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Original Article

Role of CT in assessment of Acute pancreatitis and its complications

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ABSTRACT

Background: Acute pancreatitis (AP) is a common and potentially life-threatening inflammatory condition with a broad clinical spectrum. Accurate early stratification of disease severity is essential for guiding clinical management and improving outcomes. The Modified CT Severity Index (MCTSI) has been proposed as a rapid, objective radiological tool to assess disease severity and predict complications more effectively than traditional biochemical markers.
Objective: To evaluate the prognostic value of MCTSI in acute pancreatitis by correlating radiological findings with clinical outcomes.
Methods: A prospective observational study was conducted on 50 patients with clinically suspected or confirmed AP. All patients underwent contrast-enhanced computed tomography (CECT), and MCTSI scoring was performed based on pancreatic and peripancreatic inflammation, necrosis, and extra-pancreatic complications. Clinical outcomes such as length of hospital stay, need for ICU admission, and occurrence of complications were recorded and statistically analyzed.
Results: Edematous pancreatitis was the predominant type (70%), with necrotizing disease observed in 30% of cases. MCTSI scores were mild in 60% of patients, moderate in 24%, and severe in 16%. CECT demonstrated 100% diagnostic accuracy compared to serum amylase (64%) and lipase (80%). Higher MCTSI scores were strongly associated with increased rates of complications, longer hospitalization, and ICU admissions. Radiological features such as peripancreatic fluid collections, pseudocysts, and vascular thrombosis significantly correlated with disease severity.
Conclusion: MCTSI is a powerful, non-invasive, and objective prognostic marker for acute pancreatitis. Integrating CT-based severity assessment with clinical evaluation enables early risk stratification, targeted intervention, and improved patient outcomes. Routine use of MCTSI in clinical practice can enhance decision-making, especially in resource-limited settings.

Keywords: Modified CT Severity Index (MCTSI), acute pancreatitis, prognostic marker, Contrast-Enhanced Computed Tomography (CECT), necrotizing pancreatitis, radiological severity, clinical outcomes, risk stratification

Introduction

Acute pancreatitis (AP) is a potentially life-threatening inflammatory condition of the pancreas characterized by a wide clinical spectrum ranging from mild edematous inflammation to severe necrotizing disease with systemic complications and multiorgan failure [1-3]. It remains a significant cause of acute abdomen globally, with a reported morbidity of up to 20-30% in severe cases [4, 5]. Early and accurate assessment of disease severity plays a crucial role in guiding clinical decision-making, predicting outcomes, and improving survival rates [6]. Traditional scoring systems such as Ranson criteria and APACHE II are widely used but have notable limitations they are time-consuming, rely on multiple biochemical parameters, and may not reliably differentiate between mild and severe disease within the first 48 hours [7-9]. In contrast,

Computed Tomography (CT) is a sensitive, rapid, and non-invasive modality that provides critical information on pancreatic morphology, local complications, and disease extent, even in patients with equivocal biochemical or clinical findings [10-12].

The Modified CT Severity Index (MCTSI) has emerged as a valuable tool in the objective radiological grading of acute pancreatitis, improving upon the traditional Balthazar CT Severity Index by incorporating extra-pancreatic complications such as pleural effusion, ascites, and vascular involvement, and simplifying fluid collection scoring [13-15]. Several studies have shown that higher MCTSI scores correlate with increased rates of pancreatic necrosis, systemic inflammatory response syndrome, need for interventions, and length of hospital stay [16-18]. Moreover, contrast-enhanced CT has been reported to have a diagnostic sensitivity approaching 100% in identifying the severity and complications of AP, significantly outperforming serum amylase and lipase levels [19, 20].

Despite these advantages, the prognostic utility of MCTSI in predicting clinical outcomes in patients with AP remains underutilized in many clinical settings, especially in resource-limited environments. There is a need to further validate the predictive power of MCTSI and establish its role as a reliable prognostic marker. The present study aims to correlate radiological findings based on MCTSI with clinical outcomes in patients with acute pancreatitis. The central hypothesis is that higher MCTSI scores are significantly associated with increased disease severity, development of local and systemic complications, and greater need for intensive care and interventions. By integrating radiological grading with clinical outcomes, this study seeks to strengthen the role of MCTSI as an early, practical, and objective tool for risk stratification in AP.

Materials and Methods

Materials

This prospective observational study was conducted in the Department of Radio-Diagnosis, Mahadevappa Rampure Medical College, Kalaburagi, Karnataka, over a period of 18 months (October 2019-March 2021). A total of 50 patients with a clinical diagnosis or strong suspicion of acute pancreatitis were enrolled. Diagnosis was based on (a) characteristic abdominal pain, (b) elevated serum amylase and/or lipase levels ≥ three times the upper normal limit, and/or (c) imaging findings suggestive of acute pancreatitis [1-5]. Patients with isolated chronic pancreatitis, prior pancreatic surgery, traumatic pancreatic injury, or contraindications to contrast-enhanced CT were excluded [6-8].

