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# ROLE OF COMPUTED TOMOGRAPHY SEVERITY INDICES IN PREDICTING OUTCOMES OF ACUTE PANCREATITIS: A PROSPECTIVE OBSERVATIONAL STUDY

Radio-Diagnosis

**Dr. Krishna Soni** PG Resident Department of Radiodiagnosis Zydus Medical College and Hospital, Dahod

**Dr. Megha Baria*** Associate Professor Department of Radiodiagnosis Zydus Medical College and Hospital, Dahod*Corresponding Author

**Dr. Gavan Dhola** PG Resident Department of Radiodiagnosis Zydus Medical College and Hospital, Dahod

## ABSTRACT

**Background and Objectives:** Acute pancreatitis (AP) ranks among the more frequently encountered emergencies in gastrointestinal practice and presents along a broad clinical continuum, varying from a brief, self-resolving episode to a fulminant disease accompanied by failure of multiple organ systems. Cross-sectional imaging by computed tomography (CT) provides a reproducible, non-invasive method for examining inflammatory and necrotic changes within the pancreas and adjacent tissues. The present work was undertaken to assess how two CT-derived grading systems—the Balthazar CT Severity Index (CTSI) and the Modified CT Severity Index (MCTSI)—perform in categorising disease severity and forecasting clinical course in patients presenting with AP.**Methods:** The investigation followed a prospective, observational design and ran for two calendar years (2023–2025) at a tertiary-level teaching institute. A consecutive cohort of fifty patients in whom AP was either suspected on clinical grounds or already established was recruited. Each subject was imaged with contrast-enhanced computed tomography (CECT) of the abdomen, and the resulting studies were graded using both the Balthazar CTSI and the MCTSI. Outcomes captured during follow-up comprised the duration of inpatient stay, the requirement for intensive-care management, recourse to surgical treatment, evolution of organ dysfunction, and in-hospital death.**Results:** The cohort had a mean age close to 39 years and was strikingly male-skewed (86%; M:F = 6.14:1). Application of the Balthazar CTSI placed 12% of patients in the mild category, 64% in the moderate band, and 24% in the severe band, while the MCTSI yielded a distribution of 26% mild, 50% moderate, and 24% severe. Each of the two indices correlated, to a statistically meaningful degree, with hospital stay, ICU utilisation, surgical intervention, organ failure, and mortality ($p < 0.05$ throughout). Of the two, MCTSI carried marginally greater prognostic weight.**Conclusion:** The CTSI and the MCTSI are both dependable and easily applied imaging tools for anticipating how AP will evolve clinically. When CT is performed promptly and interpreted alongside bedside findings, clinicians are placed in a far better position to grade risk accurately.

## KEYWORDS

Acute Pancreatitis, CT Severity Index, Mctsi, Prognosis

## INTRODUCTION

Among acute abdominal conditions seen in everyday practice, AP figures prominently, and reports from across the world point to a continuing rise in its incidence. Contemporary epidemiological data place the global yearly occurrence at roughly 34 per 100,000 individuals, a figure that has trended upward across each of the last three decades (Iannuzzi et al., 2022). How AP behaves clinically varies widely from one patient to another. Most individuals run an uncomplicated course that settles within a few days, yet a sizeable minority—on the order of 15 to 25%—progress to moderately severe or severe disease, marked by features such as necrosis of the gland, the formation of pseudocysts, the systemic inflammatory response syndrome (SIRS), or sustained failure of one or more organ systems (Garber et al., 2018; Pretis, Amodio, & Frulloni, 2018). When pancreatic necrosis becomes infected, the case-fatality rate may climb to between 30 and 40% (Werge et al., 2016).

Two underlying causes—biliary calculi and excessive alcohol intake—together explain roughly 70 to 80% of all presentations (Sand, Lankisch, & Nordback, 2007; van Geenen et al., 2010). Less common but well-described triggers include elevated triglyceride levels (Pretis et al., 2018), inherited susceptibility (Whitcomb, 2013), and disorders of immune origin (Shimosegawa et al., 2011).

