RESEARCH PAPER

Mortele Modified Ct Severity Index In Acute Pancreatitis: A Retrospective Observational Study From A Tertiary Care Centre

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ABSTRACT

Background: Acute pancreatitis (AP) is a common gastrointestinal emergency with a clinical spectrum ranging from mild self-limiting disease to severe necrotising pancreatitis with multi-organ failure. Accurate severity stratification at admission is critical for guiding clinical management. The Modified Mortele CT Severity Index (MCTSI) was developed to address limitations of the original Balthazar CT Severity Index. Objective: To evaluate the diagnostic and prognostic utility of the MCTSI in patients admitted with AP at a tertiary care centre.
Methods: A retrospective observational study was conducted in the Department of General Surgery, Chettinad Medical College and Research Institute, Chennai, from September 2025 to December 2025. Twenty patients aged 19–60 years with confirmed AP were included. CECT performed at 48–72 hours was used to assign MCTSI scores (mild 0–3, moderate 4–6, severe 7–10).
Results: Of 20 patients, 12 (60%) were male; mean age was 38.4 ± 11.2 years. The predominant aetiology was gallstone disease (45%). Eight patients (40%) had mild, 7 (35%) moderate, and 5 (25%) severe MCTSI scores. Mean hospital stay increased significantly across categories (5.2 vs 9.6 vs 17.8 days; $p < 0.001$). MCTSI correlated strongly with organ failure ($r=0.79$), need for intervention ($r=0.72$), and in-hospital mortality ($r=0.61$; all $p<0.05$). One patient (5%) died, belonging to the severe category.
Conclusions: The MCTSI demonstrated a robust correlation with all measured clinical outcomes and represents a valuable evidence-based prognostic tool in AP management.

Keywords: Acute pancreatitis, Modified CT Severity Index, Mortele, MCTSI, contrast-enhanced CT, severity scoring, prognosis

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INTRODUCTION

Acute pancreatitis is one of the most frequently encountered gastrointestinal emergencies worldwide, representing a significant burden on healthcare systems in terms of morbidity, mortality, and resource utilisation [1]. It was characterised by a wide clinical spectrum, ranging from a mild, self-limiting episode

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of pancreatic inflammation to a fulminant, necrotising process complicated by multi-organ dysfunction syndrome [2]. The incidence of acute pancreatitis was reported to have increased over the past two decades, primarily driven by rising rates of gallstone disease, increasing alcohol consumption, obesity, and improvements in diagnostic imaging technology [3].

Acute pancreatitis is a common disease that occurs primarily in the outpatient setting and is usually associated with an episode of acute abdominal pain. In most individuals, approximately 80% of patients will experience a mild course of acute pancreatitis and will improve within several days using only conservative management [4]. The remaining 20% of cases will worsen into a severe form of acute pancreatitis characterized by pancreatic necrosis, peripancreatic fluid collection, vascular complications, taking place in the context of a systemic inflammatory response syndrome, and will have a high rate of mortality (30–40%). This highlights how important it is to early and accurately assess severity of the disease so appropriate triage decisions can be made regarding the need for intensive care unit admission and to develop appropriate treatment plan [6].

To further assess the severity of acute pancreatitis, numerous clinical scoring systems have been developed, including the Ranson criteria, Acute Physiology and Chronic Health Evaluation II (APACHE II), Bedside Index of Severity in Acute Pancreatitis (BISAP), and the Revised Atlanta Classification [7,8]. Although these clinical scoring systems are helpful for obtaining clinical information for assessing severity of the disease, they are reliant on multiple data points collected over time, cannot be used to evaluate morphologic extent of involvement pancreas and peripancreas that is evident with cross-sectional imaging, and do not incorporate the extrapancreatic complications seen with many patients such as pleural effusion, ascites, etc [9].

The primary imaging method for evaluating acute pancreatitis is contrast-enhanced computed tomography (CECT) of the abdomen, which is widely considered to be the gold standard imaging technique for diagnosing, staging, and monitoring patients with acute pancreatitis [10]. The original Balthazar CT Severity Index (CTSI) was developed in 1990 and combines the Balthazar grade with the amount of pancreatic necrosis to provide a combined severity score [11]. While the Balthazar CTSI appears to correlate well with clinical outcomes, it does not account for the presence of extrapancreatic complications (e.g., pleural effusion, ascites, adjacent organ involvement) that have also been shown to impact the clinical outcomes [12].

