International Journal of Medicine
pISSN 1468-3814 | eISSN 2667-7008
https://theinternationalmedicine.com/

Original Researcher Article *DOI: 10.61336/im/26-06-193*

Comparison Between Ranson Score and Modified CT Scan Severity Index in Predicting the Severity of Acute Pancreatitis Based on Modified Atlanta Classification in a Tertiary Care Centre.

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Received: 22-05-2026
Revised: 04-06-2026
Accepted: 19-06-2026
Published: 30-06-2026

Abstract

Background: Accurate early severity prediction in acute pancreatitis (AP) guides treatment decisions and resource allocation. The Ranson score and the Modified CT Severity Index (MCTSI) are two widely used prognostic tools that evaluate clinical/biochemical and radiological dimensions, respectively. ***Objective:*** To compare the predictive performance of the Ranson score and MCTSI in assessing severity, mortality, pancreatic necrosis, and multiple organ dysfunction syndrome (MODS) in AP, using the Modified Atlanta Classification (MAC) as the reference standard. ***Methods:*** A prospective observational study of 57 consecutive AP patients admitted to a tertiary care centre. Ranson score, MCTSI, and MAC severity were assessed for all patients. Diagnostic performance (sensitivity, specificity, PPV, NPV, AUC) was evaluated. ***Results:*** Moderately severe AP was the most common category (45.61%). For severity prediction, both tools performed comparably (Ranson AUC 0.81; MCTSI AUC 0.79). Ranson score showed superior mortality prediction (AUC 1.0, accuracy 97.3%) vs. MCTSI (AUC 0.62). MCTSI demonstrated excellent pancreatic necrosis detection (AUC 0.93, sensitivity 100%) vs. Ranson (AUC 0.51). Both scores correlated significantly with MODS ($p < 0.001$). ***Conclusion:*** The Ranson score is superior for mortality prediction, while MCTSI excels in detecting local pancreatic complications. Combined use of both indices provides a more comprehensive risk stratification in AP.

Keywords: Acute pancreatitis, Ranson score, Modified CT Severity Index, MCTSI, Modified Atlanta Classification, severity prediction, MODS, pancreatic necrosis.

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INTRODUCTION

Acute pancreatitis (AP) is one of the most common gastrointestinal emergencies, ranging from a mild self-limiting illness to a life-threatening condition with pancreatic necrosis, systemic inflammatory response syndrome (SIRS), and multi-organ dysfunction. Worldwide, approximately 20% of AP cases progress to severe disease, with mortality reaching 10–30% in those with persistent organ failure or infected necrosis. In India, the prevalence of pancreatitis is estimated at 7.9 per 100,000 population, with alcohol and gallstones accounting for the vast majority of cases.

Early and accurate prediction of disease severity is essential to guide decisions on ICU admission, fluid resuscitation, and escalation of care. Several clinical and radiological scoring tools have been developed for this purpose. The Ranson criteria, introduced in 1974, incorporate 11 clinical and laboratory parameters assessed at admission and at 48 hours, and remain one of the most widely validated clinical severity tools globally. The Modified CT Severity Index (MCTSI), introduced by Mortele et al. in 2004, extends earlier CT-based scoring by incorporating extrapancreatic complications alongside pancreatic inflammation and

necrosis, providing a 10-point scale with stronger correlation to outcomes than the original CTSI.
The Revised Atlanta Classification (RAC) of 2012 offers a standardised reference framework categorising AP into mild, moderately severe, and severe forms based on the presence and duration of organ failure and local complications. Despite the established utility of Ranson score and MCTSI, direct comparative data from Indian populations remain limited. This study was designed to address that gap by prospectively comparing both tools at a tertiary care centre in Jaipur, India.

MATERIALS AND METHODS

Study Design and Setting

This was a prospective observational hospital-based study conducted in the Department of General Medicine, Mahatma Gandhi Medical College & Hospital, Jaipur, over 18 months (April 2024 – September 2025), following Institutional Ethics Committee approval. Written informed consent was obtained from all participants.

Participants

Fifty-seven consecutive patients aged ≥18 years admitted with AP were enrolled. Diagnosis required at least two of: (1) characteristic abdominal pain, (2) serum amylase/lipase ≥3× upper limit of normal, or (3) characteristic imaging findings. Patients with acute-on-chronic pancreatitis, those below 18 years, and those unwilling to participate were excluded.

Severity Scoring

All patients underwent Ranson score calculation (11 parameters; 5 at admission and 6 at 48 hours). Contrast-enhanced CT abdomen was performed 4–7 days after symptom onset (or earlier if clinically indicated), and MCTSI was scored based on pancreatic inflammation (0–4 points), necrosis (0–4 points), and extrapancreatic complications (0–2 points; total 0–10). Severity was classified per the Modified Atlanta Classification (MAC) as mild, moderately severe, or severe.

