

# Comparison of C-Reactive Protein, Neutrophil Count and Computed Tomography Severity Index in Predicting Outcome in Acute Pancreatitis

C-Reactive Protein and CT Index in Pancreatitis

Mumtaz Ahmad Khan<sup>1</sup>, Namrah Mahmood<sup>1</sup> and Saira Mahmood<sup>2</sup>

## ABSTRACT

**Objective:** To compare the severity and outcome of acute pancreatitis by comparing the CLI and computed tomography, the serum C-reactive protein and neutrophil levels.

**Study Design:** Prospective study

**Place and Duration of Study:** This study was conducted at the Department of General Surgery, Pakistan Institute of Medical Sciences Islamabad from June 2016 to June 2020.

**Materials and Methods:** A total of 354 patients were enrolled. All patients > 18 years, with confirmed diagnosis of AP were eligible to take part in the study. Patients with symptoms for more than 3 months at the time of data collection were excluded from the study. Complete clinical history and examination were performed on all patients. An improved abdominal computed tomography test was carried out intravenously for pancreas status assessment and computed tomography severity index (CTSI) measurement in these patients. Both patients were also tested on a neurological basis in addition to CTSI, neutrophil-lymphocyte ratio (NLR) and C-reactive protein (CRP). The length of hospital stay, ICU admission and hospital mortality have been measured for the seriousness of acute pancreatitis.

**Results:** The mean age of 54.5±12.4 years. The most frequent etiology of acute pancreatitis was gallstone, 195 (55.1%) followed by infection in 79 (22.32%) and hyperlipidemia in 50 (14.12%) of the patients. The majority of the patients (84;53.8%) with a CTSI score between 7-10 were hospitalized for more than two weeks. Hospital mortality within 72 hours was most frequent in patients who scored higher on CTSI. Out of the 25 patients who expired, 8 (32%) had moderate acute pancreatitis while 15 (60%) had severe acute pancreatitis. Neutrophil to leukocyte ratio and C-reactive protein were both more frequently elevated in patients with severe acute pancreatitis as assessed by hospital stay, ICU admission, and hospital mortality.

**Conclusion:** Computed tomography severity index and C-reactive protein were better predictors of patient severity and outcome while neutrophil-lymphocyte ratio did not seem to differ with the severity of the disease.

**Key Words:** C-reactive protein, computed tomography severity index, neutrophil, neutrophil-lymphocyte ratio.

**Citation of article:** Khan MA, Mahmood N, Mahmood S. Comparison of C-Reactive Protein, Neutrophil Count and Computed Tomography Severity Index in Predicting Outcome in Acute Pancreatitis. *Med Forum* 2020;31(10):123-126.

## INTRODUCTION

Acute pancreatitis is usually characterized as self-limiting disease with very minute systemic effects and is usually non-lethal. Nevertheless, in a small percentage of patients, complications develop including progression into a systemic inflammatory response syndrome (SIRS) and multiple organ failure.<sup>1</sup> The mortality rate of acute pancreatitis can be up to fifty per cent as per some studies.

<sup>1</sup>. Department of Surgery, PIMS, Islamabad.

<sup>2</sup>. Department of Surgery, Rawal Institute of Health Sciences, Islamabad.

Correspondence: Dr. Mumtaz Ahmad Khan Associate Professor of Surgery, PIMS, Islamabad.

Contact No: 0300-5241242

Email: drmumtazak@szabmu.edu.pk

Received: August, 2020

Accepted: September, 2020

Printed: October, 2020

In case of severe presentation of the disease, if the patient is recognized at the initial stage then the prognosis and mortality rate could be improved by timely intervention and close monitoring.<sup>2</sup> The mortality and severity of AP is linked with old age, obesity, consumption of tobacco and alcohol, serum, urea and creatinine levels and inflammatory response markers like cytokines, chemokines and others.<sup>1,2</sup>

For detecting and predicting acute pancreatitis severity and prognosis, measures of multifactorial clinical and laboratory measurement scales (such as Ranson score, BISAP (Security Index) score, acute physiology, and Chronic Health Assessment (APACHE II) are used for the existence of systemic inflammatory response syndrome (SIRS) Score, harmless acute pancreatitis score (HAPS).<sup>3-5</sup>

Currently, the AP updated computed tomographical severity (MCTSI) prognostic radiological scoring system, computed tomography extra-pankreatic inflammation (EPIC) and the renal rhythmic sign are in use. APACHE II (score 8) is considered to be the gold standard for all the above listed techniques.<sup>6,7</sup> It is

however, a highly complex and time-consuming technique and therefore in any scenario not a viable option.

