eosinophils in healthy children and children suffering from infectious diseases. A retrospective study. Minerva Pediatr. 1997 May;49(5):179-86.
23. Krause JR, Boggs DR. Search for eosinopenia in hospitalized patients with normal blood leukocyte concentration. Am J Hematol. 1987 Jan;24(1):55-63.
24. Khosla SN, Anand A, Singh U, Khosla A, Haematological profile in typhoid fever. Trop Doct. 1995 Oct;25(4):156-8.
25. Shaaban H, Daniel S, Sison R, Slim J, Perez G. Eosinopenia: Is it a good marker of sepsis in comparison to procalcitonin and C-reactive protein levels for patients admitted to a critical care unit in an urban hospital?. J Critical Care. 2010 Dec 1;25(4):570-5.
26. Holland M, Alkhalil M, Chandromouli S, Janjua A, Babores M. Eosinopenia as a marker of mortality and length of stay in patients admitted with exacerbations of chronic obstructive pulmonary disease. Respirol. 2010 Jan;15(1):165-7.

27. Schuetz P, Christ-Crain M, Muller B. Procalcitonin and other biomarkers for the assessment of disease severity and guidance of treatment in bacterial infections. Advances Sepsis. 2008;6(3):82-9.
28. Uzzan B, Cohen R, Nicolas P, Cucherat M, Perret GY. Procalcitonin as a diagnostic test for sepsis in critically ill adults and after surgery or trauma: a systematic review and meta-analysis. Critical Care Med. 2006 Jul 1;34(7):1996-2003.
29. Jagdeesh TS, Mishra A, Saxena A, Sharma D. Eosinopenia as a prognostic marker in patients with peritonitis. ISRN Infectious Dis. 2012 Aug 28;2013.