

Comparison of Acute Physiology and Chronic Health Evaluation II, Bedside Index for Severity in Acute Pancreatitis and Modified Computed Tomography Severity Index Scores in Predicting the Outcome in Acute Pancreatitis in a Tertiary Care Centre in Nepal

Rajesh Pandey,¹ Rahul Pathak,² Anurag Jha,² Arun Gnawali,² Dinesh Koirala²

¹Department of Gastroenterology, Civil Service Hospital, Kathmandu Nepal, ² Department of Gastroenterology, Maharajgunj Medical Campus, TUTH, Institute of Medicine, Kathmandu, Nepal.

ABSTRACT

Background: It is important to identify the severity of acute pancreatitis in the early course of the disease.

Methods: This prospective observational study included 83 patients with acute pancreatitis. The Acute Physiology and Chronic Health Evaluation II and the Bedside Index for Severity in Acute Pancreatitis scores were assessed within 24 hours of admission, and the modified computed tomography severity index score was calculated in those patients who underwent contrast enhanced computed tomography. The sensitivity, specificity, positive predictive value, and negative predictive value of scoring systems were calculated. The area under the curve was calculated for assessing the prognostic value of scoring systems.

Results: The modified computed tomography severity index was the most accurate score in predicting severity and local complications with an area under the curve of 0.92 and 0.91, respectively. The Bedside Index for Severity in Acute Pancreatitis score was the most accurate in predicting organ failure and the need for intensive care unit admission with an area under the curve of 0.70 and 0.78 respectively.

Conclusions: The results of this study demonstrate that modified computed tomography severity index and Bedside Index for Severity in Acute Pancreatitis scores had overall better predictive value than the Acute Physiology and Chronic Health Evaluation II score in predicting severity, organ failure, local complication, and need for intensive care unit admission.

Keywords: Acute pancreatitis; APACHE II; BISAP; modified CTSI

INTRODUCTION

Acute pancreatitis is one of the most common reasons for hospitalization with gastrointestinal disease. The overall mortality of admitted patients with acute pancreatitis is estimated to be 5% to 10% and varies from 3% in mild acute pancreatitis to 30% in severe acute pancreatitis.^{1,2}

It is critical to identify patients with severe AP who will benefit from early intensive care treatment.³ Since the proposal of Ranson criteria in 1974,⁴ several severities scoring systems have come into practice. In addition to identifying the demographic, clinical, and etiologic spectrum of the disease, this study aims to compare the APACHE II score,⁵ the BISAP score,⁶ and the MCTSI score⁷ in predicting the pancreatitis severity, organ failure,

local complications, ICU admission, and mortality. This may help to select an early, rapid, and accurate risk stratification, that allows early initiation of intensive care for patients with severe AP to prevent adverse outcomes and potential complications.

METHODS

This hospital-based prospective observational study included a total of eighty-three consecutive patients with acute pancreatitis admitted to the Department of Gastroenterology, Tribhuvan University Teaching Hospital (TUTH) from March 2019 to April 2020. Institutional Review Board approval was obtained to conduct the study [Ref No. 340 (6-11) E2075/076]. All relevant data were collected after obtaining informed consent from the participants or their guardians.

Correspondence: Dr Rahul Pathak, Department of Gastroenterology, Maharajgunj Medical Campus, TUTH, Institute of Medicine, Kathmandu, Nepal, Email: dr.rahuliom@gmail.com, Phone: +9779851113793.

All patients diagnosed with acute pancreatitis according to the revised Atlanta criteria⁸ were included in this study, however, patients with acute on chronic pancreatitis and those who were younger than 16 years of age were excluded from the study.

Patients were treated according to the institute's standard guidelines. The APACHE II score and BISAP score were determined from data at patient admission within 24 hours. Contrast-enhanced computed tomography (CT) of the abdomen was performed, and a MCTSI score was calculated in patients failing to improve (persistent pain, fever, nausea, unable to begin oral feeding) after 48-72 hours. Literature-based values of BISAP ≥ 2 ⁶, APACHE II ≥ 8 ⁵, and modified CTSI score of 8-10⁷ were taken as cut-off values for severe acute pancreatitis in this study. Patients were followed up until discharge or in-hospital death.

All the relevant collected data were compiled in a master chart and further statistical analysis of the results was done by computer software devised with statistical package for social service (SPSS) version 23. Descriptive statistical analysis was performed as frequency and percentage (%). Sensitivity, specificity, PPV, and NPV of APACHE II, BISAP, and MCTSI scores in predicting MSAP and SAP, organ failure, local complications, ICU admission, and mortality were calculated. Receiver operating characteristics (ROC) curves for MSAP and SAP, organ failure, local complications, ICU admission, and mortality were plotted for APACHE II, BISAP, and MCTSI scores, and the predictive accuracy of each scoring system was measured by the area under ROC curve (AUC) with 95% confidence interval.

