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Original Research Article

Role of eosinophil count and neutrophil: lymphocyte count ratio as prognostic markers in patients with sepsis

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ABSTRACT

Background: Several biomarkers, such as C-reactive protein (CRP) and Procalcitonin have been used to indicate bacterial infection in sepsis. They have limited sensitivity and specificity with high cost, placing them practically out of reach for poor patients in developing countries like India. Hence the need to evaluate eosinophil count and neutrophil-lymphocyte count ratio (NLCR) as an indicator of sepsis considering their lower cost and easier accessibility. The present study was done to establish that eosinopenia and the neutrophil-lymphocyte count are simple and effective tools as prognostic biomarkers for sepsis.
Methods: A prospective observational study consisting of 50 patients with SIRS and sepsis on admission were studied. Neutrophil and lymphocyte count for first 4 consecutive days and then on alternate days up to one week was done. Absolute eosinophil count for first 2 consecutive days and then on alternate days up to one week was done.
Results: Eosinopenia was noted to have 79.3% sensitivity, 76.2% specificity, positive predictive value 82.2% and negative predictive value 95.4% in predicting diagnosis and prognosis of sepsis. Neutrophil-lymphocyte ratio was found to have 86.2% sensitivity, 85.7% specificity, positive predictive value of 89.2%, negative predictive value of 81.1% in predicting diagnosis and prognosis of sepsis.
Conclusions: Eosinophil count and neutrophil - lymphocyte count ratio are simple and effective prognostic markers of sepsis with low cost.

Keywords: Eosinophil count, NLCR, Prognostic biomarkers, Sepsis

INTRODUCTION

Several biomarkers, such as C-reactive protein (CRP) and Procalcitonin have been used to indicate bacterial infection in sepsis with limited sensitivity and specificity and high cost, placing them practically out of reach for poor patients in developing countries.[1,2] In an emergency care setting, both eosinopenia and NLCR are better predictors of bacteraemia, than routine parameters like CRP level, WBC count and neutrophil count.[3,4] Both these investigations are easily affordable. Eosinopenia can be used as a diagnostic marker of sepsis in critically ill patients. Sepsis is one of the most common causes of morbidity and mortality in the intensive care unit (ICU).[5] Sepsis is generally characterized by clinical and laboratory parameters that are not specific and can mislead because these parameters often change in critically ill patients with systemic inflammatory response syndrome (SIRS).[6]

METHODS

A prospective study was conducted on 50 patients with sepsis who were admitted in department of general surgery, Mamata General Hospital, Khammam, over a two-year period from October 2014 to September 2016.

Informed consent was taken. The protocol was approved by the Institutional ethical committee. During hospitalization, appropriate work up as deemed necessary was done and operated when required.

Patients of either sex, of age > 18 years admitted with a diagnosis of sepsis and willing to participate in the study were included in the study. Those with hematological cancer, HIV infection, bronchial asthma and other atopic disorders like hay fever, atopic dermatitis, allergic conjunctivitis, increased levels of eosinophil count as part of any parasitic infection, trauma patients and those who were unwilling to participate in the study were excluded from the study.

Following selection of subjects and after obtaining informed consent about proposed study, complete blood picture with total leukocyte count, differential leukocyte count, haemoglobin percentage, ESR was done.

Neutrophil and lymphocyte count for first 4 consecutive days and then on alternate days up to one week were done. Neutrophil-lymphocyte count ratio was calculated and cut off value was taken as 7. Absolute eosinophil count for first 2 consecutive days and then on alternate days up to one week were done; the cut off value was taken as 40cells/cmm.

Analysis of outcome measures were done using sensitivity, specificity, positive predictive value, negative predictive value.

RESULTS

The Present study was conducted over 50 Emergency surgical cases with features of sepsis admitted in the department of general surgery, Mamata general hospital between October 2014 to September 2016. Following observations and results were obtained from the study.

Table 1: Details of diagnosis.

Diagnosis	Number of cases N=50	Percentage
Gastric perforation	12	24%
Perforated gangrenous appendix	11	22%
Necrotising fasciitis	6	12%
Sigmoid volvulus	6	12%
Acute mesentric ischemia	6	12%
Duodenal perforation	4	8%
Obstructed inguinal hernia	2	4%
Ileo-psoas abscess	1	2%
Ileal perforation	1	2%
Ileo-ileal intussusception	1	2%
Total	50	100%

Diagnosis

In the present study, it was observed that maximum number of cases were diagnosed to be gastric perforation accounting 12 cases (24%). Next commonest cases were seen in perforated gangrenous appendix 11 cases (22%), followed by 6 cases (12%) each of necrotising fascitis, sigmoid volvulus and acute mesenteric ischemia, 4 cases (8%) of duodenal perforation and 2 cases (4%) of obstructed inguinal hernia along with 1 case (2%) each of ileo-psoas abscess, ileal perforation and ileo-ileal intussusception are seen. The details of diagnosis are given in Table 1.

