COMPARATIVE EVALUATION OF THE DIAGNOSTIC ACCURACY OF MODIFIED CT SEVERITY INDEX FOR PREDICTION OF ACUTE PANCREATITIS SEVERITY: A CLINICAL RADIOGRAPHIC ASSESSMENT

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ABSTRACT

Objective: The present study was conducted to comparatively assess the clinical scoring of Bedside Index for Severity in Acute Pancreatitis (BISAP) to radiographic scoring system Modified Computed Tomography Severity Index (MCTSI) for predicting the severity and organ failure in subjects with acute pancreatitis with the evaluation of the diagnostic accuracy of MCTSI.

Methods: The present study included subjects from all age groups having at least 2 features of sonographic findings of acute pancreatitis, pain in epigastrium radiating to back, and/or serum amylase/lipase 3 folds higher than the normal limit. Radiological MCTSI and clinically BISAP scoring were done and compared to assess the diagnostic accuracy of MCTSI in accurately predicting the severity and organ failure in subjects with acute pancreatitis.

Results: No organ failure was seen in 54% (n=27) study subjects wherein subjects with MCTSI <4 the sensitivity, specificity, and p-value was 96, 40, and 0.000 respectively, whereas, in subjects with BISAP <2, sensitivity, specificity, and p-value was 100, 30, and 0.000 respectively. Transient organ failure was seen in 28% (n=14) subjects wherein subjects with MCTSI score >4 (4-6) sensitivity, specificity, and p-value was 95, 30, and 0.01 respectively, whereas, for BISAP score of >2 sensitivity, specificity, and p-value were 83, 46, and 0.02 respectively. These results showed statistical significance. Persistent organ failure was seen in 9 (18%) study subjects where for MCTSI score ≥8 (8-10) sensitivity, specificity, and p-value respectively were 100, 78, and 0.000, whereas, for BISAP score of >2, these values respectively were 74, 85, and 0.000

Conclusion: The present study concludes that MCTSI accurately predicts the severity and organ failure in subjects with acute pancreatitis and is a simple scoring system.

Keywords: Acute pancreatitis**,** Bedside Index for Severity in Acute Pancreatitis, Modified Computed Tomography Severity Index, organ failure.

INTRODUCTION

One of the most commonly seen abdominal inflammatory disorders is acute pancreatitis with a high prevalence of nearly 51% globally. The etiology of acute pancreatitis is mainly attributed to gallstone, intake of alcohol, and high levels of triglycerides (HTG). Pancreatitis can be divided into mild, moderate, or severe forms depending on the 2012 classification by Revised Atlanta classification. The mortality rate associated with pancreatitis in subjects having different forms with an overall mortality of nearly 5-10%, whereas, mortality is greatly increased in subjects with severe pancreatitis with a mortality rate of nearly 36-50%.[1]

Subjects having severe pancreatitis have higher chances of developing DIC (Disseminated Intravascular Coagulation), cardiovascular failure, gastrointestinal hemorrhage, respiratory failure, renal failure related organ failure, and systemic inflammatory responses which increase the duration of hospital stay and progressively lead to death. To reduce the mortality and morbidity in subjects with acute pancreatitis, it is vital to identify and manage these subjects within 24 hours of symptom onset. Prediction of disease outcomes and severity in subjects with acute pancreatitis helps in planning accurate management for subjects with severe acute pancreatitis.[2]

Prediction of severity in subjects with acute pancreatitis includes consideration of various parameters including multi-parametric scores like APACHE II, Bedside Index of Severity in AP (BISAP), Ranson's score, and Systemic Inflammatory Response Syndrome (SIRS), and single parameter like C-reactive protein (CRP), serum blood urea, creatinine, and pleural effusion nitrogen. Various radiographic scoring systems including CT (Computed Tomography) used in assessing the severity of acute pancreatitis are renal rim sign, Modified CT Severity index (MCTSI), Computed Tomographic Severity Index (CTSI), and/or Balthazar grading system. No grading system is universally accepted as a standard grading system. However, MCTSI was developed based on CTSI which accurately predicts extra-pancreatic complications and organ failure along with the reflection of necrosis and inflammation of the pancreas.[3]