Identifying severity at, or shortly after, the moment of admission is essential for sensible triage, prompt initiation of appropriate care, and judicious use of limited critical-care resources. Several bedside scoring instruments exist for this purpose, among them the Ranson criteria, the Acute Physiology and Chronic Health Evaluation II (APACHE II) score, and the Bedside Index of Severity in Acute Pancreatitis (BISAP). Useful as these systems are, each has practical drawbacks—chiefly the volume of variables required and the time interval needed before the score can be finalised.

Contrast-enhanced CT of the abdomen continues to be regarded as the reference imaging investigation for delineating the spread of pancreatic and peripancreatic involvement in AP (Thoeni, 2012). The Revised Atlanta Classification (RAC), published in 2012, is now the prevailing framework for grading severity; it draws on the presence, character, and persistence of organ failure together with the spectrum of local complications (Banks et al., 2013; Choi et al., 2017).

Originally introduced by Balthazar and co-workers in 1990 (Balthazar et al., 1990) and refined in 2002 (Balthazar, 2002), the Balthazar CT Severity Index pairs a graded assessment of pancreatic inflammation (Grades A–E, scored 0 to 4) with an estimate of the volume of necrosis (scored 0 to 6); when summed, the index ranges between 0 and 10. In 2004, Mortelé and colleagues put forward a revised version, the MCTSI (Mortelé et al., 2004), which streamlined the parenchymal and necrosis components and added two extra points whenever extrapancreatic complications such as pleural effusion or ascitic fluid were present.

A number of subsequent series have endorsed both indices as predictors of clinical outcome (Ahmed et al., 2025; Dalal, Dalal, & Rana, 2023; Parida & Biswal, 2017; Prasad et al., 2020; Subramani, Prabhu, & Palpandi, 2021), but published comparative work originating from Indian tertiary-care institutions remains relatively sparse. Against this background, the present study set out, in a prospective fashion, to weigh the prognostic capabilities of the CTSI against those of the MCTSI in patients managed for AP at a tertiary-care centre in India, and to examine how each index relates to length of stay, ICU admission, surgical management, organ failure, and mortality.

### Materials and Methods

**Study Design and Setting** The work was framed as a prospective, observational investigation carried out across a two-year window (2023–2025) at a tertiary-care teaching institution. Approval was granted by the Institutional Ethics Committee, and signed informed consent was secured from every participant—or, where appropriate, from a legally authorised representative—before any study procedure was undertaken.

**Patient Selection** Fifty consecutive patients in whom AP had been clinically suspected or already confirmed were recruited. The diagnostic criterion required that at least two of the following three features be present: (i) abdominal pain typical of pancreatitis; (ii) a serum amylase or lipase concentration that exceeded three times the upper reference limit; or (iii) cross-sectional imaging on CECT or sonography that supported the diagnosis.

***Inclusion criteria:*** Patients of any age with a clinical picture

suggestive of AP, regardless of underlying aetiology, who consented to take part and underwent CECT of the abdomen. *Exclusion criteria:* Individuals with previously diagnosed chronic pancreatitis, with other pancreatic disorders (including cystic or malignant lesions), with a prior history of pancreatic surgery, or with contraindications to iodinated contrast (documented allergy or appreciable renal dysfunction) were not enrolled. Postoperative patients and pregnant women were likewise omitted.

**CT Imaging Protocol** Imaging was acquired on a multi-detector scanner using a triphasic abdominal CECT protocol incorporating non-contrast, arterial, and portal-venous phase acquisitions. The initial study was timed to coincide with the acute presentation, with repeat imaging arranged whenever the clinical situation made it necessary. Two experienced radiologists reviewed every dataset, and the imaging features were translated into both the Balthazar CTSI and the Mortelé MCTSI.

**Severity Scoring Systems** *Balthazar CTSI:* The composite score was generated by combining the inflammation grade (A = 0, B = 1, C = 2, D = 3, E = 4) with the necrosis subscore (no necrosis = 0; less than 30% = 2; 30 to 50% = 4; greater than 50% = 6), giving a total ranging from 0 to 10. The numerical value was then translated into one of three bands—mild (0–3), moderate (4–6), or severe (7–10).

