Original Article

Assessment of Severity of Acute Pancreatitis Using Modified Computed Tomography Severity Index and Revised Atlanta Classification and Their Association with Clinical Outcome Parameters

Swasti Jain, Ankur Malhotra, Shruti Chandak, Deepti Arora[1], Aman Taneja

Departments of Radiodiagnosis and [1]Pathology, Teerthanker Mahaveer Medical College and Research Centre, Moradabad, Uttar Pradesh, India

Abstract

Introduction: Acute pancreatitis (AP) is a serious gastrointestinal condition with significant morbidity and mortality. It can lead to various complications and is commonly diagnosed using laboratory tests and contrast-enhanced computed tomography (CT) scans. This study evaluates the efficacy of the Modified CT Severity Index (MCTSI) and the neutrophil-to-lymphocyte ratio (NLR) in predicting the severity of AP compared to the Revised Atlanta Classification (RAC). In addition, we will also assess concordance of MCTSI and RAC with NLR. **Materials and Methods:** After approval from IEC, this prospective observational study, conducted over 18 months at Teerthanker Mahaveer Medical College Hospital, Moradabad, Uttar Pradesh, included 65 adult patients clinically diagnosed with AP. All participants satisfying the inclusion criteria were enrolled after taking a written informed consent and they underwent standard laboratory tests (including a complete blood count) and radiological evaluation (including CT scan performed using 128-slice scanner Ingenuity CT, Philips Healthcare) during their hospital stay. The primary outcome measures were the sensitivity, specificity, and accuracy of NLR and MCTSI, as well as their alignment with the RAC for assessing AP severity. **Results:** In this study of 65 patients with clinically diagnosed AP, the mean age was 38.82 ± 15.82 years with a range of 15–85 years of age, with a male predominance (61.5%) and male to female ratio of 1.6:1. The study evaluated the effectiveness of MCTSI, NLR, and RAC methods for predicting the severity of AP. Severe AP cases, as classified by all methods, were associated with higher rates of surgical intervention (up to 45.5%), infection (up to 66.7%), persistent organ failure (up to 100%), mortality (up to 36.4%), and longer hospital stays (mean of up to 20.21 days), highlighting the need for accurate severity assessment in managing AP. The sensitivity, specificity, and accuracy of NLR were 67%, 90.9%, and 76%, respectively, while MCTSI had sensitivity of 95%, specificity of 13.6%, and accuracy of 62%. NLR showed a high area under the curve (0.855) compared to MCTSI (0.645). NLR was found to be a viable alternative for predicting severity, especially in resource-limited settings. **Conclusion:** The Modified Computed Tomography Severity Index (MCTSI) is a well-established tool for assessing the severity of AP, demonstrating ease of calculation and a close correlation with clinical outcomes. Our study confirmed that MCTSI has superior predictive ability for moderately severe and severe cases, showing high sensitivity and positive predictive value. It aligns well with the RAC, with both scoring systems significantly correlating with clinical outcomes such as the need for surgical intervention, infection, organ failure, mortality, and hospital stay duration. More adverse outcomes were observed in moderate and severe grades compared to mild cases. Additionally, NLR which is a novel parameter demonstrates strong concordance with RAC in assessing moderate-to-severe AP and offers a cost-effective alternative to MCTSI and traditional radiological methods. It can effectively predict disease severity and guide early diagnosis and treatment, particularly in settings with limited resources.

Keywords: Acute pancreatitis, modified computed tomography severity index score, neutrophil-to-lymphocyte ratio, Revised Atlanta Classification

Introduction

Acute pancreatitis (AP) is a medical emergency characterized by the sudden onset of severe abdominal pain, often

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Address for correspondence: Dr. Ankur Malhotra, Department of Radiodiagnosis, Teerthanker Mahaveer Medical College and Research Centre, Moradabad - 244 001, Uttar Pradesh, India.
E-mail: drankur.m7@gmail.com

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accompanied by nausea and vomiting. The most common causes include alcohol abuse and gallstones. Diagnosis is typically based on clinical presentation, elevated serum amylase and lipase levels (with lipase being more specific), and imaging studies. The prevalence of AP varies globally, with a range of 4.9% to 73.4% per 100,000 individuals. There lies a high probability of survival for most of the patients, as they experience a moderate illness. Nevertheless, a severe clinical course is experienced by 15–20% of AP patients, resulting in a 20–30% increase in mortality and morbidity and both local and systemic consequences.[1-3]

The Atlanta classification, introduced in 1992, initially divided pancreatitis into mild and severe categories. The classification was updated in 2012, further categorizing the disease into mild, moderate, and severe, based on a modified Marshall scoring system.[4,5] This revision also considered the presence of local complications and organ failure.[5]

Several scoring systems are routinely used to predict morbidity and mortality in AP, including the Ranson score, the Marshall score, APACHE II, BISAP, SOFA, and the Glasgow Coma Scale.[6] These systems are often complex and rely heavily on laboratory tests, increasing resource demands. Some also require reassessment over time.[6]