Mode of infection

In the present study, it was observed that patients presented with both non-infectious causes (only SIRS) 22 cases and infectious causes (SIRS with SEPSIS) 28 cases. In cases due to infectious causes, sepsis was seen in 16 cases; 7 cases showed severe sepsis and septic shock were seen in 5 cases. The percentage of morbidity and mortality is more in patients with septic shock. The details of mode of infection are given in Table 2.

Table 2: Details of mode of infection.

	SIRS	Sepsis	Severe sepsis	Septic shock
Number of cases	22	16	7	5
Percentage	44%	32%	14%	10%

Eosinophil count

Based on the eosinophil count measured in patients on the first two consecutive days followed by every alternative day till one week, the cut off value was taken as 40cells/cmm. It was observed that more number of cases was seen below the cut of value (29 cases, 58%) and the rest of the cases were found to be above the cut of value (21 cases, 42%).

Sensitivity and specificity for eosinophil count

In the present study, 79.3% sensitivity, 76.2% specificity is seen for eosinopinea. Thus, eosinophil count is a better dignostic and prognostic marker in predicting the sepsis.

Positive and negative predictive value for eosinophil count

In the present study, positive predictive value 82.2%, negative predictive value 95.4% is seen for eosinopenia. This indicates eosinophil count is better diagnostic and prognostic marker of sepsis.

Neutrophil-lymphocyte ratio

Based on the neutrophil-lymphocyte ratio measured in patients on the first four consecutive days followed by alternate day till one week, the N/L ratio less than 7 was

observed in 21 cases (42%) and more than 7 is seen in 29 cases (58%).

Sensitivity and specificity for neutrophil-lymphocyte ratio

In the present study, 86.2% sensitivity, 85.7% specificity is seen for neutrophil-lymphocyte ratio. Thus neutrophil-lymphocyte ratio is a better prognostic marker in predicting the sepsis.

Positive and negative predictive value for neutrophil-lymphocyte ratio

In the present study, positive predictive value of 89.2%, negative predictive value of 81.1% is seen for neutrophil-lymphocyte. This indicates neutrophil-lymphocyte is better prognostic marker of sepsis.

DISCUSSION

Among surgical patients, sepsis is a leading cause of morbidity and mortality. A large epidemiologic study by Martin et al, determined that surgical patients account for nearly one third of sepsis cases in the United States.[7] A recent analysis of the National Surgical Quality Improvement Project Database determined that sepsis and septic shock were ten times more common than perioperative myocardial infarction and pulmonary embolism.[8]

In the study conducted by Mohan A et al, the mortality in patients with septic shock was 65.7%.[9] In the present study mortality in septic shock patients was 80%.

It was observed that 86% of abdominal cases are source of infection which indicates, in surgical patient's sepsis is more in abdominal cases such as gangrene of bowel, ileal perforation and acute *Mesentric ischaemia*.

The diagnosis of sepsis is difficult, particularly in the ICU where signs of sepsis may be present in absence of a real infection.[10] The effort of many investigating groups has been to find a reliable marker to discriminate the inflammatory response to infection from other types of inflammation. Gold standards for the diagnosis of infection do not exist; but procalcitonin is known to be among the most promising sepsis markers in critically ill patients, and is capable of complementing clinical signs and routine laboratory variables that are suggestive of sepsis.[11]

Eosinophil count

The procalcitonin plasma concentration measure remains expensive in countries with low income and is not systematically used at our hospital. In this study, the effectiveness of eosinophil count as a sepsis marker was assessed in the differential diagnosis between all sepsis-related conditions and SIRS.

The optimal eosinophil cutoff values have not yet been established and may differ depending on the clinical setting and the site and the etiology of infection. In the present study, the cut off value was taken as 40cells/cu.mm. 58% of the cases were below the cut off value and the rest of the cases were above the cut of value, i.e., 42%. Sensitivity and specificity of eosinophil count in the present study were 79.3% and 76.2% respectively. The findings of the present study are consistent with that of Khalid Abidi et al (80% Sensitivity and 80% specificity).[12]

In the present study, positive predictive value 82.2%, negative predictive value 95.4% is seen for eosinopenia. This indicates eosinophil count is better diagnostic and prognostic marker of sepsis.

Neutrophil-lymphocyte ratio

In the present study, the sensitivity is 86.2% and specificity is 85.7%. In the study conducted by Yong Xia et al (13), the sensitivity and specificity for NLR were 40.91% and 93.22% respectively. This suggests that NLR is good prognostic marker in sepsis.

In the study conducted by Ljungstrom LL et al, the NLCR shows significantly higher sensitivity than Procalcitonin at recommended cutoff levels for bacteremia. In severe sepsis with bacteremia NLCR 85% versus procalcitonin 70%.[14] In the present study sensitivity for NLCR is 86.2%. this is suggestive that NLCR can be used in the emergency department as a biomarker for bacteremia as well as severe sepsis and seems to perform as well as or even better than procalcitonin. Rapid response, low cost and no need for extra sampling make it useful as a screening tool.

CONCLUSION

Sepsis is one of the leading causes of in hospital mortality and morbidity among medical and surgical patients. Eosinophil count and neutrophil – lymphocyte count ratio are simple and effective prognostic markers of sepsis with low cost.

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