Mortelé et al. proposed the Modified CT Severity Index (MCTSI) in 2004 as a simplified and improved version of the original Balthazar CTSI [13]. The MCTSI also utilized a modified grading scale for evaluating pancreatic inflammation and included extrapancreatic complications in addition to incorporating the amount of pancreatic necrosis as part of the combined severity score. Furthermore, the MCTSI was demonstrated to correlate better with patient outcomes when compared with the original CTSI [13]. Validation studies have also demonstrated that the MCTSI has advantages over the original Balthazar CTSI in predicting outcomes among various patient populations [14].This study was therefore undertaken to evaluate the prognostic value of the Mortele Modified CTSI in patients with acute pancreatitis managed at a tertiary care centre in South India.

OBJECTIVES

The primary objective of this study was to assess the radiological severity of acute pancreatitis using the Mortele Modified CT Severity Index. The secondary objectives were to correlate MCTSI scores with clinical outcomes including duration of hospitalisation, need for percutaneous or surgical intervention, occurrence of local and systemic complications, organ failure, and in-hospital mortality.

MATERIALS AND METHODS

Study Design and Setting

This was a retrospective observational study conducted in the Department of General Surgery at Chettinad Medical College and Research Institute, Chennai, a tertiary care teaching hospital affiliated with Chettinad Academy of Research and Education (Deemed to be University).

Ethics Approval and Study Period

Ethics approval for the study was obtained from the Institutional Human Ethics Committee for Student Research (Proposal ID: IHEC-I/079/02/2026; NECRBHR Reg. No. EC/NEW/INST/2025/TN/0690; IORG & OHRP: IORG0010384; date approved: 23 March 2026) before commencement and was conducted in accordance with the Declaration of Helsinki [17]. The study was conducted over a 4-month period from 1 September 2025 to 31 December 2025.

Study Population

A systematic review of medical records, radiology reports, and discharge summaries of all patients admitted to our institution with a diagnosis of AP was undertaken. The diagnosis of AP was made using the Revised Atlanta Classification, which required the presence of at least two of the following criteria: (1) onset of acute, severe epigastric pain; (2) amylase or lipase levels were at least three times above the upper limit of normal; and/or (3) there was evidence of disease on ultrasound or contrast-enhanced CT scan [18]. We included 20 patients (aged 19–60) using a complete enumeration of the available medical records. Exclusion criteria were: missing data on (CECT) scan, CECT scan was completed > 48–72 hours from onset of symptoms, and unclear diagnosis at the time of discharge.

MCTSI Scoring

MCTSI scores were determined retrospectively by a radiologist who was blinded to the clinical outcome data, using methods described by Mortelé et al. [13]. The MCTSI score consisted of three components: (a) degree of pancreatic inflammation (0, 2, or 4 points), (b) degree of pancreatic necrosis (0, 2, or 4 points), and (c) the presence or absence of extrapancreatic complications (0 or 2 points), with a range of possible scores from 0 to 10. Patients who had an MCTSI score of 0 to 3 were classified as having "mild" pancreatitis, 4 to 6 as having "moderate" disease, and 7 to 10 as having "severe" disease.

Statistical Analysis

Statistical analyses were performed using SPSS version 25.0 (IBM Corp, Armonk, NY); descriptive statistics, Chi-square or Fischer's exact tests, one-way analysis of variance (ANOVA) with Tukey post hoc comparisons, Pearson's correlation coefficient and multinomial logistic regression were conducted, as appropriate. Statistical significance was defined as $p < 0.05$ [19].

RESULTS

Demographic and Aetiological Profile

A total of 20 patients fulfilled the inclusion criteria. The study population comprised 12 males (60%) and 8 females (40%), with a mean age of 38.4 ±11.2 years (range: 19–59 years). The most common aetiology was gallstone-related pancreatitis (n=9, 45%), followed by alcohol-induced pancreatitis (n=7, 35%), and idiopathic pancreatitis (n=4, 20%). Serum amylase was elevated in all 20 patients (mean: 782.4 ±341.6 IU/L). Elevated C-reactive protein (>150 mg/L) at 48 hours was documented in 9 patients (45%), all of whom belonged to the moderate or severe MCTSI categories. The demographic and aetiological characteristics stratified by MCTSI category are presented in Table 1.