Recently, the neutrophil-to-lymphocyte ratio (NLR) has emerged as a predictor of disease severity and outcome in AP, as well as in other conditions.[7] An elevated NLR indicates a heightened inflammatory response, with an increased neutrophil count reflecting acute inflammation and a decreased lymphocyte count indicating a decline in overall health.[8] NLR has shown a sensitivity of 78.12% and a specificity of 70.27% for predicting the severity of AP, with a normal NLR ranging from 1 to 3, mild stress from 6 to 9, moderate stress from 9 to 18, and severe stress at levels >18.[8]

Imaging techniques, including ultrasound and computed tomography (CT) scans, are also crucial in diagnosing and determining the severity of pancreatitis. Contrast-enhanced CT is considered the gold standard for diagnosing AP, as it is highly sensitive in detecting pancreatic necrosis and extrapancreatic complications.[9] Among radiological scoring systems, the CT severity index (CTSI) and the modified CT severity index (MCTSI) are widely used in both clinical practice and research. MCTSI assesses AP severity based on radiological findings, including the presence of pancreatic inflammation, necrosis, and extrapancreatic complications. MCTSI has been reported to have a sensitivity of 100%, specificity of 92.3%, positive predictive value (PPV) of 94.4%, and accuracy of 96.7% in identifying moderate to severe disease.[9]

The MCTSI has yet to be fully validated as a reliable and accurate tool for assessing the severity of AP when compared to the Revised Atlanta Classification (RAC) and the NLR. There is a notable lack of studies in Indian literature that compare MCTSI (a radiological measure), RAC (a clinicoradiological measure), and NLR (a laboratory measure) to evaluate their correlation with clinical outcomes. Only a few anecdotal studies have explored this relationship.[9-14] In response to this gap, the current study aims to assess the concordance between MCTSI and RAC in predicting the severity of AP and associated clinical outcomes. In addition, the study will investigate the alignment between MCTSI, RAC, and NLR as a laboratory parameter.

Materials and Methods

This prospective observational study was conducted in the Department of Radiodiagnosis at Teerthanker Mahaveer Medical College Hospital in Moradabad, U.P., over 18 months (December 2023 to May 2024), focusing on assessing the severity of AP using the MCTSI and RAC and their association with clinical outcomes. This was a time bound study and included 65 adult patients clinically diagnosed with AP, who underwent contrast-enhanced CT (CECT) scans. Ethical approval was obtained from institutional ethical committee (TMMC and RC/IEC/2021-22/08 dated November 23, 2022). The written informed consent was obtained from all the enrolled patients. The procedures used follow the guidelines laid down in the Declaration of Helsinki.

Inclusion criteria

- Adult patients (>18 years) coming to radio diagnosis department for CECT abdomen with clinical diagnosis of AP were included.

Exclusion criteria

- Patients with other pancreatic pathologies
- Any history of previous pancreatic surgery
- Pregnant females
- Patients with known history of allergy to iodinated contrast agents
- Patients who are unwilling to give informed consent.

Patients satisfying the inclusion criteria were subjected to the computed tomography (CT) examination performed using 128-slice scanner (Ingenuity CT, Philips Healthcare) followed by laboratory tests including, i.e., total leukocyte count (TLC), differential leukocyte count (DLC), and NLR. A history of the patients was recorded regarding age, sex, and any familial history of similar diseases. All eligible patients were properly counseled and explained about the nature and purpose of the study. Secrecy and confidentiality were maintained. After informed written consent, patients were recruited into the study.

All studies were performed using 128-slice scanner (Ingenuity CT, Philips Healthcare). Patients were asked to remove clothes and any metallic objects, and were asked to wear a gown. Scan was performed in supine position sometimes in right lateral decubitus position. A scanogram was obtained and plain and postcontrast series of the abdomen and pelvis were taken. Oral contrast was given as per requirement and patient clinical condition.

Scan parameters were as follows:

- kVp: 80–120

- mAs: 250–300
- Slice thickness: 1 mm
- Reconstruction Increment: 2 mm.

The images were analyzed in all views (axial, coronal and sagittal), Multiplanar reformation was done. Maximum intensity projection images were reformatted for evaluation of vessels. The severity of AP was graded using the MCTSI and RAC, with findings recorded on a predesigned pro forma.

Table 1: Severity grading as per Modified CT severity index in patients of Acute pancreatitis

Prognostic Indicator	Points
Pancreatic Inflammation	
• Normal pancreas	0
• Intrinsic pancreatic abnormalities with inflammatory changes in peripancreatic fat	2
• Pancreatic or peripancreatic fluid collection or peripancreatic fat necrosis	4
Pancreatic Necrosis	
• None	0
• ≤30%	2
• ≥30%	4
Extra Pancreatic Complications	
• One or more of the following: Pleural effusion, ascites, vascular complications, parenchymal complications or gastrointestinal tract involvement	2

MCTSI[15] [Table 1] – The sum of the values was used to determine the AP, which was subsequently classified as:

- "Mild Pancreatitis" defined as Modified CTSI score 0–2
- "Moderate Pancreatitis" defined as Modified CTSI score 4–6
- "Severe Pancreatitis" defined as Modified CTSI score 8–10.

