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A COMPARATIVE EVALUATION OF BEDSIDE INDEX FOR SEVERITY IN ACUTE PANCREATITIS AND MODIFIED CT SEVERITY INDEXSYSTEMS IN THE EARLY PREDICTION OF SEVERITY IN ACUTE PANCREATITIS

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ABSTRACT **Background:** Acute pancreatitis is an inflammatory condition of pancreas caused by auto digestion of the gland by its digestive enzymes leading to functional impairment and morphological changes. Several clinical scoring systems have been developed to assess the severity of pancreatitis. The patient outcome can be improved by early detection of the severity of disease and triaging patients correctly towards intensive care units based on severity. Hence, this study was planned to compare Bedside Index for Severity in Acute Pancreatitis (BISAP) score with Modified Computed Tomography Severity Index (MCTSI) in predicting the outcomes in acute pancreatitis. **Methods:** A Prospective hospital-based study was conducted among 85 study participants with diagnosis of Acute Pancreatitis in Department of General Surgery, HIMS Teaching Hospital, Hassan. BISAP score and MCTSI were calculated **Results:** The mean age was 34.34±10.12 years. 12% of the study participants had pancreatic necrosis and 30% had organ failure. 97% had a favourable outcome which was recovery. 88% had mild pancreatitis according to BISAP Severity grade and 12% had severe pancreatitis. 62% of the participants had moderate pancreatitis, 26% had mild pancreatitis and 12% had severe pancreatitis according to MCTSI Severity grade. The association between BISAP and pancreatic necrosis, organ failure was found to be statistically significant. The association between MCTSI and pancreatic necrosis, organ failure, patient outcomes was found to be statistically significant. **Conclusions:** BISAP and MCTSI grading are both useful in predicting severity of pancreatitis, possibility of organ failure, and death in patients with acute pancreatitis. BISAP scoring can be calculated at admission, repeatedly at bedside for severity grading, serial monitoring.

KEYWORDS : Acute pancreatitis; BISAP; MCTSI

INTRODUCTION

Acute pancreatitis is an inflammatory condition of pancreas caused by auto digestion of the gland by its digestive enzymes leading to functional impairment and morphological changes [1]. This condition may recur intermittently giving rise to chronic pancreatitis [2]. Severe acute pancreatitis is seen in about 25% of cases of acute pancreatitis [3].

The diagnosis of AP is established by the presence of at least 2 of the following: stereotypical abdominal pain, serum amylase and/or lipase greater than three times the upper limit of normal, and/or characteristic findings on abdominal imaging [4,5]. Patients with AP typically present with mid-epigastric and/or right upper quadrant pain that is constant, stabbing in character with radiation to the back or flank. Contrast-enhanced computed tomography (CT) and/or magnetic resonance imaging (MRI) of the pancreas should be reserved for patients in whom the diagnosis is uncertain from clinical and laboratory evaluation alone or patients who fail to improve clinically within the first 72 hours of hospitalization [6,7].

Timely and accurate identification of patients who are at high risk of developing severe acute pancreatitis may help to improve their individual prognosis while reducing their risk of complications. In particular, high☐risk individuals can be admitted into the high☐dependency care unit, can receive better monitoring, and can be given treatments such as appropriate fluid and nutritional therapy [8]. Several clinical scoring systems such as APACHE II score, RANSON'S score, MOSS score, MCTSI and BISAP score have been developed to assess the severity of pancreatitis at presentation or at 48 hours [9-11].

In the past two decades, several radiologic prognostic scoring systems have been developed. Among them, the CT severity index (CTSI) is the most widely adopted for clinical and research settings [12]. In 2004, a modified computed tomographic severity index (MCTSI) was designed to account for several potential limitations of the CTSI. The MCTSI incorporates extra pancreatic complications in the assessment and simplifies the evaluation of the extent of pancreatic parenchymal necrosis [13]. Research has shown that a MCTSI score ≥ 5 correlated with prolonged hospitalization and higher rates of mortality and morbidity. Previous studies have shown that MCTSI was 71% sensitive and 93% specific, while positive predictive value was 69% and negative predictive value was 94% [14].

The Bedside Index of Severity in Acute Pancreatitis (BISAP) score, which is used to predict severe acute pancreatitis, is based on blood urea nitrogen, impaired mental status, SIRS, age, and pleural effusion. BISAP score contains data that can be evaluated at the time of admission which are accurate in predicting patient's outcome within 24 hours [15]. Studies have concluded that BISAP score is a valuable tool in predicting severity of severe acute pancreatitis being simple, easy and cost effective and allows early decision making and prompt management [16].

