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A Comparative Study Between The CT Severity Index And Modified CT Severity Index In The Evaluation Of Acute Pancreatitis

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I. Introduction

Acute pancreatitis typically manifests as epigastric pain accompanied by elevated serum pancreatic enzymes. It exhibits a wide clinical and radiological spectrum, ranging from mild interstitial or oedematous inflammation to severe necrotizing forms accompanied by substantial local and systemic complications. Acute pancreatitis is a potentially lethal disease in certain circumstances, so early detection and severity assessment are necessary to prevent complications and reduce mortality.

Computed tomography (CT) is the investigation of choice for evaluating acute pancreatitis. It effectively identifies pancreatic pathology as well as its associated complications. Unlike the ultrasonography , CT is not affected by obesity and bowel gases. Contrast-enhanced computed tomography (CECT) facilitates early detection, stratification of disease severity, and comprehensive evaluation of complications in acute pancreatitis, thereby serving as a critical tool in prognostic assessment.

The CT severity index (CTSI), proposed by Balthazar et al. has been well accepted as an accurate method for the severity assessment of acute pancreatitis, and it is well related with clinical outcome. It focuses on the degree of pancreatic inflammation and necrosis and defines its result based on a 10-point ordinal scale, categorized as mild (score 0-3), moderate (score 4-6), and severe (score 7-10) acute pancreatitis. It predicts the severity, morbidity, and mortality of acute pancreatitis patients well, but it is limited in its ability to predict extra pancreatic complications and organ failure.

The modified CT severity index (MCTSI) was developed in 2004 by Mortele et al. with the addition of extra pancreatic complications as keys for the MCTSI calculation, with the aim of improving the accuracy of predicting the severity, morbidity, and mortality of acute pancreatitis patients. They reduced the score of pancreatic necrosis since they acknowledged that there was no significant difference in morbidity and mortality between patients with thirty to fifty percent pancreatic necrosis and patients with more than fifty percent pancreatic necrosis. MCTSI also employs a 10-point metric scale that categorizes mild (score 0-2), moderate (score 4-6) and severe (score 8-10) acute pancreatitis. Mortele et al. reported that MCTSI is correlated more closely with the patient outcome than CTSI. Meanwhile, Bollen et al. reported no significant differences between the two in assessing the severity of acute pancreatitis.

Aims and Objectives

To compare CTSI and MCTSI in assessing the severity of acute pancreatitis.

II. Materials And Methods:

The present study was a hospitalbased retrospective study. It was conducted from February 2023 to April 2025 at PESIMSR, Kuppam, Andhra Pradesh. Data were collected from hospital records. The study included 37 patients who were referred for the evaluation of epigastric abdomen pain.

The CT scans were performed via 32-slice CT scanner, GE Healthcare, Revolution. The scan area covered the upper abdomen as a minimum. All subjects underwent non-contrast and contrast enhanced phase scans before and after an intravenous injection of 80-100 millilitres (ml) of nonionic iodinated contrast agent followed by 20-40 ml of normal saline through a power injector with a rate of 3 ml/second. A porto-venous phase scan with an 80-second delay was obtained in all participants. Some participants had an additional pancreatic phase scan at a 40-second delay or a delayed phase scan at a 5-minute delay, depending on clinical indication.

Image Analysis

All 37 digital CT studies from the hospital were retrospectively reviewed on a PACS workstation (Centricity, GE Healthcare). Each study was interpreted by an experienced radiologist separately and independently. The radiologist reviewed all imaging studies and recorded all pancreatic, peri-pancreatic, and extra-pancreatic findings and complications, each blinded to patient outcome. Pancreatic findings included pancreatic enlargement and the presence and extent of areas lacking enhancement. Peripancreatic findings included peripancreatic fat stranding and the number of fluid collections.

Extra-pancreatic complications assessed included ascites, pleural effusion, pericardial effusion, vascular complications like venous thrombosis, hemorrhage, and arterial pseudoaneurysm formation, gastrointestinal complications including adynamic ileus, mechanical obstruction, features of ischemia, significant bowel wall thickening, perforation, and intramural fluid collections, as well as extrapancreatic parenchymal complications such as organ infarction, hemorrhage, and subcapsular fluid collections. Both scoring indices were evaluated concurrently during a single image interpretation session.