RAC defines AP as either interstitial edematous pancreatitis (IEP) or necrotizing pancreatitis (NP), and it differentiates between an early phase (1st week) and a late phase (after the 1st week). The first phase is distinguished by clinical parameters, while the second phase is defined morphologically by contrast-enhanced CT findings in conjunction with clinical staging. The severity was classified into three categories based on clinical and morphologic finding[14] [Table 2].

Laboratory tests, including TLC, DLC, and NLR, were also conducted to assess disease severity. A rise in the neutrophil count suggests an acute inflammatory response, while a

Table 2: Severity categories as per Revised Atlanta Classification

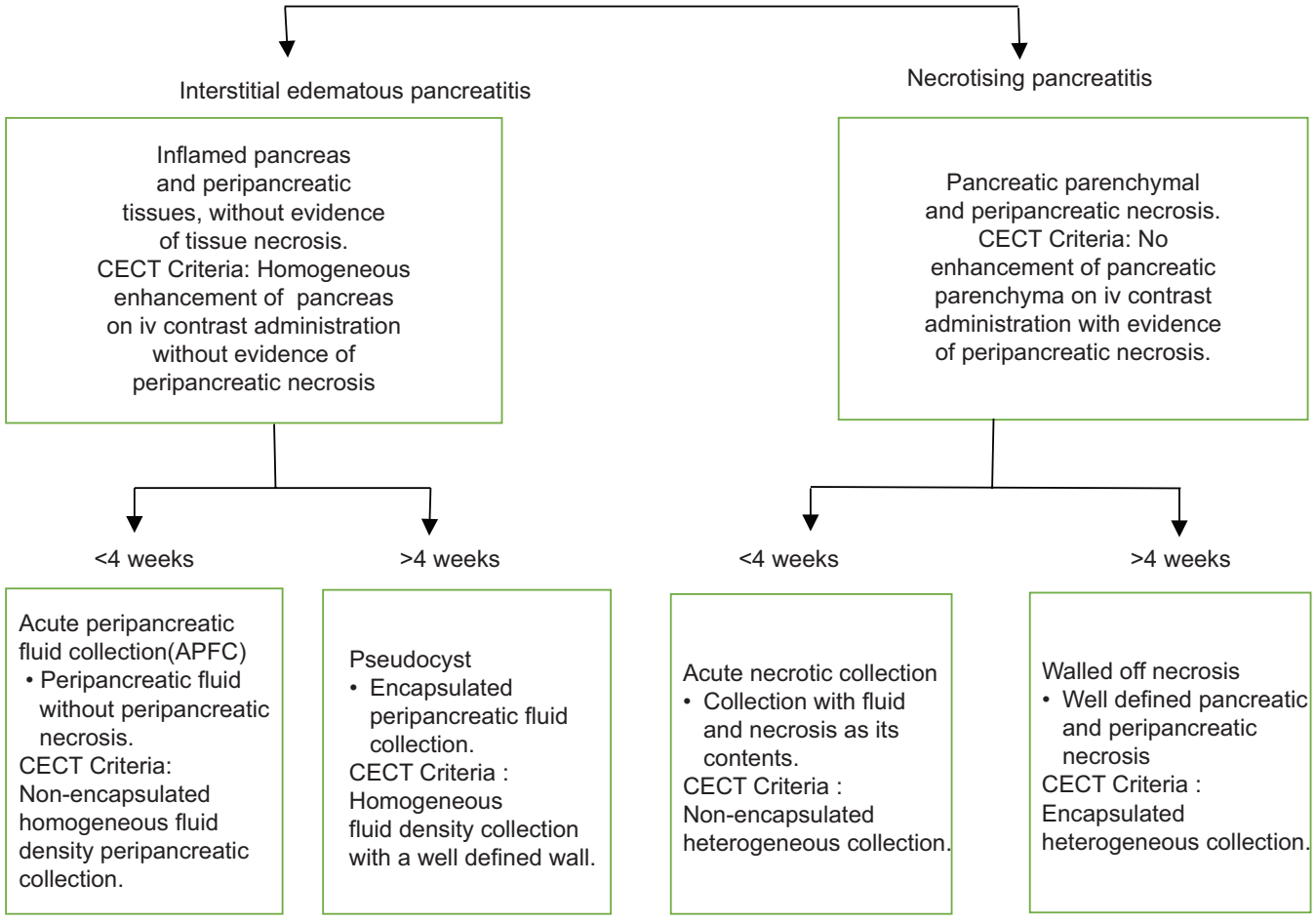

Table 3: Modified Marshall Scoring System for organ failure in patients of Acute pancreatitis

Organ system	Score				
	0	1	2	3	4
Respiratory (PaO2/FiO2)	>400	301-400	201-300	101-200	<101
Renal* (Serum creatinine, mg/dl)	<1.4	1.4-1.8	1.9-3.6	3.6-4.9	>4.9
Cardiovascular (systolic blood pressure, mmHg)	>90	<90, fluid responsive	<90, not fluid responsive	<90, pH <7.3	<90, pH <7.2
	For non-ventilated patients, the FiO_2 can be estimated from below:				
Supplemental oxygen (l/min)	FiO_2 (%)				
Room air	21				
2	25				
4	30				
6-8	40				
9-10	50				