The most common and simple scoring system used clinically is BISAP which was first introduced in 2008 by Wu et al where scores of more than/equal to 3 show increased mortality with moderate and severe acute pancreatitis. Wide and global use of BISAP and MCTSI is attributed to it being easily obtained, routinely used, and is ineffective.[4] The present study was conducted to comparatively assess the clinical scoring of Bedside Index for Severity in Acute Pancreatitis (BISAP) to radiographic scoring system Modified Computed Tomography Severity Index (MCTSI) for predicting the severity and organ failure in subjects with acute pancreatitis with an evaluation of the diagnostic accuracy of MCTSI.

MATERIALS AND METHODS

The present cross-sectional clinical study was conducted to comparatively assess the clinical scoring of Bedside Index for Severity in Acute Pancreatitis (BISAP) to radiographic scoring system Modified Computed Tomography Severity Index (MCTSI) for predicting the severity and organ failure in subjects with acute pancreatitis with the evaluation of the diagnostic accuracy of MCTSI. The study was conducted at Department of Radiodiagnosis, Nalanda Medical College, Patna, Bihar.

The inclusion criteria for the study were subjects from both the genders, all ages, having at least 2 features of sonographic findings of acute pancreatitis including peripancreatic fluid

collection, pancreatic enlargement, decreased/heterogenous echogenicity), pain in epigastrium radiating to back, and/or serum amylase/lipase 3 folds higher than the normal limit which is >180 U/L and 210 U/L respectively. The exclusion criteria were subjects with multiple myeloma, kidney diseases, asthma history, allergy to iodinated contrast, and the subjects not willing to participate in the study.

After the final inclusion of the study subjects, detailed history was recorded and a general examination was done for all the subjects. Followed by this, all the subjects underwent contrast-enhanced and non-contrast MDCT within 5 days of inclusion and symptom onset. Similar radiographic parameters and the same equipment were used for MDCT using scans of 5mm thickness reconstructed at 0.625 to 1.5 mm starting from upper diaphragm border to below pubis symphysis.

The calculation of BISAP scores was done based on biochemical parameters and clinical conditions using 5 points with 24 hours of presentation as scoring criteria where each point reflects the presence of a pleural effusion, age of more than 60 years, Systemic inflammatory response syndrome, altered mental status, and blood urea nitrogen of more than 25mg/dl. The radiographic scoring system used was MCTSI which used 10 scores system including the presence of extrapancreatic complications (0-2 points), necrosis of Pancrease (0-4 points), and degree of inflammation of Pancrease (0-4 points). MCTSI was calculated following the post-contrast study and grading was done as mild, moderate, and severe based on the respective scores of 0-2, 4-6, and 8-10.

The collected data were subjected to the statistical evaluation using SPSS software version 21 (Chicago, IL, USA) and one-way ANOVA and t-test for results formulation. The data were expressed in percentage and number, and mean and standard deviation. The level of significance was kept at $p < 0.05$.

RESULTS

The present study was conducted to comparatively assess the clinical scoring of the Bedside Index for Severity in Acute Pancreatitis (BISAP) to radiographic scoring system Modified Computed Tomography Severity Index (MCTSI) for predicting the severity and organ failure in subjects with acute pancreatitis with an evaluation of the diagnostic accuracy of MCTSI. The present study included a total of 50 subjects from both genders within the age range of 12-73 years and the mean age of 38.3±6.28 years. The demographic characteristics of the study subjects are listed in Table 1. Majority of the study subjects were in the age range of 31-40 years with 38% (n=19) subjects followed by 20% (n=10) subjects in 21-30 years, 14% (n=7) subjects from 12-20 years, 8% (n=4) subjects from the age of 41-50 and >70 years, and least subjects from 51-60 and 61-70 years with 6% (n=3) study subjects. There were 82% (n=41) males and 18% (n=9) females in the present study (Table 1).