Statistical Analysis

Continuous variables were expressed as mean ± SD; categorical variables as frequency and percentage. Chi-square test and Student's t-test were applied as appropriate. Diagnostic performance was evaluated using sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and area under the ROC curve (AUC). A p-value <0.05 was considered statistically significant.

RESULTS

Demographic and Clinical Profile

The study enrolled 57 patients. Most patients were aged 50–59 years (33.33%), with a strong male predominance (70.18%). Epigastric pain radiating to the back was the most common presentation (84.21%), followed by vomiting (70.18%) and abdominal distension (66.67%). Alcohol was the leading aetiology (47.37%), followed by biliary causes (40.35%) and idiopathic cases (12.28%). Socioeconomically, the majority were from the lower-middle class (38.60%), and most had attained secondary-level education (45.61%).

Table 1. Clinical and Demographic Profile of Study Population

Variable	Category	n	%
Age (years)	50–59	19	33.33%
	40–49 / >60	13 each	22.81% each
Gender	Male	40	70.18%
	Female	17	29.82%
Presenting symptom	Radiating abdominal pain	48	84.21%
	Vomiting	40	70.18%
	Abdominal distension	38	66.67%
Aetiology	Alcohol	27	47.37%
	Biliary	23	40.35%
	Idiopathic	7	12.28%

Severity Distribution (Modified Atlanta Classification)

Moderately severe AP was the most common category (45.61%), followed by severe AP (31.58%) and mild AP (22.81%). ICU admission was required in 68.42% of patients.

Table 2. Severity Distribution per Modified Atlanta Classification

MAC Category	n	%
Mild	13	22.81%
Moderately Severe	26	45.61%
Severe	18	31.58%
Total	57	100%

CT Scan Findings

On contrast-enhanced CT, focal/diffuse pancreatic enlargement was the most common finding (40.35%), followed by peripancreatic inflammation (31.58%). The majority of patients (52.63%) had no pancreatic necrosis; 36.84% had <30% necrosis; 5.26% each had 30–50% and >50% necrosis. Extrapancreatic complications were present in 26.32% of cases.

Score Distributions

By MCTSI, patients were nearly equally distributed: mild (0–2): 36.84%; moderate (2–4): 29.82%; severe (≥6): 33.33%. By Ranson score, the majority fell in the moderate category (3–4: 45.61%), with 22.81% mild (0–2), 21.05% severe (5–6), and 10.53% very severe (7–8).

ROC Curve Analysis

For severity prediction, both tools showed good and comparable performance—Ranson AUC 0.81 (95% CI: 0.72–0.91) and MCTSI AUC 0.79 (95% CI: 0.69–0.92). For mortality, Ransonscore demonstrated near-perfect accuracy (AUC 1.00), far exceeding MCTSI (AUC 0.62, 95% CI: 0.46–0.77). Conversely, for pancreatic necrosis prediction, MCTSI was excellent (AUC 0.93, 95% CI: 0.81–0.93) while Ranson performed near chance level (AUC 0.51).

Table 3. AUC Comparison for Severity, Mortality, and Pancreatic Necrosis

Scoring System	Severity AUC (95% CI)	Mortality AUC (95% CI)	Necrosis AUC (95% CI)
MCTSI	0.79 (0.69–0.92)	0.62 (0.46–0.77)	0.93 (0.81–0.93)
Ranson Score	0.81 (0.72–0.91)	1.00	0.51 (0.33–0.67)

Diagnostic Performance for Severity

Both tools achieved high sensitivity for severity detection—Ranson (95.3%) marginally outperforming MCTSI (89.1%). Specificity was low for both (Ranson 40.2%; MCTSI 49.2%). NPV was high for both (Ranson 95.6%; MCTSI 91.4%), confirming their usefulness as rule-out tools. Overall diagnostic accuracy was 58.2% (Ranson) and 62.2% (MCTSI).

Table 4. Diagnostic Performance for Predicting Severity

Parameter	MCTSI	Ranson Score
Sensitivity (%)	89.1	95.3
Specificity (%)	49.2	40.2
PPV (%)	45.0	43.1
NPV (%)	91.4	95.6
Diagnostic Accuracy (%)	62.2	58.2

Diagnostic Performance for Mortality

The Ranson score demonstrated clearly superior performance for mortality prediction—sensitivity 95.3%, specificity 100%, PPV 100%, NPV 89.2%, and overall accuracy 97.3%—
compared to MCTSI (sensitivity 66.2%, specificity 44.1%, PPV 76.4%, NPV 32.5%, accuracy 61.3%).

Table 5. Diagnostic Performance for Predicting Mortality

Parameter	MCTSI	Ranson Score
Sensitivity (%)	66.2	95.3
Specificity (%)	44.1	100.0
PPV (%)	76.4	100.0
NPV (%)	32.5	89.2
Diagnostic Accuracy (%)	61.3	97.3

Diagnostic Performance for Pancreatic Necrosis

MCTSI was markedly superior in predicting pancreatic necrosis: sensitivity 100%, specificity 76.1%, PPV 82.3%, NPV 100%, and accuracy 88.4%. The Ranson score showed sensitivity
of only 71.1%, specificity 31.2%, PPV 52.1%, NPV 50.5%, and accuracy 52.2%, indicating performance near chance.