TABLE 1: CT Severity Index (CTSI) and Modified CTSI (MCTSI)

Characteristics	CTSI (0–10)	MCTSI (0–10)
Pancreatic inflammation		
Normal pancreas	0	0
Focal or diffuse enlargement of pancreas	1	2
Peripancreatic inflammation	2	2
Single acute fluid collection	3	4
Two or more acute fluid collections	4	4
Pancreatic parenchymal necrosis		
None	0	0
Less than 30%	2	2
Between 30% and 50%	4	4
More than 50%	6	4
Extrapancreatic complications a	0	2

Inclusion Criteria

1. Clinically suspected case of acute pancreatitis of all ages.

Exclusion Criteria

1. Previous pancreatic surgery and Postoperative cases.
2. Chronic pancreatitis with intraductal calculi, ductal stricture and parenchymal calcification.
3. Pancreatic malignancy, cyst.
4. Contrast material sensitive patient.
5. Pregnant women.

Statistical Analysis

Data analysis was conducted using SPSS version 25. Data transformation involved recoding, counting, and cross-tabulation. The processed data were analysed using Pearson's chi-square test and Fisher's exact test. Spearman's rank correlation and Cohen's kappa were employed to assess the agreement between the two scoring systems.

III. Results

Out of 37 patients, 34 were men only 3 were women. The male to female ratio of 11.33:1, and the age at presentation ranged from 27 to 68 years. The mean age of 40.76 years. The aetiology of pancreatitis was alcohol induced in 28 patients (52%), gallstone induced in 19(35%), followed by drug induced and idiopathic. Male preponderance might be due to alcoholism.

The most common CT finding in the group is Peripancreatic fat stranding and collection, seen in 15 (41%) of patients, followed by Pancreatic necrosis, seen in 9(24%) patients. According to the CTSI, they were divided into mild 12 (32%), moderate 13(35%), and severe 12 (32%). As per the MCTSI, they were also categorized as mild, moderate, and severe 8(22%), 24 (65%), and 5(13%), respectively.

The modified CTSI showed a more significant correlation with the occurrence of mortality and organ failure than the CTSI. The modified CTSI also correlated more closely with the length of hospital stay (>7 days) than the CTSI, although both indices showed a significant correlation. The Spearman rank correlation r value is

0.69, which denotes strong agreement between CTSI and MCTSI. the P value of less than 0.05 is statistically significant.

Table 2: Severity distribution based on CTSI and MCTSI

Severity	CTSI	MCTSI
Mild	12	8
Moderate	13	24
Severe	12	5
Total	37	37

Graph1: Graphical representation of severity in CTSI and MCTSI

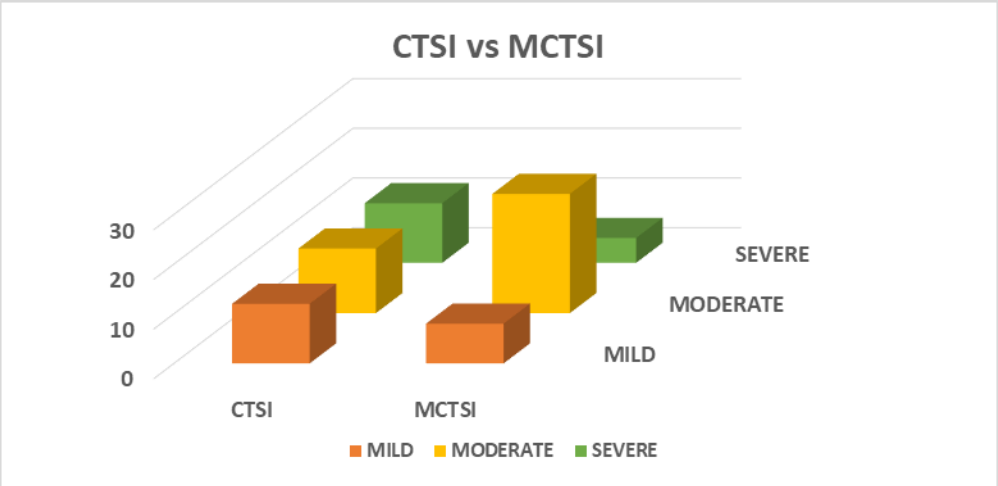

Table 3: Disease Characteristics

	Number of cases	Percentage
Pancreatic necrosis	9	24%
Peripancreatic collection	15	41%
Extra pancreatic collection	7	19%
Extra pancreatic complication	19	51%
Organ failure	3	8%
Sepsis	7	19%
Morbidity	2	5%