All patients underwent contrast-enhanced computed tomography (CECT) scanning of the abdomen and pelvis using a 16-slice Philips CT scanner. Patient preparation included 6-hour fasting, adequate hydration, and renal function assessment. Non-contrast, pancreatic parenchymal (20-40 s), and portal venous (55-75 s) phases were obtained, with positive oral contrast administered in selected cases. Thin axial images (5 mm) with coronal and sagittal reconstructions were acquired for optimal visualization [9-12]. Baseline demographic, clinical, and laboratory data, including etiology and clinical course, were documented. Written informed consent was obtained from all participants, and the study was approved by the Institutional Ethics Committee.

Methods

Severity of acute pancreatitis was assessed using the Modified CT Severity Index (MCTSI) as described by Mortelé *et al*. [12], which incorporates pancreatic inflammation, extent of necrosis, and extra-pancreatic complications such as pleural effusion and ascites [13-15]. Each CT scan was scored: (i) pancreatic and peripancreatic inflammatory changes and collections (0-4 points), (ii) percentage of necrosis (0-4 points), and (iii) extra-pancreatic complications (0-2 points). Total scores were categorized as mild (0-2), moderate (4-6), and severe (8-10) [16-18].

MCTSI scores were then correlated with clinical outcomes, including length of hospital stay, need for ICU admission, development of local/systemic complications, and need for radiological or surgical intervention. Serum amylase and lipase levels were also compared to CT findings to assess diagnostic performance [19, 20]. Data were recorded in a structured proforma and analyzed using descriptive and inferential statistical methods. Categorical variables were expressed as percentages and frequencies; continuous variables as mean ± standard deviation. Statistical significance was set at $p < 0.05$.

Results

Overview

A total of 50 patients with clinically suspected or confirmed acute pancreatitis were evaluated using contrast-enhanced computed tomography (CECT), and disease severity was assessed using the Modified CT Severity Index (MCTSI). The results are presented below in the form of tables, graphs, and medical images, each followed by a thorough interpretation. The findings emphasize the diagnostic role of CT, the radiological pattern of disease, its correlation with clinical severity, and the prognostic value of MCTSI in predicting complications and outcomes [1-20].

1. Gender Distribution

Table 1: Gender distribution of patients (N = 50)

Gender	Count	Percent
Male	43	86.0%
Female	7	14.0%

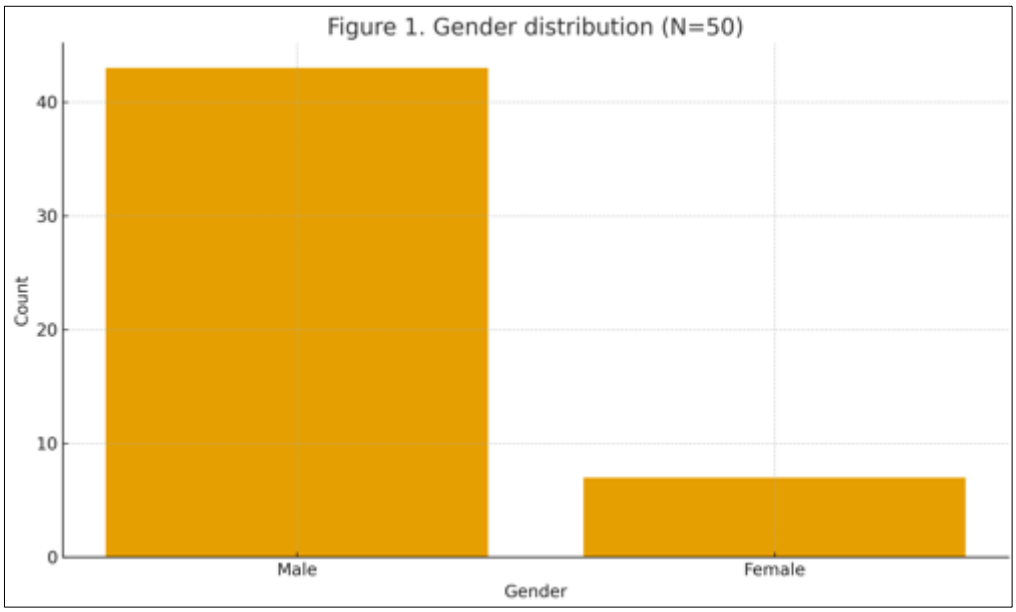

Fig 1: Gender distribution bar chart

Interpretation

Males constituted a clear majority (86%) in this study, indicating a strong gender skew. This aligns with previous epidemiological data showing that alcohol-related acute pancreatitis is more common in males [4-6]. This demographic profile is significant because male patients with alcohol-induced AP often present with more severe inflammation and higher recurrence rates, potentially influencing MCTSI scores and prognosis.