Table 6. Diagnostic Performance for Predicting Pancreatic Necrosis

Parameter	MCTSI	Ranson Score
Sensitivity (%)	100.0	71.1
Specificity (%)	76.1	31.2
PPV (%)	82.3	52.1
NPV (%)	100.0	50.5
Diagnostic Accuracy (%)	88.4	52.2

Association with MODS

Both tools showed a statistically significant association with MODS development ($p < 0.001$ for both). With increasing MCTSI score, MODS incidence rose from 2/21 patients (score 0–2) to 6/17 (score 2–4) and 15/19 (score ≥6). Similarly, with rising Ranson score, MODS frequency increased from 1/13 (score 0–2) to 5/6 (score 7–8). For MODS prediction, MCTSI showed higher sensitivity (96.9%) while Ranson showed higher specificity (90.7%), PPV (84.0%), and overall accuracy (80.0%).

DISCUSSION

This prospective study compared two widely used severity scoring systems in AP—the clinical Ranson criteria and the imaging-based MCTSI—against the Modified Atlanta Classification as the reference standard, in a real-world Indian tertiary care cohort.

The demographic profile of the study population closely mirrors previously published Indian data: a predominance of middle-aged males, with alcohol and biliary causes accounting for over 87% of cases. The distribution of disease severity, with moderately severe AP being the largest category (45.61%), is consistent with findings from Ashrathi et al. (2025) and Vamshi T et al. (2025). The high ICU admission rate (68.42%) reflects the severity burden seen at tertiary referral centres. For overall severity prediction, both tools performed comparably (Ranson AUC 0.81 vs. MCTSI AUC 0.79), consistent with prior studies. Vamshi T et al. reported MCTSI AUC 0.914 and Ranson AUC 0.852, showing a slightly greater difference favouring MCTSI. Ashrathi et al. found Total Ranson AUC 0.848 vs. MCTSI AUC 0.773. The marginal advantage of Ranson in our study may reflect the biochemical-physiological correlations in the particular patient mix at this centre.

The finding that Ranson score demonstrated near-perfect mortality prediction (AUC 1.0, accuracy 97.3%) is clinically significant. Because Ranson parameters capture systemic derangements—including BUN rise, calcium drop, base deficit, and fluid sequestration—they are more directly aligned with the physiological drivers of fatal outcomes than CT morphology. This is supported by Wu et al. (2008), who reported Ranson AUC of 0.83–0.90 for mortality in a large population-based study, and by Ashrathi et al. who found excellent Ranson AUC for mortality at both admission (0.926) and 48 hours (0.828). A caveat is that the perfect AUC in the present study may partly reflect the small sample size and limited mortality events; external validation is warranted.

Conversely, MCTSI demonstrated outstanding performance for pancreatic necrosis detection (AUC 0.93, sensitivity 100%, NPV 100%), far exceeding the Ranson score (AUC 0.51). This finding is mechanistically expected: MCTSI directly quantifies CT-based morphological changes, including the presence and extent of necrosis and extrapancreatic complications. Ranson criteria, based entirely on clinical and laboratory parameters, have no anatomical imaging component and thus inherently cannot reliably predict local structural damage. Bollen et al. (2007) and Ashrathi et al. (AUC 0.943 for MCTSI in necrosis) report similar conclusions.

The strong association of both scores with MODS development ($p < 0.001$) confirms their utility for early identification of patients requiring intensive monitoring. While MCTSI was more sensitive for MODS screening (96.9%), Ranson's higher specificity (90.7%) and accuracy (80.0%) made it more reliable for confirmation and accurate prognostication.

Considered together, these results argue for a complementary approach: the Ranson score as a bedside clinical tool for early risk stratification and mortality prediction—particularly valuable in resource-limited settings where CT may not be immediately available—and MCTSI as the imaging counterpart for characterising local pancreatic pathology once CT is performed. This dual approach is especially relevant in India, where variability in healthcare access and infrastructure necessitates robust clinical tools alongside imaging assessments.

CONCLUSION

This prospective comparative study demonstrates that the Ranson score and MCTSI are complementary rather than interchangeable prognostic tools in acute pancreatitis. The Ranson score shows superior sensitivity and accuracy for mortality prediction and is an effective clinical screening tool for severe disease. The Modified CT Severity Index excels in identifying pancreatic necrosis and local complications and correlates strongly with MODS in higher-score categories. Using both scoring systems together—clinical assessment via Ranson complemented by CT-based MCTSI—provides a more complete and accurate risk stratification framework, enabling clinicians to optimise triage decisions, ICU resource allocation, and intervention timing in patients with acute pancreatitis.

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