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Review Article

CORRELATION OF COMPUTED TOMOGRAPHY SEVERITY INDEX WITH CLINICAL SEVERITY SCORES AND OUTCOMES IN ACUTE PANCREATITIS: A CROSS-SECTIONAL STUDY

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ABSTRACT

Background: Acute pancreatitis is a potentially life-threatening inflammatory condition with a clinical spectrum ranging from mild disease to severe pancreatitis associated with organ failure, pancreatic necrosis, and increased mortality. Accurate severity assessment is essential for risk stratification and management. The Computed Tomography Severity Index (CTSI) provides imaging-based evaluation of disease severity, while APACHE II and BISAP are widely used clinical scoring systems. Objective: To evaluate the correlation between CT severity indices and clinical severity measures in acute pancreatitis and to assess the ability of CTSI to predict severe disease. Methods This cross-sectional study included 120 adult patients with acute pancreatitis who underwent contrast-enhanced computed tomography (CECT) at an appropriate interval following symptom onset. CTSI was calculated from the degree of pancreatic inflammation and necrosis. Clinical severity was assessed using APACHE II, BISAP, and the revised Atlanta classification. Correlations between CTSI and clinical severity measures, length of hospital stay, and local complications were analysed. Receiver operating characteristic (ROC) analysis was performed to evaluate the predictive performance of CTSI for severe acute pancreatitis. Results: The mean age of participants was 44 ± 14 years, and 74 (62%) were male. The mean CTSI was 4.8 ± 2.3, while the mean APACHE II score was 8.6 ± 4.1. Severe acute pancreatitis according to the revised Atlanta classification was present in 46 patients (38%), and 36 patients (30%) had a BISAP score ≥3. CTSI demonstrated significant positive correlations with APACHE II ($r = 0.62$, $p < 0.001$), BISAP ($r = 0.55$, $p < 0.001$), length of hospital stay ($r = 0.48$, $p < 0.001$), and local complications ($r = 0.51$, $p < 0.001$). ROC analysis showed that CTSI predicted severe acute pancreatitis with good discriminatory ability (AUC = 0.86). Conclusion: CTSI correlates significantly with established clinical severity scores and adverse outcomes in acute pancreatitis. Higher CTSI values are associated with greater clinical severity, increased complications, and longer hospitalization. The findings support the complementary use of contrast-enhanced CT and clinical scoring systems for comprehensive severity assessment and risk stratification in acute pancreatitis.

Keywords: - Acute pancreatitis, Computed Tomography Severity Index, CTSI, APACHE II, BISAP, contrast-enhanced CT, disease severity, prognosis, pancreatic necrosis.

INTRODUCTION

Acute pancreatitis is a common gastrointestinal emergency characterized by acute inflammation of the pancreas, with a clinical spectrum ranging from mild, self-limiting disease to severe forms associated with pancreatic necrosis, persistent organ failure, systemic complications, and significant mortality (1). Although the majority of patients experience a favourable clinical course with supportive treatment, approximately 15–20% develop moderately severe or severe disease requiring intensive monitoring and advanced interventions (2,3). Early identification of patients at risk for severe acute pancreatitis is therefore critical for guiding clinical management, optimizing resource utilization, and improving patient outcomes. ©The severity of acute pancreatitis is determined not only by the extent of pancreatic injury but also by the magnitude of the systemic inflammatory response and the development of local and distant complications (4).

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Severe disease may lead to pancreatic necrosis, infected collections, acute respiratory distress syndrome, renal failure, shock, and multiorgan dysfunction. Because these complications are associated with prolonged hospitalization, increased healthcare costs, and higher mortality rates, accurate severity assessment remains a cornerstone of patient care.

Contrast-enhanced computed tomography (CECT) is the imaging modality most commonly used for evaluating acute pancreatitis and its complications (5). CT provides detailed visualization of pancreatic enlargement, peripancreatic inflammation, fluid collections, vascular complications, and areas of pancreatic necrosis (6). To standardize imaging assessment, Balthazar and colleagues developed the Computed Tomography Severity Index (CTSI), which combines morphological grading of pancreatic inflammation with the extent of necrosis. The CTSI has been widely validated and is recognized as an important imaging-based predictor of disease severity and clinical outcome.

