Section: Radiation Oncology

Original Research Article

A STUDY OF RELATIONSHIP BETWEEN THE NEUTROPHIL-TO-LYMPHOCYTE RATIO IN ACUTE PANCREATITIS AND ITS CORRELATION WITH SEVERITY

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Abstract

Background: Acute pancreatitis is an inflammatory condition of the pancreas characterized by abdominal pain and elevated levels of pancreatic enzymes in the blood. Acute pancreatitis is a leading gastrointestinal cause of hospitalization in the United States. In order to reduce the risk of early mortality and to develop early interventions to reduce morbidity and mortality, clinicians should identify the severity of Acute Pancreatitis and the presence of complications early. The neutrophil-lymphocyte ratio (NLR) is a more comprehensive biomarker that used neutrophil and lymphocyte counts to respond rapidly to the extent of inflammatory progression and serves as a useful predictive marker to identify the severity of AP. Objective: The aim of this study was to demonstrate the usefulness of the NLR in predicting the manifestation of Severe AP and organ failure in the early stages in patients with acute pancreatitis. **Materials and Methods:** We conducted a prospective, single-center, observational study in Department of General Medicine & Gastroenterology wards, SMS Medical College and attached group of hospitals, Jaipur, with a sample size of 140 patients. Results: The NLR was calculated in relation to the severity of pancreatitis. On admission, the mean NLR for patients with mild pancreatitis was 5.29 whereas it was 8.04 for patients with severe pancreatitis. The P – value was 0.001, which was statistically significant. Similarly, the NLR was calculated after 48 hours of admission and compared with the severity of pancreatitis. The mean NLR for patients with mild pancreatitis was 3.88 while for severe pancreatitis was 11.51. The P – value was <0.001, which was statistically significant. Conclusion: The NLR had a significant association both on admission and after 48 hours with the severity of AP. Neutrophil to Lymphocyte ratio (NLR) can be used as a predictor of severity of acute pancreatitis, right at the time of initial diagnosis.

INTRODUCTION

Acute pancreatitis is an inflammatory condition of the pancreas characterized by abdominal pain and elevated levels of pancreatic enzymes in the blood. Acute pancreatitis is a leading gastrointestinal cause of hospitalization in the United States.[1] The occurrence of acute pancreatitis appears to be increasing as the population is adapting sedentary lifestyle, increasing obesity, increasing alcohol consumption. The frequency of gallstones is arising as the most common cause of acute pancreatitis. An increase in the annual incidence for acute pancreatitis has been observed in numerous recent studies. Prognostic indices are used to speculate the severity of the disease process and to guide management, commonly used ones are Ranson's, BISAP, APACHE-II and the Balthazar computed tomography (CT) severity index.[2] Patients with mild AP have mortality rates of less than 1%, but it is rapidly increased up to 10-30% in cases with severe AP, and mortality in second phase is dependent on factors such as organ failure secondary to necrosis or interventional complications. Therefore, to reduce the risk of early mortality and to develop early interventions to reduce morbidity and mortality, clinicians should identify the severity of Acute Pancreatitis and the presence of complications early. Clinical diagnosis of acute pancreatitis is established by two of the following three characteristics: abdominal pain suggestive of acute pancreatitis, serum lipase levels (or amylase levels) at least three

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times greater than the upper limit of normal, and characteristic findings of acute pancreatitis on radiological imaging (CT, MRI or USG). So, early detection of severe pancreatitis is essential for proper care and management and to limit its complications. Neutrophil-to-lymphocyte ratio (NLR) is a simple parameter to easily assess the inflammatory status of a subject. It has proven its usefulness in the stratification of mortality in major cardiac events[3], as a strong prognostic factor in several types of cancers[4], or as a predictor and a marker of inflammatory or infectious pathologies and postoperative complications.[5] A normal range of NLR is between 1-2.[6] The aim of this study was to demonstrate the usefulness of the NLR in predicting the manifestation of Severe AP and organ failure in the early stages in patients with acute pancreatitis. A score based upon Ranson's criteria is one of the earliest scoring systems for severity in AP. Ranson's criteria consist of 11 parameters. Five of the factors are assessed at admission and six are assessed during the next 48 hours. Mortality increases with an increasing score. Using the 11-component score, mortality was 0 to 3 percent when the score was <3, 11 to 15 percent when the score was ≥3, and 40 percent when the score was ≥6.[7]

MATERIALS AND METHODS

This prospective observational cohort study was conducted in Department of General Medicine & Gastroenterology wards, SMS Medical College and attached group of hospitals, Jaipur from July 2021 to September 2022. A sample size of 140 participants was taken in our study.