*Modified CTSI (MCTSI):* This index draws together three components: pancreatic inflammatory features (graded as normal = 0, intrinsic abnormalities only = 2, or pancreatic/peripancreatic inflammation = 4), the extent of necrosis (none = 0; up to 30% = 2; greater than 30% = 4), and the presence of extrapancreatic complications such as pleural fluid or ascitic accumulation (each adding 2 points). The aggregate runs from 0 to 10 and is then assigned to mild (0–2), moderate (4–6), or severe (8–10) categories (Mortelé et al., 2004).

*Revised Atlanta Classification (RAC):* Each patient was additionally placed within the RAC framework as having mild AP (no organ failure and no local or systemic complications), moderately severe AP (transient organ failure resolving inside 48 hours and/or local complications), or severe AP (organ failure that persisted beyond 48 hours) (Banks et al., 2013; Choi et al., 2017).

**Clinical Outcome Measures** The pre-specified outcomes recorded for each patient were: (1) overall length of inpatient stay in days; (2) admission at any point to the intensive-care unit (ICU); (3) requirement for surgical management; (4) the appearance of organ failure during admission; and (5) death occurring before discharge.

**Statistical Analysis**

All study data were entered and processed in IBM SPSS Statistics version 26.0. Continuous measurements are reported as mean values together with their standard deviation (SD), while categorical measurements appear as counts and percentages. The strength of association between CT severity scores and continuous outcomes was examined with Pearson's correlation coefficient (r). Receiver-operating-characteristic (ROC) analysis was used to gauge discriminative performance. Findings with a p-value below 0.05 were treated as statistically significant.

**Results**

**Demographic Profile** Fifty patients with a diagnosis of AP entered the analysis. Looking at age, the largest single group fell between 31 and 40 years (32%), clustering among young and middle-aged adults. The cohort had a mean age of approximately 39 years. Males were heavily over-represented, with 43 men (86%) compared to 7 women (14%), giving a male-to-female ratio of 6.14 to 1.

**Table 1. Age and gender distribution of study participants (n = 50)**

| Parameter | Category | n (%) |
|---|---|---|
| Age group (years) | <20 | 2 (4%) |
| | 21–30 | 13 (26%) |
| | 31–40 | 16 (32%) |
| | 41–50 | 10 (20%) |
| | 51–60 | 9 (18%) |
| Gender | Male | 43 (86%) |
| | Female | 7 (14%) |

**Laboratory Parameters** Renal function was largely unaffected, as reflected by a mean serum creatinine of 1.14 ± 0.34 mg/dL and a mean blood urea of 27.7 ± 13.73 mg/dL. The hepatic transaminases were only modestly elevated. Pancreatic enzymes were strikingly raised—mean serum amylase 1,728.88 ± 1,436.3 U/L and mean serum lipase 1,456.1 ± 694.88 U/L.

**Table 2. Laboratory parameters on admission (n = 50)**

| Parameter | Mean | SD |
|---|---|---|
| Hemoglobin (g/dL) | 12.10 | 2.47 |
| Total leukocyte count (/μL) | 11,318.86 | 5,321.6 |
| Platelets (/μL) | 303,126 | 151,688 |
| Serum creatinine (mg/dL) | 1.14 | 0.34 |
| Blood urea (mg/dL) | 27.70 | 13.73 |
| SGOT (IU/L) | 68.87 | 132.06 |
| SGPT (IU/L) | 44.52 | 50.06 |
| Serum amylase (U/L) | 1,728.88 | 1,436.3 |
| Serum lipase (U/L) | 1,456.1 | 694.88 |

Balthazar CT Grading and CTSI Distribution Stratification by overall CTSI band gave 12% with mild disease, 64% with moderate disease, and 24% with severe disease.

