

Original Research Article

# Modified Ct Severity Index for Acute Pancreatitis And its Correlation with Clinical Outcome.

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## Abstract

**Introduction:** Acute Pancreatitis is an acute inflammatory process of the pancreas and significant cause of morbidity and mortality. Treatment of patients with acute pancreatitis is based on the initial assessment of disease severity.

**Aim:** To determine the value of computed tomography evaluation in the early diagnosis of acute pancreatitis and to assess the clinical outcome based on Modified CT severity index.

**Material and Methods:** This observational prospective study was done on 127 patients referred to the Radiodiagnosis department with strong clinical and biochemical suspicion of pancreatitis and those diagnosed by ultrasonography, for a period from March to August 2022. Relevant clinical history and examination was done. A contrast enhanced CT abdomen was performed after checking serum creatinine and severity of pancreatitis was evaluated using MCTSI.

**Results:** Maximum patients with age group was 31 to 40 years (30%) with male preponderance. Gall stone was the most common etiology (45%) followed by alcoholism (35.4%). Amylase was elevated in 76.3% patients and Lipase in 74%. Pancreatic inflammation was seen in 100% of patients. 60% patients had no evidence of pancreatic necrosis on CT scan while 32% had less than 30% necrosis and only 8% had more than 30% necrosis. 61% patients had one or more extra pancreatic complications. According to Modified CT Severity Index, 17% patients had mild, 63% had moderate and 20% had severe pancreatitis. Duration of hospital stay ranged from 5 to 20 days with mean duration of 10.9days. 38% patients are considered to have end organ failure. 10% patients required surgical interventions.

**Conclusion:** MDCT proved to be the imaging modality of choice for the evaluation of the Acute pancreatitis. MCTSI which revealed a strong correlation with clinical outcome and is helpful in assessing disease progression and patient mortality.

**Keywords:** Acute pancreatitis, Modified Computed Tomography Severity Index

## 1. INTRODUCTION

Acute pancreatitis is a complex and challenging abdominal disorder. It is an inflammatory condition that is not limited to pancreas but may also extend to tissues in the vicinity of pancreas(1), usually associated with a systemic inflammatory process requiring emergent

care. Considering only clinical features, fails to identify about two thirds of patients of acute pancreatitis and is a poor indicator of the severity of Acute pancreatitis.

The annual incidence of acute pancreatitis ranges from 4.9 to 73.4 cases per 100,000 population, with the total mortality of 2–10%. It has an increasing trend due to increase consumption of alcohol and gallstones(2,3). Approximately, 80% to 85% of patients with acute pancreatitis will have the mild form with an uncomplicated clinical course whereas 15% to 20% develop a complicated clinical course characterized by organ failure and local complications(4).

Staging the severity of acute pancreatitis and early recognition of severe cases are essential so that the appropriate treatment will be provided for every patient, with the aim of reducing morbidity and mortality. Although the initial diagnosis of acute pancreatitis is based upon the clinical and laboratory parameters, imaging plays a very important role in evaluation of these patients.

Among various imaging modality Computed Tomography (CT) is highly precise, and sensitive method of evaluating features of acute pancreatitis include focal or diffuse enlargement of the pancreas, peripancreatic fat stranding, peripancreatic fascial thickening and fluid collections. It is unaffected by bowel gas distension and obesity, which is a definite advantage over ultra-sonographic evaluation.

The chance of diagnosing pancreatic necrosis is highest when the CECT scan is performed 24-48 hours after disease onset. Acute pancreatitis is suspected when abdominal CT demonstrates enlargement of pancreas (with or without necrosis) with peripancreatic fat stranding and fluid collections. In 1990, Balthazar introduced CT Severity Index (CTSI) as a grading system for assessing the severity of acute pancreatitis(5). However this scoring system did not include extrapancreatic complications such as organ failure, vascular complications etc.

To overcome these drawbacks, in 2004 Mortelet et al introduced Modified CTSI (MCTSI), a more simpler and easier index which has a better correlated with clinical outcome such as length of hospital stay, requirement of intervention, presence of infection and solid organ failure(6). The aim of this study is to determine the value of computed tomography evaluation in the early diagnosis of acute pancreatitis and to evaluate the clinical outcome based on Modified CT severity index.