Although several scoring systems have been developed to predict severe acute pancreatitis, evidence on their predictive performance is variable and inconsistent [14, 17]. The patient outcome can be improved by early detection of the severity of disease and triaging patients correctly towards intensive care units based on severity. Hence, this study was planned to compare Bedside Index for Severity in Acute Pancreatitis (BISAP) score with Modified Computed Tomography Severity Index (MCTSI) in predicting the outcomes in acute pancreatitis.

The patient outcome can be improved by early detection of the severity of disease and triaging patients correctly towards intensive care units based on severity. The response to pancreatic injury varies from person to person and is often difficult to predict. Though the overall mortality of acute pancreatitis is 2-5% but it reaches to about 20-30% in severe cases. Our study is intended to find a better scoring system which helps in early prediction of severity of disease and triaging.

OBJECTIVE OF THE STUDY
- To compare Bedside Index for Severity in Acute Pancreatitis (BISAP) score with Modified Computed Tomography Severity Index (MCTSI) in predicting
- a. Severity in acute pancreatitis.
- b. Pancreatic Necrosis in acute pancreatitis.
- c. Early complication (within 30days) in acute pancreatitis.

METHODOLOGY

Study Design: Prospective hospital-based study
Study Duration: 18 months (January 2021 - June 2022)
Study Area: Department of General Surgery, Hassan Institute of Medical Sciences (HIMS) Teaching Hospital, Hassan.
Study Participants: In-Patients with diagnosis of Acute Pancreatitis in Department of General Surgery, HIMS Teaching Hospital, Hassan.

Inclusion Criteria
- All patients admitted with the diagnosis of Acute Pancreatitis based on the presence of at least two of the following three criteria:
- Characteristic epigastric abdominal pain, with or without radiation to the back.
- Serum amylase or lipase levels elevated to at least three times the upper limit of normal.
- Characteristic finding of Acute Pancreatitis on abdominal CT scan and/or Ultrasonography of abdomen.

Exclusion Criteria
- Patients with deranged kidney function test which may be associated with elevated Blood Urea Nitrogen values were excluded from the study as they may result in a high BISAP score.
- Portal HTN.
- Patient with alcohol withdrawal.
- Congenital anomalies of pancreas.
- Abnormal mental status.

Estimation Of Sample Size
On the basis of statistics obtained from Department of Surgery, Hassan institute of Medical Sciences, an average of 6 cases per month fitting the criteria of the study with study duration of 18 months, we can expect to have N=108. Based on this population size, using YAMANE equation, for a known population size, sample size (n) equal to
$n = N/1 + Ne2$
n=sample size
N=population size
e= margin of error (for 95% of confidence level, margin error =0.05)
$n = 108/1 + 108 * 0.05 * 0.05 = 108/1.27 = 85$
Therefore, after approximating, the sample size of the study participants was fixed at 86.

Method Of Collection Of Data
All In-Patients with diagnosis of Acute Pancreatitis in Department of General Surgery, HIMS Teaching Hospital, Hassan were included in the study. Clearance from the institutional ethical committee was taken before starting the study. Study participants were included in the study by Purposive Sampling technique.

The study participants with diagnosis of Acute Pancreatitis were included in the study, till the sample size was reached. Written informed consent was taken from the study participants before collecting the data. A pre-tested, semi-structured questionnaire was used to collect information on socio-demographic variables and clinical history related to acute pancreatitis by interview method. Relevant Laboratory and Radiological investigations such as complete hemogram, serum electrolytes, renal function test, liver function test, serum amylase, lipid profile, chest X-ray, USG abdomen etc. were done. BISAP score was calculated using data from the first 24 hours, MCTSI was calculated from CECT within 72 hours from admission [15,110].

Statistical Analysis
The data was collected and compiled in MS Excel. Descriptive statistics has been used to present the data. To analyse the data SPSS (Version 26.0) was used. Significance level was fixed as 5% (α = 0.05. Qualitative variables are expressed as frequency and percentages and Quantitative variables are expressed as Mean and Standard Deviation. To compare the mean values between groups chi-square test was applied.