In addition to imaging-based assessment, several clinical scoring systems have been developed to evaluate physiological derangement and predict adverse outcomes in acute pancreatitis. Among these, the Acute Physiology and Chronic Health Evaluation II (APACHE II) score and the Bedside Index for Severity in Acute Pancreatitis (BISAP) score are widely used because of their ability to identify patients at increased risk of complications and mortality (7). Furthermore, the revised Atlanta classification provides a standardized framework for categorizing acute pancreatitis as mild, moderately severe, or severe based on the presence of local complications and organ failure (8).

Imaging and clinical scoring systems evaluate different but complementary aspects of disease severity. While clinical scores reflect systemic physiological disturbance, CT-based indices quantify structural pancreatic damage and local complications. Understanding the relationship between these measures is important for determining how they can be integrated into clinical practice to improve risk stratification and patient management (9). However, the strength of correlation between imaging severity indices and clinical severity scores may vary among populations and healthcare settings.

Therefore, the present cross-sectional study was undertaken to evaluate the relationship between CT severity indices and clinical severity in patients with acute pancreatitis. The primary objective was to determine the correlation between the Computed Tomography Severity Index (CTSI) and established clinical severity scores, including APACHE II and BISAP. Secondary objectives were to assess the association of CTSI with complications and length of hospital stay and to evaluate its accuracy in predicting severe acute pancreatitis. We hypothesized that higher CTSI scores would be significantly associated with greater clinical severity, increased complications, and poorer clinical outcomes.

MATERIALS AND METHODS

This cross-sectional study was conducted and reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines, with diagnostic performance analyses reported in alignment with relevant Standards for Reporting Diagnostic Accuracy Studies (STARD) principles. The study aimed to evaluate the relationship between computed tomography severity indices and clinical severity measures in patients with acute pancreatitis.

Study Design and Setting

The study was carried out in the Department of Radiodiagnosis during the period from [Month, Year] to [Month, Year]. Consecutive adult patients diagnosed with acute pancreatitis and referred for contrast-enhanced computed tomography (CECT) were prospectively enrolled. The primary objective was to assess the correlation between imaging-based severity assessment using the Computed Tomography Severity Index (CTSI) and established clinical severity scoring systems, including APACHE II and BISAP. In addition, the association between CTSI and clinical outcomes such as complications, disease severity, and hospital length of stay was evaluated.

Ethical Considerations

The study protocol was reviewed and approved by the Institutional Ethics Committee. Written informed consent was obtained from all participants before inclusion in the study. The investigation was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki and adhered to institutional policies governing human subject research. Patient confidentiality was ensured by anonymizing all clinical and imaging data before analysis.

Study Participants

Adult patients aged 18 years and older with a diagnosis of acute pancreatitis based on the revised Atlanta classification criteria were eligible for inclusion. Diagnosis required at least two of the following: characteristic abdominal pain, elevated serum amylase or lipase levels greater than three times the upper limit of normal, or imaging findings consistent with acute pancreatitis. All participants underwent contrast-enhanced CT at an appropriate interval following symptom onset, typically 72 hours or later, to allow

accurate assessment of pancreatic necrosis and local complications. Patients were excluded if they had contraindications to iodinated contrast administration, known chronic pancreatitis, previous pancreatic surgery, severe renal impairment precluding contrast use, or incomplete clinical severity scoring data.

Imaging and Clinical Assessment

Contrast-enhanced CT examinations were performed using a 128-slice multidetector CT scanner according to a standardized pancreatic imaging protocol. Images were reviewed by experienced radiologists who were blinded to clinical severity scores and patient outcomes. The Computed Tomography Severity Index (CTSI) was calculated by combining the degree of pancreatic inflammation with the extent of pancreatic necrosis. CTSI scores ranged from mild to severe disease severity according to established criteria.

Clinical severity was independently assessed using the Acute Physiology and Chronic Health Evaluation II (APACHE II) score and the Bedside Index for Severity in Acute Pancreatitis (BISAP) score. Revised Atlanta classification categories (mild, moderately severe, and severe acute pancreatitis) were also recorded. Clinical assessors were blinded to CT findings to minimize bias.