A score of 2 or more in any system defines the presence of organ failure. Multiorgan failure is defined as two or more organ systems failing during same period. *A score for patients with pre-existing chronic renal failure depends on the extent of further deterioration of baseline renal function. No formal correction exists for a baseline serum creatinine >134 umol/l or >1.4mg/dl

Table 4: Clinicodemographic profile of study patients

Demographic variables	Frequency (Percentage)
Age Group (in years)	
≤25	10 (15.4%)
26-35	16 (24.6%)
36-45	19 (29.2%)
46-55	11 (16.9%)
≥56	9 (13.8%)
Total	65 (100.0%)
Gender	
F	25 (38.5%)
M	40 (61.5%)
Total	65 (100%)
Symptoms	
Pain	65 (100%)
Fever	32 (49.2%)
Jaundice	20 (30.8%)
Abdominal Distension	13 (20%)
Vomiting	57 (87.7%)
Dyspnea	13 (20%)
Past History	
Gall Stone	27 (41.5%)
Alcohol	16 (24.6%)
Trauma	1 (1.5%)
Post ERCP*	4 (6.2%)
Idiopathic	21 (32.3%)
Total	65 (100%)

*ERCP - Endoscopic retrograde cholangiopancreaticography

Table 5: Distribution of study population on Basis of Laboratory values

Laboratory Values	Grades	Frequency (Percentage)
TLC	Abnormal	21 (32.3%)
	Normal	44 (67.7%)
Neutrophil lymphocyte ratio (NLR)	Normal	13 (20%)
	Mild	11 (16.9%)
	Moderate	29 (44.6%)
	Severe	12 (18.5%)

NLR: Neutrophil lymphocyte ratio, TLC: Total leukocyte count

decrease in the lymphocyte count indicates a decline in overall health. Normal values was defined as an NLR of 1–3, mild derangement as 6–9, moderate derangement as 9–18, and severe derangement as >18.[16]

Clinical follow-up data were collected for all patients until their discharge or demise. The parameters comprised the duration of hospitalization, the occurrence of organ failure, presence of infections, the necessity for intervention (surgical or percutaneous) following pancreatic or extra-pancreatic complications, and mortality. Evidence of infection was defined as the following: A fever exceeding 1000°F and an elevated white blood cell count exceeding 15,000/m^3, positive results on a gramme stain of aspirate, or positive results on a culture. The Modified Marshall score was used to define organ failure in the following manner[17] [Table 3].

Statistical analysis

The statistical analysis was performed using "SSPS statistical software version 21.0" after the raw data were inputted into Microsoft Excel. Descriptive and inferential statistics were utilized to analyze the data. Profiling of the patients on varied demographic and anatomic parameters was done. The quantitative variables will be represented as the mean (SD), whereas qualitative variables were represented in terms of frequencies/percentages. "Chi-Square test" was used to correlate Qualitative variables. A diagnostic procedure was implemented for calculation of "sensitivity, specificity, PPV, negative predictive value (NPV), and accuracy." $P < 0.05$ was considered as significant.

Results

In this study of 65 patients with clinically diagnosed AP, the mean age was 38.82 ± 15.82 years with a range of 15–85 years of age, with a male predominance (61.5%) and male to female ratio of 1.6:1. The most common presenting symptom was pain (100%), followed by vomiting (87.7%), fever (49.2%),

Table 6: Distribution of study population on Basis of Imaging Findings

Imaging Findings	Frequency (Percentage)
Enlargement in size of pancreas	36 (55.38%)
Peri pancreatic fat standing/inflammation	61 (93.85%)
Peripancreatic fluid	50 (76.92%)
Pancreatic necrosis	20 (30.77%)
Main pancreatic dilatation	13 (20%)
Presence of gas (adjacent to pancreas)	5 (7.69%)
Presence of Calcification	9 (13.85%)
Presence of Hemorrhage	2 (3.08%)
Percentage of Necrosis	
<30	10 (15.4%)
>30	9 (13.8%)
0	46 (70.8%)

Table 7: Distribution of study population on Basis of Basis of Extra Pancreatic Complications, type of pancreatitis and type of collectio

	Frequency (Percentage)
Extra pancreatic complication	
Left Pleural effusion	12 (18.5%)
Right Pleural effusion	3 (4.6%)
Pleural effusion Bilateral	18 (27.7%)
Ascites	33 (50.8%)
Vascular Thrombosis	14 (21.54%)
Thickening of stomach and bowel wall	14 (21.54%)
Types of Pancreatitis	
Interstitial edematous pancreatitis (IEP)	44 (67.69%)
Necrotizing pancreatitis (NP)	21 (32.31%)
Types of Collection	
Acute Peripancreatic Fluid Collection (APFC <4wks)	30 (46.15%)
Acute Necrotic Collection (ANC <4wks)	11 (16.92%)
Walled off necrosis (>4wks)	9 (13.85%)
Pseudocyst (>4wks)	7 (10.77%)

