

Evaluation of diagnostic accuracy of modified computed tomography severity index in predicting severity of acute pancreatitis

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Abstract

Objective: To compare the radiological scoring system Modified Computed Tomography Severity Index (MCTSI) with clinical scoring of Bedside Index for Severity in Acute Pancreatitis (BISAP) in predicting Organ failure and severity in Acute Pancreatitis there by to evaluate the diagnostic accuracy of MCTSI. **Methods:** Patients of all the age groups, presenting with two or more features of pain in epigastrium radiating to back, serum lipase or amylase three times the normal limit and sonographic findings of acute pancreatitis were included. The clinical BISAP score and radiological MCTSI were calculated and compared by plotting ROC curve to calculate the diagnostic accuracy of MCTSI in predicting organ failure and severity. **Results:** The Age of the study group ranged from 10 to 75 years with mean age of 38 years. When MCTSI is more than or equal to 8 its sensitivity, specificity, Area Under Curve (AUC) and P-value is 81%, 79%, 0.856 and 0.000. MCTSI score ≤ 4 has sensitivity of 97%, specificity of 40%, AUC 0.86 for predicting no organ failure. MCTSI ≥ 4 (4-6) has a sensitivity of 96%, specificity of 31%, AUC of 0.65. Area under the receiver operating characteristic curve for the prediction of accuracy for persistent organ failure by MCTSI revealed that MCTSI score ≥ 8 has sensitivity of 100 %, specificity of 79%, AUC of 0.91 and for BISAP >2 has sensitivity of 87%, specificity of 87% and AUC of 0.81. **Conclusion:** Modified CT severity index is a simple scoring system and can be used for predicting severity of pancreatitis and organ failure more accurately.

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

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Introduction

Acute Pancreatitis, (AP) a commonly encountered acute abdominal inflammatory disorder[1]. Prevalence of acute pancreatitis is found to be 51.07%[1,2]. 60 - 80% cases of Acute Pancreatitis are either due to alcohol intake or gallstone, followed by high triglyceride (HTG) levels [1-3]. The disease is classified into mild, moderate and severe acute pancreatitis based on Revised Atlanta classification which was held in 2012. Overall mortality rate is about 5% ~ 10%, but 36% ~ 50% in patients with severe pancreatitis category[1]. Severe pancreatitis patients are more likely to develop systemic inflammatory response or organ failure

relating to renal, respirator failure, gastrointestinal haemorrhage, cardiovascular failure, Disseminated Intra-vascular Coagulation (DIC) leading to prolonged hospital stay and also progresses rapidly leading to death. So it is essential to identify these group of patients with in 24 hrs of onset of symptoms to reduce morbidity and mortality[4,5]. Severity and outcome prediction in AP helps in guiding appropriate management protocol for the patients, especially in those having severe disease.

Severity prediction in AP involves a multi-parametric approach including isolated parameters like pleural effusion nitrogen, creatinine, serum blood urea, C-reactive protein(CRP) and multi-parametric scores like Systemic Inflammatory Response Syndrome (SIRS), Ranson's score, Bedside Index of Severity in AP (BISAP) and APACHE II. Importance of Computed Tomography (CT) for predicting severity of AP has been evaluated with scoring systems like Balthazar grading system, Computed Tomographic Severity Index (CTSI), Modified CT Severity index (MCTSI) and renal rim sign. There is no universally adopted standard grading system. Modified CT Severity index (MCTSI) formed

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on the basis of CTSI which not only reflects inflammation and necrosis of Pancrease, but also organ failure and extrapancreatic complications [6,7]. Bedside index for severity in acute pancreatitis (BISAP) score is the most simple scoring system initially proposed by Wu (Wu et al, 2008) [8] in 2008. When it is ≥ 3 , it is expected to correspond with moderate and severe acute pancreatitis and the mortality rate markedly increased. MCTSI and BISAP scores are widely used because of inexpensive, based on routine and easily obtained. The main aim of the study was to evaluate the diagnostic accuracy of MCTSI compared with BISAP scoring system in predicting organ failure and severity in Acute Pancreatitis.