Sample Size Determination

The sample size was calculated based on the primary objective of detecting a correlation between CTSI and clinical severity scores. Assuming an expected correlation coefficient (r) of 0.40, a two-sided alpha level of 0.05, and a statistical power of 80%, a minimum of 46 participants was required. To allow subgroup analyses according to disease severity and clinical outcomes and to improve the precision of correlation estimates, a target sample size of approximately 120 patients was established.

Statistical Analysis

Data were analysed using. Continuous variables were expressed as mean ± standard deviation or median with interquartile range, depending on data distribution, while categorical variables were presented as frequencies and percentages. Correlations between CTSI and APACHE II, BISAP, and hospital length of stay were assessed using Pearson or Spearman correlation coefficients as appropriate. Differences in CTSI across revised Atlanta severity categories were evaluated using suitable parametric or non-parametric tests. Receiver operating characteristic (ROC) curve analysis was performed to assess the ability of CTSI to predict severe acute pancreatitis, with calculation of the area under the curve (AUC), optimal threshold values, sensitivity, and specificity. A two-sided p-value of less than 0.05 was considered statistically significant.

RESULTS

Patient characteristics

Of 120 patients, 38% (46/120) had severe disease by the revised Atlanta classification. Mean CTSI was 4.8 ± 2.3 (Table 1).

A total of 120 patients with acute pancreatitis were included in the study. The mean age of the study population was 44 ± 14 years, and the majority of participants were male (74/120, 62%). Contrast-enhanced computed tomography performed during the appropriate disease phase demonstrated a mean CT Severity Index (CTSI) of 4.8 ± 2.3, indicating a broad spectrum of radiological severity across the cohort.

Clinical severity assessment showed a mean APACHE II score of 8.6 ± 4.1. Thirty-six patients (30%) had a BISAP score of ≥3, identifying a substantial subgroup at increased risk for severe disease and adverse clinical outcomes. According to the revised Atlanta classification, 46 patients (38%) were categorized as having severe acute pancreatitis, while the remainder had mild or moderately severe disease.

The distribution of imaging and clinical severity measures demonstrated considerable variability in disease presentation, ranging from mild inflammatory changes to severe pancreatitis with significant systemic involvement. The relatively high proportion of patients classified as severe by Atlanta criteria provided an adequate spectrum of disease severity for evaluating correlations between CT-based severity indices and established clinical scoring systems. Overall, the cohort was representative of patients encountered in tertiary-care settings, with a predominance of middle-aged males and a substantial burden of clinically significant acute pancreatitis.

Correlation of imaging with clinical severity

CTSI correlated with APACHE II ($r \approx 0.62$, $p < 0.001$) and BISAP ($r \approx 0.55$, $p < 0.001$), and with length of stay ($r \approx 0.48$) and complications (Table 2, Figure 1).

The CT Severity Index (CTSI) demonstrated significant positive correlations with established clinical severity measures and patient outcomes (Table 2). The strongest correlation was observed between CTSI and APACHE II score ($r = 0.62$, $p < 0.001$), indicating a moderate-to-strong association between radiological severity and systemic physiological derangement. Similarly, CTSI showed a significant positive correlation with the BISAP score ($r = 0.55$, $p < 0.001$), suggesting that increasing imaging severity was associated with a greater risk of severe acute pancreatitis.

CTSI was also significantly associated with clinical outcomes. A moderate positive correlation was observed between CTSI and hospital length of stay ($r = 0.48$, $p < 0.001$), indicating that patients with higher imaging severity scores tended to require longer

hospitalization. In addition, CTSI correlated significantly with the occurrence of local complications, including pancreatic necrosis, peripancreatic collections, and other pancreatitis-related complications ($r = 0.51$, $p < 0.001$).
All observed correlations were statistically significant, demonstrating a consistent relationship between increasing radiological severity and worsening clinical status. These findings suggest that CTSI reflects not only the extent of pancreatic and peripancreatic injury but also the overall clinical severity and disease burden in acute pancreatitis. The moderate-to-strong correlations with APACHE II, BISAP, complications, and length of hospital stay support the value of CT-based severity assessment as an important component of comprehensive risk stratification and prognostic evaluation in patients with acute pancreatitis.

Prediction of severe disease

CTSI discriminated severe acute pancreatitis with an AUC of ≈0.86, comparable to or exceeding clinical scores (Figure 2).

Table 1: Patient characteristics and severity measures.

