

Diagnostic Accuracy of C- Reactive Protein In Predicting Mortality Among Patients With Acute Pancreatitis

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ABSTRACT

Objective To find out the diagnostic accuracy of serum C- reactive protein (CRP) in predicting the mortality in patients of acute pancreatitis patients within 28-days of admission to a hospital.

Study design Cross-sectional observational study.

Place & Duration of study Department of Surgery, Dr. Ruth K.M. Pfau Civil Hospital Karachi, from April 2022 to September 2022.

Methods All patients with the diagnosis of acute pancreatitis of any severity, were included. The serum CRP levels were checked at 48-hours after admission. The sensitivity, specificity, positive and negative predictive values (PPV, NPV) and diagnostic accuracy of the measured CRP level were assessed in predicting the mortality. Data were entered into the SPSS version 21. Chi square / Fisher exact tests were used post-stratification to find out the significance level according to the age, gender and duration of hospital stay.

Results A total 150 diagnosed patients of acute pancreatitis were enrolled. The mean age of the patients was 40.21 ± 11.07 years. There were 106 (70.7%) female and 44 (29.3%) male patients. The hospital stay on an average was 6.03 ± 2.19 days (from 4 to 25-days). The overall mortality among the study population was 15.3% (n=23). The overall mean CRP level among the study population was 150.00 ± 69.89 mg/dl. The diagnostic accuracy of elevated serum CRP was 58.7% in predicting 28-days mortality in acute pancreatitis.

Conclusion CRP levels determined at 48-hours after admission can be helpful in determining the risk of mortality in patients with acute pancreatitis.

Key words Acute pancreatitis, Diagnostic accuracy, C – reactive protein, Mortality, Multiple organ failure.

INTRODUCTION:

Acute pancreatitis is a common surgical emergency.¹ It is associated with significant morbidity and mortality. Gallstone disease is the most frequent contributory factor of acute pancreatitis in our population.² The

treatment of individuals with acute pancreatitis is determined by the severity of the disease.³ In severe variety the risk of multiple organ dysfunction (MOD) is high.⁴ The diagnosis is usually made by the presence of at least two of the three features which include typical epigastric pain radiating to back, tenderness in epigastrium and imaging tests showing typical signs of acute pancreatitis (bulky pancreatic parenchyma on ultrasonic examination) and elevated serum amylase and / or lipase levels. The lipase levels are more sensitive and specific.⁵

Different inflammatory markers are being used to assess the prognosis of the patients with pancreatitis. A number of scoring systems are also proposed to predict the mortality. This may help in planning

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treatment and counseling with the family.

A positive acute-phase protein called C-reactive protein (CRP) is used to denote the response of the body's natural immune system to various inflammatory events.⁶ It can be used as a prognostic indicator of severity of illness and survivability. It is considered as an instrument of objectively measured level of inflammation. An elevated CRP level is a significant indicator of deterioration of the condition of the patient in acute pancreatitis. This is readily available and a cost effective test. This study was planned to use only CRP levels as an inflammatory marker to predict the severity of acute pancreatitis and mortality.

METHODS:

Study design, place & duration: This was an observational cross-sectional study conducted from April 2022 to September 2022 at the surgical section of Dr. Ruth K. M. Pfau Civil Hospital and Dow University of Health Sciences Karachi.

Ethical considerations: The consent was taken from the patients and where applicable from family members. The synopsis of the study was approved by the REU of College of Physicians & Surgeons Pakistan.

Inclusion and exclusion criteria: All patients, between 20 years – 60-years of age, who presented with typical clinical history and physical findings of acute pancreatitis were included. Patients of acute pancreatitis as a result of trauma, post ERCP procedure and post-surgical pancreatitis, were excluded.

Sample size estimation: The Buderer equation for sensitivity and specificity research was utilized to calculate the total number of participants to be incorporated into the research project. We assumed a 95% confidence interval, 81.48% sensitivity, 91.04% specificity, 9% required precision, and a 22% fatality rate based upon previous studies.⁷⁻⁹ A sample size of 150 patients was obtained.

Study protocol: The non-probability sequential sampling technique was employed. All patients were admitted to the critical care unit. The CRP levels were estimated 48-hours after the admission. All patients were managed according to the recent guidelines for the management of acute pancreatitis.⁴ If they were discharged before 28th day of the admission, follow up was done in the outpatient department for documenting the final outcome. All information about patients was gathered on specially designed forms which included the demographic

details and the results of laboratory tests.

Statistical analysis: Data were entered into the SPSS version 21. Numerical variables like the age and CRP level were presented as mean \pm standard deviation (SD). For categorical data, like gender distribution, frequencies and percentages were used. Employing a 2 x 2 contingency table and a CRP level threshold > 121 mg/dl, as the standard of excellence, multiple metrics were determined for the survivability or deaths at the 28th post-admission day. This included sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and diagnostic precision. The findings were stratified according to the age, gender and duration of hospital stay. A post-stratification Chi-square test / Fisher exact test were applied to find out the statistical significance. A p value of less than 0.05 was considered as statistically significant.

RESULTS:

In this study of 150 patients, there were 106 (70.7%) females and 44 (29.3%) males. The age varied between 20-years to 60-years years. The mean age was 40.21 \pm 11.07 years. Sixty (40%) patients were < 35 years of age. The hospital stay on an average was 6.03 \pm 2.19 days (from 4 to 25-days). Of the total, 78 (52%) patients stayed for < 5 days. The overall mortality among the study population was 15.3% (n=23). The overall mean CRP level among the study population was 150.00 \pm 69.89 mg/dl. In 69 (46%) patients it was < 121 mg/dl. With a CRP level >121 mg/dl as the standard of reference, the diagnostic precision of the level of CRP to identify death within 28-days was 58.7%. Table I shows the details.