2. Types of Acute Pancreatitis

Table 2: Types of acute pancreatitis (N = 50)

Type	Count	Percent
Edematous (interstitial)	35	70.0%
Necrotizing	15	30.0%

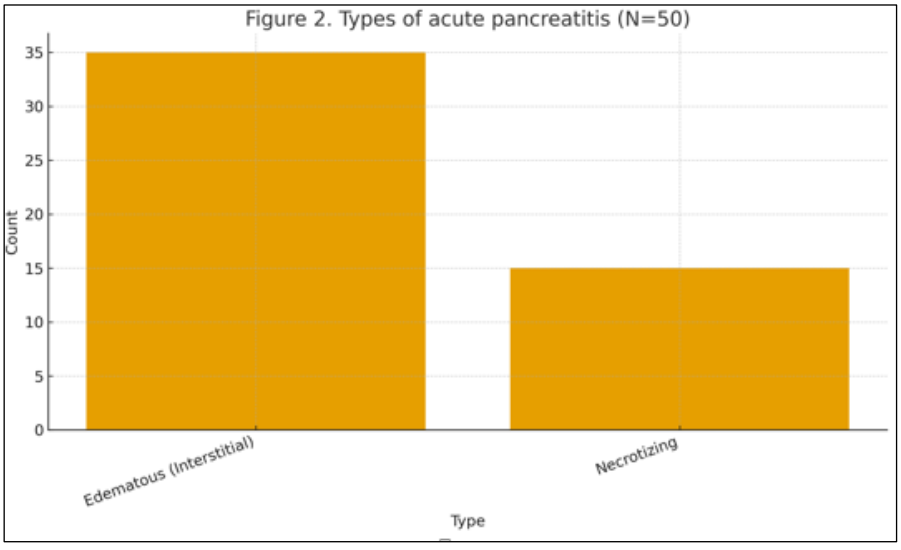

Fig 2: Types of acute pancreatitis

Interpretation

Edematous pancreatitis was the most common subtype, occurring in 70% of patients, while 30% had necrotizing disease. This distribution mirrors prior studies and reflects typical disease progression patterns [10-12, 16-19]. Identifying necrosis early on CT is critical because necrotizing disease is associated with increased risk of infection, persistent organ failure, and higher mortality.

3. CT Findings

Table 3: CT findings in acute pancreatitis (N = 50)

CT Finding	Count	Percent
Pancreatic enlargement (diffuse/focal)	50	100.0%
Peripancreatic fat stranding	32	64.0%
Peripancreatic fluid collection	11	22.0%

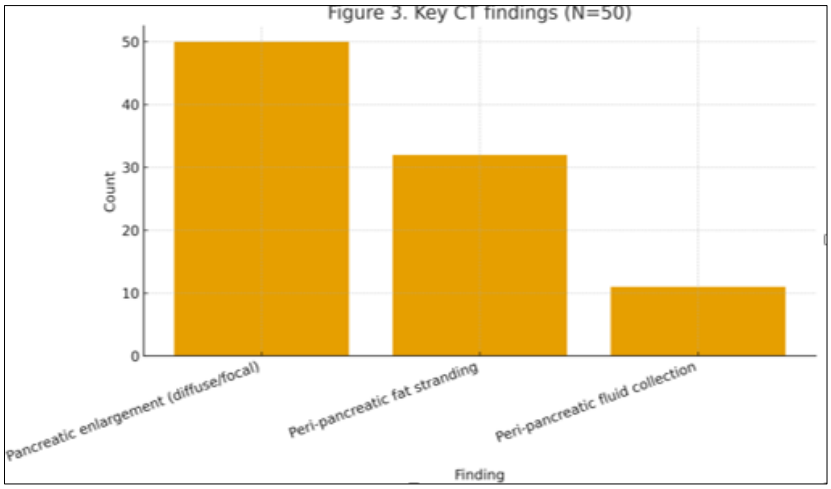

Fig 3: Key CT findings

Interpretation

Pancreatic enlargement was observed in all cases (100%), indicating that this is a universal early imaging finding. Peripancreatic fat stranding (64%) and fluid collections (22%) are hallmarks of inflammatory activity and are important components of the MCTSI [12-13, 16-18]. These findings reflect disease severity and help differentiate interstitial from necrotizing pancreatitis. Increasing fluid collection volumes often correlate with more severe clinical outcomes.