## 2. MATERIAL AND METHODS

This observational prospective study was done on 127 adult patients referred to the Radio diagnosis Department of Mahatma Gandhi Memorial Medical College & M.Y. Hospital, Indore, Madhya Pradesh after receiving approval from Institutional Scientific and Ethical Committee with strong clinical and biochemical suspicion of pancreatitis and those diagnosed by ultrasonography. Study was done for a period from March 2021 to August 2022. Informed and written consent was taken. All these patients underwent multiphasic contrast enhanced CT evaluation of abdomen **and** severity of acute pancreatitis was analysed using MCTSI [Table-1]. Study excluded children, any trauma history, patients with renal failure, known case of chronic pancreatitis and pregnant females.

**CT ANALYSIS:**

**[Table-1]: Modified CTSI for severity of Acute Pancreatitis**

<b>I.PANCREATIC INFLAMMATION</b>	<b>SCORE</b>
Normal pancreas	0
Intrinsic pancreatic abnormalities with inflammatory changes in peripancreatic fat	2
Pancreaticorperipancreatic fluid collection or peripancreatic fat necrosis	4
<b>II.PANCREATIC NECROSIS</b>	
None	0
≤30%	2
>30%	4
<b>III. Extra-pancreatic complications</b>	
One or more of pleural effusion, ascites, vascular complications (venous thrombosis, arterial hemorrhage, pseudoaneurysm),parenchymal complications (infarction, hemorrhage, subcapsular fluid collection) or GI involvement (inflammation, perforation, intraluminal fluid collection)	2

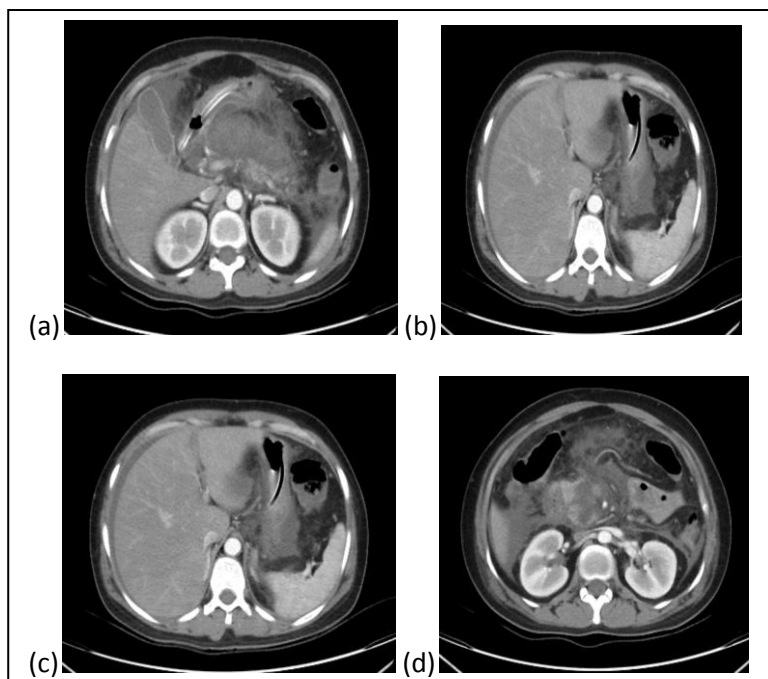
**MODIFIED CT SEVERITY SCORE**

- a) Mild (0–3 points)
- b) Moderate (4–6points)
- c) Severe (7–10 points)

Clinical outcome parameters include the length of hospital stay,infection,end organ failure and surgical intervention.