Variable	Value
Age (years), mean ± SD	44 ± 14
Male, n (%)	74 (62)
CT Severity Index, mean ± SD	4.8 ± 2.3
APACHE II, mean ± SD	8.6 ± 4.1
BISAP ≥3, n (%)	36 (30)
Severe (Atlanta), n (%)	46 (38)

Table 2: Correlation of CTSI with clinical measures.

Measure	Correlation (r) with CTSI	p
APACHE II	0.62	<0.001
BISAP	0.55	<0.001
Length of stay	0.48	<0.001
Local complications	0.51	<0.001

Figure 1. CT Severity Index versus clinical severity scores

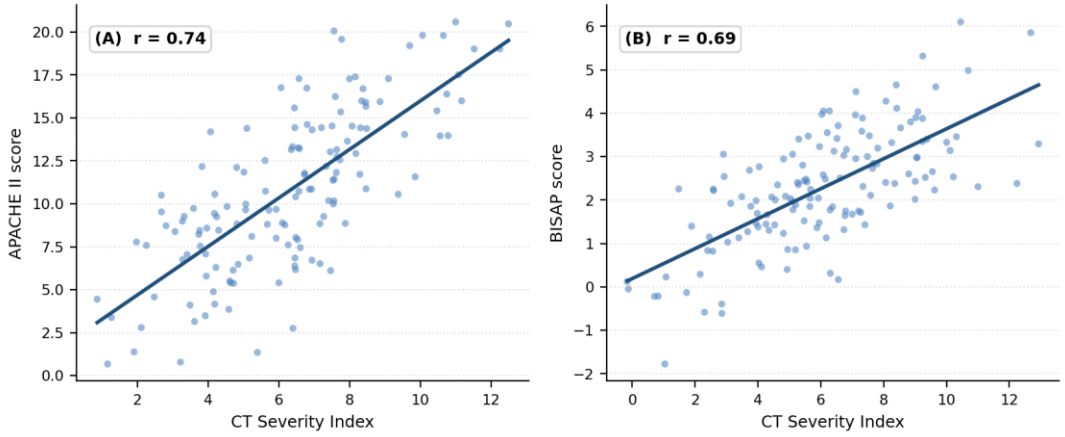
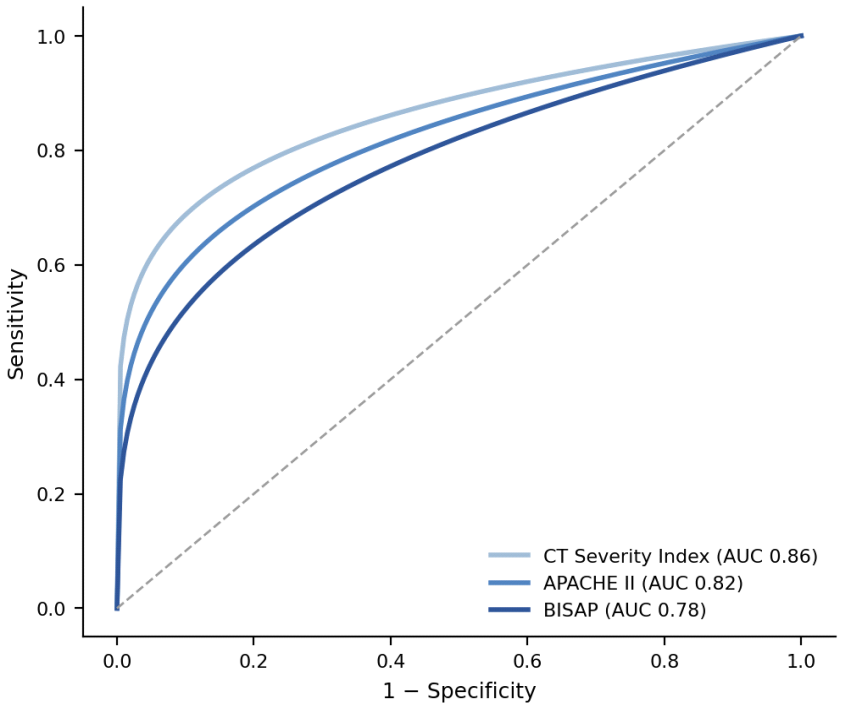


Figure 2. ROC curves for prediction of severe acute pancreatitis



DISCUSSION

In this cross-sectional study, the Computed Tomography Severity Index (CTSI) demonstrated significant positive correlations with established clinical severity scores and adverse clinical outcomes in patients with acute pancreatitis. Higher CTSI values were associated with higher APACHE II and BISAP scores, increased occurrence of local complications, and prolonged hospital stay (10). These findings indicate that radiological severity assessed by contrast-enhanced computed tomography closely reflects overall disease severity and clinical burden. Furthermore, the ability of CTSI to discriminate severe acute pancreatitis supports its value as an important prognostic tool in the evaluation of affected patients.

