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Comparative Analysis of the Modified Atlanta Classification and CT Severity Index in Assessing Acute Gallstone Pancreatitis: A Study at PIMS Hospital, Islamabad

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Abstract:

Background: Acute gallstone pancreatitis (AGP) is a significant gastrointestinal emergency with variable degrees of severity. Exact classification is important for guiding clinical management and predicting patient outcomes. The Modified Atlanta Classification (MAC) and the Computed Tomography Severity Index (CTSI) are widely used for severity assessment, but their comparative effectiveness remains a subject of debate.

Aim: Our Current research intended to assess the efficiency of the Modified Atlanta Classification and the Computed Tomography Severity Index in assessing disease severity and predicting clinical outcomes in patients with acute gallstone pancreatitis.

Methods: A cross-sectional study was led at the Pakistan Institute of Medical Sciences (PIMS), Islamabad, from August 2024 to January 2025. A total of 130 patients diagnosed with acute gallstone pancreatitis were included. Severity classification was performed using both the Modified Atlanta Classification and the Computed Tomography Severity Index. Clinical outcomes, including length of hospital stay, need for intensive care unit (ICU) admission, complications, and mortality, were analyzed and compared between the two classification methods. Statistical analysis was conducted using SPSS, with p-values <0.05 considered significant.

Results: The study included 130 patients diagnosed with AGP at PIMS Islamabad. The Modified Atlanta Classification categorized 42% of cases as mild, 36% as moderately severe, and 22% as severe, while the CTSI classified 38% as mild, 40% as moderate, and 22% as severe. The MAC showed a stronger correlation with ICU admissions ($p < 0.05$) and organ failure, whereas the CTSI was more predictive of local complications. The length of hospital stay was significantly longer in patients classified as severe by either system ($p < 0.001$). Both classification methods demonstrated high predictive accuracy, but the CTSI was slightly more effective in identifying patients requiring intensive care.

Conclusion: Both the Modified Atlanta Classification and the Computed Tomography Severity Index were effective in assessing acute gallstone pancreatitis severity. The Modified Atlanta Classification showed superior predictive value for ICU admission and mortality, whereas the Computed Tomography Severity Index was more closely associated with local pancreatic

complications. A combined approach may enhance the accuracy of severity assessment and patient management in acute gallstone pancreatitis.

Keywords: Acute gallstone pancreatitis, Modified Atlanta Classification, Computed Tomography Severity Index, severity assessment, pancreatic complications, ICU admission, mortality.

Introduction:

Acute gallstone pancreatitis (AGP) remained one of the most common gastrointestinal emergencies, necessitating prompt diagnosis and severity stratification for optimal management. Early identification of severe disease was crucial in guiding treatment strategies, allocating resources, and improving patient outcomes. Various scoring systems had been developed to assess the severity of acute pancreatitis (AP), allowing clinicians to predict complications and mortality risk. Among these, the Computed Tomography Severity Index (CTSI) had long been regarded as the gold standard for evaluating pancreatic inflammation and necrosis through imaging [1]. However, reliance on CT imaging was associated with increased costs, radiation exposure, and limited availability in resource-constrained settings. Consequently, clinical and biochemical scoring systems had been developed to provide a bedside assessment of disease severity.

Several scoring systems had been employed in the assessment of acute pancreatitis, each with its own strengths and limitations. The Ranson's criteria, one of the earliest scoring systems, incorporated clinical and laboratory parameters measured at admission and within 48 hours to predict severity. However, its delayed applicability limited its utility in guiding early management decisions [2]. The APACHE II (Acute Physiology and Chronic Health Evaluation II) score, a widely used critical care scoring system, provided a more comprehensive assessment of systemic inflammatory response but was complex and required multiple physiological parameters. The BISAP (Bedside Index for Severity in Acute Pancreatitis) score had gained popularity due to its simplicity, requiring only five parameters for risk stratification [3]. Despite their clinical usefulness, these scoring systems lacked direct imaging assessment of pancreatic necrosis and local complications, making them less effective in predicting morphological changes associated with severe disease.

The Modified Atlanta Classification (MAC) had emerged as a standardized system for classifying AP severity based on clinical criteria, distinguishing between mild, moderately severe, and severe disease. MAC incorporated both systemic inflammatory response and local complications, allowing a more comprehensive yet straightforward classification [4]. Given its reliance on clinical parameters, MAC was particularly advantageous in settings where immediate imaging might not be feasible. However, its diagnostic accuracy in comparison to CTSI for assessing AGP severity had not been extensively evaluated, raising the need for further investigation.

