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Comparison of Serum Procalcitonin Levels with Glasgow Score to Predict Severity of Acute Biliary Pancreatitis

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ABSTRACT

Objective: To compare the diagnostic accuracy of serum procalcitonin levels versus the Glasgow score in predicting the severity of acute biliary pancreatitis.

Study Design: Cross-sectional validation study.

Place and Duration of Study: Department of General Surgery, Combined Military Hospital, Rawalpindi Pakistan, Dec 2021 to Apr 2022.

Methodology: One hundred twenty-three patients suffering from acute biliary pancreatitis were included in the study. The severity of pancreatitis was established based on contrast-enhanced computed tomography of the abdomen as per the Balthazar score. All patients were assessed using the Glasgow score for pancreatitis and received a test for serum procalcitonin levels at 24-hours post-admission.

Results: The mean age of our study sample was 49.03±8.88 years. The Glasgow score predicted that 51(41.5%) had severe disease and had a sensitivity of 61.4%, a specificity of 75.8% and an identical diagnostic accuracy of 69.1% for detecting severe acute biliary pancreatitis. Serum Procalcitonin levels at a cut-off of 0.5ng/mL as an indicator of the severity of pancreatitis had a sensitivity of 75.4%, a specificity of 63.6% and a diagnostic accuracy of 69.1%, which estimated that 67(54.5%) patients had severe disease.

Conclusion: Both serum procalcitonin levels and the Glasgow score were equally effective in predicting the severity of acute biliary pancreatitis. However, neither testing modality was sufficiently accurate in predicting the presence of severe acute biliary pancreatitis.

Keywords: Glasgow score, Pancreatitis, Procalcitonin.

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INTRODUCTION

Acute pancreatitis is estimated to be between 600 and 700 per 100,000 individuals annually. However, this may vary depending on geography. Western countries have a preponderance of cases associated with alcohol,while Eastern countries such as Pakistan have a higher incidence of biliary pancreatitis.[1] The disease is associated with a mortality rate as high as 21.1% in certain populations.[2] Early recognition of the severity of acute biliary pancreatitis and timely transfer to an early institution of intensive management results in shorter in-hospital stays and reduced morbidity and mortality.[3,4]

Procalcitonin is a relatively new marker which has been determined to be a highly specific indicator of inflammation secondary to bacterial infection and concurrent sepsis.[5,6] This compound is proposed to also be useful for the detection of the severity of pancreatitis due to the inflammation induced by the release of enzymes from the exocrine pancreas, which results in a vicious cycle of damage followed by further release of enzymes, which results in ever-increasing serum procalcitonin levels.[7,8] However, this compound is produced by the parafollicular C cells in the thyroid, the neuroendocrine cells in the lung and the intestines in response to bacterial infection and, as such, its role in predicting the severity of acute biliary pancreatitis remains controversial, as the role of bacteria in the pathogenesis of acute biliary pancreatitis is questionable, and the compound is raised in several other disorders as well.[9,10]

Acute biliary pancreatitis remains a common disease, and prediction of severity is an important tool for providing the appropriate management, which, in turn, is useful in reducing mortality. Numerous compounds and scoring systems have been devised with variable utility, and this study was conducted to determine the usefulness of procalcitonin in this regard

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and compare it to a more established modality, namely the Glasgow score for acute pancreatitis, to determine the role, if any, for procalcitonin in the management of acute biliary pancreatitis.

METHODOLOGY

The cross-sectional validation study was conducted from December 2021 to April 2022 in the Department of General Surgery, Combined Military Hospital, Rawalpindi after IERB approval. The WHO sample size calculator was used to calculate the sample size, keeping an expected sensitivity of 86.2%, expected specificity of 75%, expected prevalence of 57.1%.[11]

Inclusion Criteria: Patients of either gender, aged 18-60 years with acute biliary pancreatitis (confirmed presence of gallstones in the common bile duct) based on any two of the following: 1) characteristic abdominal pain, 2) serum amylase and/or lipase ≥3 times the upper limit of normal, and 3) characteristic findings on abdominal contrast-enhanced computed tomography, were included in the study.

Exclusion Criteria: Patients who had suffered from abdominal trauma, thyroid disorders, neoplastic disease, autoimmune illnesses, chronic infections or were on immunomodulatory drugs within the past month were excluded from the study.