**Table 3. Balthazar CT grade and CTSI distribution**

| CT Grade | n | % |
|---|---|---|
| Grade B | 6 | 12 |
| Grade C | 13 | 26 |
| Grade D | 4 | 8 |
| Grade E | 27 | 54 |
| CTSI Category | n | % |
| Mild (0–3) | 6 | 12 |
| Moderate (4–6) | 32 | 64 |
| Severe (7–10) | 12 | 24 |

Modified CTSI Distribution Applying the MCTSI, 13 patients (26%) were graded as mild, 25 (50%) as moderate, and 12 (24%) as severe.

Clinical Outcomes The mean overall hospital stay worked out to 10.58 ± 6.37 days. Nineteen patients (38%) needed care in the ICU at some point. Surgical management was undertaken in 4 patients (8%), every one of whom had been classified as severe on CT grading. Organ failure developed in 3 patients (6%), and 2 patients (4%) died.

**Table 4. Clinical outcomes of study participants**

| Outcome Measure | Value |
|---|---|
| Mean hospital stay (days, mean ± SD) | 10.58 ± 6.37 |
| ICU admission | 19 (38%) |
| Surgical intervention | 4 (8%) |
| Organ failure | 3 (6%) |
| In-hospital mortality | 2 (4%) |

Correlation of Indices with Clinical Outcomes Mean length of stay rose progressively—and significantly—across successive Balthazar grades ($p < 0.001$). A consistent and statistically significant gradient was also apparent across all outcomes when patients were stratified by MCTSI band. Mean hospital stay was 4.69 ± 1.03 days for the mild group, 11.04 ± 4.73 days for the moderate group, and 16.83 ± 7.04 days for the severe group ($p < 0.001$).

**Table 5. Correlation of Balthazar CTSI and MCTSI with clinical outcomes**

| Outcome | Mild | Moderate | Severe | p-value |
|---|---|---|---|---|
| MCTSI – Hospital stay (days, mean ± SD) | 4.69 ± 1.03 | 11.04 ± 4.73 | 16.83 ± 7.04 | <0.001 |
| MCTSI – ICU admission | 7.69% | 36% | 75% | 0.002 |
| MCTSI – Surgery | 0% | 0% | 33.33% | <0.001 |
| MCTSI – Organ failure | 0% | 4% | 16.67% | 0.006 |
| MCTSI – Mortality | 0% | 0% | 16.67% | <0.001 |
| CTSI – Hospital stay (Gr E vs rest) | 4.50 days | 7.40 days | 14.48 days | <0.001 |

CTSI grades: mild = Grade B; moderate = Grades C–D; severe = Grade E (representative). MCTSI: mild 0–2, moderate 4–6, severe 8–10.

ROC Curve Analysis MCTSI scores carried a moderate, statistically significant positive association with the need for ICU admission (AUC = 0.739). The same index produced an AUC of 0.896 for the prediction of mortality.

## DISCUSSION

In this prospective series we examined how two CT-derived severity indices, the CTSI and the MCTSI, performed prognostically in a group of 50 patients with AP cared for in a tertiary-level setting. Both indices tracked closely with each of the principal clinical endpoints. Our observations sit comfortably alongside earlier work from India and elsewhere, adding further support to the use of CT-guided severity grading in everyday AP practice.

Our cohort skewed towards young and middle-aged men. These figures correspond closely with the demographic features described by Narendra and Navlaspur (2021), Parida and Biswal (2017), Subramani et al. (2021), and Prasad et al. (2020). The pronounced male preponderance documented here is in keeping with patterns repeatedly reported in Indian series and is generally ascribed to the higher prevalence of alcohol use and gallstone-related disease among younger men (Sand, Lankisch, & Nordback, 2007; van Geenen et al., 2010).

Mean serum amylase and lipase values were appreciably above the reference range, which is concordant with the biochemical signature of AP and with the figures reported in earlier cohorts (Dalal, Dalal, & Rana, 2023; Narendra & Navlaspur, 2021; Parida & Biswal, 2017). As is widely accepted, the absolute height of the enzyme rise is a poor predictor of how severe an attack will become; this disconnect was again evident in our patients (Dalal, Dalal, & Rana, 2023; Parida & Biswal, 2017).