Materials and methods

It is a cross sectional study done in the department of Radio-Diagnosis of Kalinga Institute of Medical Sciences between September 2018 to September 2020 on 100 patients after clearance from institutional ethical committee. Patients of all the age groups, presenting with two or more features of pain in epigastrium radiating to back, serum lipase or amylase three times the normal limit (i.e., more than 210 U/L and >180 U/L, respectively) and sonographic findings of Acute Pancreatitis, (i.e. decreased or heterogeneous echogenicity, pancreatic enlargement, peripancreatic fluid collection), were included in the study. They underwent non-contrast and contrast enhanced MDCT within 3-5 days (mean 3.16 ± 0.04 day) after onset of symptoms. Scans were performed using GE Optima 660, 64 slice Scanner (64 Channel configuration) using the following scan parameters i.e. 5 mm thick contiguous slice, reconstructed at 0.625 to 1.5 mm, 80-120KVp and variable mA ranging from 250-375 in Helical mode with a Pitch of 0.984, starting from upper border of diaphragm to just below pubis symphysis. Patients with allergy to iodinated contrast, past history of asthma, kidney diseases and multiple myeloma were excluded. BISAP score was calculated on the basis of clinical condition and

biochemical parameters. It is 5 point scoring system which had, blood urea nitrogen of more than 25mg/dl, altered mental status, Systemic inflammatory response syndrome, age of more than 60 years, presence of a pleural effusion. The BISAP score was calculated within 24 hr of admission with each one representing one point. The MCTSI[6] is a ten-point Scoring system. It contains the degree of inflammation of Pancrease (0-4 points), necrosis of Pancrease (0-4 points) and presence of extrapancreatic complications (0-2 points). Modified CT severity index was calculated after post contrast study and were graded in to mild moderate and severe when the scores were 0-2, 4-6 and 8-10 respectively

Statistical analysis -Biostatistical analysis was done by logistic regression statistical model by using IBM SPSS Statistics for windows version 27.0. The diagnostic performance of MCTSI scoring system for severity of acute pancreatitis was analyzed in term of sensitivity, specificity and Area Under Curve (AUC). Secondly severity of acute pancreatitis was assessed on the basis of organ failure. ROC curve was plotted for organ failure and compared with MCTSI as radiological scoring system and BISAP as clinical scoring system. The scoring systems were compared in term of sensitivity, specificity and Area Under curve (AUC).

Result

The Age of the study group ranged from 10 to 75 years with mean age of 38 years. 38 % of them belonged to age group of 31-40 years. 84% were male and 16% being females and male to female ratio was 5.2:1.

BISAP score: We found 22(22 %) patients having BISAP score (3-5) had high morbidity and mortality and 78(78%) patients having BISAP score (0-2) had low morbidity and mortality.

MCTSI: Fifteen (15%) patients developed mild (0-2), fifty (50%) moderate (4-6) and thirty-five(35%) patients developed severe (8-10) Acute Pancreatitis.

Predication of severity of acute pancreatitis-

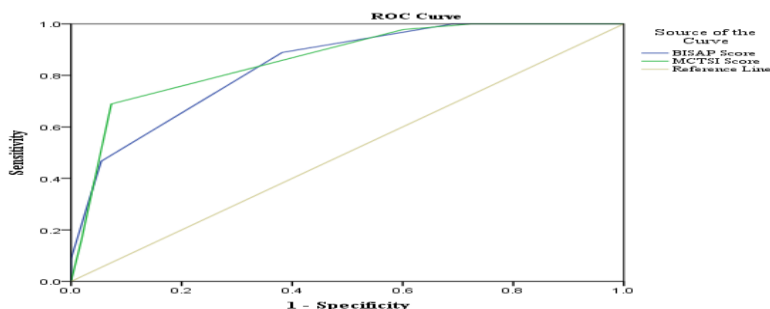


Fig 1:ROC Curve depicting no organ failure

ROC curve was plotted for MCTSI taking BISAP score more than 2 as reference line. We found that when MCTSI is more than or equal to 8 its sensitivity, specificity, AUC and P-value is 81 %, 79%, 0.856 and 0.000 which is highly sensitive for predication of severity of Acute Pancreatitis.