The study results showed that on assessing the clinical scoring based on BISAP score, it was seen that BISAP score of 0-2 was seen in 20% (n=10) study subjects, whereas, in 80% (n=40) subjects, BISAP score of 3-5 was seen. Radiographic scoring was assessed based on MCTSI scoring where the score of 0-2 was seen in 14% (n=7) subjects, 4-6 in 50% (n=25) subjects, and MCTSI score of 8-10 was seen in 36% (n=18) study subjects as depicted in Table 2.

On predicting the disease severity and organ failure in the subjects with acute pancreatitis, no organ failure was seen in 54% (n=27) study subjects wherein subjects with MCTSI <4 the sensitivity, specificity, and p-value was 96, 40, and 0.000 respectively, whereas, in subjects with BISAP <2, sensitivity, specificity, and p-value was 100, 30, and 0.000 respectively. Transient organ failure was seen in 28% (n=14) subjects wherein subjects with MCTSI score >4 (4-6) sensitivity, specificity, and p-value was 95, 30, and 0.01 respectively, whereas, for BISAP score of >2 sensitivity, specificity, and p-value were 83, 46, and 0.02 respectively. These results showed statistical significance. Persistent organ failure was seen in 9 (18%) study subjects where for MCTSI score ≥8 (8-10) sensitivity, specificity, and p-value respectively were 100, 78, and 0.000, whereas, for BISAP score of >2, these values respectively were 74, 85, and 0.000 (Table 3). Axial and coronal CT image of Acute necrotising pancreatitis (Modified CTSI score 10/10) are shown in Figure 1 below the literature.

DISCUSSION

The present study was conducted to comparatively assess the clinical scoring of the Bedside Index for Severity in Acute Pancreatitis (BISAP) to radiographic scoring system Modified Computed Tomography Severity Index (MCTSI) for predicting the severity and organ failure in subjects with acute pancreatitis with the evaluation of the diagnostic accuracy of MCTSI. The present study included a total of 50 subjects from both genders within the age range of 12-73 years and the mean age of 38.3±6.28 years. The demographic characteristics of the study subjects are listed in Table 1. Majority of the study subjects were in the age range of 31-40 years with 38% (n=19) subjects followed by 20% (n=10) subjects in 21-30 years, 14% (n=7) subjects from 12-20 years, 8% (n=4) subjects from the age of 41-50 and >70 years, and least subjects from 51-60 and 61-70 years with 6% (n=3) study subjects. There were 82% (n=41) males and 18% (n=9) females in the present study. These demographics were comparable to the studies of Wu BU et al[5] in 2008 and Mortele KJ et al[6] in 2004 where authors assessed subjects of acute pancreatitis having similar demographics.

On assessing the clinical scoring based on BISAP score, it was seen that a BISAP score of 0-2 was seen in 20% (n=10) study subjects, whereas, in 80% (n=40) subjects, a BISAP score of 3-5 was seen. Radiographic scoring was assessed based on MCTSI scoring where the score of 0-2 was seen in 14% (n=7) subjects, 4-6 in 50% (n=25) subjects, and MCTSI score of 8-10 was seen in 36% (n=18) study subjects. These results were consistent with the studies of Huang W et al[7] in 2013 and Conner OJ et al[8] in 2011 where authors reported comparable clinical and radiographic scoring in subjects with acute pancreatitis.