RESULTS

A total of 83 patients with acute pancreatitis were included in this study. The mean age of the studied patients was 43.60 ± 16.13 years, and 52 patients (62.7%) were male. Causes of AP included alcohol (48.2%), biliary (22.9%), hypertriglyceridemia (12%), idiopathic (12%), post ERCP (2.4%), pancreatic divisum (1.2%), and carcinoma head of the pancreas (1.2%). Eleven (13.3%) patients had recurrent episodes of acute pancreatitis.

The majority of the patients had moderately severe pancreatitis (MSAP) (53%), followed by mild pancreatitis (37.3%). Twenty-six patients (31.3%) had an APACHE II score of ≥ 8 , while 31 patients (37.3%) had a BISAP score of ≥ 2 . According to the modified CTSI score, 16 patients (24.6%) had severe pancreatitis (Table 1).

Table 1. Severity of acute pancreatitis

Scoring System	Number	Percentage (%)
BISAP		
≥ 2	31	37.3
< 2	52	62.7
APACHE II		
≥ 8	26	31.3
< 8	57	68.7
Revised Atlanta Classification		
Mild	31	37.3
Moderately Severe	44	53
Severe	8	9.7
Modified CTSI score		
Mild (0-2)	12	18.5
Moderate (4-6)	37	56.9
Severe (8-10)	16	24.6

Organ failure was seen in 30 patients (36.1%), while local complications developed in 45 patients (54.21%), the majority of whom (28.9%) had acute peripancreatic fluid collections (APFC) (Table 2).

Table 2. Complications

Complications	Number	Percentage(%)
Organ Failure		
Transient Organ Failure	22	26.5
Persistent Organ Failure	8	9.6
Local Complications		
APFC	24	28.9
ANC	17	20.5
Pseudocyst	3	3.6
WON	1	1.2
Other complications		
Pleural effusion	44	53
Ascites	12	14.4
Splenic vein thrombosis	4	4.8
Pancreaticopleural fistula	2	2.4
Lymphadenopathy	2	2.4
Pancreaticocolonic fistula	1	1.2
Pancreaticoperitoneal fistula	1	1.2
Left Subcapsular abscess	1	1.2

The median length of stay in hospital was 8 days (IQR 6-12). Seventeen patients (20.5%) were admitted to ICU and the median length of ICU stay was 6 days (IQR 3-8). Out of 83 patients, only 1 patient who underwent necrosectomy died.

The MCTSI was the most accurate score in predicting moderately severe and severe pancreatitis (AUC 0.919), in predicting local complications (AUC 0.914), and in predicting mortality (AUC 0.867), while the BISAP score was the most accurate score in predicting organ failure

(AUC 0.701) and in predicting the need for ICU admission (AUC 0.782) (Table 3).

The modified CTSI score ≥ 4 had the highest sensitivity and negative predictive value in predicting severity (95.9 and 81.8% respectively), organ failure (88 and 72.7% respectively), and local complications (97.7 and 90.9% respectively), while BISAP ≥ 2 had the highest sensitivity and negative predictive value in predicting severity (38.7% and 71.2% respectively) (Table 4).

Table 3. AUC (95% CI) of different scoring systems in predicting MSAP and SAP, organ failure, local complications, ICU admission and mortality.

	MSAP and SAP	Organ failure	Local complications	ICU admission	Mortality
APACHE II	0.61 (0.48-0.73)	0.65 (0.53-0.77)	0.54 (0.41-0.66)	0.64 (0.48-0.79)	0.70 (0.57-0.84)
BISAP	0.77 (0.67-0.87)	0.70 (0.58-0.82)	0.67 (0.56-0.79)	0.78 (0.68-0.89)	0.73 (0.53-0.94)
MCTSI	0.92 (0.85-0.99)	0.55 (0.41-0.70)	0.91 (0.84-0.99)	0.76 (0.64-0.88)	0.87 (0.73-1)

Table 4. Predictive value of different scoring systems in predicting MSAP and SAP, organ failure, local complications, ICU admission, and mortality.