Inclusion Criteria

1. Abdominal pain consistent with Acute Pancreatitis (acute onset, often radiating to the back, continuous, and severe pain)
2. Elevation over three times the upper normal limit of serum amylase/lipase
3. Characteristic findings of Acute Pancreatitis on abdominal ultrasonography (USG), contrast-mediated computed tomography (CT), or magnetic resonance imaging.

Exclusion Criteria:

1. Patients <18 years old Pregnancy
2. Patients with onset of symptoms >48 h ago
3. Patients with hemoproliferative disease
4. Patients receiving chemotherapy (in previous month)
5. Patients with chronic liver disease
6. Patients currently on steroids Patients who have received blood transfusion (in the previous month)
7. Patients with findings or symptoms of infections of other organ systems

Complete Blood Count, Liver Function Test, Kidney Function Test, Serum Electrolytes, Serum Amylase, Serum Lipase, USG/CECT Abdomen were done. Results were assessed. Data were collected in pre structured proforma.

RESULTS

In our study, we took in 140 individuals, out of which 27.1% were in the age group of 30-39 years. Only 8 individuals were of in the age group of 70-79 years. The mean age of our study was 43.84 years.

Males made up a majority with 70.7% (99) as against women who were 29.3% (41).

The most common presenting feature by far was Abdominal pain, which was prevalent in 114 cases, 81.4%. Less common presentations were early satiety, shortness of breath, and decreased urine output, in a total of one patient each.

Out of all the subjects, 40.7% of all patients were chronic alcoholics. 48.6% patients did not harbour any addictions.

Patients were distributed according to their Ranson score. Most common score shared was 2, in a total of 58 individuals (41.4%).

According to Ranson score, the patients were divided as mild and severe. 54.3% of all patients (76 subjects) placed in Mild Ranson category and 45.7% in Severe Ranson category.

55.3% of all individuals in the Mild Ranson category were in the age group of 30-39 years. Similarly 55.2% of all individuals in the Severe Ranson category were placed in the 40-49 years age group.

50.5 % of all male subjects were placed in the mild pancreatitis category, while 63.4 % of all female subjects were placed in the same. There were more female subjects in the mild category as compared to the severe category, while the ratio between mild and severe was almost equal in males.

Most patients in our study had elevated Amylase and Lipase, with Mild Pancreatitis having mean value of Amylase as 550.57 and Lipase as 413.79. Severe Pancreatitis on the other hand had a mean value of Amylase as 560.13 and Lipase as 489.22.

In our study, Total Leucocyte Count in relation to severity was found to be significant after 48 hours, with Severe Pancreatitis patients having TLC as 16.65 after 48 hours as against 10.63 for Mild Pancreatitis.

The absolute neutrophil counts were significant on both admission and after 48 hours. The ANC on admission was 9.28 for mild AP and 11.35 for severe AP. After 48 hours, 7.29 was the mean ANC for mild AP and 14.15 was the mean ANC for severe AP.

ALC, similarly was significant on both admission and after 48 hours. On admission, ALC was 2.48 in mild AP and 1.78 in severe AP, whereas it was 2.43 in mild AP and 1.78 in severe AP.

The NLR was significant both on admission and after 48 hours. On admission, the mean NLR was 5.29 in mild AP while 8.04 in severe AP, and after 48 hours,

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the mean NLR was 3.88 in mild AP and 11.51 in severe AP.

In our study, 15 patients (10.7%) died. Other 125 subjects (89.3%) survived. While looking at the Mortality in relation to age of patients, the highest mortality was found in the age group of 70-79 and 60-69 years of age. 12.2% out of all males expired and 10.1% out of all the females expired.