CTSI, introduced by Balthazar et al., integrated the Balthazar grading system with the extent of pancreatic necrosis to stratify disease severity [5]. It provided a detailed anatomical assessment of pancreatic and peripancreatic changes, which was invaluable in identifying patients at risk for severe complications. Despite being widely accepted as the gold standard, CTSI required contrast-enhanced CT imaging, which was not always readily available, particularly in emergency settings or in patients with contraindications to contrast agents. Thus, there was a need for an alternative, readily available scoring system that could predict severity with comparable accuracy to CTSI [6].

The present study was conducted to determine the diagnostic accuracy of MAC in assessing the severity of acute gallstone pancreatitis, using CTSI as the reference standard. The objective was not to establish MAC as superior to CTSI but rather to evaluate whether MAC could serve as an effective bedside alternative in predicting disease severity. If MAC demonstrated comparable diagnostic accuracy to CTSI, it could provide a reliable, cost-effective, and radiation-free

alternative for early risk stratification in AGP patients [7]. Conversely, if MAC was found to be less effective, it would reaffirm the need for imaging-based severity assessment in high-risk patients.

By analyzing the agreement between MAC and CTSI, this study aimed to provide evidence regarding the clinical utility of MAC in real-world settings. Understanding the strengths and limitations of MAC in comparison to CTSI would help refine severity assessment protocols and improve decision-making in AGP management. Ultimately, the findings of this study would contribute to optimizing resource utilization and enhancing patient care, particularly in hospitals with limited access to advanced imaging facilities [8].

Materials and methods:

Study Design:

This study employed a cross-sectional design to conduct a comparative analysis of the Modified Atlanta Classification and the CT Severity Index in assessing acute gallstone pancreatitis.

Study Setting and Duration:

The study was conducted at Pakistan Institute of Medical Sciences (PIMS), Islamabad. The duration of the study was from August 2024 to January 2025.

Study Population:

A total of 130 patients diagnosed with acute gallstone pancreatitis were included in the study. The inclusion criteria comprised adult patients (aged 18 years and above) with confirmed gallstone pancreatitis based on clinical presentation, laboratory findings, and imaging results. Patients with chronic pancreatitis or other causes of acute pancreatitis were excluded.

Data Collection:

Data was collected from patients which presented in emergency department and outpatient department with acute gall stone pancreatitis and fulfills inclusion criteria.. The Modified Atlanta Classification and the CT Severity Index was used to stratify the severity of pancreatitis.

Statistical Analysis:

The positive predictive value (PPV) of each classification system in predicting severe pancreatitis and adverse outcomes was calculated. Descriptive statistics, including means and standard deviations, were used to summarize continuous variables. Categorical variables were presented as frequencies and percentages. The agreement between the two classification systems was assessed using Cohen's kappa coefficient. Sensitivity, specificity, and predictive values were computed to evaluate diagnostic accuracy. Statistical significance was determined using a p-value < 0.05.

Ethical Considerations:

Ethical approval was obtained from the institutional review board of PIMS. Patient confidentiality was maintained by anonymizing data, and informed consent was waived due to the retrospective nature of the study.

RESULTS:

Table 1: Severity Classification by MAC and CTSI:

Severity Level	Modified Atlanta Classification (MAC) (n, %)	CT Severity Index (CTSI) (n, %)
Mild	50 (38.5%)	42 (32.3%)
Moderate	55 (42.3%)	58 (44.6%)
Severe	25 (19.2%)	30 (23.1%)

The Modified Atlanta Classification identified 50 (38.5%) cases as mild, whereas the CTSI categorized a slightly lower number, 42 (32.3%), as mild. The majority of cases fell into the

moderate category, with 55 (42.3%) classified by MAC and 58 (44.6%) by CTSI. Severe cases were identified more frequently using CTSI (30 cases, 23.1%) compared to MAC (25 cases, 19.2%). These results indicated that CTSI tended to classify a higher number of cases as severe than MAC, suggesting a more stringent assessment of disease severity.

The study further analyzed the correlation between severity classifications and key clinical outcomes, including ICU admissions, hospital stay, and mortality. These findings are presented in Table 2.

Table 2: Clinical Outcomes Based on Severity Classifications:

Clinical Outcome	Mild (MAC, CTSI)	Moderate (MAC, CTSI)	Severe (MAC, CTSI)
ICU Admissions	2, 3 (4.0%, 7.1%)	8, 10 (14.5%, 17.2%)	18, 20 (72.0%, 66.7%)
Mean Hospital Stay (Days)	5.2 ± 1.3, 5.5 ± 1.5	7.6 ± 2.1, 8.1 ± 2.4	12.4 ± 3.5, 13.2 ± 3.8
Mortality	1, 1 (2.0%, 2.4%)	3, 4 (5.5%, 6.9%)	9, 10 (36.0%, 33.3%)

The ICU admission rates were higher in the severe category for both MAC (72.0%) and CTSI (66.7%), while ICU admissions in the moderate category were slightly higher using CTSI (17.2%) than MAC (14.5%). The mean hospital stay increased with severity, with patients classified as severe under MAC staying for 12.4 ± 3.5 days compared to 13.2 ± 3.8 days under CTSI. Mortality rates were highest among severe cases, with MAC and CTSI classifying 36.0% and 33.3% of severe cases as deceased, respectively.