APFC: Acute peripancreatic fluid collection, ANC: Acute necrotic collection, NP: Necrotizing pancreatitis, IEP: Interstitial edematous pancreatitis

jaundice (30.8%), abdominal distension (20.0%), and dyspnea (20.0%). Past medical history revealed that gallstones were the most common cause of AP (41.5%), followed by idiopathic (32.3%), alcohol (24.6%), post-ERCP (6.2%), and trauma (1.5%) [Table 4]. Laboratory findings showed that 67.7% of patients had a normal TLC, while 32.3% had deranged TLC. NLR categorization revealed that 44.6% of patients had moderate grading, 20% had normal grading, 18.5% had severe grading, and 16.9% had mild grading [Table 5].

The most common imaging finding was peripancreatic fat stranding/inflammation (93.85%), followed by peripancreatic fluid (76.92%), pancreatic enlargement (55.38%), and pancreatic necrosis (30.77%). The study reported that 70.8% of cases showed no evidence of necrosis, while 15.4% had <30% necrosis and 13.8% had more than 30% necrosis [Table 6].

Table 8: Distribution of study population on Basis of different grading systems (NLR, MCTSI and RAC)

Grading System	Frequency (Percentage)
NLR Grading	
Normal	11 (16.9%)
Mild	13 (20%)
Moderate	29 (44.6%)
Severe	12 (18.5%)
Total	65 (100%)
MCTSI Grading	
Mild	15 (23.1%)
Moderate	36 (55.4%)
Severe	14 (21.5%)
Total	65 (100%)
RAC Grading	
Mild	23 (35.4%)
Mod Severe	31 (47.7%)
Severe	11 (16.9%)

RAC: Revised Atlanta Classification, NLR: Neutrophil-to-lymphocyte ratio, MCTSI: Modified computed tomography severity index

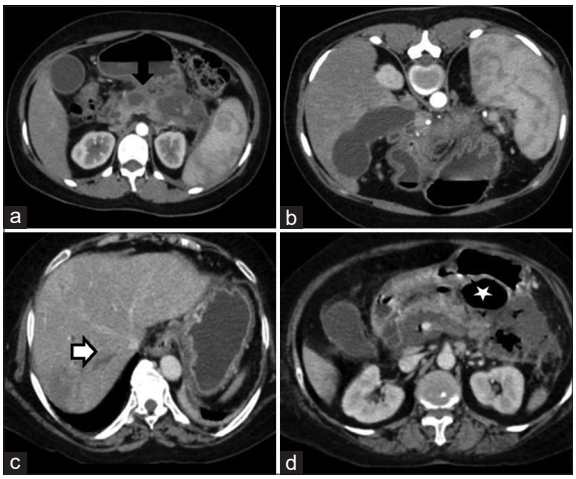

Figure 1: A 45-year-old female presented with complaints of acute onset severe epigastric pain radiating to back, vomiting & fever. NLR was 24 (Severe). (a) CECT revealed heterogeneously enhancing pancreas (Black arrow). (b) shows more than 30% necrosis, peripancreatic fluid and extensive fat stranding. (c) shows filling defect (thrombus) in right hepatic vein (White arrow). (d) shows air foci (*) in necrotic areas of pancreas. MCTSI score was 10 (Severe). Patient developed persistent organ failure and RAC grade was severe. Unfortunately, Patient died after being admitted for 22 days in hospital

Extra pancreatic complications were observed, with ascites being the most common (50.8%), followed by bilateral pleural effusion (27.7%), vascular thrombosis (21.54%), and pleural effusion on only one side (23.1%). The study found that the majority of patients (67.69%) had IEP, while NP was present in 32.31% of cases [Table 7 and Figure 1].

The severity of AP was most commonly moderate, as assessed by NLR (44.6%), MCTSI (55.4%), and RAC (47.7%) [Table 8 and Figures 2-4]. Surgical intervention was required in 16.9% of cases, and infection was found in 30.8%. Organ

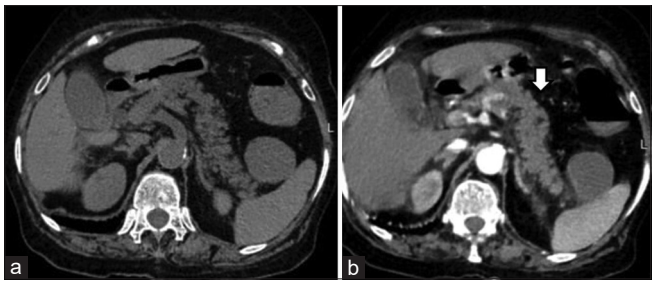

Figure 2: A 68-year-old male presented with complaints of acute onset epigastric pain and history of gallstone disease. NLR was 2 (normal). (a) NCCT shows bulky pancreas with mild peripancreatic fat stranding. (b) On contrast CT pancreas shows homogeneous postcontrast enhancement (white arrow). MCTSI score was 2 (Mild). Patient did not develop any organ failure and severity grade according to RAC was also mild. Patient was discharged in 6 days without any adverse clinical outcomes