Prediction of severity in term of organ failure-For predication of severity of Acute Pancreatitis in term of organ failure by MCTSI and BISAP score, ROC curves were plotted and compared in terms of sensitivity, specificity, AUC and p-value for severity of acute pancreatitis.

A)**No organ failure** –Out of 100,55 patients did not develop organ failure (Fig 1)The sensitivity, specificity, AUC, P value of MCTSI for no organ failure was found to be 97%, 40%, 0.862 and 0.000 respectively when the score less than 4.The sensitivity, specificity, AUC, P value of BISAP for no organ failure was found to be 100%, 31%, 0.838 and 0.000 respectively when the score less than 2.

B)**Transient organ failure**: 28 patients had transient organ failure. (Fig 2)

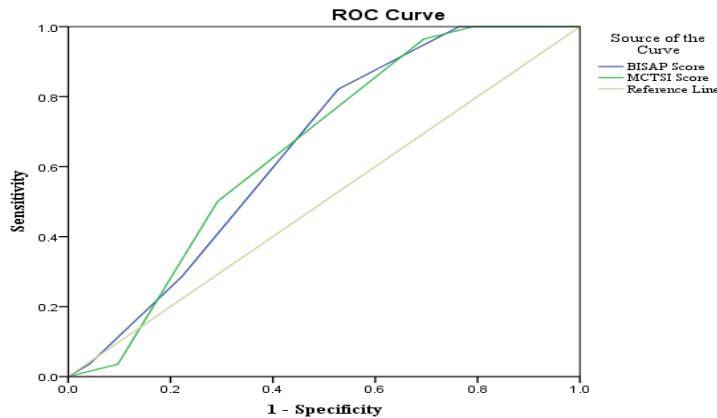


Fig 2:ROC Curve depicting Transient organ failure

The sensitivity, specificity, AUC, P value of MCTSI for transient organ failure was found to be 96%, 31%, 065 and 0.018 respectively when the score more than 4(4-6)The sensitivity, specificity, AUC, P value of BISAP for transient organ failure was found to be 83%, 48%, 065 and 0.020respectively when the score more than 2.

Persistent organ failure:17 patients had POF (Fig 3)

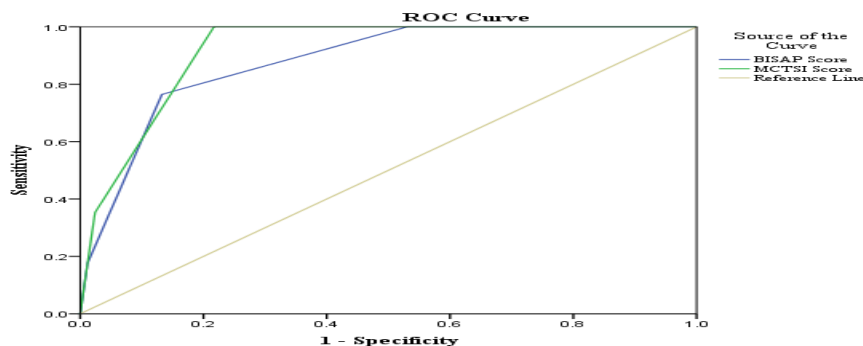


Fig 3:ROC Curve depicting persistent organ failure

The sensitivity, specificity, AUC, P value of MCTSI for persistent organ failure was found to be 100% 79%, 0.91 and 0.00 respectively when the score more than or equal to 8(8-10)The sensitivity, specificity, AUC, P value of BISAP persistent organfailure was found to be 76%, 87%, 0.875 and 0.000 respectively when the score more than 2. Mortality- Our study show only 2% mortality rate rest of patients were recovered.