All patients were thoroughly evaluated by history and clinical examination on enrollment in the study, along with demographic data collection. The severity of acute pancreatitis was based on contrast-enhanced computed tomography using the Balthazar score, as shown in Table-I, which was used to assess severity.

Table-I: Balthazar Score on Computed Tomography

Grade	Findings	Score
A	Normal pancreas	0
B	Enlargement of pancreas	1
C	Inflammatory changes in pancreas/peripancreatic fat	2
D	Ill-defined single peripancreatic fluid collection	3
E	Two or more fluid collections/ Necrosis	4

Severity	Grade
Mild	A or B
Moderate	C or D
Severe	E

All patients also underwent testing for serum procal-citonin levels (where a level of ≥0.5ng/mL indicated severe pancreatitis) and scored with the Glasgow score for acute pancreatitis, as shown in Table-II, 24 hours after admission.

Table-II. Glasgow Score for Acute Pancreatitis

Score	Finding
1	Age >55 years
1	White cell count >15x10^9/L
1	PaO2 <60 mmHg
1	Serum lactate dehydrogenase levels >600U/L
1	Serum aspartate aminotransferase levels >200U/L
1	Serum albumin <32g/L
1	Serum calcium <2mmol/L
1	Serum glucose >10mmol/L
1	Serum urea >16mmol/L

Interpretation: A score of 3 or more indicated severe pancreatitis.

Data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 26.0. Quantitative variables were expressed as Mean±SD and qualitative variables were expressed as frequency and percentages. Chi-square test was applied to explore the inferential statistics. The *p* value of ≤0.05 was considered statistically significant. Diagnostic parameters were calculated using a 2x2 table. Sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy were determined by using the standard formulae.

RESULTS

Our study sample was composed of 123 patients, with a mean age of 49.03±8.88 years. A total of 83 (67.5%) patients were female. The mean body mass index of the sample was 28.70±2.81kg/m^2. The patients in this study had a mean Glasgow score of 2.87±2.28, with 51(41.5%) having severe disease, according to this score. Serum procalcitonin levels were seen at the mean of 2.78±3.02 ng/mL, and the levels predicted severe disease in 67(54.5%) patients. Our "gold-standard" combination of abdominal contrast-enhanced computed tomography with an assessment of the Balthazar score showed that 57(46.3%) suffered from severe disease. The study results are displayed in Table-III, where the variables are divided according to gender. The 2x2 table for Procalcitonin is shown in Table-IV. Procalcitonin levels at a cut-off of 0.5ng/mL as an indicator of severity of pancreatitis had a sensitivity of 75.4%, a specificity of 63.6% and a diagnostic accuracy of 69.1%. The Glasgow Score for assessing the severity of pancreatitis had a sensitivity of 61.4%, a specificity of 75.8% and an identical diagnostic accuracy of 69.1%. The results for the various characteristics of the tests are shown in Table-V.

DISCUSSION

In this study, we have compared serum procalcitonin levels with a cut-off of 0.5ng/mL, with the

Table-III: Study results according to Gender (n=123)

Variables	Male	Female	*p*-value
Gender	40(32.5%)	83(67.5%)	-
Age (years)	48.88±9.56	49.11±8.59	0.892
Body Mass Index (kg/m^2)	28.36±2.86	28.87±2.78	0.357
Glasgow Score	2.84±2.71	2.89±2.05	0.909
Severe Disease as per Glasgow Score	15(37.5%)	36(43.4%)	0.536
Procalcitonin Levels (ng/mL)	2.73±2.79	2.80±3.14	0.911
Severe Disease as per Procalcitonin	23(57.5%)	44(53.0%)	0.640
Severe Disease as per Imaging/CECT Abdomen	15(37.5%)	42(50.6%)	0.172

Table-IV: Contingency Table for Presence of Severe Acute Pancreatitis according to Contrast-Enhanced Computed Tomography (n=123)

	Presence of Severe Acute Pancreatitis according to Contrast-Enhanced Computed Tomography	
	Yes/Positive	No/Negative
Presence of Severe Acute Pancreatitis according to Procalcitonin		
Yes/Positive	43(34.9%)	24(19.5%)
No/Negative	14(11.3%)	42(34.1%)

Table-V: Diagnostic Parameters (n=123)

Diagnostic Parameters	Values
Sensitivity=True Positive/(True Positive+False Negative)	75.4%
Specificity=True Negative/(True Negative+False Positive)	63.6%
Positive Predictive Value=True Positive/(True Positive+False Positive)	64.2%
Negative Predictive Value=True Negative/(True Negative+False Negative)	75.0%
Diagnostic Accuracy=(True Positive+True Negative)/All Patients	69.1%

Glasgow score in predicting the presence of severe acute biliary pancreatitis, to determine whether a simple biochemical marker can serve as a sufficient surrogate in place of unwieldy scoring systems at 24-hours post-admission.