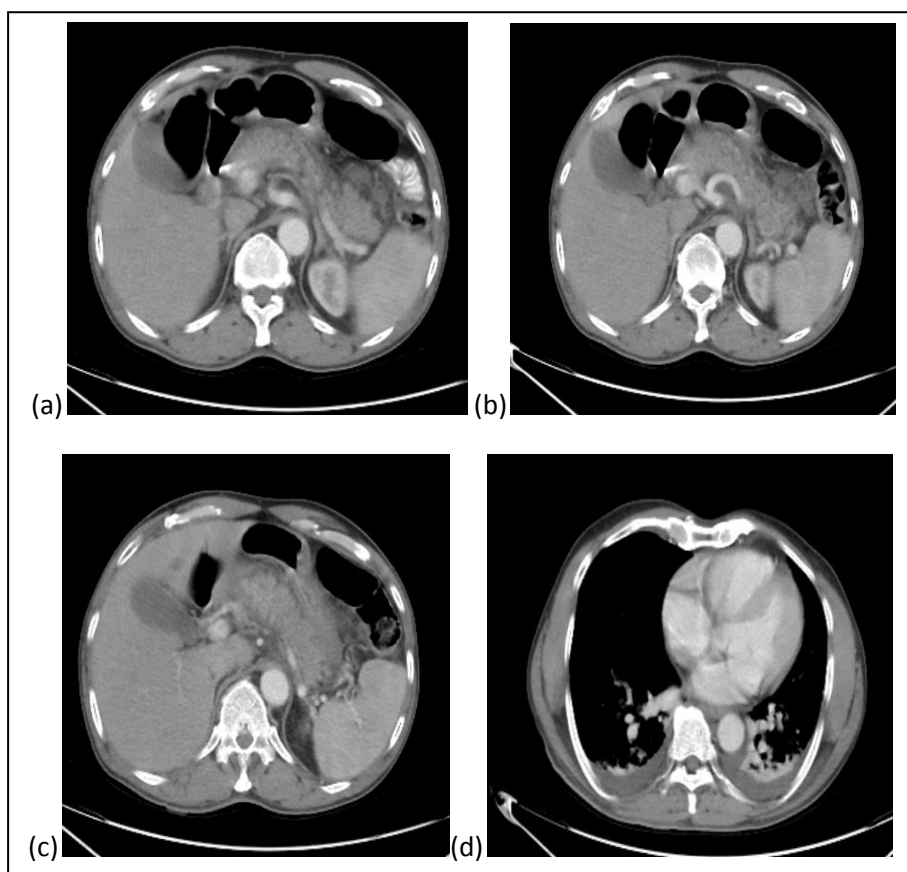
**Statistical analysis**

- Quantitative data is presented with the help of Mean and Standard deviation.
- Qualitative data is presented with the help of frequency and percentage table.
- Association among the study groups was assessed with the help of chi-Square test
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[Fig-1]: A 38 years female presented with abdomen pain with nausea and vomiting. Figure(a)and(b)CECT axial image shows bulky pancreas and large necrotic non enhancing parenchyma in the head, body and tail region with moderate peripancreatic fat stranding at portal venous phase. Figure (c) shows non opacification of contrast in left branch of portal vein and mild ascites. Figure (d) shows fat stranding seen along transverse mesocolon

Diagnosis - Acute necrotising pancreatitis (Modified CT Severity Score -10- Severe)



[Fig-2]:A 39 year old man presented with abdomen pain. Figure(a) and (b)CECT axial image shows heterogeneously enhancing enlarged pancreas with moderate fat stranding Figure(c)shows loss of pancreatic lobulations and Figure (d) shows bilateral mild pleural effusion.

Diagnosis- Acute interstitial pancreatitis (Modified CT Severity Score -4- Moderate)

### 3. RESULTS

The study included patients between the age group ranging from 20 years to 60 years with a mean age of 40.20years. Maximum no of patients belonged to 31-40 years 30%. In present study, 76.8% and 25.2% were male and females.

Pain abdomen (78.7%) was the most common complaint followed by nausea and vomiting(48.8%), jaundice (11.8%), abdominal distension (7.8%), and diarrhea (1.5%). Gall

stone was the most common etiology 45% followed by alcoholism 35.4%. 19.6% cases were found in others category include Hyperlipidemia, hypercalcaemia, viral infection, drug induced, post ERCP[Table-2]. Amylase was elevated in 76.3% patients. Lipase was elevated in 74% patients.

