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Original Article

Diagnostic Accuracy of Bedside Index for Severity in Acute Pancreatitis and Modified Computed Tomography Severity Index in Determining the Severity of Acute Pancreatitis using Revised Atlanta Classification as the Gold Standard

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ABSTRACT

Objective: To determine the diagnostic accuracy of modified computed tomography severity index (CTSI) and Bedside index for severity in acute pancreatitis (BISAP) scoring system in predicting severity in acute pancreatitis, keeping the Revised Atlanta Classification (RAC) as the gold standard.

Study Design: Prospective longitudinal study.

Place and Duration of Study: Department of Gastroenterology, Pak Emirates Military Hospital, Rawalpindi Pakistan, Pakistan from Jan to Jul 2022.

Methodology: This study was conducted on 100 patients with acute pancreatitis, both genders and ages. Patients with chronic pancreatitis, pancreatic calcifications, dilated pancreatic duct, areas of atrophy and pseudocysts were excluded. Detailed history and physical examination, and laboratory investigations were performed. Modified CTSI, BISAP and RAC were calculated. RAC was used as the gold standard. Sensitivity, specificity and other diagnostic parameters were calculated using R programme.

Results: The mean age was 42.42±18.07 years. The males were 53%, and the females were 47%. CTSI was sensitive at 100%, specific at 58.43%, and overall diagnostic accuracy at 63%. BISAP was sensitive at 100%, specific at 68.54%, and overall diagnostic accuracy at 72%.

Conclusion: BISAP and modified CTSI can assess severe acute pancreatitis (SAP) at primary and secondary care levels, enabling early triage and referral to higher centers.

Keywords: Acute pancreatitis, Atlanta classification, BISAP score, CT severity index.

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INTRODUCTION

The term acute pancreatitis connotes the inflammation of the Pancreas having clinical manifestation from mild to severe, resulting in the release of pancreatic enzymes which cause self-destruction of this organ.[1] Acute pancreatitis can be mild, moderately severe, and severe according to the revised Atlanta classification (RAC).[2] In more than 80% of circumstances, pancreatitis is mild, having less mortality, but in about 20%, Severe Acute Pancreatitis (SAP) occurs, which has around a 30% mortality rate.[3,4] The outcomes of SAP are necrosis of the Pancreas, organ failure requiring admission to intensive care units and higher mortality (up to 40%).[5]

In clinical practice, early prediction of severity in acute pancreatitis is a great challenge for clinicians.[6,7] In many contemporary factors like obesity, age, use of alcohol and smoking are considered predicting factors for SAP.[8] Many scoring systems are available for predicting the severity of acute pancreatitis, like acute physiology and chronic health evaluation (APACHE) II, Ranson criteria, and Modified Computed Tomo-Graphy Severity Index (CTSI).[9]

Modified CTSI is an advanced form of computed tomography severity index imitating inflammation and necrosis of the Pancreas, organ failure and extra-pancreatic complications. One of the simplest scoring systems for severity prediction in acute pancreatitis is the bedside index for severity in acute pancreatitis (BISAP).[10]

The BISAP scoring system is versatile, inexpensive, and easily performed. Many variations are present for these tests in the literature. However, CT scan is only widely available in some centres having limited resources. To our knowledge, there is no local

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study. This study will provide the local data for these tests. The study aimed to determine the diagnostic accuracy of the MCTSI and BISAP scoring systems in predicting the severity of acute pancreatitis, keeping RAC as the gold standard.

METHODOLOGY

The prospective longitudinal study was conducted at the Department of Gastroenterology, Pak Emirates Military Hospital, Rawalpindi Pakistan, from January to July 2022, after ethical approval (Ltr no. A/28/134). The sample size was calculated using a sample size calculator for diagnostic studies (https://wnarifin.github.io/ssc/sssnsp.html), taking the prevalence of disease in the study population as 62%, 81.82% sensitivity, specificity 83.33% for BISAP.[11]

Inclusion Criteria: Patients of either gender or any age group, having acute pancreatitis based on the above criteria, were included from the study.

Exclusion Criteria: Patients with chronic pancreatitis, pancreatic calcifications, dilated pancreatic duct, areas of atrophy and pseudocysts were excluded from the study.

Patients were labelled positive for acute pancreatitis having two features; a) abdominal pain pathognomic of acute pancreatitis; b) 3-fold higher amylase level in serum; c) pathognomic feature of acute pancreatitis on CT or ultrasound of the abdomen. After detailed history and physical examination, laboratory investigations like HbA1c, haemoglobin, total leukocytes, platelets, oxygen saturation, C-reactive protein, amylase, lipase, urea, creatinine, bilirubin, alanine transaminase, alkaline phosphatase, and blood urea and nitrogen were performed.