Operational Definitions
Criteria For Bisap Score
a. BUN more than 25mg/dl
b. Abnormal mental status with GCS < 15
c. Evidence of SIRS as per the standard criteria (TLC, RR, HR, Temperature)
d. Age > 60 years
e. Presence of Pleural Effusion on X Rays

Modified Ct Severity Index (MCTSI)

MCTSI was calculated from CECT within 72hours. Modified CT Severity Score is calculated as follows:
- Normal Pancreas   Point 0
- Intrinsic Pancreatic Abnormality with Peripancreatic fat stranding Point 2
- Peripancreatic fluid collection   Point 4
- Pancreatic Necrosis
- Absent   Point 0
- < 30 percent   Point 2
- ≥ 30 percent   Point 4
- Extra Pancreatic Complications   Point 2

RESULTS
67% of the study participants belonged to the age group of 21-40 years. 26% of the participants belonged to the age group of 41-50 years. The mean age of this sample is 34.34 ± 10.12 years. Most of the study participants were males (95%) with the male: female ratio of 19:1. Majority of the study participants (38%) had a BISAP score of 0 followed by 1 in 26% participants and 2 in 24% participants. Nearly 9/10th of the participants (88%) was seen to have mild pancreatitis according to BISAP Severity grade and 12% had severe pancreatitis in this study.

32% of the study participants had a MCTSI score of 4 in this study followed by 6 in 30% participants. More than half (62%) of the participants were seen to have moderate pancreatitis according to MCTSI Severity grade. 26% had mild pancreatitis and 12% had severe pancreatitis in this study.

12% of the study participants had pancreatic necrosis and 30% had organ failure. Majority of the patients (97%) had a favourable end outcome which was recovery. only 1% developed pseudocyst and 2% ended up in death.

The association between BISAP and MCTSI systems for acute pancreatitis severity grading was found to be statistically significant (p-value <0.001). When association between laboratory parameters and BISAP severity is assessed, a statistically significant association is seen for Urea & Creatinine (p-value < .001). When association between laboratory parameters and MCTSI severity is assessed, a statistically significant association is seen for Urea & Creatinine (p-value < .001). The association between BISAP and presence of pancreatic necrosis and organ failure was found to be statistically significant (p-value <0.001). The association between MCTSI and presence of pancreatic necrosis, organ failure and patient outcomes was found to be statistically significant (p-value <0.001).

DISCUSSION
In this study the usefulness of the Bedside Index for Severity in Acute Pancreatitis (BISAP) and Modified CT Severity Index (MCTSI) in the prediction of the severity, early complications and final outcome of acute pancreatitis was evaluated.

Most of the patients of acute pancreatitis in this study were males, the male:female ratio being 19:1 and belonged to the age group of 21 to 50 years with the mean age being 34.34±10.12 years. This distribution is similar to the participant demography of a study conducted by Hagjer et al. on acute pancreatitis in the year 2018 in the state of Assam, India. Here, males were predominant and the mean age was in the late thirties [19].

A huge proportion of patients with acute pancreatitis (92%) had history of alcohol consumption. In a 2020 study conducted in China on Acute Pancreatitis by Wang et al., it was seen that nearly 30% of the patients with Sever acute pancreatitis had alcoholic history. This number is much lower than our findings as the most common cause for Sever acute pancreatitis identified in this study was Cholelithiasis. However, the cases of acute pancreatitis is our setting were most probably alcohol related in etiology [20].

BISAP and MCTSI Scoring In Acute Pancreatitis
In this study, most of the patients with acute pancreatitis (88%) had lower BISAP scores of 1, 2 & 3. About 12% of them had higher scores of 4 & 5 and had severe grade pancreatitis according to BISAP.

In the Hagjer et al [19] study, severe disease developed in 23.3% of patients and 11.6% died. There was also an increasing trend in severity, organ failure, necrosis and mortality with increasing BISAP scores in this study which is in consensus with our study findings.

When severity was assessed by MCTSI scores, it was seen that a majority (88%) had lower scores of 2, 4 & 6 and had Mild to Moderate severity of Pancreatitis. Only about 12% had higher scores of 8 & 10 and had severe grade pancreatitis according to MCTSI. The severity grading of the patients obtained by BISAP was thus seen to correspond with the severity obtained through MCTSI.