[Table-2]: Aetiological distribution of Acute pancreatitis

Aetiological Factors	No. of cases	Percentage(%)
Alcohol abuse	45	35.4%
Gallstones	57	45%
Others(Hyperlipidemia, hypercalcaemia, viral infection, drug induced, post ERCP)	25	19.6%

In our study, 127 Patients presenting with clinical suspicion of acute pancreatitis, CECT was performed, 27 patients had no evidence of pancreatitis. Pancreatic inflammation was seen in 100 patients. out of 100 patients 42% patients had intrinsic pancreatic abnormalities with inflammatory changes in peripancreatic fat and 58% patients had pancreatic or peripancreatic fluid collection. 60% patients had no evidence of pancreatic necrosis on CT scan. 32% of patients had less than 30% necrosis and only 8% had more than 30% necrosis. Pseudocyst and walled of pancreatic necrosis was seen in 15% and 3% of the patients.[Table-3]

[Table-3]: CT features of Acute pancreatitis

S.NO	CT FEATURES	FINDINGS	NO. OF CASES	(%)
1.	SIZE	Enlarged	78	78%
		Normal	22	22%
2.	DENSITY	Decrease	88	88%
		Normal	12	12%
		No enhancement	2	2%
3.	POST CONTRAST ENHANCEMENT	Homogenous	53	53%
		Heterogenous	45	45%
		No enhancement	2	2%
4.	PANCREATIC DUCT DIAMETER	Normal(<3mm)	96	96%
		Dilated(>3mm)	04	04%
5.	PANCREATIC INFLAMMATION	Peripancreatic fat stranding	42	42%
		Peripancreatic fluid collection	58	58%
6.	PANCREATIC NECROSIS	Less than 30%	32	32%

		More than 30%	8	8%
		Acute necrotic collection		
		Pancreatic Parenchymal Necrosis	18	45%
		Parenchymal and peripancreatic Necrosis	22	55%

In our study, extra pancreatic complications like pleural effusion 61%, ascites 56%, GI involvement 15%, vascular complications, 9% extra pancreatic parenchymal abnormality 6% were seen[Table-4].

[Table-4]: Extrapancreatic complications in Patients of Acute Pancreatitis

Radiological Findings	No. of cases	Percentage
Extra pancreatic parenchymal abnormality - Subcapsular collection (hepatic, splenic, renal) - Haemorrhage	6 5 1	6%
Pleural effusion <b>Unilateral</b> - Left - Right <b>Bilateral</b>	61 37 21 16 24	61% 60.6% 39.3%
Ascites	56	56%
Vascular complications - Venous thrombosis (portal vein, splenic vein) - Pseudo-aneurysm	9 8 1	9% 8% 1%
GIT inflammation - Bowel wall thickening	25	15%

The local complications Pseudocyst was seen in 15% in our study. Walled of pancreatic necrosis was detected in 3 patient (3%). The total percentage of patients developing local complications in the study was 18% [Table-5].

[Table-5]: Local complications of Acute Pancreatitis

Local complication	No. of cases	Percentage
Pseudocyst	15	15%
Walled of necrosis	3	3%

According to Modified CT Severity Index, 17% patients had mild, 63% patients had moderate and 20% had severe pancreatitis[Table/Fig-6]. According to Modified CT Severity Index, duration of hospital stay ranged from 5 to 20 days with mean duration of 10.9days. 38% patients are considered to have end organ failure. 44% patients had evidence of systemic infection and 10% patients required surgical interventions[Table/Fig-7].

[Table-6]: Distribution of patients with grades of severity assessment based on MCTSI score

CT Grade	Grading system	No. of Cases	Percentage
2	MILD(0-2)	17	17%
4	MODERATE (4-6)	20	63%
6		43	
8	SEVERE (8-10)	13	20%
10		7	
Total		100	100.0%

[Table-7]: Patient Outcome using Modified CT Severity Index in Acute pancreatitis

Outcome Factor	Modified CT Severity Index		
	Mild	Moderate	Severe
No. of Patients	17	63	20
Mean duration of hospital stay(days)	6.33	9.94	17.95
Infection	0	32	12
End-Organ Failure	0	5	10
Surgical intervention	0	2	8

Our results demonstrate the effectiveness of the widely used CT severity score as a tool for predicting morbidity in individuals with acute pancreatitis. We found a statistically significant correlation between the numerical score derived from the currently accepted index and the presence of infection, the requirement for surgical interventions, and the length of the hospital stay when comparing patients with mild pancreatitis and those with severe pancreatitis.