Indices of renal and hepatic function were largely unremarkable in our cohort. Comparable patterns of mild biochemical disturbance have been reported by several authors (Ahmed et al., 2025; Narendra & Navlaspur, 2021; Prasad et al., 2020; Subramani et al., 2021); the last of these noted that creatinine elevation tends to become more conspicuous as severity worsens.

Balthazar grading produced a clear preponderance of Grade E disease (54%), with 64% of patients falling in the moderate CTSI band. This profile aligns well with the figures of Narendra and Navlaspur (2021), Parida and Biswal (2017), and Dalal et al. (2023). Our MCTSI distribution was virtually superimposable on that of Parida and Biswal (2017) and very close to the figures of Dalal et al. (2023).

Each of the two CT indices showed clear, statistically meaningful relationships with every primary outcome studied. These patterns parallel the influential analysis published by Bollen et al. (2012), which demonstrated that the CTSI and the MCTSI both surpass clinical scoring tools such as APACHE II in the early identification of severe AP. Dalal et al. (2023) documented strong positive Pearson correlations between MCTSI and the totals for hospital stay and ICU stay. Parida and Biswal (2017) similarly observed that both indices correlated meaningfully with organ failure and the need for intervention.

Nagarchi et al. showed that a CTSI value above 3 was associated with higher CRP levels, and Ahmed et al. (2025) reported a positive correlation between the CTSI and the Modified Marshall Score. In our cohort, the MCTSI carried a slightly stronger prognostic signal than the CTSI. This modest edge is at least partly explained by the fact that the MCTSI scores extrapancreatic complications as a separate domain (Dalal, Dalal, & Rana, 2023; Mortelé et al., 2004; Parida & Biswal, 2017).

Limitations Several caveats apply. First, with only 50 patients enrolled, statistical power for endpoints with very few events, such as mortality, is limited. Second, the timing of the index CT varied from patient to patient, which could weaken apparent correlations (Bollen et al., 2012). Third, because the work was conducted at a single tertiary-care institution, the case mix is likely weighted towards severe disease. Fourth, we did not perform aetiology-stratified subgroup analyses (Dalal, Dalal, & Rana, 2023; Parida & Biswal, 2017).

## CONCLUSION

Both the Balthazar CT Severity Index and its modified counterpart are dependable, easily applied, and prognostically useful measures for grading severity in AP. Within the present series, higher CT-derived scores were repeatedly and significantly linked with prolonged hospitalisation, increased ICU utilisation, more frequent recourse to surgical intervention, a higher incidence of organ failure, and greater mortality. The MCTSI offered a marginally superior overall prognostic profile in comparison with the CTSI. Performing CECT of the abdomen in a timely manner considerably sharpens risk stratification; on this basis, it should be embedded within the standard care pathway for AP at every level of the health system.

