

# Evaluation of correlation of clinical outcomes with severity index in acute pancreatitis patients

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## Abstract

**Introduction:** Acute pancreatitis is a significant cause of morbidity and mortality and is known to run an unpredictable course. Severe pancreatitis occurs in 20%-30% of all patients with acute pancreatitis and is characterized by a protracted clinical course, multiorgan failure, and pancreatic necrosis. Computed Tomography Severity Index (CTSI) and Modified Computed Tomography Severity Index (MCTSI) is used as a scoring system in acute pancreatitis. This study aims to correlate the CTSI and MCTSI grading system with patient outcome in terms of organ failure, mortality and duration of hospital stay.

**Materials and Methods:** This was a prospective study conducted for a period of two years. 40 Cases diagnosed as acute pancreatitis were included in this study. These patients underwent contrast enhanced computed tomography (CECT) of the abdomen and pelvis. The findings were recorded as per the CT severity index and modified CT severity index.

**Results:** There was significant correlation between necessity of ICU admission and duration of hospital stay and grade of pancreatitis, positive correlation with duration of ward stay and strong correlation with total duration of hospital stay. Higher CT grade is positively associated with development of local complications and systemic complications.

**Conclusion:** Grading by modified CT severity index has a significant correlation with necessity of ICU admission and total duration of hospital stay. CT severity index and Modified CT severity index can be used to predict the possibility of developing local and systemic complications, the need for interventions and necessity of hospital stay.

**Keywords:** Acute pancreatitis, modified ct severity index, hospital stay etc.

## Introduction

Acute Pancreatitis (AP) is a challenging disease which presents itself as acute abdominal pain and elevated pancreatic enzymes. In the majority of cases, acute pancreatitis is mild and resolves with conservative therapy. In 10%-20% of cases, the disease is severe and may lead to significant morbidity and mortality, usually due to multi-system organ failure or complications as a result of infected necrosis <sup>[1]</sup>.

The task for the clinician is to suspect, within few hours of admission, those patients who will progress to multi organ system failure and to provide appropriate care, including fluid resuscitation, respiratory support and intensive care if needed. A severity index scoring can thus be of help in this pursuit <sup>[2]</sup>.

Although there are several clinical scoring systems for assessing the clinical parameters of acute pancreatitis, both in the adult and paediatric population, no single clinical scoring system is able to predict clinical outcome with statistical significance. Computed Tomography based severity scoring system comes into play at this level. Many studies have pointed out the usefulness of CT based severity scoring system in the setting of acute pancreatitis with varying levels of statistical significance <sup>[3]</sup>.

The CT scoring system developed by Balthazar was the initial step in this outset. He based this scoring system based on the appearance of pancreatic inflammation on CT. Later, he and his team system improvised this scoring system and introduced the CT severity index (CTSI) by taking both the pancreatic inflammation and the presence of necrosis into account. This CTSI was the widely used system until Mortelet and his team introduced the modified CT severity index (MCTSI). This scoring system along with the pancreatic inflammation and the presence of necrosis, included the presence of extra pancreatic complications into foray and made CT scoring system a more inclusive one <sup>[4-6]</sup>.

Alcoholism is a serious health as well as a socio-economic hazard, which is one of the major causes of acute pancreatitis in our part of the country. Devising a scoring system which is valid and accurate in predicting the course and outcome of the acute pancreatitis and its associated complications will be of great help in managing this serious disease entity <sup>[7]</sup>.

In this regard, the present study has assessed the correlation of clinical outcomes with severity index in Acute Pancreatitis patients.

## Materials and Methods

**Study Design:** This study was a cross-sectional study conducted in Department of Radiology, Department of Radio diagnosis, Sree Lakshmi Narayana Institute of Medical Sciences, Puducherry, during the period of April, 2021 to December 2022.

**Subject enrolment:** Minimum sample size was calculated as 49. With 10% as attrition rate, final minimal sample size required was kept as 60. Patients more than 40 years of age, visited Department of Radiodiagnosis for diagnosis of Acute Pancreatitis and referred from the Department of General Medicine and General Surgery. Further categories of patients were excluded from this study: Patients with known history of allergy to iodinated contrast agents. Patients with deranged renal function test (serum creatinine > 1.5 mg/dl after rehydration). Patients with chronic pancreatitis suggested by intraductal calculi, ductal stricture and parenchymal calcification. Other pancreatic pathologies like pancreatic malignancy, cyst. Any previous pancreatic surgery.

**Study protocol:** Clinical outcome parameters were recorded by visiting the surgical ward and seeing the case sheets. The clinical details recorded were demographic data, detailed clinical history with presenting symptoms, physical examination (local and systemic) including pulse rate, blood pressure, respiratory rate, temperature and icterus and any history suggestive of possible aetiology such as gallstone pathology, alcohol intake, history of abdominal injury, drug history, any metabolic disease or any recent surgical intervention or procedure.