The mean Amylase and Lipase levels were higher in patients who expired as against the ones who survived. The mean Amylase levels in patients who expired was 689.6 and the Lipase levels were 519.13 in the same.

In our study, there was a significant relation in TLC counts with mortality after 48 hours. The mean TLC in patients who survived was 12.44 while those who expired was 21.21.

Our study also had a significant correlation between ANC with mortality after 48 hours. The mean value of ANC for those who survived 9.52 after 48 hours as against 17.94 in those who expired, respectively.

The absolute Lymphocyte count was not found to be significant in both on and after 48 hours in relation to mortality.

NLR was found to be significant in relation to mortality in both on admission and after 48 hours. The mean value of NLR for those who survived was 6.05 and 6.99 on admission and after 48 hours respectively. The NLR was found to be higher on both admission and after 48 hours as 10.65 and 10.48 respectively for those who expired.

For our study analysis, we discussed ROC curve for Ranson score in relation to severity and we observed that the Area under the Curve is 0.706 at admission and 0.855 at 48 hours. The sensitivity for NLR ratio was 85.9% on admission and 73.4% at 48 hours. The specificity for NLR ratio was 58.1% on admission and 91.8%. The critical cut off value was >3.85 on admission and > 8.25 after 48 hours. The study was found to be significant.

We discussed ROC curve for Ranson score in relation to mortality and we observed that the Area Under the Curve is 0.702 at admission and 0.696 at 48 hours. The sensitivity for NLR ratio was 60% on admission and 66.7% at 48 hours. The specificity for NLR ratio was 81.6% on admission and 76.8%. The critical cut off value was >8.94 on admission and > 9.55 after 48 hours. The study was found to be significant.

Table 1: Age distribution of study subjects

Age group (years)	N	Percentage
<30	26	18.6
30-39	38	27.1
40-49	29	20.7
50-59	18	12.9
60-69	21	15
70-79	8	5.7
Total	140	100
Mean ± SD	43.84 ± 15.24	
Median (Range)	43 (18 – 79 years)	

Table 2: Gender distribution of study subjects

Gender	N	Percentage
Male	99	70.7
Female	41	29.3
Total	140	100

Table 3: Frequency of clinical features among patients with acute pancreatitis

Clinical features	N	Percentage
Pain abdomen	114	81.4
Fever	27	19.3
Vomiting	75	53.6
Constipation	19	13.6
Obstipation	18	12.9
Jaundice	21	15
SOB	1	0.7
Early satiety	1	0.7
Nausea	4	2.9
Distension	2	1.4
Decrease urine output	1	0.7

Table 4: Distribution of study subjects according to their personal habit

Personal habit	N	Percentage
Chronic alcoholic	57	40.7
Chronic alcoholic + smoker	9	6.4
Chronic smoker	6	4.3
No addiction	68	48.6
Total	140	100

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Table 5: Distribution of study subjects according to their Ranson score

Ranson score	N	Percentage
0	1	0.7
1	17	12.1
2	58	41.4
3	11	7.9
4	11	7.9
5	15	11
6	12	8.6
7	11	7.9
9	3	2.1
11	1	0.7
Total	140	100

Table 6: Distribution of study subjects according to severity of pancreatitis

Severity of pancreatitis	N	Percentage
Mild (Ranson score 0 - 2)	76	54.3
Severe (Ranson score ≥3)	64	45.7
Total	140	100

Table 7: Neutrophil to lymphocyte ratio in relation to severity of pancreatitis

N:L ratio	Mild	Severe	P value
On admission	5.29 ± 4.66	8.04 ± 5.05	0.001 (S)
After 48 hours	3.88 ± 2.93	11.51 ± 7.65	<0.001 (S)

Table 8: Distribution of study subjects according to mortality

	N	Percentage
Mortality	15	10.7
Survived	125	89.3
Total	140	100

Table 9: Neutrophil to lymphocyte ratio in relation to mortality

N:L ratio	Survived	Mortality	P value
On admission	6.05 ± 4.41	10.65 ± 7.57	0.001 (S)
After 48 hours	6.99 ± 6.8	10.48 ± 6.15	0.04 (S)