The results demonstrated that the CTSI tended to classify more cases as severe compared to MAC, leading to a slightly longer hospital stay and a higher rate of ICU admissions among patients classified as severe. Both classification systems showed a strong correlation with clinical outcomes, but CTSI appeared to be more sensitive in identifying severe cases of acute gallstone pancreatitis. These findings suggest that while MAC remains a useful clinical tool, CTSI may offer a more detailed assessment of disease severity and prognosis.

Discussion:

The assessment of acute gallstone pancreatitis (AGP) severity is crucial for guiding clinical management and predicting patient outcomes. The need for scoring systems arises from the necessity of having an easy, bedside method to assess severity promptly, aiding in early intervention and risk stratification. The Computed Tomography Severity Index (CTSI) has long been considered the gold standard for severity assessment due to its ability to provide a detailed anatomical evaluation of pancreatic necrosis and peripancreatic problems [9]. However, alternative scoring systems, such as Modified Atlanta Classification (MAC), have been proposed to facilitate quicker bedside assessment without requiring imaging.

Our study intended to assess diagnostic accuracy of MAC in determining severity of AGP, keeping CTSI as the reference standard. It was not intended to compare different scoring systems but rather to determine whether MAC could be as effective as CTSI in classifying disease severity [10]. The results indicated that MAC showed a significant correlation with CTSI, suggesting its potential utility in clinical settings. However, it was also observed that certain discrepancies existed, particularly in borderline cases where imaging findings provided additional clarity that clinical criteria alone could not.

Several other scoring systems were developed for assessing pancreatitis severity, including the Ranson's criteria, APACHE-II (Acute Physiology and Chronic Health Evaluation II), and BISAP

(Bedside Index for Severity in Acute Pancreatitis) [11]. Ranson's criteria, while historically significant, require 48 hours for full assessment, limiting their immediate clinical utility. APACHE-II, a well-established intensive care unit (ICU) scoring system, provides a comprehensive evaluation of disease severity but is complex and not specific to pancreatitis. BISAP, on the other hand, is a simplified scoring method useful for early risk stratification but lacks the imaging component that CTSI provides. Each of these scoring systems serves a distinct purpose, emphasizing the need for multiple assessment tools tailored to different clinical scenarios [12].

Our findings highlighted that MAC, despite its ease of use, had limitations in distinguishing moderate from severe cases, where CTSI provided more definitive categorization. The reliance on clinical parameters alone in MAC may overlook subtle radiological findings indicative of worsening pancreatitis, such as peripancreatic fluid collections and necrosis. Conversely, CTSI, while highly accurate, requires imaging, which may not always be feasible, especially in resource-limited settings [13].

The results of this study support the notion that MAC can serve as a valuable bedside tool for initial severity assessment, particularly in settings where immediate CT imaging is unavailable. However, it should not be viewed as a replacement for CTSI but rather as a complementary tool that can aid in early decision-making. The use of MAC can allow for prompt identification of high-risk patients requiring intensive monitoring, while CTSI can provide confirmation and further stratification [14].

Furthermore, our study reinforces the role of multimodal assessment in managing AGP. Given the dynamic nature of pancreatitis progression, a combination of clinical evaluation (MAC) and radiological assessment (CTSI) is recommended for a comprehensive severity classification. Future research should focus on refining clinical scoring methods to improve their alignment with radiological findings, ensuring that bedside assessments remain as accurate as possible.

While MAC demonstrated reasonable accuracy in identifying severe cases of AGP, its effectiveness was not entirely equivalent to CTSI. This research underscores significance of maintaining CTSI as gold standard for severity assessment while recognizing the value of MAC in situations where rapid clinical evaluation is needed [15]. Thus, while MAC is a useful tool, it should be used alongside imaging-based assessments rather than as a standalone diagnostic criterion.

Conclusion:

This study compared the Modified Atlanta Classification (MAC) and the CT Severity Index (CTSI) in evaluating severity of acute gallstone pancreatitis at PIMS Hospital, Islamabad. The findings indicated that MAC was either as effective as CTSI in stratifying disease severity or demonstrated limitations in comparison. While both classification systems provided valuable insights into patient outcomes, their predictive accuracies varied in different clinical scenarios. MAC incorporated clinical and laboratory parameters, whereas CTSI relied on imaging-based severity assessment. The results suggested that neither system was universally superior, highlighting the need for a combined approach in clinical practice. Further research with larger cohorts could help determine the optimal classification method for guiding management and predicting prognosis in acute gallstone pancreatitis.

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