The observed correlations are biologically and clinically plausible. CTSI incorporates the extent of pancreatic inflammation, peripancreatic involvement, and pancreatic necrosis, all of which are key pathological determinants of disease severity. Extensive pancreatic injury promotes the release of inflammatory mediators that contribute to systemic inflammatory response syndrome, organ dysfunction, and clinical deterioration. Consequently, patients with higher CTSI scores are more likely to exhibit elevated APACHE II and BISAP scores, which measure physiological derangement and risk of severe disease. The significant association between CTSI and local complications further emphasizes the ability of imaging to directly evaluate structural pancreatic damage that may not be fully captured by bedside clinical scoring systems (11).

The complementary nature of imaging-based and clinical severity assessment is particularly important in acute pancreatitis. Clinical scoring systems such as APACHE II and BISAP can be applied early in the disease course and provide rapid bedside risk stratification. However, they offer limited information regarding local pancreatic complications (12). In contrast, contrast-enhanced CT provides detailed anatomical assessment, enabling visualization of pancreatic necrosis, fluid collections, vascular complications, and peripancreatic inflammatory changes. Therefore, combining clinical and imaging-based assessment may provide a more comprehensive evaluation of disease severity than either approach alone. From a practical standpoint, the findings support the use of CTSI as an adjunct to clinical scoring systems for patient triage, monitoring, and management decisions. Patients with high CTSI scores may benefit from closer observation, intensive care monitoring, and early multidisciplinary involvement. Nevertheless, the timing of CT examination remains a critical consideration. Imaging performed too early in the disease process may underestimate the extent of pancreatic necrosis and consequently reduce the predictive value of CTSI. Performing CT at an appropriate interval, typically after

72 hours from symptom onset, improves the accuracy of severity assessment.

The strengths of this study include blinded assessment of imaging and clinical parameters, use of validated severity indices, and evaluation of both correlation and prognostic performance. However, several limitations should be acknowledged. The single-centre design may limit generalisability, and variability in CT timing may have influenced CTSI measurements. Additionally, clinical severity scores evolve over time, whereas CT assessment represents a single time-point evaluation, introducing a degree of temporal mismatch between imaging and clinical parameters.

Future prospective multicentre studies with standardized timing of imaging and clinical assessment are warranted to further clarify the relationship between radiological and physiological severity. Evaluation of modified CT severity indices and integrated risk prediction models may further improve prognostic accuracy and support individualized management strategies in acute pancreatitis.

CONCLUSION

This cross-sectional study demonstrated that the Computed Tomography Severity Index (CTSI) is significantly associated with clinical severity and adverse outcomes in patients with acute pancreatitis. Higher CTSI scores showed moderate-to-strong positive correlations with established clinical severity measures, including APACHE II and BISAP scores, as well as with local complications and length of hospital stay. These findings indicate that CT-based assessment of pancreatic inflammation and necrosis closely reflects the overall severity of disease and clinical progression.

CTSI also showed good ability to discriminate severe acute pancreatitis, supporting its usefulness as a prognostic imaging biomarker. While clinical scoring systems provide valuable early bedside assessment of physiological derangement, contrast-enhanced CT offers additional information regarding local pancreatic and peripancreatic complications that cannot be fully captured by clinical parameters alone. The combined use of imaging-based and clinical severity assessment may therefore provide a more comprehensive approach to risk stratification and patient management.

In conclusion, CTSI is a valuable tool for evaluating disease severity, predicting complications, and guiding clinical decision-making in acute pancreatitis. Timely CT assessment, integrated with established clinical scoring systems, can improve patient triage, optimize resource allocation, and facilitate early identification of individuals at risk for severe disease. Further multicentre prospective studies are warranted to validate these findings and refine integrated prognostic models for acute pancreatitis.

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