Table 4: Disease outcome parameters in CTSI and MCTSI

	HOSPITAL STAY (<1week, >1week)		PANCREATIC NECROSIS		ORGAN FAILURE		MORTALITY	
	CTSI	MCTSI	CTSI	MCTSI	CTSI	MCTSI	CTSI	MCTSI
MILD	0	0	0	0	0	0	0	0
MODRATE	7	11	4	5	1	0	0	0
SEVERE	9	5	5	4	2	3	2	2

IV. Discussion

Fig 1 :Coronal (A) and axial (B) contrast enhanced CT images of a 28 years old male patient with acute pancreatitis showing Diffuse bulky pancreas with areas of necrosis involving part of head,body and proximal tail of pancreas(>30%)(*)and extensive peripancreatic inflammatory changes and fluid collection seen in the perisplenic space, left paracolic gutter, lesser sac .Thickening of bilateral anterior, posterior renal fascia and lateral conal fascia with moderate ascitis - Features suggestive of Acute Necrotizing pancreatitis. Using CTSI and MCTSI,the patient was assessed to have severe acute pancreatitis (CTSI =10 and MCTSI =10)

Fig2: Axial contrast enhanced CT image showing diffusely bulky Pancreaswith irregular margins with small area of necrosis involving head and uncinate process-necrosis 20%. Using CTSI and MCTSI,the patient was assessed to have severe acute pancreatitis (CTSI =8 and MCTSI =8)

Fig 3:Axial contrast enhanced CT image showing acute pancreatitis with thick walled large fluid collectionin peripancreatic region (Pseudocyst).(CTSI =6 and MCTSI =4moderate acute pancreatitis)

Fig 4: Axial contrast enhanced CT image showing diffusely bulky Pancreas with peri-pancreatic fat stranding and minimal fluid collection with mild pancreatic necrosis.Using CTSI and MCTSI,the patient was assessed to have severe acute pancreatitis (CTSI =8 and MCTSI =8).

Computed tomography imaging is the preferred investigation tool for evaluating acute pancreatitis. It provides an accurate diagnosis, identifies possible causes, discloses severity, shows complications, guides appropriate treatment, and can also be performed for follow-up after treatment. Introduction of the CTSI revolutionized the assessment of acute pancreatitis by helping clinicians differentiate between mild, moderate and severe pancreatitis. Limitations of CTSI were lack of correlation with outcome parameters such as organ failure, extra-pancreatic, parenchymal or peripancreatic vascular complications. Patients with more than 30% pancreatic necrosis exhibit comparable rates of morbidity and mortality, making the inclusion of an additional 50% threshold in the scoring system clinically irrelevant. Modified CTSI to overcome the shortcomings of the currently accepted CTSI. Greater weightage is given to the presence of extra-pancreatic complications to allow a more accurate clinical outcome prediction.

Modified CTSI correlated more significantly with the occurrence of organ failure and the extra pancreatic complications than the CTSI, although both indices showed significant correlation. CTSI and MCTSI are established CT-based scoring systems used to evaluate the severity of acute pancreatitis, both of which have demonstrated strong correlation with clinical outcomes.

There was a strong agreement between CTSI and MCTSI in relation to the severity assessment of acute pancreatitis. This could be easily explained since the main indicators of both scoring systems are the signs of pancreatic inflammation and the degree of pancreatic necrosis. A difference between these 2 scoring systems is that MCTSI partly focuses on extra pancreatic complications. However, because the extra pancreatic complication component contributes only 0–2 points, it does not substantially differentiate the overall scores between the two systems. As our study was retrospective design, we acknowledge some limitations. First, its sample size was small, and the time between the CT scan and the onset of the disease had considerable variation (1-12 days). Second, two participants who passed away had short durations of hospital stay, which decreased the accuracy of using the length of hospital stay as a clinical outcome. Third, some participants had co-morbid diseases, such as cirrhosis, and some CT features that affected the CTSI and MCTSI interpretation (e.g., ascites, bowel wall oedema, etc.). Furthermore, some participants were admitted with a primary diagnosis of acute pancreatitis but developed other systemic complications during admission, which affected their clinical outcome.

V. Conclusion

In this study the agreement between CTSI and MCTSI scores was strong. Modified CTSI simplifies the evaluation of acute pancreatitis by considering only the presence or absence of fluid collections rather than the number of collections and also by grading necrosis into just 2 grades (<30% and >30%). Contrast-enhanced

computed tomography (CECT) is an excellent imaging modality for staging the severity of inflammation, detecting pancreatic necrosis, and identifying local complications in acute pancreatitis. The modified Mortele index has demonstrated a stronger correlation with clinical outcomes across all patients compared to the Balthazar index.

Conflicts of interest: Nil

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