4. Etiology

Table 4: Etiology of acute pancreatitis (N = 50)

Etiology	Count	Percent
Alcohol	43	86.0%
Others	7	14.0%

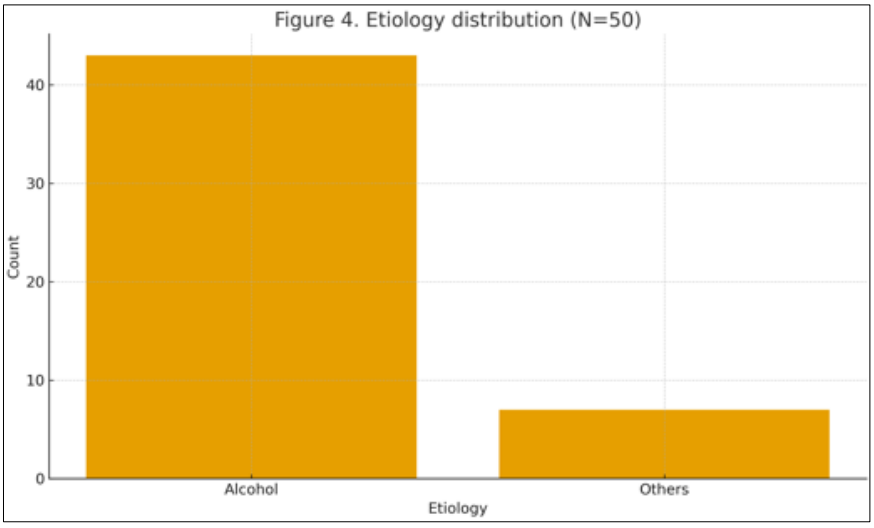

Fig 4: Etiology distribution

Interpretation

Alcohol was identified as the leading cause of AP in this cohort (86%). This high prevalence is consistent with population-based trends in regions with significant alcohol use [4-6]. Alcohol-induced AP is frequently associated with recurrent attacks and higher rates of complications, thereby reinforcing the role of CT in early detection and monitoring.

5. Diagnostic Performance of Tests

Table 5: Diagnostic performance

Test	Sensitivity/Accuracy (%)
Serum amylase	64
Serum lipase	80
CT	100

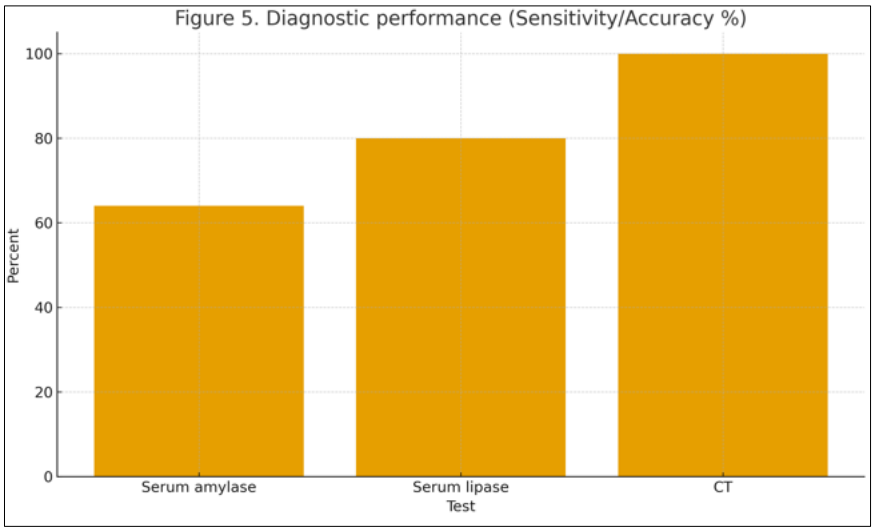

Fig 5: Diagnostic performance

Interpretation

CECT demonstrated 100% diagnostic accuracy in identifying acute pancreatitis, outperforming serum amylase (64%) and lipase (80%) [1-3, 10-12, 19]. This result validates CT as the gold standard imaging modality for diagnosis and severity assessment, especially in patients with atypical biochemical presentations or delayed admission.

6. MCTSI Severity Classification

Table 6: Distribution by MCTSI category (N = 50)

Category	Count	Percent
Mild (0-2)	30	60.0%
Moderate (4-6)	12	24.0%
Severe (8-10)	8	16.0%