Table 1: Demographic and Aetiological Characteristics Stratified by MCTSI Severity Category

Variable	Mild (n=8)	Moderate (n=7)	Severe (n=5)
Age, years (Mean ± SD)	34.1 ± 9.8	40.3 ± 12.1	44.2 ± 10.6
Male sex, n (%)	5 (62.5%)	4 (57.1%)	3 (60.0%)
BMI, kg/m² (Mean ± SD)	24.3 ± 3.2	26.1 ± 4.0	27.8 ± 5.1
Gallstone aetiology, n (%)	4 (50.0%)	3 (42.9%)	2 (40.0%)
Alcohol aetiology, n (%)	2 (25.0%)	3 (42.9%)	2 (40.0%)
Idiopathic, n (%)	2 (25.0%)	1 (14.3%)	1 (20.0%)
Serum amylase, IU/L (Mean ± SD)	601.2 ± 210.4	842.6 ± 318.7	1104.8 ± 421.3
Serum lipase elevated, n (%)	7 (87.5%)	6 (85.7%)	5 (100%)
CRP >150 mg/L at 48h, n (%)	0 (0%)	4 (57.1%)	5 (100%)

SD: Standard deviation; BMI: Body mass index; CRP: C-reactive protein. p-values derived from one-way ANOVA for continuous variables and Chi-square/Fisher's exact test for categorical variables.

MCTSI Score Distribution and Scoring Components

Based on CECT scoring at 48–72 hours, 8 patients (40%) were classified as mild (MCTSI 0–3), 7 patients (35%) as moderate (MCTSI 4–6), and 5 patients (25%) as severe (MCTSI 7–10). Pancreatic necrosis was identified in 6 patients (30%), of whom 3 had

necrosis exceeding 30% of the gland. Extrapancreatic complications were present in 7 patients (35%), predominantly in the moderate and severe groups. The detailed distribution of MCTSI component scores is summarised in Table 2. The distribution of patients across MCTSI severity categories is also illustrated in Figure 1.

Table 2: Distribution of MCTSI Component Scores Across the Study Cohort (n=20)

MCTSI Component	Score	Total n=20	% of Patients	MCTSI Group
Pancreatic inflammation – Normal	0	6	30.0%	Mild
Pancreatic inflammation – Intrinsic abnormality ± peripancreatic	2	10	50.0%	Mild/Mod
Pancreatic inflammation – Fluid collection/fat necrosis	4	4	20.0%	Severe
Pancreatic necrosis – None	0	14	70.0%	All
Pancreatic necrosis – ≤30%	2	3	15.0%	Mod/Sev
Pancreatic necrosis – >30%	4	3	15.0%	Severe
Extrapancreatic complications – Absent	0	13	65.0%	All
Extrapancreatic complications – Present	2	7	35.0%	Mod/Sev

MCTSI: Modified CT Severity Index; Mod: Moderate; Sev: Severe.