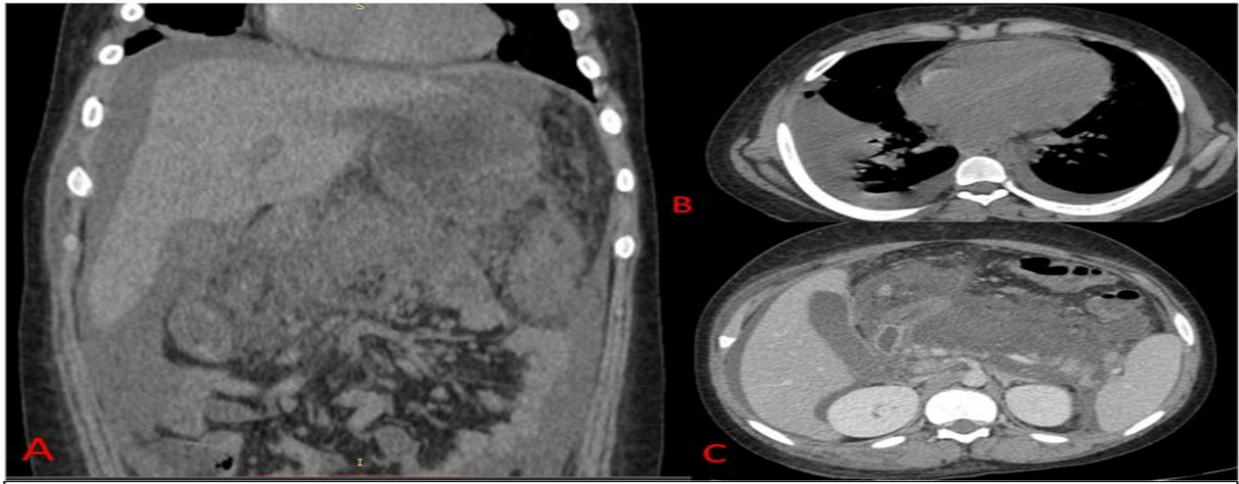


Fig 1: 12-year male presented with epigastric pain, vomiting and raised amylase. The Coronal(A) and axial (B) NCCT image depicts collection in perihepatic, paracolic gutter, retroperitoneal and mesenteric inflammation with bilateral pleural effusion. Axial CECT image (C) depicts intrapancreatic as well as peripancreatic necrosis with ascites and retroperitoneal collection (MCTSI)

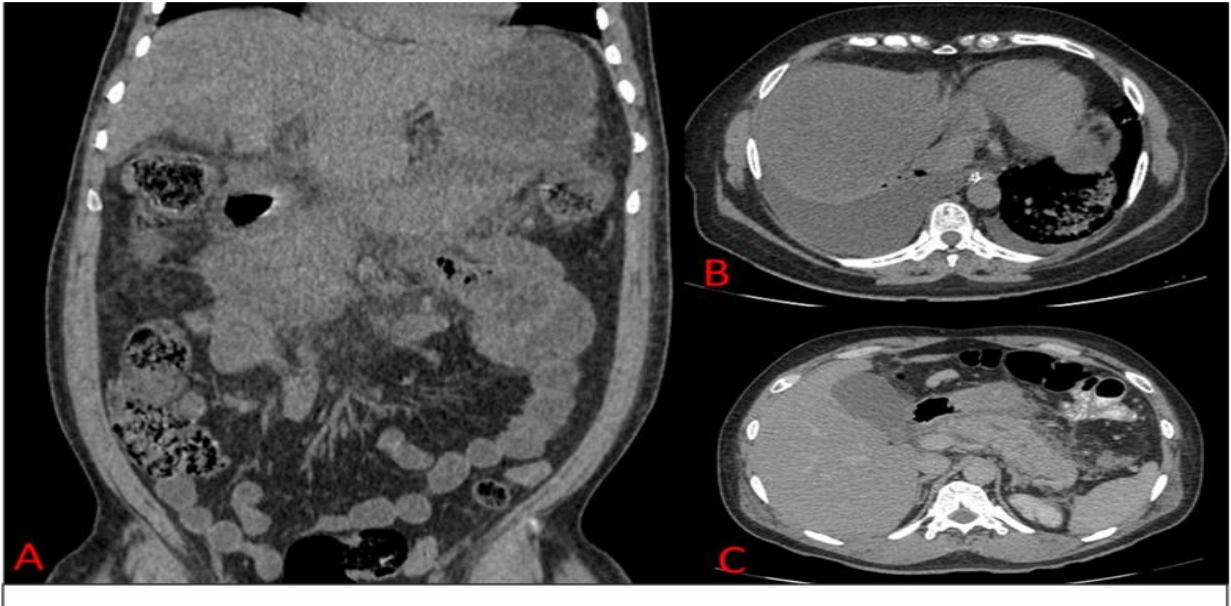


Fig 2: 39-year male presented with complains of sudden onset of pain in epigastric region, Coronal(A) and Axial (B) NCCT image depicts Mesentric inflammation & bilateral pleural effusion. Axial CECT image(C) show peripancreatic collection with fat stranding.(MCTSI=6).