#### 4. DISCUSSION

In present study, maximum subjects were from the age group of 31-40 years (30%) followed by 41-50 years(26%) and 20-30 years (24.4%). It was concurrent with the study done by Thomas et al(7), Jauregui et al. and Sawarkar et al(2019)(8)Majority (76.8%) of the patients were males. Similarly Sawarkar et al(2019)(8) and Banday et al(2015)(9)in their study revealed male predominance in 84.78% and 66% their patients respectively. Pain abdomen (78.7%) was the most common complaint followed by nausea and vomiting(48.8%), jaundice (11.8%), abdominal distension (7.8%), and diarrhea (1.5%). This is in accordance with study conducted by Sawarkar et al(2019)(8).

In the present study, the most common etiology was found to be gall stones (45%) followed by alcoholism (35.4%). Less common etiologies were hyperlipidemia, hypercalcaemia, viral

infection, drug induced pancreatitis, post ERCP (19.6%). This is in concordance with Raghuwanshi et al(2016)(10)who also found cholelithiasis (42%) and alcoholism (38%) to be major cause. Similar findings were seen in in the study conducted by Steinberg et al(11).

Majority of patients(76.3%) had an elevated serum amylase followed by serum lipase (74%). This was similar to the study by Winselet et al(12) in which he encountered raised amylase in 96.1% of all mild and in 87.4% of severe cases of pancreatitis.

The most common CT findings observed in the series were peripancreatic inflammatory changes. 100% patients had this finding. Parenchymal changes in the pancreas included diffuse or focal enlargement of pancreas in 78%, density decreased in 88% and non-homogenous attenuation of pancreas in 45% patients. Acute interstitial type of pancreatitis was seen in 60% while acute necrotising pancreatitis was reported in 40%. These findings correlated well with Sawarkar et al(8) where 63% of the patients had acute interstitial edematous pancreatitis and 37% patients had acute necrotic pancreatitis.32% reported less than 30% necrosis while 8% cases had more than 30% necrosis. Similar findings obtained by Sawarkar et al(8) where majority (52.94%) were having less than 30% necrosis while 47.05% had necrosis more than 30%. Sahu et al(2017)(13) observed that 25% of the cases presented with less than 30% necrosis, 23.33% cases presented with more than 30% pancreatic necrosis while 51.66% cases did not have any necrosis. .

Extra pancreatic complications like pleural effusion 61%, ascites 56%, GI involvement 15%, vascular complications and extra parenchymal complications were also taken into consideration. Among vascular complications, 8% cases of venous thrombosis (portal and splenic vein) and 1% of pseudo-aneurysm were found.Among extra pancreatic parenchymal abnormality, 5% cases of subcapsular collection and 1% case of haemorrhage were seen. More than one complication was present in most of the cases and was present in higher grade(moderate and severe). Similar results were also observed by Banday et al(2015)(9). Our findings were in concordance with the study done by Raghuwanshi et al(2016)(10) where similar findings of pleural effusion and ascites were found to be the most common extra pancreatic complications.

On the basis of MCTSI, patients were divided into 2, 4, 6, 8 and 10 grades,which were further classified as mild (grade 2 & 4), moderate (grade6) and severe (grade 8 &10). 17% patients were in 2 grade, 20% patients in 4 grade, 43% patients in 6 grade,13% patients in 8 grade and 7% patients in 10 grade. which were further classified as majority of patients 63% were categorized as moderate pancreatitis, 20% patients were grouped into severe pancreatitis while 17%were categorized as mild pancreatitis according to MCTSI. Similarly studies done by Banday et al.(2015)(9) and Sawarkar et al(2019)(8)who found lesser number of patients with mild pancreatitis and more number of patients with moderate and severe pancreatitis.