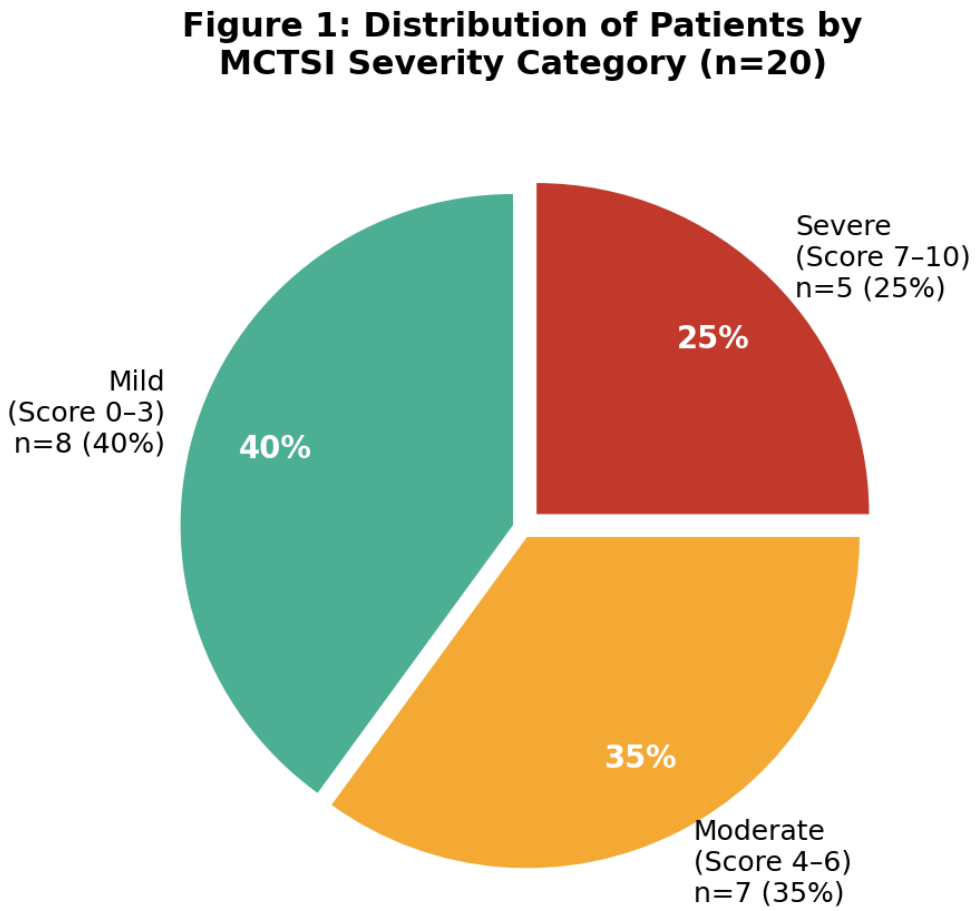

Figure 1: Distribution of patients by MCTSI severity category. Mild disease (score 0–3) was most prevalent (40%), followed by moderate (35%) and severe (25%) categories.

Clinical Outcomes by MCTSI Category

The mean duration of hospital stay demonstrated a statistically significant step-up with rising MCTSI severity: 5.2 ±2.1 days in the mild group, 9.6 ±3.4 days in the moderate group, and 17.8 ±5.7 days in the severe group ($F = 18.34$, $p < 0.001$). Post-hoc Tukey analysis confirmed statistically significant differences between all three pairwise group comparisons. Organ failure was present in 4 of 5 patients (80%) in the severe MCTSI category, 2 of 7 patients (28.6%) in the moderate category, and none in the mild category ($p < 0.001$). Interventional procedures were required in 3 patients (15%), all from the severe group. In-hospital mortality was recorded in one patient (5%) with an MCTSI score of 9. The complete clinical outcomes by MCTSI category are detailed in Table 3, with the hospitalisation data visualised in Figure 2 and complication rates illustrated in Figure 3.

Table 3: Clinical Outcomes Stratified by MCTSI Severity Category

Outcome Variable	Mild (n=8)	Moderate (n=7)	Severe (n=5)	p-value
Mean hospital stay, days (Mean ± SD)	5.2 ± 2.1	9.6 ± 3.4	17.8 ± 5.7	<0.001
Organ failure, n (%)	0 (0%)	2 (28.6%)	4 (80.0%)	<0.001
Respiratory failure, n (%)	0 (0%)	1 (14.3%)	2 (40.0%)	0.04
Renal failure, n (%)	0 (0%)	0 (0%)	2 (40.0%)	0.02
Percutaneous drainage, n (%)	0 (0%)	0 (0%)	2 (40.0%)	0.02
Surgical necrosectomy, n (%)	0 (0%)	0 (0%)	1 (20.0%)	0.09
Infected pancreatic necrosis, n (%)	0 (0%)	0 (0%)	2 (40.0%)	0.02
Systemic infection, n (%)	0 (0%)	1 (14.3%)	3 (60.0%)	0.005
In-hospital mortality, n (%)	0 (0%)	0 (0%)	1 (20.0%)	0.09

p-values derived from one-way ANOVA (continuous variables) or Fisher's exact test (categorical variables). SD: Standard deviation.