Procalcitonin ( $> 1.8 \text{ ng / mL}$ ) and C-reactive protein (CRP) –  $150 \text{ mg / l}$  provide serum biomarker of some pregnancy-managed AP factors. It was proposed that these two variables be used to predict the seriousness of the disease. After 48 hours of admission, serum procalcitonin and CRP are evaluated.<sup>8</sup> Some inflammatory, such as interleukins (IL) 6, 8, and 10, are also used as an early indicator of acute pancreatitis<sup>9</sup> for assessing the extent of organ dysfunction in AP patients.

The recent targets are the platelet-to-lymphocyte link and the peripheral blood count of CD4+ T cells<sup>10</sup> for the assessment and forecasting of inflammation in AP patients' neutrophil-lymphocyte ratio (NLR). The precise determination of the degree of inflammatory reactions in an AP patient is an excellent guide for predicting or not intensive treatment complications or phases of the disease. However, there is insufficient and contentious comparative evidence on the medical and radiological scoring systems for the collection of results for AP.<sup>6-10</sup> In order to predict the severity and outcome of acute pancreatitis, the current trial aimed at comparing the clinical-computer gravity index (CTSI), serum CRP level, and neutrophil levels.

## MATERIALS AND METHODS

A prospective observational was conducted at the general surgery department, Pakistan Institute of Medical Sciences, Islamabad between June 2016 to June 2020 for a duration of five years. All patients  $>18$  years of age with verified AP diagnosis were included. At the time of data collection, patients with symptoms longer than 3 months were removed. Both participants were given with informed written or verbal consent. The criteria were used to diagnose AP<sup>(1)</sup> abdominal pain trait, <sup>(2)</sup> higher serum or lipase amylase than a typical level of three and <sup>(3)</sup> AP's standard studies on contrast-enhanced computed tomography (CT), MRI, or ultrasonography (US). A total of 354 patients were included with confirmed AP diagnosis. Both patients have had full clinical records and tests. There have been recorded etiologies like gallstones, alcohol, medications etc. Everyone was watched and monitored until they were released or died. Blood samples were obtained within 1 hour of admission for haematological and biochemical results. NLR was described as the absolute neutrophil count quotient to the absolute lymphocyte count. An improved abdominal CT test was carried out intravenously for pancreas status assessment and CTSI measurement in these patients. The spectrum of pancreatic inflammation, necrotizing and the presence or lack of fluid collections were determined for the CTSI. On entry, the score for Ranson and BISAP were determined. Both patients were also tested on a

neurological basis in addition to CTSI, lymphocyte neutrophil ratio (NLR) and C-reactive protein (CRP). The length of hospital stay, ICU admission and hospital mortality measured the seriousness of acute pancreatitis. The data was analyzed through SPSS-26.

## RESULTS

A total of 354 patients were presented with acute pancreatitis during the study period. The mean age plus standard deviation was 54.5 (12.4) years. Most frequent etiologies of acute pancreatitis in our setting were gallstone, 195 (55.1%) followed by infection in 79 (22.32%) and hyperlipidemia in approximately one-fourth of the patients. Mean Body mass index (BMI) of patients was  $22.8 \pm 5.4 \text{ kg/m}^2$ . Upon assessing the comorbidities, it was found that one-half the population had hypertension, followed by diabetes mellitus type 2 and chronic liver disease in 12.7% patients ((Table 1).