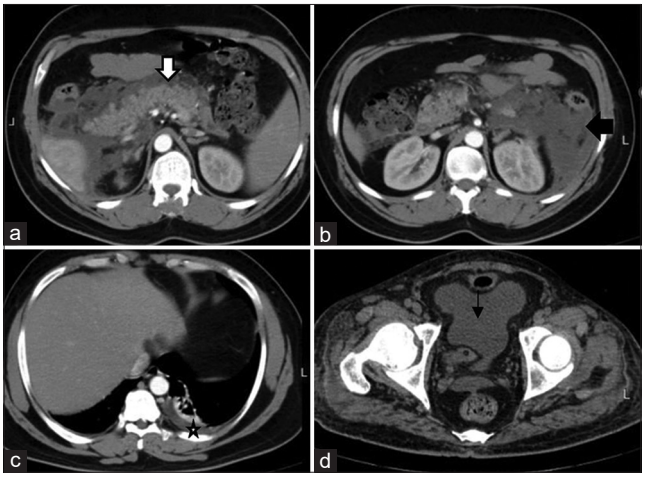

Figure 3: A 25-year-old male presented with complaints of acute onset pain epigastrium, fever and history of gallstone disease. NLR was 10 (moderate). (a) On CECT imaging pancreas was bulky (white arrow) with homogeneous parenchymal enhancement. (b) shows peripancreatic fluid (black thick arrow) & adjacent moderate peripancreatic fat stranding. (c) shows associated left sided pleural effusion (*). (d) shows mild ascites (black thin arrow). MCTSI score was 6 (moderate). There was transient organ failure and RAC grade was moderately severe. Patient developed infection and was discharged in 12 days

failure occurred in 53.9% of patients, with a mortality rate of 9.2%.

Surgical intervention was required in 16.9% of cases, while 83.1% did not require any surgical intervention. Infection was noted in 30.8% of patients, while 69.2% had no evidence of infection. Organ failure was observed in 53.8% of patients, with 35.4% having transient organ failure and 18.5% having persistent organ failure. The mortality rate was 9.2% [Table 9].

The study evaluated the effectiveness of MCTSI, NLR, and RAC methods for predicting the severity of AP. The MCTSI method demonstrated a sensitivity of 100%, specificity of 84%, PPV of 65.22%, NPV of 100%, and accuracy of 87.96% when compared to the RAC method [Table 10]. The NLR method, compared to RAC, showed a sensitivity of 90.48%, specificity

Table 9: Distribution of study population on Basis of Clinical Outcome parameters

Outcome Parameters	Frequency (Percentage)
Surgical intervention	
Absent	54 (83.1%)
Present	11 (16.9%)
Total	65 (100%)
Infection	
Absent	45 (69.2%)
Present	20 (30.8%)
Total	65 (100%)
Organ failure Grades	
None	30 (46.2%)
Transient	23 (35.4%)
Persistent	12 (18.5%)
Total	65 (100%)
Mortality	
Alive	59 (90.8%)
Death	6 (9.2%)
Total	65 (100%)

of 92.68% [Table 11], PPV of 86.96%, NPV of 83.33%, and accuracy of 89.23%. When NLR was compared to MCTSI, it had a sensitivity of 82%, specificity of 100%, PPV of 100%, NPV of 62.50%, and accuracy of 86.16% [Table 12].

Severe AP cases, as classified by all methods, were associated with higher rates of surgical intervention (up to 45.5%), infection (up to 66.7%), persistent organ failure (up to 100%), mortality (up to 36.4%), and longer hospital stays (mean of up to 20.21 days), highlighting the need for accurate severity assessment in managing AP.

Discussion

The present hospital-based prospective observational study was conducted at Teerthanker Mahaveer Medical College Hospital, Moradabad, Uttar Pradesh, involving 65 clinically diagnosed cases of AP who underwent CECT abdomen in the Radiology Department aimed to compare two scoring systems, the MCTSI and the RAC, to predict the severity of AP and correlate them with clinical outcomes and the NLR, a laboratory parameter.

In the present study, patients ranged from 15 to 85 years old, with a mean age of 38.82 ± 15.82 years. This is consistent with Sahu *et al*.[13] (36.6 ± 9.8 years), Bhanou NM *et al*.[1] (39.5 years), and Tahir *et al*.[9] (43.7 ±16.67 years). Padu *et al*.[14] reported a mean age of 44.73 ± 11.61 years, while Carnovale A *et al*.[18] found a median age of 61.5 years. Raghu *et al*.[19] observed an average age of 42.9 ± 15.9 years in their patients. The study observed a male preponderance with a ratio of 1.6:1, possibly due to the rural setting affecting female patient turnout. Similar male predominance was reported by Sahu *et al*.[13] (3:1), Tahir *et al*.[9] (64.45% male), and Bhanou NM *et al*.[1] (5:1), whereas Padu *et al*.[14] showed a higher proportion of females (5.2:1). Other studies by Malik *et al*.,[20] Sandblom