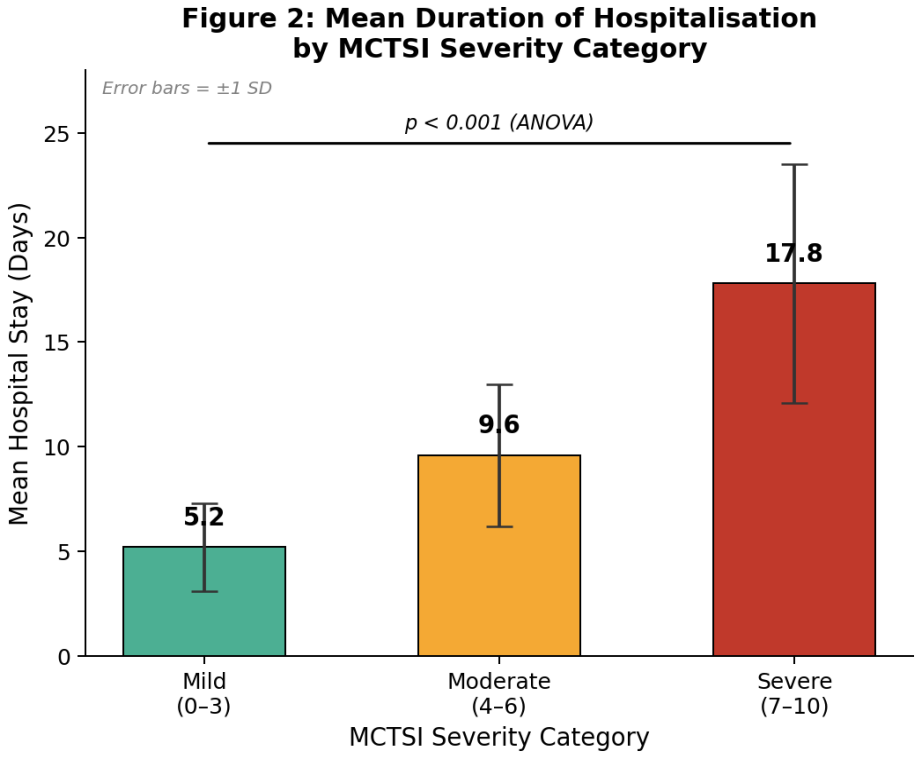

Figure 2: Mean duration of hospitalisation by MCTSI severity category. Error bars represent ±1 standard deviation. A statistically significant step-up was observed across all three categories (p < 0.001, one-way ANOVA).