**Table No.1: Patients characteristics and clinical profile (n=354)**

Variable	No. (%)
Mean age (years)	54.5±12.4
<b>Gender</b>	
Male	240 (67.80%)
Female	111 (31.36%)
<b>Etiologies of AP</b>	
Gallbladder	195 (55.08%)
Hyperlipidaemia	50 (14.12%)
Infection	79 (22.32%)
Obscured causes	30 (8.47%)
Mean BMI ( $\text{kg/m}^2$ )	22.8±5.4
<b>Comorbidities</b>	
Diabetes mellitus	91 (37.3%)
Hypertension	122 (50%)
Chronic liver disease	31 (12.7%)
<b>Scoring systems</b>	
Ranson	3.6±1.9
CT Severity Index	3.2±1.4
Bedside index of severity in acute pancreatitis score	2.9±1.5
White blood cells in $\text{mm}^3$	15,745±4566
Neutrophil to lymphocyte ratio	18.1±16.4
C-reactive protein (mg/dL)	8.6±5.4
Mean Hospital stay (days)	10.5±3.6
ICU admission	149 (42.09%)
Hospital Mortality	25 (7%)

Two hundred and ninety-eight (84.18%) patients were treated conservatively, 57 (16.10%) patients underwent surgical intervention in the form of laparotomy, washout and drain placement. One hundred and forty-nine (42.09%) patients with severe acute pancreatitis were admitted to ICU for intensive support. 25/354 (7%) patients expired within 48 to 72 hours of presenting to the emergency department secondary to sepsis and co-morbid. The mean hospital stay

(standard deviation) was found to be  $10.5 \pm 3.6$  days. 156 (44.07%) patients were hospitalized for more than two weeks while the remaining 198 (55.93%) had a hospital stay of <2 weeks. The majority of the patients 84 (53.8%) with a CTSI score between 7-10 (severe) were hospitalized for more than two weeks. Hospital mortality within 72 hours was most frequent in patients who scored higher on CTSI. Out of the 25 patients who expired, 8 (32%) had moderate acute pancreatitis while 15 (60%) had severe acute pancreatitis. Neutrophil to leukocyte ratio and C-reactive protein were both more frequently elevated in patients with severe acute pancreatitis as assessed by hospital stay, ICU admission, and hospital mortality (Table 2).

**Table 2: Association of CTSI, CRP, and NLR with the severity of acute pancreatitis**

Modalities	Hospital stay of > 2 weeks (n = 156)	ICU admission (n = 149)	Mortality (n = 25)
<b>CTSI score</b>			
Mild	27 (17.3%)	24 (16.1%)	2 (8%)
Moderate	45 (28.8%)	40 (26.8%)	8 (32%)
Severe	84 (53.8%)	85 (57%)	15 (60%)
NLR	$28.5 \pm 15.2$	$26.2 \pm 12.6$	$29.4 \pm 14.3$
<b>CRP</b>			
Moderate elevation (1.0 to 10.0)	22 (14.1%)	19 (12.7%)	1 (4%)
Marked elevation (10.0-50.0)	42 (26.9%)	51 (34.2%)	7 (28%)
Severe elevation (>50.0)	91 (58.3%)	79 (53%)	17 (68%)

## DISCUSSION

This study was conducted to compare clinical values of CTSI (CT severity Index), neutrophil count and serum CRP to predict the outcome of acute pancreatitis. In our results, we found out that the majority of the patients were treated conservatively and the minority had undergone surgical procedures. 42.09% of the patients who were suffering from severe acute pancreatitis were transferred to the intensive care unit however, only 7% of the patients passed away in 48 to 72 hours. Majority of patients who had a severe CTSI score were hospitalized for more than 2 weeks and had a higher hospital mortality rate.

A study was conducted in 2015 in Rawalpindi, Pakistan, during the duration of nine months to find out the prevalence of patients having necrotising pancreatitis while also suffering from acute pancreatitis and serum CRP above 150mg/l.<sup>11</sup> It was concluded that CRP is the gold standard marker to find out the gravity

of pancreatitis. Patients who had a serum CRP level of less than 150 mg/l were less likely to progress into necrosis however those with serum CRP level of more than 150 mg/l were more likely to progress to acute necrotising pancreatitis. CRP was also concluded to be easily available and posed no economic burden.