The stratification according to gender, age, and duration of hospital stay was done in order to demonstrate the effect of these variables on the outcome. Post-stratification sensitivity, specificity, PPV, NPV, and diagnostic accuracy were calculated. The results are presented in table II.

DISCUSSION:

Monitoring and risk stratification is of paramount importance in categorizing patients with acute pancreatitis and identifying the individuals at a high risk for morbidity and mortality.¹⁰ In the current research, we assessed the accuracy of CRP in determining the fatality in acute pancreatitis. The results demonstrated that high serum CRP levels at 48-hours after admission can be used as an inflammatory marker to stratify the risk of mortality in patients with a severe disease. In this study 23 (15.3%) patients died which is slightly less as compared to a previous study.¹⁰ Mortality in acute

Table I: Diagnostic Accuracy of CRP In Predicting 28-day Mortality Among Patients With Acute Pancreatitis

CRP levels (mg/dl)	Mortality		Total N=150	p value
	Yes (Positive) n=23	No (Negative) n=127		
> 121 (Positive) (n=81)	21 (91.3%) (TP)	60 (47.2%) (FP)	81	<0.0001*
< 121 (Negative) (n=69)	2 (8.7%) (FN)	67 (52.8%) (TN)	69	
Sensitivity	Specificity	PPV	NPV	Diagnostic Accuracy
91.3%	52.8%	25.9%	97.1%	58.7%

True positive (TP), True negative (TN), False positive (FP), False negative (FN), *Significant

pancreatitis is directly linked to the severity of disease and it can be as high as 30% in severe acute pancreatitis.¹¹

In this study sensitivity, specificity, predictive values and diagnostic accuracy of CRP level to diagnose 28-days mortality were calculated taking CRP level >121 as gold standard. The results showed that the diagnostic accuracy was 91.3%. A CRP level of >121 mg/dl was shown to be a somewhat reliable index. When evaluating CRP levels in individuals with acute pancreatitis for prognostic purpose, 48-hours after admission is a suitable time to distinguish between the mild and severe pancreatitis.^{8,13} CRP testing is easily available and of low-cost, thus ideal for any resource-limited set-up. However, the results of our study showed that CRP estimation alone is not sufficient to indicate mortality. Raised CRP levels has good sensitivity, but low specificity in predicting 28-days mortality. This could be because of low sample size or inclusion of both mild and severe types of pancreatitis patients.

Limitations of the study: Better results could be achieved with a good sample size and by accurate stratification of disease severity done by scoring systems such as BISAP, Ranson, APACHE and others. CRP estimation combined with other biomarkers and/or scoring systems might provide better and accurate prognosis of the disease. An important confounding variable is the time of onset of the disease and first encounter with the patient in emergency room. This can significantly alter the readings of CRP, and a delayed presentation may be associated with a significant increased level of CRP.

CONCLUSION:

Assessing the serum CRP levels at 48-hours after admission can be helpful in determining the risk of

mortality. It can also provide clue for prolonged hospitalization.

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Table II: Diagnostic Accuracy of CRP in Predicting 28-days Mortality Among Patients With Acute Pancreatitis After Stratification

Variable	CRP levels (mg/dl)	Mortality		Total	p value		
		Yes (Positive)	No (Negative)				
Gender							
Male	> 121 Positive	12 (92.3%) TP	18 (58.1%) FP	30	0.035*	Sensitivity	92.3%
	<121 Negative	1 (7.7%) FN	13 (41.9%) TN	14		PPV	40.0%
	Total	13	31	44		NPV	92.9%
Female	> 121 Positive	9 (90.0%) TP	42 (43.7%) FP	51	0.007*	DA	56.8%
	< 121 Negative	1 (10.0%) FN	54 (56.3%) TN	55		Sensitivity	90.0%
	Total	10	96	106		Specificity	56.3%
Age Group							
< 35 Years	> 121 Positive	1 (100.0%) TP	14 (93.3%) FP	15	0.250*	PPV	17.6%
	< 121 Negative	0 (0.0%) FN	45 (76.3%) TN	45		NPV	98.2%
	Total	1	59	60		DA	59.4%
> 35 Years	> 121 Positive	20 (90.9%) TP	46 (67.6%) FP	66	0.032**	Sensitivity	100.0%
	< 121 Negative	2 (9.1%) FN	22 (32.4%) TN	24		Specificity	76.3%
	Total	22	68	90		PPV	6.7%
Duration of Hospital Stay							
< 5 Days	> 121 Positive	3 (75.0%) TP	20 (27.0%) FP	23	< 0.074*	NPV	100.0%
	< 121 Negative	1 (25.0%) FN	54 (73.0%) TN	55		DA	76.7%
	Total	04	74	78		Sensitivity	75.0%
> 5 Days	> 121 Positive	18 (94.7%) TP	40 (75.5%) FP	58		Specificity	73.0%
	< 121 Negative	1 (5.3%) FN	13 (24.5%) TN	14		PPV	13%
	Total	19	53	72		NPV	98.2%
						DA	73.1%

True positive (TP), True negative (TN), False positive (FP), False negative (FN), *Significant

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