Table 10: ROC curve analysis for N:L ratio for identifying severe pancreatitis

	NLR at admission	NLR after 48 hours
AUC (95% CI)	0.706 (0.617 – 0.794)	0.855 (0.787 – 0.923)
P value	<0.001 (S)	<0.001 (S)
Critical cutoff value	>3.85	> 8.25
Sensitivity	85.9%	73.4%
Specificity	58.1%	91.8%
PPV	63.2%	87%
NPV	83.1%	80%
Diagnostic accuracy	70.7%	82.9%

Table 11: ROC curve analysis for N:L ratio for predicting mortality

	NLR at admission	NLR after 48 hours
AUC (95% CI)	0.702 (0.546 – 0.858)	0.696 (0.553 – 0.836)
P value	0.011 (S)	0.013 (S)
Critical cutoff value	>8.94	>9.55
Sensitivity	60%	66.7%
Specificity	81.6%	76.8%
PPV	28.2%	22%
NPV	94.4%	95%
Diagnostic accuracy	79.3%	75%

DISCUSSION

Relation between Neutrophil – to – Lymphocyte Ratio and Severity of Acute Pancreatitis: Our study was based on the aim that NLR can be used as a marker to assess the severity of Acute Pancreatitis. Our study was conducted on 140 individuals. Out of the 140 patients, 99 were males while rest were females. Most patients in our study were in the age group of 30 - 39 years (27.1%) while only 8 patients were in the age group of 70-79 years (5.7%).

Clinical Features: The most common presenting feature by far was Abdominal pain, which was prevalent in 114 cases, 81.4%. This was followed by Vomiting in 75 subjects (53.6%). Further on, fever, constipation and obstipation were seen. Less common presentations were early satiety, shortness

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of breath, and decreased urine output, in a total of one patient each.

Rason Score: Patients were distributed according to their Ranson score. Most common score shared was 2, in a total of 58 individuals (41.4%). Following this, the next most common score was 1, in a total of 17 individuals (12.1%). The least common was a score of 11 (Maximum score) in 1 subject (0.7%).

Distribution of subjects on the basis of severity: According to Ranson score, the patients were divided as mild and severe. 54.3% of all patients (76 subjects) placed in Mild Ranson category and 45.7% (64 subjects) in Severe Ranson category.

Relation of NLR to the Severity of Acute Pancreatitis: The NLR was significant both on admission and after 48 hours. On admission, the mean NLR was 5.29 in mild AP (p value 0.001) while 8.04 in severe AP, and after 48 hours, the mean NLR was 3.88 in mild AP and 11.51 in severe AP. (p value <0.001).

Relation of NLR to Mortality: In our study, the NLR was found to be significant in relation to mortality in both on admission and after 48 hours. The mean value of NLR for those who survived was 6.05 and 6.99 on admission (p value: 0.001) and after 48 hours respectively. The NLR was found to be higher on both admission and after 48 hours as 10.65 and 10.48 respectively for those who expired. (p value: 0.04)

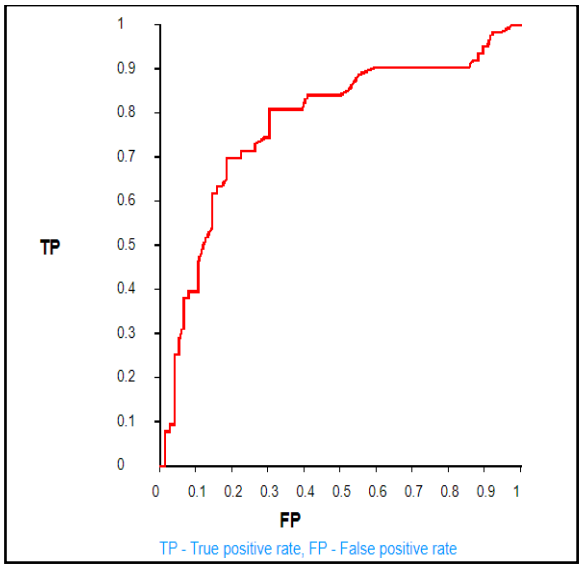

Fig 1: ROC curve analysis for NLR at admission for identifying severe pancreatitis