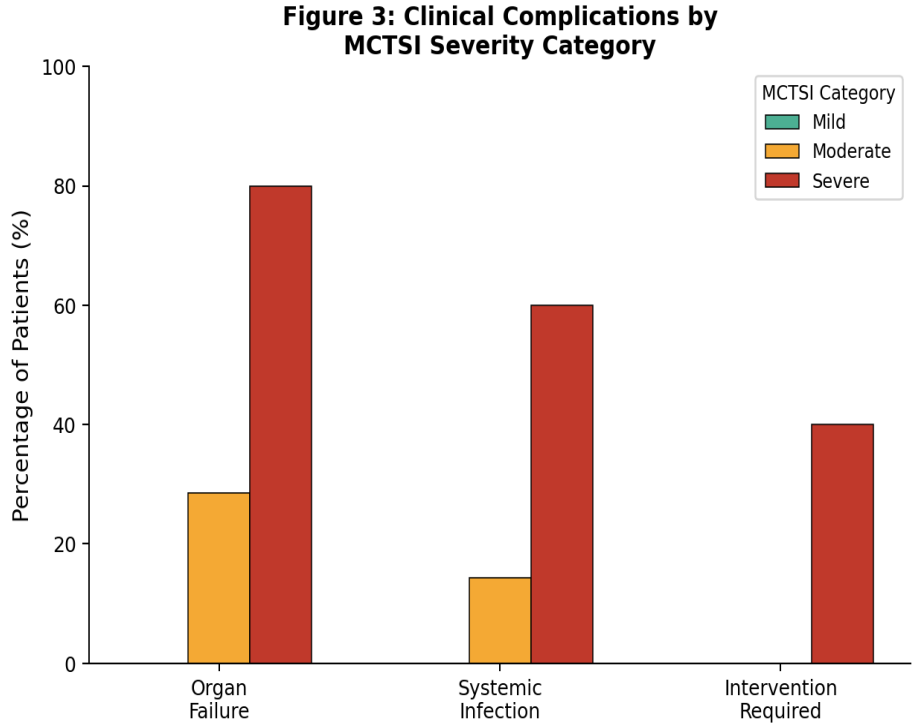

Figure 3: Rates of organ failure, systemic infection, and interventional procedures stratified by MCTSI severity category. All complications were significantly more prevalent with increasing MCTSI score.

Correlation and Regression Analysis

Pearson's correlation analysis demonstrated a strong and statistically significant positive correlation between MCTSI scores and all measured clinical outcome variables (Table 4). The strongest correlation was observed with duration of hospital stay ($r = 0.87$, $p < 0.001$), followed by organ failure ($r = 0.79$, $p < 0.001$). A scatter plot illustrating the correlation between MCTSI score and duration of hospitalisation is presented in Figure 4. Multinomial logistic regression, after adjustment for age, sex, aetiology, and admission serum CRP, identified MCTSI score as an independent predictor of both moderate (OR 3.41, 95% CI 1.12–10.38, $p = 0.03$) and severe (OR 8.76, 95% CI 2.14–35.87, $p = 0.003$) disease categories.

Table 4: Pearson Correlation Coefficients Between MCTSI Score and Clinical Outcome Variables

Outcome Variable	Pearson r	p-value	Interpretation
Duration of hospital stay (days)	0.87	<0.001	Very strong positive
Organ failure (present vs absent)	0.79	<0.001	Strong positive
Need for interventional procedure	0.72	<0.001	Strong positive
Infected pancreatic necrosis	0.68	0.001	Moderate-strong positive
Systemic infection/sepsis	0.65	0.002	Moderate positive
In-hospital mortality	0.61	0.004	Moderate positive

r: Pearson correlation coefficient. Statistical significance set at $p < 0.05$. Very strong: $r \geq 0.80$; Strong: 0.60–0.79; Moderate: 0.40–0.59.

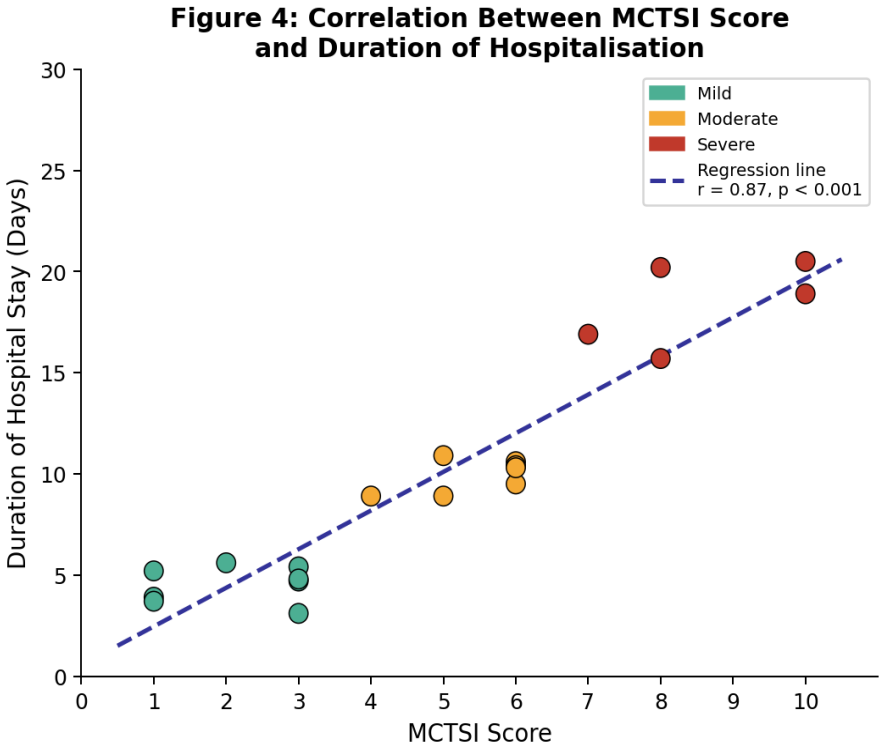

Figure 4: Scatter plot illustrating the correlation between MCTSI score and duration of hospital stay (n=20). Individual data points are colour-coded by MCTSI severity category. Pearson r = 0.87, p < 0.001