	Sensitivity (95% CI)	Specificity (95% CI)	PPV (95% CI)	NPV (95% CI)
MSAP and SAP				
APACHE II ≥ 8	40.4 (27-54.9)	83.9 (66.3-94.6)	80.8 (63.8-90.9)	45.6 (45.3-67.5)
BISAP ≥ 2	51.9 (37.6-65.9)	87.1 (70.2-96.4)	87.1 (72.3-94.6)	51.9 (44.1-59.6)
MCTSI ≥ 4	95.9 (86-99.5)	60 (32.3-83.7)	88.7 (80.8-93.6)	81.8 (52.1-94.9)
Local complications				
APACHE II ≥ 8	37.8 (23.8-53.5)	76.3 (59.8-88.6)	65.4 (48.8-78.9)	50.9 (43.7-58)
BISAP ≥ 2	48.9 (33.7-64.2)	76.3 (59.8-88.6)	70.9 (56.2-82.3)	55.8 (47.4-63.8)
MCTSI ≥ 4	97.7 (87.7-99.9)	47.6 (25.7-70.2)	79.2 (71.7-85.2)	90.9 (57.8-98.7)
Organ failure				
APACHE II ≥ 8	36.7 (19.9-56.1)	71.7 (57.7-83.2)	42.3 (27.9-58.1)	66.7 (59.2-73.4)
BISAP ≥ 2	60 (40.6-77.3)	75.5 (61.7-86.2)	58.1 (44.3-70.7)	76.9 (67.7-84.1)
MCTSI ≥ 4	88 (68.8-97.5)	20.5 (9.3-36.5)	41.5 (36.4-46.8)	72.7 (43.9-90.1)
ICU admission				
APACHE II ≥ 8	34.6 (17.2-55.7)	85.9 (74.2-93.7)	52.9 (32.9-72.1)	74.2 (68.1-79.5)
BISAP ≥ 2	38.7 (21.9-57.8)	90.4 (78.9-96.8)	70.6 (48.3-86.1)	71.2 (64.9-76.8)
MCTSI ≥ 4	30.2 (18.3-44.3)	100 (71.5-100)	100 (71.5-100)	22.9 (19.9-26.2))
Mortality				
APACHE II ≥ 8	100 (2.5-100)	69.5 (58.4-79.2)	3.8 (2.8-5.3)	100 (2.5-100)
BISAP ≥ 2	100 (2.5-100)	63.4 (52.1-73.8)	3.2 (2.4-4.2)	100 (2.5-100)
MCTSI ≥ 4	100 (2.5-100)	17.4 (9.1-29.1)	1.9 (1.7-2.1)	100 (2.5-100)

DISCUSSION

Early evaluation of the severity of acute pancreatitis allows the clinician to identify patients with severe acute pancreatitis who will benefit from early intensive care therapy. However, no simple scoring system with maximal utility is available, highlighting the need for

the development of unique models to achieve further improvement in predictive accuracy.

In this study, based on AUC comparisons, the MCTSI (AUC 0.92) was the most accurate score in predicting moderately severe and severe pancreatitis, followed by the BISAP score (AUC 0.77) and APACHE II (AUC 0.61).

MCTSI score ≥ 4 was also found to have a high sensitivity (95.9%) and negative predictive value (81.8%) for predicting moderately severe and severe pancreatitis. This is similar to the findings of the other study⁹, where modified CTSI had the highest accuracy (0.92). However, it was poor in predicting severity in another study.¹⁰

The BISAP score (AUC 0.70) had the highest AUC in predicting organ failure, followed by the APACHE II score (AUC 0.65) and MCTSI score (AUC 0.55). In contrast to this finding, APACHE II had been most accurate (AUC 0.99), in predicting the presence of organ failure in one study,¹¹ while MCTSI had the highest AUC (0.89) in another study.¹⁰ However, MCTSI score ≥ 4 had the highest sensitivity (88%) and NPV (72.7%) in predicting organ failure in this study.

In this study, MCTSI had an outstanding performance in predicting local complications, with an AUC of 0.91, followed by BISAP score (AUC 0.67) and APACHE II score (AUC 0.54), which is similar to another study,¹¹ in which MCTSI demonstrated the highest AUC (0.98) in predicting local complications. In one of the studies¹⁰ using modified CTSI, researchers found modified CTSI to have good performance (AUC 0.79) in predicting local complications as compared to APACHE II and BISAP. MCTSI score ≥ 4 had the highest sensitivity (97.7%) and NPV (90.9%) in predicting local complications in this study. This is fairly similar to the findings of the other study.¹¹ This outstanding performance of MCTSI in predicting local complications is because it is a radiological parameter.

CONCLUSIONS

The modified CT severity index (MCTSI) was the most accurate score in predicting moderately severe and severe pancreatitis and local complications, while the Bedside Index for Severity in Acute Pancreatitis (BISAP) score was the most accurate in predicting organ failure and the need for ICU admission. The MCTSI score ≥ 4 had the highest sensitivity and negative predictive value in predicting moderately severe and severe pancreatitis, organ failure, and local complications. The results of this study demonstrate that MCTSI and BISAP scores had overall better predictive value in predicting moderately severe and severe pancreatitis, organ failure, local complication, and need for ICU admission.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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