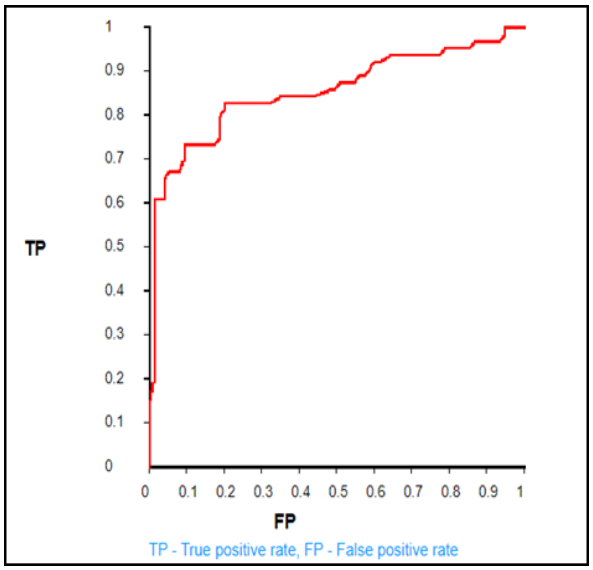

Fig 2: ROC curve analysis for NLR after 48 hours for identifying severe pancreatitis

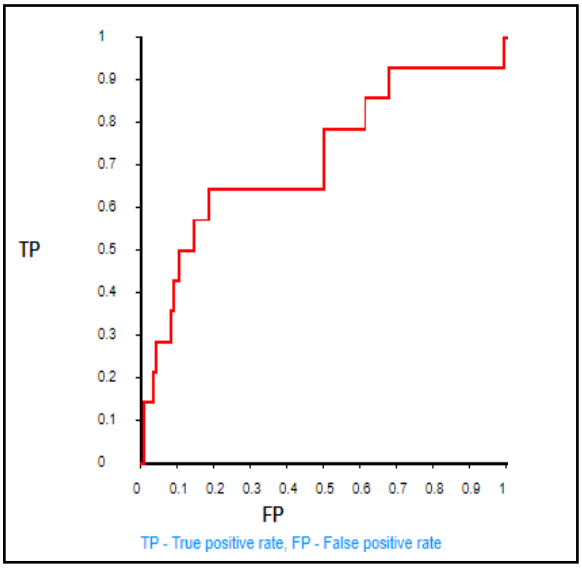

Fig 3: ROC curve analysis for NLR at admission for predicting mortality

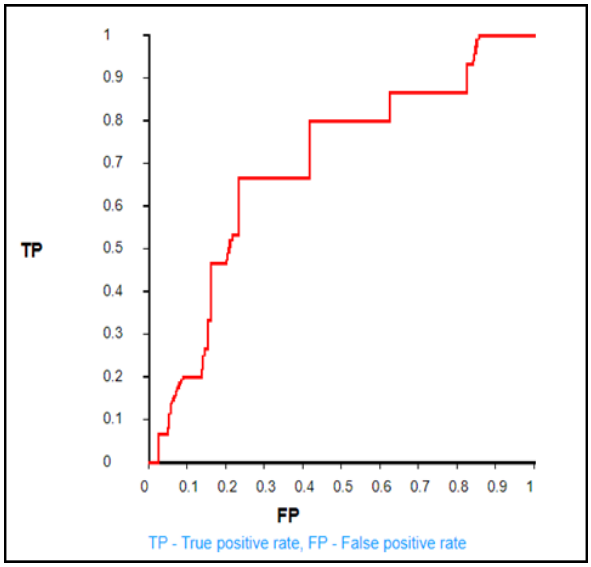

Fig 4: ROC curve analysis for NLR after 48 hours for predicting mortality

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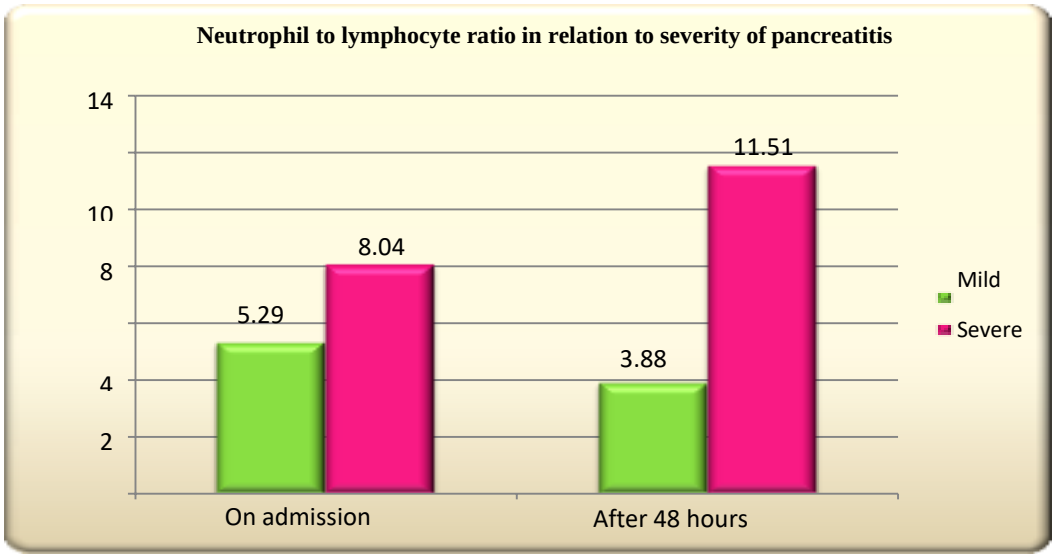