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DISCUSSION

This retrospective observational study evaluated the prognostic value of the Mortele Modified CT Severity Index in a cohort of 20 patients with acute pancreatitis managed at a tertiary care centre in South India. The study indicated that patients with higher MCTSI scores were more likely to experience better clinical outcomes. In addition, the characteristics of the cohort were consistent with previous reports of acute pancreatitis in the Indian subcontinent, where gallstones and alcohol consumption were the leading causes of the disease [20]. Most of the patients in the cohort were male because of the greater incidence of alcohol-related pancreatitis among men. Compared to studies from Western countries, the average age of presentation in this cohort was younger and likely reflects cultural differences in diet, causes of disease, and genetics as well [16].

The MCTSI was developed by Mortelé et al. as a refined version of the Balthazar CTSI and improved upon the limitations of the Balthazar method [13]. The Balthazar system classifies pancreatic inflammation using a 5-point scale but separates the score for the amount of necrotic tissue; however, it does not factor in complications outside the pancreas, which were later found to lead to worse outcomes [11,12]. The MCTSI simplified the classification of inflammation from 5 to 3 categories and included complications outside of the pancreas as part of the scoring process, and showed a greater correlation with patient outcomes than did the original study with the Balthazar scoring system [13].

The distribution of MCTSI categories in the current study (40% mild, 35% moderate, 25% severe) was broadly consistent with published series from referral centre cohorts [14,15]. The mean hospital stay in the mild group (5.2 ±2.1 days) reflected the favourable prognosis of mild AP managed with supportive care including fluid resuscitation, analgesia, and early enteral nutrition [21]. The markedly prolonged stay in the severe group (17.8 ±5.7 days) was attributable to the high burden of systemic complications, the need for invasive procedures, and the requirement for intensive monitoring, consistent with findings from Bollen et al. [14].

The rate of organ failure in the current cohort (25% overall, 80% in the severe group) was consistent with published data. The stepwise increase in organ failure rates with rising MCTSI category underscored the utility of this imaging-based system as a surrogate marker for systemic inflammatory severity. The conservative step-up management approach, with percutaneous drainage as the primary interventional strategy, reflected current international guidelines advocating minimally invasive approaches as the preferred initial strategy for infected walled-off necrosis [22]. The in-hospital death rate of 5% aligns with current meta-analytic evidence that shows more favourable outcomes related to newer treatment methods [23].

While all studies have limitations, the small size of our study (20 patients) means that statistical power is limited and fewer robust comparisons of subgroups can be performed. The fact that this study is retrospective and a single institution means that selection bias was inherently present and there was no means of standardising the time point imaging and/or management protocols. Alternative scoring systems (such as the APACHE II or BISAP) could not be compared and, as a result, no comparisons of the prognostic value were able to be made.

It is clear that future studies involving larger patient populations in a prospective multi-institutional manner of South Asians will further validate our findings.

CONCLUSION

Three major conclusions were reached regarding the Mortele modified CT severity index (MCTSI) on the assessment of patients presenting with the diagnosis of acute pancreatitis and some of its important clinical outcome measures. First, The MCTSI is a viable assessment tool that demonstrates significant and clinically relevant correlations with key markers of severity, including clinical severity, length of hospital stay, need for intervention, organ failure, and mortality during hospital stay. Second, MCTSI score can be used routinely in clinical assessments at 48-72 hours after receipt of contrast-enhanced computed tomography in a well-defined cohort of patients with acute gastroenteritis. Finally, because of its practicality, reliability and prognostic value, MCTSI has the potential to provide substantial contributions to evidence-based practices for the management of patients with acute pancreatitis. It is recommended that larger prospective studies be performed to confirm the results of this study and explore additional implications of these findings outside this initial cohort of subjects..

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