The disease severity and organ failure were also assessed in the present study in the subjects with acute pancreatitis, no organ failure was seen in 54% (n=27) study subjects where, in subjects with MCTSI <4 the sensitivity, specificity, and p-value were 96, 40, and 0.000 respectively, whereas, in subjects with BISAP <2, sensitivity, specificity, and p-value were 100, 30, and 0.000 respectively. Transient organ failure was seen in 28% (n=14) subjects where, in subjects with MCTSI score >4 (4-6) sensitivity, specificity, and p-value was 95, 30, and 0.01 respectively, whereas, for BISAP score of >2 sensitivity, specificity, and p-value were 83, 46, and 0.02 respectively. These results showed statistical significance. Persistent organ failure was seen in 9 (18%) study subjects where for MCTSI score ≥8 (8-10)

sensitivity, specificity, and p-value respectively were 100, 78, and 0.000, whereas, for BISAP score of >2, these values respectively were 74, 85, and 0.000. These results were in agreement with the studies of Meher S et al[9] in 2015 and Khanna A et al[10] in 2013 where disease severity and organ failure prediction showed similar significance in subjects of acute pancreatitis.

CONCLUSION

Within its limitations, the present study concludes that Contrast-enhanced computed tomography is reliable and efficacious imaging modality for assessing and diagnosing acute pancreatitis, and MCTSI is an accurate and simple radiographic scoring system with the reliable prediction of disease severity and organ failure in subjects with acute pancreatitis. However, the present study had a few limitations including small sample size, short monitoring period, and geographical area biases. Hence, more longitudinal studies with larger sample size and longer monitoring period will help reach a definitive conclusion.

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TABLES

S. No	Scoring system	Percentage (%)	Number (n=50)
1.	Clinical scoring		
a)	BISAP score		
i.	0-2	20	10
ii.	3-5	80	40
2.	Radiographic scoring		
a)	MCTSI		
a)	0-2	14	7
b)	4-6	50	25
c)	8-10	36	18

S. No	Characteristics	Percentage (%)	Number (n=50)
1.	Mean age (years)	38.3±6.28	
2.	Age range (years)	12-73	
a)	12-20	14	7
b)	21-30	20	10
c)	31-40	38	19
d)	41-50	8	4
e)	51-60	6	3
f)	61-70	6	3
g)	>70	8	4
3.	Gender		
a)	Males	82	41
b)	Females	18	9

Table 1: Demographic characteristics of the study subjects

S. No	Scoring system	Percentage (%)	Number (n=50)
3.	Clinical scoring		
b)	BISAP score		
iii.	0-2	20	10
iv.	3-5	80	40
4.	Radiographic scoring		
b)	MCTSI		
d)	0-2	14	7
e)	4-6	50	25
f)	8-10	36	18

Table 2: Clinical and radiographic scoring in the study subjects

S. No	Organ failure	% (n)	Sensitivity	Specificity	p-value
1.	No organ failure				

a)	MCTSI <4	54 (27)	96	40	0.000
b)	BISAP <2	54 (27)	100	30	0.000
2.	**Transient organ failure (BISAP)**				
a)	MCTSI score >4 (4-6)	28 (14)	95	30	0.01
b)	BISAP >2	28 (14)	83	46	0.02
3.	**Persistent organ failure**				
a)	MCTSI score ≥8 (8-10)	18 (9)	100	78	0.000
b)	BISAP >2	18 (9)	74	85	0.000

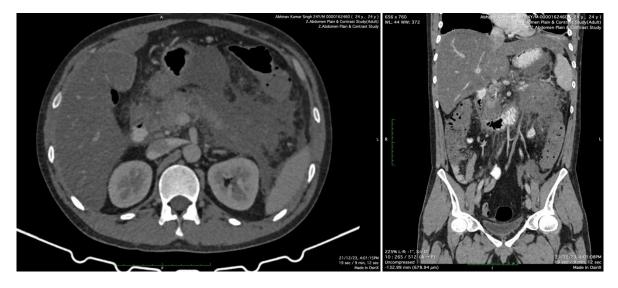**Table 3: Prediction of severity and organ failure in the study subjects**

Figure 1: Axial and coronal CT image of Acute necrotising pancreatitis (Modified CTSI score 10/10)