Table 10: Association between RAC method and MCTSI method

MCTSI Outcomes		RAC Outcomes		Total
		Moderate severe + Severe	Mild	
Moderate + Severe	Count	42	8	50
	%	100.0%	34.8%	76.9%
Mild	Count	0	15	15
	%	0.0%	65.2%	23.1%
Total	Count	42	23	65
	%	100.0%	100.0%	100.0%
Pearson Chi-square	Value	Df	*P*	Result
	35.609[a]	1	0.000	Significant
Sensitivity	Specificity	PPV	NPV	Accuracy
100.00%	65.22%	84.00%	100.00%	87.69%

[a]Indicates significant relationship between RAC Outcome and MCTSI Outcome (P<0.05). RAC: Revised Atlanta Classification, PPV: Positive predictive value, NPV: Negative predictive value, MCTSI: Modified computed tomography severity index

Table 11: Association between RAC Method and NLR Method

NLR Outcomes		RAC Outcomes		Total
		Moderate severe + Severe	Mild	
Moderate + Severe	Count	38	3	41
	%	90.5%	13.0%	63.1%
Mild + Normal	Count	4	20	24
	%	9.5%	87.0%	36.9%
Total	Count	42	23	65
	%	100.0%	100.0%	100.0%
Pearson Chi-square	Value	Df	*P*	Result
	38.260[a]	1	0.000	Significant
Sensitivity	Specificity	PPV	NPV	Accuracy
90.48%	86.96%	92.68%	83.33%	89.23%

[a]Indicates significant relationship between RAC Outcome and NLR Outcome (P<0.05). RAC: Revised Atlanta Classification, PPV: Positive predictive value, NPV: Negative predictive value, NLR: Neutrophil-to-lymphocyte ratio

et al.,[21] and Ugane *et al*.[22] reported varying female- to-male ratios of 2:1, 1:0.6, and 3:2, respectively.

The most common presenting complaint was pain (100%), followed by vomiting (87.7%), fever (49.2%), jaundice (30.8%), abdominal distension (20.0%), and dyspnea (20.0%). These findings align with studies by Sahu *et al*.,[13] Tahir *et al*.,[9] and Kokulu *et al*.,[7] who also reported abdominal pain as the most prevalent symptom. The most common etiological factor was gallstones (41.5%), consistent with studies by Raghuvanshi *et al*. [23] and Bhanou NM *et al*.,[1] who reported gallstones as the most prevalent cause, although Bhanou NM *et al*.[1] found a higher prevalence of alcohol intoxication (65.8%).

Laboratory findings showed that 67.7% of patients had a normal TLC, while the NLR categorized most patients

Table 12: Association between MCTSI method and NLR method

		MCTSI Outcomes		Total
		NLR Outcomes	Mild	
Moderate + Severe	Count	41	0	41
	%	82.0%	0.0%	63.1%
Mild + Normal	Count	9	15	24
	%	18.0%	100.0%	36.9%
Total	Count	50	15	65
	%	100.0%	100.0%	100.0%
Pearson Chi-square	Value	df	P	Result
	33.313[a]	1	0.000	Significant
Sensitivity	Specificity	PPV	NPV	Accuracy
82.00%	100.00%	100.00%	62.50%	86.15%

[a]Indicates significant relationship between NLR Outcome and MCTSI Outcome (P<0.05). RAC: Revised Atlanta Classification, PPV: Positive predictive value, NPV: Negative predictive value, MCTSI: Modified computed tomography severity index, NLR: Neutrophil-to-lymphocyte ratio

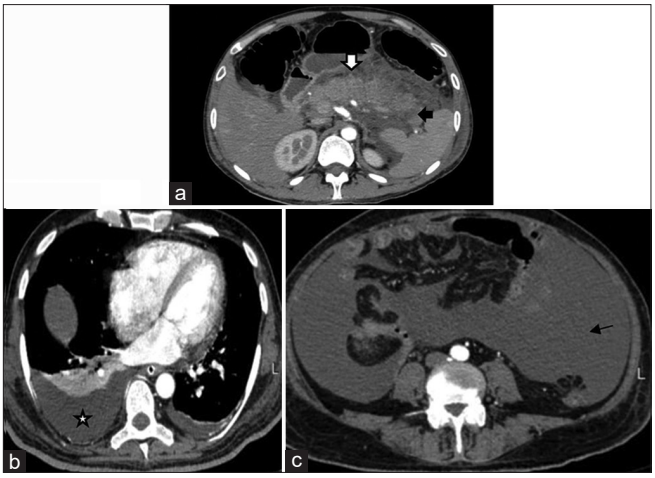

Figure 4: A 39-year-old male presented with complaints of acute onset severe epigastric pain, fever and vomiting and history of alcohol intake. NLR was 26 (severe). (a) On CECT diffuse pancreatic enlargement (white arrow) with ill-defined non-enhancing parenchymal hypodensities (black thick arrow) were noted in distal body & tail suggestive of necrosis < 30% with peripancreatic fluid collection, fat stranding. (b) shows bilateral pleural effusion (*). (c) shows ascites (black thin arrow). MCTSI score was 8 (severe). Patient developed transient organ failure and RAC grade was moderately severe. Patient developed infection during the hospital stay and was discharged in 24 days

as moderate (44.6%). Studies by Zahorec *et al*.[24] and Li *et al*. [25] highlight the prognostic significance of NLR in various diseases, including acute pancreatitis.