Discussion

Acute pancreatitis is a common gastrointestinal emergency. Depending upon organ failure Revised Atlanta classification divided pancreatitis into mild, moderate and severe. Severe category seen in approximately 15-25 % of patients. Early diagnosis and quick severity assessment helps in predicting outcome and in triaging patients. Among the clinical scoring system, BISAP is more convenient system for quick evaluation of severity of acute pancreatitis. MCTSI is the most commonly used Radiological scoring system for prediction of the severity and outcome of Acute Pancreatitis. This study was conducted for comparing the radiological scoring system evaluating MCTSI with clinical scores (BISAP,) in predicting Organ failure and severity in Acute Pancreatitis. The study was conducted on hundred patients with clinical impression of Acute Pancreatitis referred for CECT between 3-5 days of onset of symptoms. Majority of the patient were under the age group of 31-40 year which constituted about 38% of total cases. Average age of 40 years with male preponderance was observed in cases of Acute Pancreatitis. In our study, we observed that a BISAP score of more than 2 helps in differentiating between mild and severe Acute Pancreatitis. Keeping that BISAP score as reference line Area Under the Receiver Operating characteristic (AUROC) Curve For accuracy Prediction of MCTSI revealed that for MCTSI score of ≥ 8 has sensitivity of 81%, specificity of 79% and AUC of .856 for severe Acute Pancreatitis. Hence, it can be assumed that MCTSI score of ≥ 8 is highly sensitive for prediction of severe Acute Pancreatitis.

Organ failure-Severity of Acute Pancreatitis is assessed on the basis of organ failure as suggested in the revised Atlanta classification. The organ failure divided into 3 groups of no organ failure, transient organ failure and persistent organ failure as per Revised Atlanta classification. In our study, out of hundred patients fifty-five (55%) had no organ failure, twenty-eight (28%) developed transient organ failure and seventeen (17%) developed persistent organ failure. MCTSI score ≤ 4 has sensitivity of 97%, specificity of 40%, AUC 0.86 for predicting no organ failure and BISAP score ≤ 2 has sensitivity of 100%, specificity of 31% and AUC of 0.83 for making similar prediction. It can be assumed that in Acute Pancreatitis cases, when MCTSI score is < 4 , then there is high probability of no organ failure. As per revised Atlanta classification organ failure is absent in mild category of Acute Pancreatitis. So we can infer MCTSI score of < 4 can be categorized as mild Acute Pancreatitis as per revised Atlanta Classification. MCTSI ≥ 4 (4-6) has a sensitivity of 96%, specificity of 31%, AUC of 0.65 and BISAP score ≥ 2 has sensitivity of 83%, specificity of 48% and AUC of 0.65 for prediction of transient organ failure. Area Under The Receiver Operating Characteristic (AUROC) Curve for the prediction of accuracy for persistent organ failure by MCTSI

revealed that MCTSI score ≥ 8 has sensitivity of 100 %, specificity of 79%, AUC of 0.91 and for BISAP > 2 has sensitivity of 87%, specificity of 87% and AUC of 0.81. In Revised Atlanta classification system persistent organ system occur in severe acute pancreatitis, so we can presume that MCTSI score of 8-10 comes under the severe category of acute pancreatitis. From the above data, it can be concluded that radiological scoring system MCTSI can be used for predicting severity of pancreatitis and organ failure more accurately.

Conclusion

To conclude the CECT is an excellent imaging modality for diagnosis, grading and prognosis of Acute Pancreatitis. Modified CT severity index is a simple scoring system and accurately predicts severity of Acute Pancreatitis. In this study, it had a good statistical correlation with the occurrence of organ failure and overall mortality and also predict the need for interventional procedures.

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