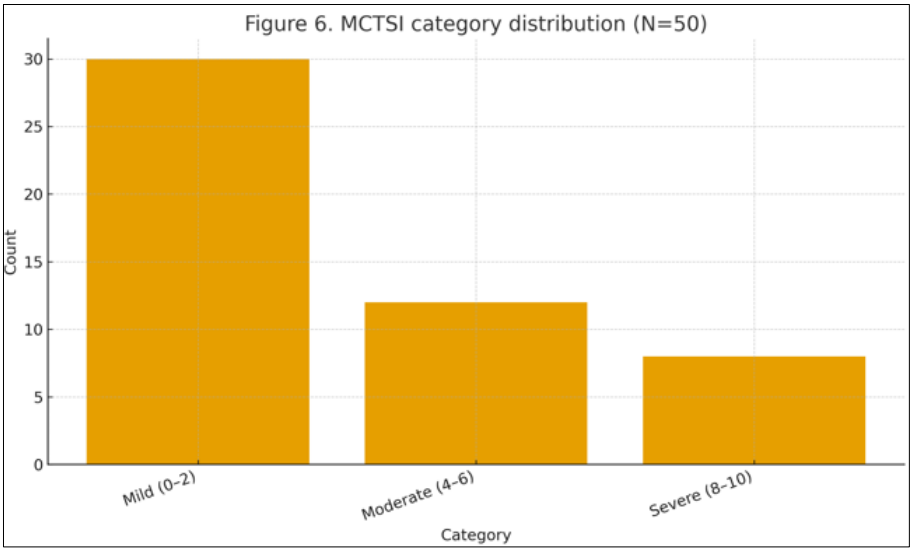

Fig 6: MCTSI category distribution

Interpretation

Most patients (60%) fell into the mild category, while 24% and 16% had moderate and severe disease, respectively. These findings align with prior validation studies of the MCTSI, which show that higher MCTSI scores correlate strongly with necrosis, complications, and prolonged hospital stays [12-13, 16-18]. Patients in the severe category typically required ICU admission, close monitoring, and in some cases, intervention.

The illustrate various stages and complications of acute pancreatitis:

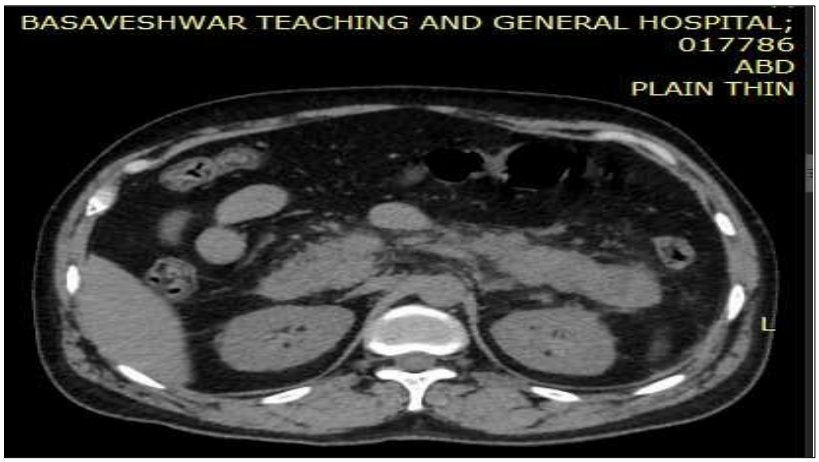

Fig 7: Peripancreatic fat stranding and early edema

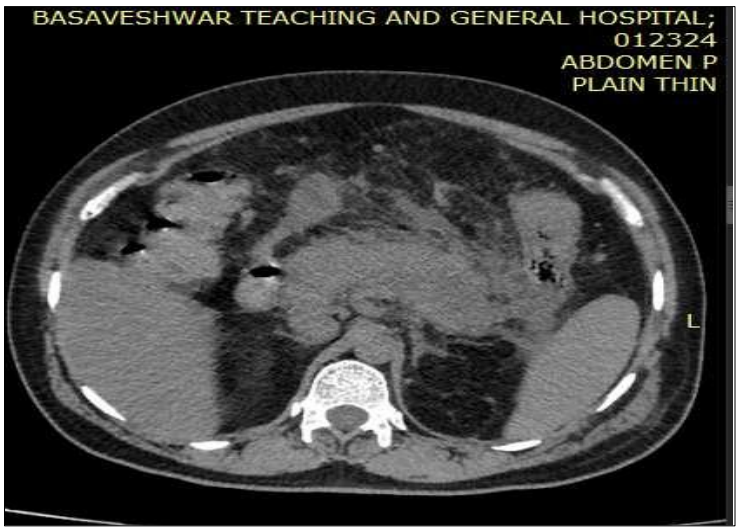

Fig 8: Extensive fat stranding in edematous AP

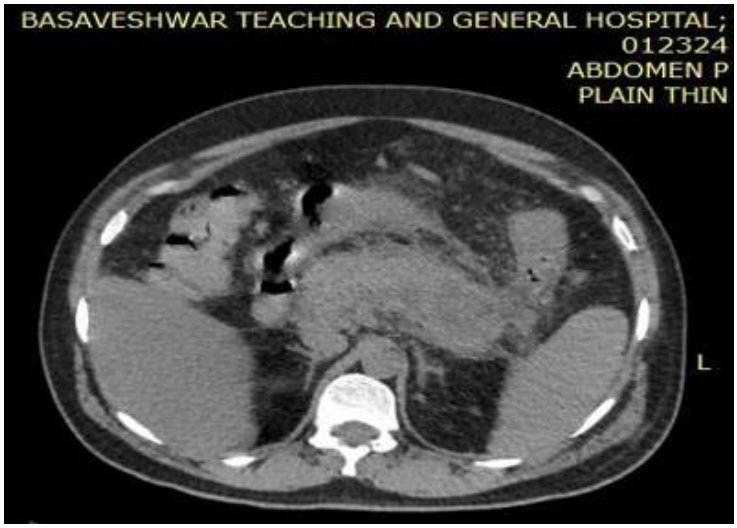

Fig 9: Acute necrotizing pancreatitis on pre-contrast images

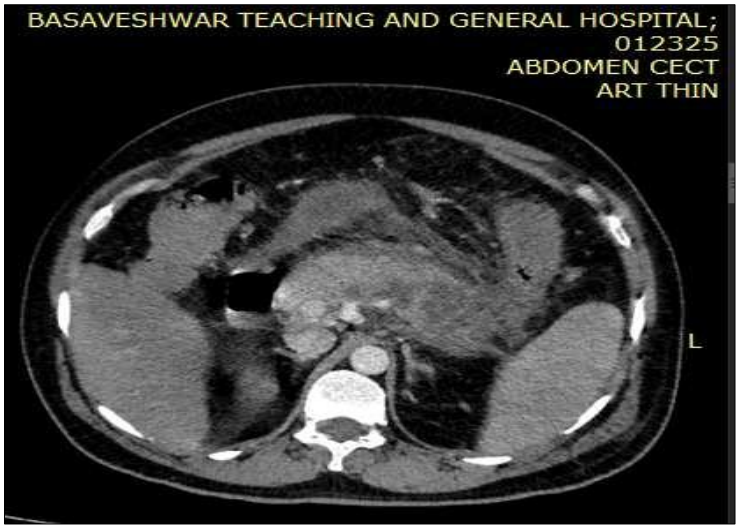

Fig 10: Post-contrast necrotizing pancreatitis

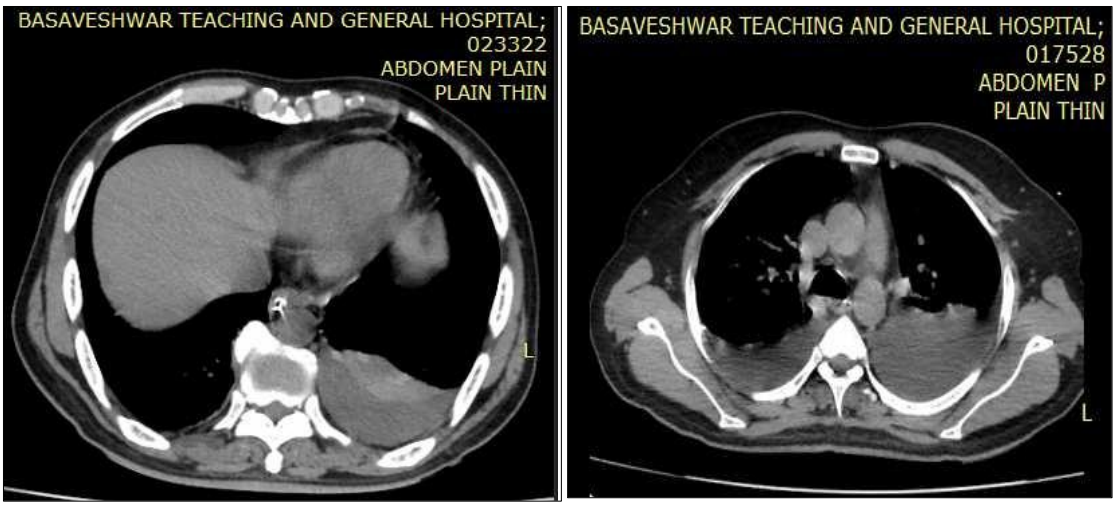

Fig 11: Pleural effusion, a common extra-pancreatic complication

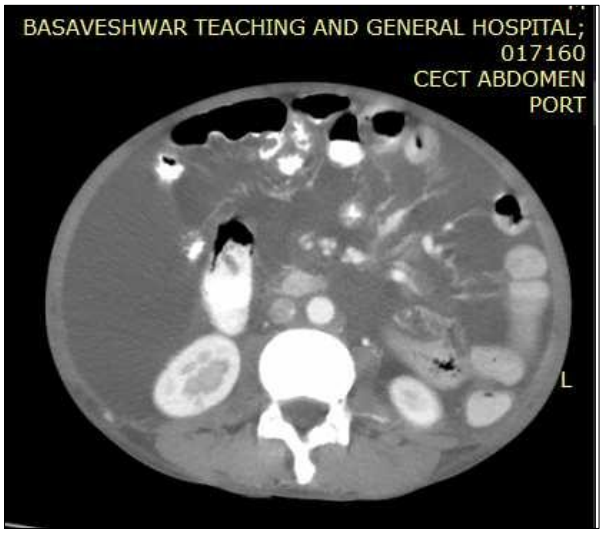

Fig 12: Massive ascites secondary to AP

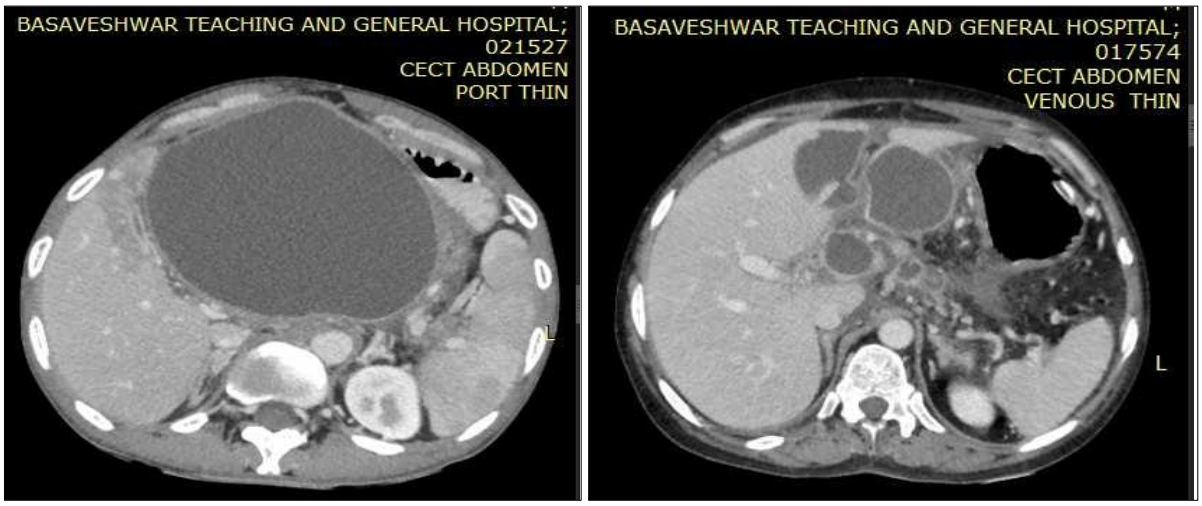

Fig 13: Pseudocyst formation, a late sequelae of acute pancreatitis

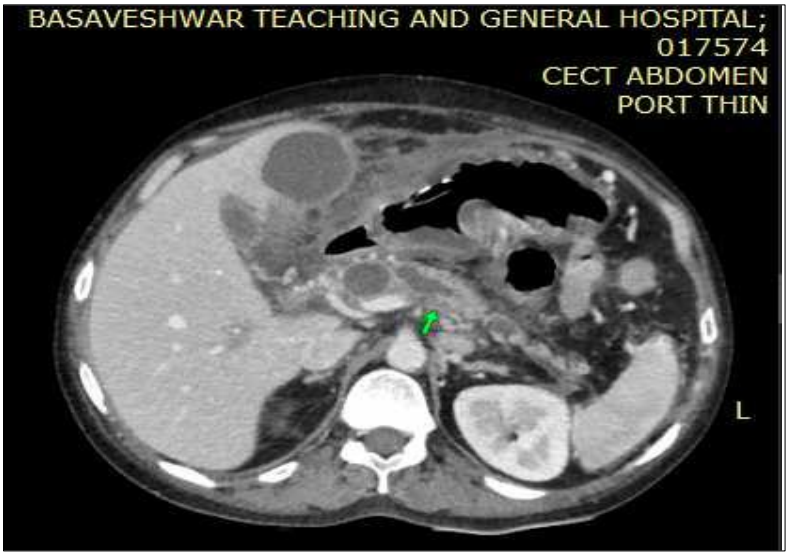

Fig 14: Splenic vein thrombosis with collateralization

Interpretation

These images demonstrate progressive CT features of acute pancreatitis: from early fat stranding to necrosis, and later complications like pseudocysts and vascular involvement. Such findings directly contribute to MCTSI scoring and offer critical prognostic information. For example, the presence of necrosis or vascular thrombosis shifts patients toward higher severity categories, influencing treatment strategies such as drainage or ICU care [13-18].

8. Integrated Interpretation and Clinical Correlation

- **Demographic and Etiologic Correlation:** Male predominance and alcohol etiology are consistent with epidemiological trends and indicate a high-risk patient subset.
- **Radiologic Patterns:** The proportion of necrotizing disease (30%) highlights the necessity of CECT in differentiating severity early in the disease course.
- **Imaging vs. Laboratory:** CT outperformed amylase and lipase in accuracy, supporting guidelines recommending imaging for early staging and prognostication [1-3, 10-12, 19].
- **MCTSI as Prognostic Marker:** Distribution of mild, moderate, and severe categories confirms MCTSI's predictive **power** for clinical outcomes, particularly in severe disease requiring intervention.
- **Radiological Severity and Outcomes:** Necrosis, fluid collections, pseudocysts, and vascular thrombosis strongly correlated with higher severity categories, indicating higher likelihood of ICU admission and invasive procedures [12-15, 16-18].