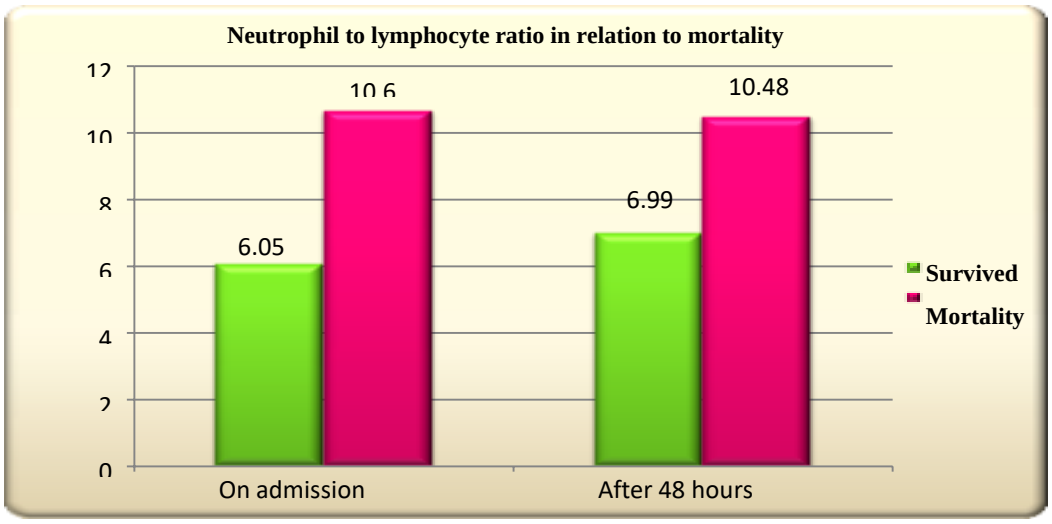

CONCLUSION

The NLR had a significant association both on admission and after 48 hours with the severity of AP. On admission, the mean NLR was 5.29 in mild AP while 8.04 in severe AP, and after 48 hours, the mean NLR was 3.88 in mild AP and 11.51 in severe AP. Neutrophil to Lymphocyte ratio (NLR) can be used as a predictor of severity of acute pancreatitis, right at the time of initial diagnosis.

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