**CT Imaging Protocol:** CT abdomen examinations were conducted using GE Optima 660 128 slice CT and Toshiba Alexion 16 slice CT machines. Plain and post-contrast images of the abdomen and pelvis were taken in the axial sections and reformatted in sagittal and

coronal planes. Continuous serial axial sections, of thickness 5mm, with interval of 5mm and large FOV in cranio-caudal direction from the level of the xiphisternum to pubic symphysis, before and after administration of oral (10-20ml water soluble contrast in 500-1000ml distilled water) and intravenous non-ionic iodinated contrast of 1.5-2ml/kg dose at 34ml/s were taken. All images were viewed in a range of soft tissue window settings. The images were reported by a senior resident and were reviewed by a senior consultant radiologist.

The modified CTSI was established by summing the points given below and acute pancreatitis was then classified as:

Mild MCTSI score 0-2

Moderate MCTSI score 4-6

Severe MCTSI score 8-10

### Modified CT severity index

Prognostic Indicators		Points
Pancreatic Inflammation	Normal pancreas	0
	Intrinsic pancreatic abnormalities with or without inflammatory changes in peripancreatic fat.	2
	Pancreatic or peripancreatic fluid collection or peripancreatic fat necrosis.	4
Pancreatic Necrosis	None	0
	≤ 30%	2
	> 30%	4
Extra Pancreatic Complications	One or more of following: Pleural Effusion, ascites, vascular complications, parenchymal complications, or gastrointestinal tract involvement.	2

Assessment of Clinical Outcome Parameters: The length of hospital stay (in days), Need for Intensive care unit (ICU) stay. Need for percutaneous intervention (aspiration and drainage)/surgical debridement. Evidence of organ failure ( $\text{PaO}_2 < 60$  mm Hg or need of ventilation, systolic BP of  $< 90$  mm Hg, serum creatinine of  $> 300 \mu\text{moles/L}$  or urine output of  $< 500$  ml/24 h). Death.

**Statistical Analysis:** The data was compiled and entered into Microsoft excel data sheet (MS office 10) and was analysed using the SPSS version 16 software.

### Result

Demographic characteristics, imaging findings, complications and outcomes, The most common clinical presentation was epigastric pain in 47 (78.3%) patients, followed by vomiting in 46 (76.7%). Chronic alcohol abuse was the most common cause of AP (n = 32, 53.33%), followed by gallstone disease (n = 14, 23.33%). The details of demographic characteristics, etiologies, imaging findings, local complications and outcomes are shown in Table 1. Two types of acute pancreatitis were identified on interstitial oedematous pancreatitis (IEP) in 51.67% (31/60) and Necrotizing pancreatitis (NP) in 56.67% (34/60). Two patients with (mild) AP showed no CT abnormality (radiologically normal). Acute collections were noted in 53.3% of the cases overall; however, were much more common in cases of NP (29/30, 96.7% showed acute necrotic collections) rather than IEP (3/28, 10.7% showed acute peripancreatic fluid collections).

**Table 1:** Demographic characteristics, imaging findings, complications and outcomes in patients with acute pancreatitis (n=60)

Characteristics		No. of Cases (%)
Gender	Male	34 (56.67%)
	Female	26 (43.33%)
	M:F	3:2
Aetiology	Gall stone disease	14 (23.33%)
	Alcoholic	32 (53.33%)
	Idiopathic	9 (15%)
	Others	3 (5%)
Types of acute pancreatitis	Interstitial oedematous pancreatitis	31 (51.67%)
	Necrotizing pancreatitis	34 (56.67%)
	Pancreatic + peripancreatic necrosis	27 (45%)
	Peripancreatic necrosis alone	1 (1.67%)
	Pancreatic necrosis alone	0 (0%)

Severity grading of pancreatitis as per the Table 2 describes the distribution of severity-mild, moderately severe, or severe AP-according to the CTSI, and MCTSI scoring systems.

**Table 2:** Comparison of pancreatitis severity according to the CTSI, modified CTSI scoring system

Severity	CTSI no of cases (%)	Modified CTSI no of cases (%)
Mild	25 (41.67%)	23 (38.33%)
Moderate	19 (31.67%)	17 (28.33%)
Severe	16 (26.67%)	20 ((33.33%)

**Patient Outcome** The length of the hospital stay ranged from 0 to 14 days (mean, 7 days). Table 3 outlines the mean length of stay for the different severity subgroups for both indexes. A total of 18 (30%) of the 60 patients underwent surgical or percutaneous interventions. Surgical débridement was performed in four patients; percutaneous CT guided catheter drainage of pancreatic fluid collections was performed in four patients; and percutaneous CT-guided needle aspiration of pancreatic fluid collections was performed in seven patients. Evidently, some patients underwent a combination of procedures (aspiration, drainage, and surgery). Evidence of infection was present in 23 (38.33%) of the 60 patients. Organ system failure was present in nine patients (13.33%). In five of these patients, more than one organ system failed. Four patients died.