Pancreatitis Severity (by BISAP & MCTSI) and Laboratory Parameters

In our study, we found that as the severity of pancreatitis increased according to BISAP, the levels of Urea and Creatinine were also seen to significantly increase in these patients. Similarly, the Amylase and Random Blood sugar levels were also seen to increase with increase in pancreatitis severity, however these did not have any statistical significance. Also, the levels of Lipase and the Total Leucocyte Count were seen to increase with increasing severity of pancreatitis according to BISAP, but not significantly.

This study showed that the more severe the pancreatitis according to MCTSI, significantly higher were the levels of Urea and creatinine. Amylase and Random blood sugar levels were also seen to increase with increase in pancreatitis severity, however these did not have any statistical significance. Also, the Total Leucocyte Count was seen to increase with increasing severity of pancreatitis according to MCTSI, but not significantly.

A 2021 study in Spain on acute pancreatitis had similar findings as our study. The levels of Urea & Creatinine were seen to be higher with greater severity of Pancreatitis [21].

Also, according to a 2018 study on Acute Pancreatitis by Sun et al. in China, the level of glucose in serum was positively correlated with the severity of pancreatitis. This finding agrees with our study finding [22]. Prediction of pancreatic necrosis

In our study, the prevalence of pancreatic necrosis was seen to be 12%. It was seen to be associated significantly with higher severity of pancreatitis both by BISAP & MCTSI grading. That is, the chances of developing pancreatic necrosis is higher when the pancreatitis is more severe. Also, pancreatic necrosis was seen to be significantly associated with higher levels of Urea, Creatinine and Random blood sugar.

According to a Brazilian study done by Fukuda et al. in 2013 on acute pancreatitis, peri-pancreatic necrosis was seen to be associated with higher severity of pancreatitis as in our studies [23].

Thus, both BISAP & MCTSI correspond significantly in predicting the chances of pancreatic necrosis in patients of pancreatitis.

Prediction Of Early Complication (within 30days)

Nearly 1/3rd of the patients with acute pancreatitis (30%) developed organ failure in this study. Organ failure was seen to be associated significantly with higher severity of pancreatitis both by BISAP & MCTSI grading. That is, the chances of developing organ failure is higher when the pancreatitis is more severe. Also, organ failure was seen to be significantly associated with higher levels of Amylase, Urea and Creatinine.

According to a Brazilian study done by Fukuda et al. in 2013 on acute pancreatitis, organ failure was seen to be associated with higher severity of pancreatitis as in our studies [23].

According to a 2017 study on acute pancreatitis by Kumar et al. in Rohtak, India, it was seen that MCTSI was a good predictor of severe acute pancreatitis, pancreatic necrosis, organ failure and ICU admission [24].

A 2014 study by Qui et al. in China showed that BISAP and MCTSI had a good performance in predicting the local complications in acute pancreatitis. This is in consensus with our study findings [25].

Thus, both BISAP & MCTSI correspond significantly in predicting the chances of organ failure in patients of pancreatitis.

Final Patient Outcome

In this study, majority of the patients (97%) had favorable outcome at the end in the form of recovery while about just 1% ended with pseudocyst. Only 2% had an adverse outcome in the form of death.

According to a 2017 study on acute pancreatitis by Kumar et al. in Rohtak, India, the recovery rate among the patients of acute pancreatitis was 86%, a little lower than our study finding [24].

Death was seen to be associated with more severe pancreatitis and the recovery rate was higher with less severe pancreatitis both by BISAP & MCTSI. However, these associations were significant only for MCTSI. In contrast, Pseudocysts were seen to be more prevalent in lower grades of pancreatitis both by BISAP and MCTSI however the significance was seen only for MCTSI.

In a 2012 study done by Thandassery et al. on acute pancreatitis in the state of Chandigarh, India, the overall mortality was found to be 18.4%, much higher than our study findings as their study population mainly constituted of patients with severe acute pancreatitis. This is in consensus with our finding that severity is a predictor of mortality [26]. Silva-vaz et al. conducted a study in 2020 in Portugal on acute pancreatitis and it was seen that although only 10% to 20% of the patients develop severe acute pancreatitis, this degree of severity is associated with a high mortality rate [27].

Mortality in acute pancreatitis was seen to be significantly associated with higher levels of Urea, Creatinine and Random blood sugar, severe form of acute pancreatitis where pancreatic necrosis was present. Similar to this, in a 2020 study conducted in China on Acute Pancreatitis by Wang et al., it was seen that serum creatinine and blood glucose were significantly associated with patient death during hospitalization [20].