## REFERENCES


1. Ahmed, J. U., Singh, B., Nath, S., & Ahmed, H. (2025). A study of severity of acute pancreatitis with correlation between Modified Marshall Score and CT Severity Index. International Journal of Medical and Pharmaceutical Research, 6(4), 1286–1295.
2. Balthazar, E. J. (2002). Acute Pancreatitis: Assessment of Severity with Clinical and CT Evaluation. Radiology, 223(3), 603–613.
3. Balthazar, E. J., Robinson, D. L., Megibow, A. J., & Ranson, J. H. (1990). Acute pancreatitis: value of CT in establishing prognosis. Radiology, 174(2), 331–336.
4. Banks, P. A., Bollen, T. L., Dervenis, C., Gooszen, H. G., Johnson, C. D., Sarr, M. G., ... & Vege, S. S. (2013). Classification of acute pancreatitis—2012: revision of the Atlanta classification and definitions by international consensus. Gut, 62(1), 102–111.
5. Bollen, T. L., Singh, V. K., Maurer, R., Repas, K., van Es, H. W., Banks, P. A., & Mortele, K. J. (2012). A comparative evaluation of radiologic and clinical scoring systems in the early prediction of severity in acute pancreatitis. The American Journal of Gastroenterology, 107, 612–619.
6. Choi, J.-H., Kim, M.-H., Cho, D. H., Oh, D., Lee, H. W., Song, T. J., ... & Seo, D. W. (2017). Revised Atlanta classification and determinant-based classification: Which one better at stratifying outcomes of patients with acute pancreatitis? Pancreatology, 17(2), 194–200.
7. Dalal, A. D., Dalal, Y. D., & Rana, D. A. (2023). Modified computed tomography severity index in evaluation of acute pancreatitis and its correlation with clinical outcome: A prospective observational study from a tertiary care teaching hospital, India. Annals of African Medicine, 22, 340–346.
8. Garber, A., Frakes, C., Arora, Z., & Chahal, P. (2018). Mechanisms and Management of Acute Pancreatitis. Gastroenterology Research and Practice, 2018, 1–8.
9. Iannuzzi, J. P., King, J. A., Leong, J. H., Quan, J., Windsor, J. W., Tanyingoh, D., ... & Kaplan, G. G. (2022). Global Incidence of Acute Pancreatitis Is Increasing Over Time: A Systematic Review and Meta-Analysis. Gastroenterology, 162(1), 122–134.
10. Mortelé, K. J., Wiesner, W., Intriere, L., Shanker, S., Zou, K. H., Kalantari, B. N., ... & Ros, P. R. (2004). A modified CT severity index for evaluating acute pancreatitis. American Journal of Roentgenology, 183, 1261–1265.
11. Narendra, G. S., & Navlaspur, R. (2021). The correlation with the patient outcome of modified CT severity index (MCTSI) in evaluation of patients with acute pancreatitis with the currently accepted CT severity index (CTSI). International Journal of Radiology and Diagnostic Imaging, 4(2), 08–11.
12. Parida, K., & Biswal, D. (2017). Acute pancreatitis – A prospective study of estimation of prognosis with MCTSI versus CTSI. International Journal of Medical Research and Review, 5(6), 547–552.
13. Prasad, P. O., Vidya, N. S., Prasad, G. V., & Anand, D. R. (2020). Modified CT severity index for evaluation of acute pancreatitis and correlation with patient outcome. MedPulse International Journal of Radiology, 13(3), 160–167.
14. Pretis, N., Amodio, A., & Frulloni, L. (2018). Hypertriglyceridemic pancreatitis: Epidemiology, pathophysiology, and clinical management. United European Gastroenterology Journal, 6(5), 649–655.
15. Sand, J., Lankisch, P. G., & Nordback, I. (2007). Alcohol Consumption in Patients with Acute or Chronic Pancreatitis. Pancreatology, 7(2–3), 147–156.
16. Shimosegawa, T., Chari, S. T., Frulloni, L., Kamisawa, T., Kawa, S., Mino-Kenudson, M., ... & Okazaki, K. (2011). International Consensus Diagnostic Criteria for Autoimmune Pancreatitis. Pancreas, 40(3), 352–358.
17. Subramani, J., Prabhu, R., & Palpandi, J. (2021). Assessing the severity of acute pancreatitis with CT severity index and other conventional methods in a tertiary care hospital in Tamil Nadu, India – A comparative cross-sectional study. Journal of Evidence Based Medicine and Healthcare, 8(41), 3541–3546.
18. Thoeni, R. F. (2012). The Revised Atlanta Classification of Acute Pancreatitis: Its Importance for the Radiologist and Its Effect on Treatment. Radiology, 262(3), 751–764.
19. van Geenen, E. J. M., van der Peet, D. L., Bhagirath, P., Mulder, C. J. J., & Bruno, M. J. (2010). Etiology and diagnosis of acute biliary pancreatitis. Nature Reviews Gastroenterology & Hepatology, 7(9), 495–502.
20. Werge, M., Novovic, S., Schmidt, P. N., & Gluud, L. L. (2016). Infection increases mortality in necrotizing pancreatitis: A systematic review and meta-analysis. Pancreatology, 16(5), 698–707.
21. Whitcomb, D. C. (2013). Genetic Risk Factors for Pancreatic Disorders. Gastroenterology, 144(6), 1292–1302.