**Table 3:** Assessment of significant association between the Patient Outcomes and CT Severity Index

Outcome Factor	CT Severity Index		
	Mild(0-3 points)	Moderate(4-6 points)	Severe(7-10 points)
No. of patients	25	19	16
Length of hospital stay (days)	4 (14.28%)	9 (36%)	14 (87.5%)
Intervention or surgery	5 (20%)	6 (24%)	7 (43.75%)
Infection	8 (32%)	9 (36%)	6 (37.5%)
Organ failure	2 (8%)	2 (10.52%)	4 (25%)

**Correlation of Scoring Indexes with Patient Outcome** For the correlation between the two indexes and the length of the hospital stay, we found a statistically significant correlation between the modified index and the length of hospital stay ( $p = 0.035$ ) for all severity groups. However, when using the current CT severity index, no significant difference ( $p = 0.15$ ) in the length of the hospital stay was seen between the moderate and severe pancreatitis group.

**Table 4:** Assessment of significant association between the Patient Outcomes and Modified CT Severity Index

Outcome Factor	Modified CT Severity Index		
	Mild(0-3 points)	Moderate(4-6 points)	Severe(8-10 points)
No. of patients	23	17	20
Length of hospital stay (days)	3 (13.04%)	9 (52.94%)	14 (70%)
Intervention or surgery	4 (17.39%)	6 (35.29%)	7 (35%)
Infection	6 (26.08%)	9 (52.94%)	6 (30%)
Organ failure	2 (8.69%)	2 (23.52%)	5 (25%)

Organ failure, death seen in only severe category in moderate and severe category in modified CTSI, mild, moderate, severe category in Modified CTSI.

**Table 5:** Comparison of outcome according to the CT Severity Index and Modified CT Severity Index

Grading system	Severity	Organ failure	Number of Death
CT Severity Index	Mild	2	0
	Moderate	2	1
	Severe	4	3
Modified CT Severity Index	Mild	2	0
	Moderate	2	0
	Severe	5	4

## Discussion

In evaluation of the severity of acute pancreatitis both MCTSI and CT severity index severity grading was applied and evaluated in the study population. Majority of the patients (41.67%) in our study population were classified as mild AP when MCTSI was applied, while majority (38.33%) were placed in mild AP when the CTSI was used.

This difference could be attributed due to the fact that single peripancreatic collection is kept as mild AP in CTSI while it comes into moderate AP in MCTSI. This finding of majority of cases being designated as mild AP in CTSI is in concordance with the study conducted by Raghuvanshi S. *et al.*<sup>[8]</sup> in which majority of the patients (42%) were grouped as mild AP when the CTSI was used.

However, in their study when MCTSI was used, majority of the patients (44%) were placed in severe AP. In our study 29 patients (26.4%) were placed in severe AP while using MCTSI. Both the MCTSI and CTSI severity grading were entered in cross tabulation and evaluated using Pearson Chi square test. The Pearson Chi square test showed significant association ( $p < 0.001$ ) between MCTSI and CTSI severity grading. Cross tabulation analysis of both the CT severity grading and the age distribution showed significant association between them<sup>[9-14]</sup>.

Average days of hospital stay was computed to be 5 days in mild AP, 9 days in moderate AP and 14 days in severe AP. Both MCTSI and CTSI showed significant correlation between the disease severity and the duration of hospital stay ( $p$  value  $< 0.001$ ). 14 out of the total 60 patients (23.33%) required ICU admission at one point of time during their stay in the hospital. Both MCTSI and CTSI showed significant correlation between the disease severity and the duration of hospital stay ( $p$  value  $< 0.001$ )<sup>[15-18]</sup>.

Percutaneous intervention including aspiration & drainage were required in 10 patients (9.3%) during their stay in the hospital, out of which 3 patients went on to receive surgical management. Surgical debridement was needed in 5 patients (4.5%). Both MCTSI and CTSI showed significant correlation between the disease severity and the need for intervention procedures ( $p$  value  $< 0.001$ ).

Organ failure was classified as transient if it lasted  $\leq 48$  hours and as persistent if it lasted above 48 hours. Transient organ failure was found in 3 patients (5%) and persistent organ failure in 5 patients (8.33%). Both MCTSI and CTSI showed significant correlation between the disease severity and the occurrence of organ failure. This is in contrast to the pioneer study conducted by Bollen *et al.*<sup>[19]</sup> in which there was no significant association between CTSI and the occurrence of organ failure.

Both the MCTSI and CTSI showed significant association between the severity grading and the clinical outcome parameters including duration of hospital stay, ICU admission, intervention procedure, occurrence of organ failure and mortality.

## Conclusion

Contrast enhanced Computed Tomography is excellent diagnostic modality to stage the severity of inflammatory process, detect the pancreatic necrosis and depict local complications and grading of severity of acute pancreatitis. The scores obtained with the modified CTSI, showed a stronger correlation for all outcome parameters in all the patients better than the CTSI. MCTSI was able to predict the ICU admission, intervention procedure and mortality better compared to CTSI. However, prediction of organ failure could not demonstrate one CT index system as statistically superior over the other. MCTSI can be a reliable tool in acute clinical setting as a predictor of adverse clinical outcome.

Since improved outcome in the severe form of acute pancreatitis is based on early diagnosis of disease severity and subsequent focused management of these high-risk patients, we advocate the use of modified CTSI as a routine investigation in patients of acute pancreatitis in order to predict a severe attack of acute pancreatitis early in the course of disease, and thus decrease overall mortality and burden of disease.

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