Table 1: Patient Characteristics And Scoring

PATIENT CHARACTERISTICS		Frequency (n)	Percentage (%)
AGE	10-20 years	2	2.0
	21-30 years	33	33.0
	31-40 years	34	34.0
	41-50 years	26	26.0
	51-60 years	3	3.0
	61-70 years	2	2.0
	MEAN + SD	34.34 ± 10.12	
GENDER	MALE	95	95.0
	FEMALE	5	5.0
BISAP SCORE	0	38	38.0
	1	26	26.0
	2	24	24.0
	3	11	11.0
	4	1	1.0
	5	-	-
	MEAN + SD	1.11 + 1.07	
BISAP SEVERITY	MILD (<3)	88	88.0
	SEVERE (>3)	12	12.0
MCTSI SCORE	2	26	26.0
	4	32	32.0
	6	30	30.0
	8	7	7.0
	10	5	5.0
	MEAN + SD	4.66 + 2.18	
MCTSI SEVERITY	MILD	26	26.0
	MODERATE	62	62.0
	SEVERE	12	12.0
PANCREATIC NECROSIS	PRESENT	12	12.0
	ABSENT	88	88.0
ORGAN FAILURE	PRESENT	30	30.0%
	ABSENT	70	70.0%
FINAL OUTCOMES	RECOVERED	97	97.0
	DEATH	2	2.0
	PSEUDOCYST	1	1.0

Table 2: Association Between Pancreatitis Severity By BISAP And MCTSI Grading

BISAP SEVERITY	MCTSI grading, n (%)			P VALUE
	MILD	MODERATE	SEVERE	
MILD	25 (28.4)	61 (69.3)	2 (2.3)	0.000
SEVERE	1 (8.3)	1 (8.3)	10 (83.3)	

Table 93 Association Between BISAP Severity With Early Complications

EARLY COMPLICATIONS		BISAP SEVERITY		P value
		MILD	SEVERE	

PANCREATIC NEROSIS	PRESENT	2 (2.3)	10 (83.3)	0.000
	ABSENT	86 (97.7)	2 (16.7)	
ORGAN FAILURE	PRESENT	19 (21.6)	11 (91.7)	0.000
	ABSENT	69 (78.4)	1 (8.3)	
PATIENT OUTCOME	RECOVERED	86 (97.7)	11 (91.7)	0.321
	DEATH	1 (1.1)	1 (8.3)	
	PSEUDOCYST	1 (1.1)	-	

Table 4. Association Between MCTSI Severity With Early Complications

EARLY COMPLICATIONS		MCTSI SEVERITY			P value
		Mild	Moderate	Severe	
PANCREATIC NEROSIS	PRESENT	-	-	12 (100)	0.000
	ABSENT	26 (100)	62 (100)	-	
ORGAN FAILURE	PRESENT	1 (3.8)	19 (30.6%)	10 (83.3%)	0.000
	ABSENT	25 (96.2%)	43 (69.4%)	2 (16.7%)	
PATIENT OUTCOME	RECOVERED	26 (100)	61(98.4)	97(97)	0.028
	DEATH	-	-	2 (2)	
	PSEUDOCYST	-	1 (1.6)	1 (1)	

CONCLUSION

Recent studies shown various scoring systems, biochemical, and hematologic markers have high predictive accuracy for severity and mortality in AP. BISAP scoring system accurately predicts the outcome in patients with acute pancreatitis. BISAP scoring system is simple, inexpensive, easy to remember and calculate at bedside. Moreover, the values in BISAP score are instantaneous and there is no time delay. CT is a useful tool in assessing the severity of pancreatitis and should be performed in all patients with acute pancreatitis. If CT scans are performed, MCTSI can be easily calculated and should be used in addition to the other scoring systems. MCTSI is an indispensable tool for the screening of patients with acute pancreatitis, for the classification of severity accurately and to predict the clinical outcome in the form of occurrence of infection and organ failure as well. Modified CT severity index as an early evaluation tool has a very good predictive value in assessing the patient outcome in the form of duration of hospital stay, morbidity and mortality. In the prediction of mortality in AP, MCTSI was revealed to be as equally valuable as BISAP. Considering severity, there was no difference in the prediction value of the scores. Thus, we conclude from this study is that BISAP and MCTSI grading are both useful in predicting severity of pancreatitis, possibility of organ failure, and death in patients with acute pancreatitis. BISAP scoring can be calculated at admission, repeatedly at bedside for severity grading, serial monitoring.

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