All patients underwent abdominal ultrasonography admission and contrast-enhanced pancreatic protocol CT scan, MRCP (magnetic resonance cholangiopancreatography), and ERCP (Endoscopic retrograde cholangiopancreatography) 72 hours after symptom onset. BISAP scoring was calculated within the first 24 hours of admission on criteria such as Altered mental status (disorientation, somnolence, coma or stupor), blood urea nitrogen >25mg/dl, pleural effusion (chest X-ray or CT scan), age above 60 years and the systemic inflammatory response syndrome (SIRS).[12] SIRS was labelled positive if a patient had more than two features; a Pulse rate of more than 90beats/min, a respiratory rate of more than 20/min, temperature >38°C or <36°C, increased or decreased white blood cells, and more than 10% immature neutrophils. Each feature was given one pint, and for the prediction of SAP as per the BISAP score, the cut-off taken was 3.[13] Based on CTSI severity of acute pancreatitis was assessed according to Sahu *et al*.[14] The morphologic severity of acute pancreatitis was categorized as mild (0–3 points), moderate (4–6 points), or severe (7–10 points) on CT evaluation.

Atlanta 2012 classification was used to classify acute pancreatitis as mild, moderate and severe at discharge/death.[14] Mild acute pancreatitis was assigned when the patient had neither organ failure nor local complications; moderately severe if transient or local complications or both; and severe acute pancreatitis if the patient has persistent organ failure. Survival rate at three and six months follow-up was recorded. All patients were managed according to standard protocol using crystalloids, primarily ringer's lactate and inotropes.

Statistical analysis was conducted in R-programming version 4.1.2. Mean±SD were computed for continuous data and frequencies, along with percentages for qualitative variables. The 2x2 table was created of BISAP against the gold standard Atlanta classification for calculating true positive, true nega-tive, false positive and false negative. These values were put in the medical calculator (https://www. medcalc.org/calc/diagnostic_test.php) to calculate sensitivity, specificity and other diagnostic parameters. ROC curves were traced for both CTSI and BISAP.

RESULTS

The mean age was 42.42±18.07 years, ranging from 10-80 years. BISAP and CTSI both were sensitive at 100% and specific at 68.54% and 58.43%, respectively. The most common comorbidity was diabetes mellitus (DM). The most common risk factor for acute pancreatitis was smoking (14%) (Table-I). For BISAP against the revised Atlanta Classification (gold standard), the true positives (sensitivity) were 11(100%), and true negatives (specificity) were 61(68.54%). For CTSI against the gold standard, the true positives (sensitivity) were 11(100%), and the true negatives (specificity) were 52(58.43%) (Table-II). BISAP was sensitive at 100%, specific at 68.54%, and overall diagnostic accuracy at 72%. CTSI was sensitive at 100% and specific at 58.43%, and overall diagnostic accuracy was 63% (Table-III). Figure-1 shows the receiver operating characteristics curve for the CTSI score with an area under the curve of 0.8912. Figure-2 shows the receiver operating characteristics curve for the BISAP score with an area under the curve of 0.9454, showing excellent accuracy.

Table-I: Distribution of Gender, Comorbidities, Risk Factors and Prognosis (at 3rd and 6th month) (n=100)

Categories	n(%)
Gender	
Female	47(47.00)
Males	53(53.00)
Comorbidities	
Chronic obstructive pulmonary disease	1(1.00)
Diabetes mellitus	9(9.00)
Diabetes mellitus, Hypertension	11(11.00)
Diabetes mellitus, Obesity	1(1.00)
Hypertension	8(8.00)
Ischemic heart disease	1(1.00)
Multiple	6(6.00)
No comorbidities	49(49.00)
Obesity	1(1.00)
Obesity, Pre diabetes	5(5.00)
Prediabetes	6(6.00)
Previous history of acute pancreatitis	2(2.00)
Risk Factor	
Diabetes mellitus	9(9.00)
Nil	27(27.00)
Post Endoscopic Retrograde Cholangiopancreatography	17(17.00)
Pre diabetes	11(11.00)
Smoking	14(14.00)
Smoking & Pre diabetes	4(4.00)
Smoking, Alcohol, Diabetes mellitus	3(3.00)
Smoking, Diabetes mellitus	13(13.00)
Smoking, Post Endoscopic Retrograde Cholangiopancreatography	2(2.00)
Prognosis at 3 months	
Alive	93(93.00)
Dead	7(7.00)
Prognosis at 6 months	
Alive	87(87.00)
Dead	13(13.00)

Table-II: Cross Tabulation of Gold Standard against the Bedside Index for Severity in Acute Pancreatitis and Modified Computed Tomography Severity Index (n=100)

Characteristics	Gold Standard (RAC)	
	Non severe n=89	Severe n=11
Bedside Index for Severity in Acute Pancreatitis		
Non severe	61(68.54)	0(0.00)
Severe	28(31.46)	11(100.00)
Modified CT Severity Index		
Non severe	52(58.43)	0(0.00)
Severe	37(41.57)	11(100.00)

Table-III: Diagnostic statistics for Bedside Index for Severity in acute Pancreatitis and modified Computed Tomography Severity Index against the Gold Standard (n=100)