Our results differed from a study done in 2018 by comparing different scoring systems such as CTSI, Ranson's and BISAP to find out the response of patients with pancreatitis.<sup>12</sup> The study was done on 106 who were diagnosed with acute pancreatitis. The BISHAP score was found to be an effective tool to foresee the prognosis of pancreatitis and also to find the patients who will be needed ICUs as a complication of acute pancreatitis. These numbers of patients could actually benefit from early life saving procedures such as resuscitation when needed.

Another study was conducted in 2005 in Karachi to find out if CT scan had an effect in management and prognosis of patients with pancreatitis.<sup>13</sup> In this study, it was found out that among the 40 patients with pancreatitis, there was no relationship between necrosis level and moderate pancreatitis. However, CTSI was found to have a correlation with complications and the level of damage in the pancreas. CT was also found to be useful with ultrasound for a few procedures involving drainage.

Another study was conducted in Iran in 2019 to examine if the ratio of neutrophils, C-reactive protein (CRP) and procalcitonin (PCT) had an effect on management and diagnosis of severe acute pancreatitis.<sup>14</sup> This study was conducted on patients with severe acute pancreatitis and mild acute pancreatitis. It was found out that procalcitonin, C-reactive protein and ratio of neutrophils were greater in patients with severe acute pancreatitis and not in mild acute pancreatitis. This proved that greater levels of procalcitonin, C-reactive protein and neutrophil ratio lead to greater chances of severe acute pneumonia.

In 2018, a study was done comparing the ratio between neutrophil and lymphocyte (NLR) and platelet and lymphocyte (PLR) and their effect on acute pancreatitis.<sup>15</sup> It was concluded that NLR and PLR work well with other systems of finding out the severity of acute pancreatitis but only for those with gallstone. In diseases such as alcoholic acute pancreatitis, PLR and NLR did not work well with other systems that were being used to find out the severity of acute pancreatitis. Although in previous studies<sup>16</sup>, it was found out that PLR was a more efficient system than NLR to find out survival rate in patients this study concluded that both were equally efficient.

In 2020, a study was done differentiating NLR, CRP, clinical values and scoring methods involving radiology to find out the death and severity level of patients suffering from acute pancreatitis.<sup>17</sup> Some others have focused on NLR as being the primary system to find out the severity and prognosis of certain diseases. A high NLR has been known to be associated with multi organ failure and SIRS<sup>18</sup> but in this study the BISAP score

system has also been proved to be effective in predicting the prognosis of patients with acute pancreatitis.

However, there proved to be some limitations in our study. A greater sample size could have ensured different probabilities in our data. An interview based questionnaire could have allowed more insight into the patients. The correlation between CRP, neutrophil count and CTSI was not fully studied more information is required in this area.

## CONCLUSION

Computed tomography severity index and C-reactive protein were better predictors of patient severity and outcome while neutrophil-lymphocyte ratio did not seem to differ with the severity of the disease.

### Author's Contribution:

Concept & Design of Study: Mumtaz Ahmad Khan  
 Drafting: Namrah Mahmood  
 Data Analysis: Saira Mahmood  
 Revisiting Critically: Mumtaz Ahmad Khan, Namrah Mahmood  
 Final Approval of version: Mumtaz Ahmad Khan