The local complications Pseudocyst was seen in 15% in our study.Walled of pancreatic necrosis was detected in 3 patient (3%). The total percentage of patients developing local complications in the study was 18%. Presence of local complications was positively correlated with CT grading. No local complications were seen in patients with mild pancreatitis. About 8% of patients with moderate pancreatitis and 65% of patients with severe pancreatitis had developed local complications.

A total of 44 (44%) patients developed systemic infection, majority i.e. 32 patients had moderate and 12 patients had severe pancreatitis while none had mild pancreatitis. Systemic infection was seen in 50.7% and 60% of moderate and severe pancreatitis cases respectively.



Similarly, in study conducted by G V.Prasad et al(2019)(14) , 36% of patients were found to have evidence of systemic infection, 40% and 88% of patients with moderate and severe pancreatitis.15 out of the 100 patients (38%) were found to have end organ failure. Of these 15 patients who developed end-organ failure, 5 patients had moderate and 10 patients had severe pancreatitis according to the MCTSI. End-organ failure was seen in 8% and 50% of patients who had moderate and severe pancreatitis respectively. A significant association was noted between the development of systemic complications and grading of AP by Bollen et al (2008)( 15).

According to the MCTSI scoring, none of the patients in our study who had mild pancreatitis underwent surgical intervention. Surgical intervention was required in 10 patients (10%). 2 out of these 10 patients had moderate pancreatitis (20%) and 8 had severe pancreatitis (80%). In contrary, the study conducted by Bollen et al (2008) showed more number of patients who underwent surgical intervention. In their study 2 (3%) patients with moderate and 17(49%) patients with severe MCTSI underwent surgical intervention [5].

In our study, hospital stays ranged from 5days to 20 days with a mean hospital stay 10.9 days. Out of 100 cases, 21(21%) patients hospital stay was 1-7 days , 52(52%) patients hospital stay was 8-14 days and 27(27%) patients hospital stay was more than 14 days as the severity of disease increase the hospital stay days also increase. Out of 17 patients with mild category,14(82.4%) patients had 1-7 days of hospital stay, out of 63 patients of moderate category,48(76.2%) patients had 8-14 days of hospital stay and out of 20 patients of severe category, 19(95%)patients had more than 14days of hospital stay.This is, in accordance, with sawarkar et al (2019) (8)who observed that majority of the subjects had hospital stay between 8-14 days (50%).

The most common segment of total duration of hospital stay was from 8 to 14 days (76.2%).Strong correlation was seen between patient's CT grade and total duration of hospital stay. Mean duration of stay was 7.2 days in mild, 11.7 days in moderate and 28.8 days in severe pancreatitis. A study by Sawarkar et al (2019)(8)and Mortelet et al (2004)(6) also showed a significant correlation between MCTSI grade of acute pancreatitis and length of hospital stay (5 days for mild, 10 days for moderate, and 15 days for severe grades of pancreatitis). In our study when the Modified CT severity index was applied the average duration of hospital stay in patients categorized as mild pancreatitis was 6.33days, in moderate pancreatitis 9.94days and in severe pancreatitis 17.95days.None of the patients categorized as mild pancreatitis had an adverse or fatal outcome. The majority (80%) of patients requiring interventional procedure fell in the severe pancreatitis group. Likewise, 10(66.6%) out of 15 patients who developed organ failure belonged to severe group.32 (72.3%) out of 44 patients and 12(27.7%) out of 44 patients who developed infections belonged to moderate and severe group respectively.

Our results demonstrate the effectiveness of the widely used CT severity score as a tool for predicting morbidity in individuals with acute pancreatitis. We found a statistically significant correlation between the numerical score derived from the currently accepted index and the presence of infection, the requirement for surgical and percutaneous interventions, and the length of the hospital stay when comparing patients with mild pancreatitis and those with severe pancreatitis.

The present study demonstrated a myriad of imaging findings, complications and was successful in establishing the usefulness of MDCT in acute pancreatitis and also the correlation of CTSI with the clinical outcome.

## 5. CONCLUSION

We concluded that with a higher CT severity score there was an increased incidence of end organ failure, systemic infection and longer duration of hospital stay . There was significant correlation between MCTSI based acute pancreatitis severity grades and patient outcome parameters.

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