Statistics	BISAP		CTSI	
	Value	95% CI	Value	95% CI
Sensitivity(%)	100.00	71.51-100.00	100.00	71.51-100.00
Specificity(%)	68.54	57.83-77.97	58.43	47.49-68.79
Positive Likelihood Ratio	3.18	2.34-4.32	2.41	1.88-3.08
Negative Likelihood Ratio	0	-	0	-
Disease prevalence (%)	11.00	-	11.00	-
Positive Predictive Value(%)	28.21	22.43-34.80	22.92	18.86-27.55
Negative Predictive Value(%)	100.00	-	100.00	-
Accuracy (%)	72.00	62.13-80.52	63.00	52.76-72.44

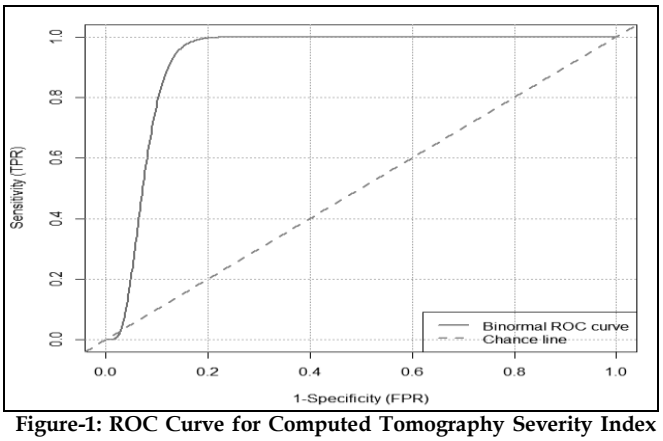

Figure-1: ROC Curve for Computed Tomography Severity Index (CTSI) score

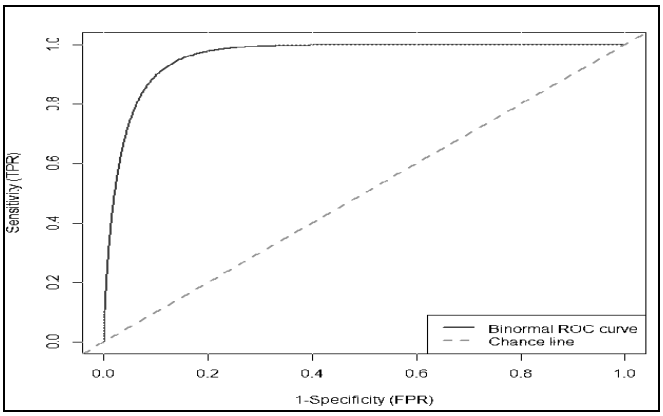

Figure-2: ROC curve for Bedside Index for Severity in acute Pancreatitis (BISAP) score

DISCUSSION

This study aimed to determine the diagnostic accuracy of modified CTSI and BISAP scoring systems in predicting the severity of acute pancreatitis (AP), keeping RAC as a gold standard. Our findings show that the sensitivity of both BISAP and CTSI was 100%, and the specificity was 68.54% for BISAP and 58.43% for CTSI. Our study showed that the BISAP score, which is easy to calculate and requires fewer expenses, is accurate. So this system can be applied for risk stratification and triage to decide referral to higher centres.[15] A previous study on the Indian population, including 87 patients with acute pancreatitis, reported that the BISAP score was sensitive in 80% and specific in 68.88%.[4] These results are similar to our findings.

A meta-analysis by Gao *et al*.[16] included 10 cohort studies and reported that pooled sensitivity for BISAP ≥3 was 51% and specificity was 91%. They also reported that when the cut-off value for SAP has adjusted to be ≥2, then sensitivity was 81%, and specificity was 70%. The difference in results showed variations across various populations. Gao *et al.* reported that the variations in diagnostic accuracy parameters were significantly associated with the location of the study, sample size, and prevalence of SAP.

Our study found that the area under the curve (AUC) or prediction ability of BISAP in the severity prediction of SAP was 0.9454. This shows that the BISAP score in our population can predict SAP with excellent accuracy. The study by Aggarwal *et al*.[13] Chen *et al*.[17] and Gao *et al*.[16] reported AUC as 0.975, 0.762 and 0.87, respectively.

Our results revealed that CTSI was 100% sensitive and 68.54% specific. These CTSI can diagnose positive cases of SAP with excellent accuracy. A study by Chatterjee *et al*.[4] reported that sensitivity and specificity for CTSI were 90% and 71.64%, respectively. These results are closer to our findings. Another study by Bollen et al.18 reported that the sensitivity and specificity of CTSI were 78% and 81%, respectively. Secondly, the CTSI score depends on morphological changes in the Pancreas, which can differ for the onset of pancreatitis.

CONCLUSION

Within the limitations of this study, it can be concluded that both BISAP and CTSI can be used to assess SAP at primary and secondary care levels to enable early triage and referral to higher centres.

Conflict of Interest: None.

Authors' Contribution

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

MBK & RSAK: Data analysis, drafting the manuscript, critical review, approval of the final version to be published.

RZAK & RUD: Study design, drafting the manuscript, data interpretation, approval of the final version to be published.

KS, RK & AM: Concept, critical review, data acquisition, drafting the manuscript, 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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