Our study showed that serum procalcitonin levels, at a cut-off value of 0.5ng/mL, carry a sensitivity of 75.4%, specificity of 63.6%, positive predictive value of 64.2% and a negative predictive value and diagnostic accuracy of 75.0% and 69.1%, respectively. Khanna *et al*. reported that procalcitonin had a sensitivity of 86.4% for detecting severe acute pancreatitis, a specificity of 75.4% and a diagnostic accuracy of 81.0%.[11] The difference between this study and our results may have resulted from the testing time; our study tested procalcitonin levels 24-hours post-admission, while Khanna *et al*. conducted their tests at 4-hours.[11] One study reported dismal results for procalcitonin in their study with a sensitivity, specificity and diagnostic accuracy of 29%, 90% and 47%, respectively, which may be accounted for the way procalcitonin was tested in this study, i.e., via indicator strip method, instead of a quantitative assay.[12] Another study determined that a higher cut-off level of 1.77ng/mL was associated with a better diagnostic accuracy of 77.3%. In contrast, the lower cut-off of 0.5ng/mL was associated with accuracies in line with our study.[13] One study reported that an even higher cut-off level greater than or equal to 3.29ng/mL increased the diagnostic accuracy to 76%.[14] The consensus that can be drawn here is that at the standard cut-off of 0.5ng/mL, the diagnostic accuracy of serum procalcitonin levels for predicting the severity of acute pancreatitis is low and can only be increased by raising the cut-off levels.[15,16]

Our study showed that the Glasgow score had a sensitivity of 61.4%, specificity of 75.8%, positive predictive value of 68.6% and a negative predictive value and diagnostic accuracy of 69.4% and 69.1%, respectively. One study demonstrated that the Glasgow score had a sensitivity of 71.0%, a specificity of 78.0% and a diagnostic accuracy of 75.0% in detecting severe acute pancreatitis.[17]Another study reported that the Glasgow score had a diagnostic accuracy of 76.0%.[18]

We found that the use of a cumbersome score like the Glasgow score can be substituted with single tests like serum procalcitonin levels in the prediction of severity of acute pancreatitis, as they have a similar utility and serum procalcitonin levels are faster and simpler to perform. However, it is pertinent to note that these prediction modalities could be better.[19,20]

STUDY LIMITATIONS

Predicting the severity of pancreatitis involves several unwieldy, expensive methods with varying degrees of utility. We only used a quantitative method to estimate serum procalcitonin levels, and it needs to be clarified how accurate the test would be with other methods, such as the strip method. In addition, we only used a single low cut-off level for prediction, which may be why our results showed a lower diagnostic accuracy than other studies. Lastly, this study was limited by a smaller sample size and localization to more than one centre.

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CONCLUSION

Serum procalcitonin is a useful substitute to the Glasgow score in predicting the presence of severity in cases with acute biliary pancreatitis. However, our study demonstrated that, at low cut-off levels, the test's sensitivity, specificity and diagnostic accuracy, while comparable to other severity-assessing methods, left much to be desired. As such, sole reliance on this testing modality may need to be revised. Still, testing with higher cut-off values may result in improved diagnostic accuracy, which should be the focus of future research. Another avenue that may be explored is incorporating serum procalcitonin levels into existing scores to improve their diagnostic accuracy, which will require well-devised research protocols.

Conflict of Interest: None

Author's Contribution

Following authors have made substantial contributions to the manuscript as under:

MUK & MAA: Study design, drafting the manuscript, data interpretation, critical review, approval of the final version to be published.

SAZ & AZ: Concept, data acquisition, drafting the manuscript, approval of the final version to be published.

AIM & SRQN: Data acquisition, data analysis, data interpretation, critical review, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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