**Conflict of Interest:** The study has no conflict of interest to declare by any author.

## REFERENCES

- Portelli M, Jones CD. Severe acute pancreatitis: pathogenesis, diagnosis and surgical management. *Hepatobiliary Pancreatic Dis Int* 2017;16(2):155-9.
- Zhu Y, Pan X, Zeng H, He W, Xia L, Liu P, Zhu Y, Chen Y, Lv N. A study on the etiology, severity, and mortality of 3260 patients with acute pancreatitis according to the revised Atlanta classification in Jiangxi, China over an 8-year period. *Pancreas* 2017;46(4):504-9.
- Gülen B, Sonmez E, Yaylaci S, Serinken M, Eken C, Dur A, et al. Effect of harmless acute pancreatitis score, red cell distribution width and neutrophil/lymphocyte ratio on the mortality of patients with nontraumatic acute pancreatitis at the emergency department. *World J Emerg Med* 2015; 6(1):29.
- Gao W, Yang HX, Ma CE. The value of BISAP score for predicting mortality and severity in acute pancreatitis: a systematic review and meta-analysis. *PloS one* 2015;10(6):e0130412.
- Papachristou GI, Muddana V, Yadav D, O'connell M, Sanders MK, Slivka A, et al. Comparison of BISAP, Ranson's, APACHE-II, and CTSI scores in predicting organ failure, complications, and mortality in acute pancreatitis. *Am J Gastroenterol* 2010;105(2):435-41.
- Khanna AK, Meher S, Prakash S, Tiwary SK, Singh U, Srivastava A, et al. Comparison of Ranson, Glasgow, MOSS, SIRS, BISAP, APACHE-II, CTSI Scores, IL-6, CRP, and procalcitonin in predicting severity, organ failure, pancreatic necrosis, and mortality in acute pancreatitis. *Hpb Surg* 2013;2013.
- Komolafe O, Pereira SP, Davidson BR, Gurusamy KS. Serum C-reactive protein, procalcitonin, and lactate dehydrogenase for the diagnosis of pancreatic necrosis. *Cochrane Database Sys Rev* 2017;(4).
- Leal C, Almeida N. Predicting severity in acute pancreatitis: a never-ending quest GE-Portuguese. *J Gastroenterol* 2019;26(4):232-4.
- Rao SA, Kunte AR. Interleukin-6: an early predictive marker for severity of acute pancreatitis. *Indian journal of critical care medicine: peer-reviewed, official publication of Indian Society of Critical Care Med* 2017;21(7):424.
- İlhan M, İlhan G, Gök AF, Bademler S, VeritAtmaca F, Ertekin C. Evaluation of neutrophil-lymphocyte ratio, platelet-lymphocyte ratio and red blood cell distribution width-platelet ratio as early predictor of acute pancreatitis in pregnancy. *J Maternal-Fetal Neonat Med* 2016; 29(9):1476-80.
- Habib A, Mansoor J, Malik S, Pervaiz M, Adeel A. Frequency of Necrotizing Pancreatitis in Patients of Acute Pancreatitis With Raised Crp. *Pak Armed Forces Med J* 2015;65(6):759-63.
- Janjua SS, Zaman F, Qamar T. Comparison of Ranson's Score, BISAP, and CTSI in Predicting the Severity of Acute Pancreatitis. *J Islamabad Med Dent Coll* 2018;7(4):255-9
- Chishty IA, Bari V, Pasha S, Burhan D, Haider Z, Rafique Z. Role of computed tomography in acute pancreatitis and its complications among age groups. *J Pak Med Assoc* 2005;55(10):431.
- Liang Y, Zhao X, Meng F. Procalcitonin, C-Reactive Protein, and Neutrophil Ratio Contribute to the Diagnosis and Prognosis of Severe Acute Pancreatitis. *Iran J Public Health* 2019;48(12): 2177-86.
- Cho SK, Jung S, Lee KJ, et al. Neutrophil to lymphocyte ratio and platelet to lymphocyte ratio can predict the severity of gallstone pancreatitis. *BMC Gastroenterol* 2018;18.
- Feng JF, Huang Y, Chen QX. Preoperative platelet lymphocyte ratio (PLR) is superior to neutrophil lymphocyte ratio (NLR) as a predictive factor in patients with esophageal squamous cell carcinoma. *World J Surg Oncol* 2014;12(1):58.
- Gezer NS, Bengi G, Baran A, Erkmen PE, Topalak ÖS, Altay C, et al. Comparison of radiological scoring systems, clinical scores, neutrophil-lymphocyte ratio and serum C-reactive protein level for severity and mortality in acute pancreatitis. *Revista da Associação Médica Brasileira* 2020;66(6):762-70.
- Chen L, Lu G, Zhou Q, Zhan Q. Evaluation of the BISAP score in predicting severity and prognoses of acute pancreatitis in Chinese patients. *Int Surg* 2013;98(1):6-12.