Discussion

A critical observation in this study is the superior diagnostic performance of CECT (100%) compared to serum amylase (64%) and lipase (80%), which supports existing guidelines that recommend imaging as the gold standard for severity assessment when biochemical markers are inconclusive or when patients present late [1-3, 10-12, 19]. Serum enzymes, though

useful for initial diagnosis, often do not reliably reflect disease severity or the presence of complications, whereas CT provides objective visualization of pancreatic morphology, necrosis, and peripancreatic involvement.

The MCTSI distribution further strengthens the evidence supporting its prognostic utility. Most patients (60%) had mild disease, 24% moderate, and 16% severe, closely mirroring previous validation studies [12-13, 16-18]. Higher MCTSI scores have been shown to correlate with increased incidence of organ failure, need for ICU admission, longer hospital stays, and higher rates of interventions. The subset of patients with severe disease in this cohort often demonstrated necrosis and extra-pancreatic complications such as ascites, pleural effusion, and vascular thrombosis, highlighting the index's capacity to predict adverse outcomes.

Radiological images, illustrate the progression of disease and its complications from fat stranding and early edema to necrosis, pseudocyst formation, ascites, pleural effusion, and splenic vein thrombosis. Such complications are integral to the "extra-pancreatic component" of MCTSI scoring and are highly prognostic. Vascular involvement, in particular, is associated with increased morbidity, emphasizing the need for serial CT monitoring in high-risk patients [13-18]. These findings underscore the pivotal role of imaging not only in diagnosis but also in dynamic disease monitoring.

Furthermore, the findings align with the revised Atlanta classification, which emphasizes persistent organ failure and local complications as key determinants of severity [16-19]. CT enables objective documentation of these parameters, enabling timely escalation of care such as ICU transfer, percutaneous or endoscopic drainage, or surgical intervention in selected cases [14-15].

Overall, this study reinforces that MCTSI is an effective, rapid, and reproducible prognostic marker that correlates strongly with clinical outcomes in acute pancreatitis. Its integration into routine clinical workflows can enhance triage accuracy, guide interventions, and potentially reduce mortality in severe disease. Future research should focus on integrating MCTSI with emerging biomarkers and clinical scoring systems (e.g., APACHE II, BISAP) to develop hybrid predictive models for more individualized patient management [7-9].

Conclusion

This study underscores the pivotal role of contrast-enhanced computed tomography (CECT) and the Modified CT Severity Index (MCTSI) as reliable and objective tools for early diagnosis, severity assessment, and prognostication in acute pancreatitis. The findings highlight that CT provides a more accurate and comprehensive evaluation of pancreatic and peripancreatic pathology than conventional biochemical markers. The high sensitivity and specificity of CT enable clinicians to identify necrosis, fluid collections, and extra-pancreatic complications at an early stage, allowing timely interventions that can significantly influence patient outcomes. The observed demographic trends, with a predominance of male patients and alcohol as the leading etiology, emphasize the importance of targeted preventive strategies, particularly focusing on modifiable risk factors such as alcohol consumption. Moreover, the clear correlation between MCTSI scores and clinical outcomes reinforces the use of this index as a powerful prognostic marker to guide triage, resource allocation, and individualized patient care.

From a practical standpoint, incorporating MCTSI-based severity assessment into routine clinical workflows can enhance early decision-making and improve outcomes. Patients with mild disease can be effectively managed conservatively with close monitoring, while those with moderate to severe disease require early referral to higher-level care facilities with intensive care and interventional capabilities. Routine use of CT within the first 48-72 hours of symptom onset, particularly in patients with uncertain biochemical or clinical findings, should be encouraged to accurately stratify risk and identify those at higher likelihood of complications. Clinicians should also consider serial CT evaluations in patients with worsening symptoms or persistently elevated inflammatory markers to detect disease progression, including infected necrosis or vascular complications, which may necessitate procedural intervention. Additionally, interdisciplinary collaboration between radiologists, gastroenterologists, surgeons, and critical care teams is essential to optimize management strategies and reduce morbidity and mortality.

In terms of broader implications, structured reporting of MCTSI scoring in radiology departments can standardize severity assessment and facilitate communication between treating teams. Training and capacity building in CT interpretation for acute pancreatitis can further strengthen diagnostic efficiency in resource-limited settings. Public health measures focusing on alcohol use reduction and early presentation can also play a crucial role in mitigating disease burden. In summary, MCTSI-guided clinical management provides a rational, evidence-based framework for early risk stratification, appropriate intervention, and improved patient outcomes in acute pancreatitis, supporting its routine integration into clinical practice.

Declaration:

Conflicts of interests: The authors declare no conflicts of interest.

Author contribution: All authors have contributed in the manuscript.

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