Imaging findings revealed that peripancreatic fat stranding/inflammation was the most common, seen in 93.85% of patients, consistent with findings by Banday *et al*.[15] Peripancreatic fluid was observed in 76.92% of patients, similar to findings by Sahu *et al*.[13] 29.2% of patients had pancreatic parenchymal necrosis, with 15.4% showing less than 30% necrosis and 13.8% showing more than 30%.

In terms of complications, ascites was the most common extra-pancreatic complication (50.8%), followed by bilateral pleural effusion (27.7%). These results align with studies by Sahu *et al*.[13] and Kokulu *et al*.,[7] who also reported pleural effusion and ascites as common complications. The study found that interstitial edematous pancreatitis (IEP) was more common (67.69%) than necrotizing pancreatitis (NP), which was observed in 32.31% of cases, aligning with findings by Sahu *et al*.[13]

In this study, acute peripancreatic fluid collection was the most common type, accounting for 46.15% of cases, followed by acute necrotic collection (16.92%), walled-off necrosis (13.85%), and pseudocyst (10.77%). Kokulu *et al*.[7] reported different local complications in 10% of patients with pancreatic necrosis, including pancreatic pseudocyst (3%), intraabdominal abscess (1%), ascites (7%), and splenic vein thrombosis (1%).

Regarding NLR grading, the majority of cases (44.6%) were classified as moderate, 20.0% as mild, 18.5% as severe, and 16.9% had normal NLR. Bhanou NM *et al*.[1] found a higher proportion of patients with mild NLR grading (50) compared to moderate (24) and severe (32) cases. Tahir *et al*.[9] reported an average NLR of (11.72 ± 9.52), with significant variations between mild (5.88 ± 2.115) and more severe cases (19.15 ± 10.102). No significant gender differences were observed in NLR values, but higher levels were noted in severe cases among females compared to males.

In this study, as per Modified Computed Tomography Severity Index (MCTSI) 55.4% of cases had moderate grading, 23.1% had mild grading, and 21.5% had severe grading. This contrasts with studies of Sahu *et al*.[13] who found 43.3% patients with severe grading, and Padu *et al*.[14] who noted 69.23% with mild pancreatitis. The possible reason could be due to differences in the demography. The Revised Atlanta Classification (RAC) revealed 47.7% with moderately severe grading, 35.4% with mild grading, and 16.9% with severe grading. This is similar to study done by Pongprasobchai *et al*.[26] study, which found 72% mild, 16% moderate, and 12% severe cases of AP.

Regarding surgical intervention, 83.1% of patients did not require surgery, while 16.9% did. Kokulu *et al*.[7] reported 29% and Sahu *et al*.[13] reported 25% requiring intervention. For infection, 69.2% had no infection, whereas 30.8% did, consistent with findings of study done by Sahu *et al*.[13] reporting 40% infection in their patients.46.2% of cases had no organ failure, 35.4% had transient failure, and 18.5% had persistent failure. Sahu *et al*.[13] found similar results with 41.7% exhibiting orthostatic hypotension. Mortality rates were 9.2% in this study, which are comparable with Sahu *et al*.[13] who reported 11.7% mortality. Infections and persistent organ failure were linked to higher mortality.

Comparative statistical evaluations showed that the NLR method had a sensitivity of 90.48%, specificity of 92.68%, PPV of 86.96%, NPV of 83.33%, and an accuracy of 89.23% when predicting the severity of AP, making it comparable to the RAC method. This finding is consistent with studies by Tahir H *et al*., [9] who reported NLR as a robust predictor of severity in acute pancreatitis, and Kong W *et al*.,[16] who reported a sensitivity of 79% and specificity of 71% for NLR. Similarly, the MCTSI method demonstrated high sensitivity (100%) and accuracy (87.96%) in predicting severe cases, comparable to the RAC method, with findings consistent with those of Bollen *et al*.[8] and Padu *et al*.[14] Sahu *et al*.[13] and Cazacu SM *et al*.[27] confirmed that NLR aligns well with clinical outcomes and provides practical benefits in predicting severity. Overall, these findings underscore that severe cases are consistently linked to higher rates of complications, prolonged hospital stays, and increased mortality, regardless of the grading system used.

Based on the preceding analysis, it is evident that current clinical scoring systems and radiological criteria for assessing acute pancreatitis (AP) pose significant challenges, resulting in delays in anticipating disease progression and determining appropriate care levels. Both the Modified Computed Tomography Severity Index (MCTSI) and the Neutrophil-to-Lymphocyte Ratio (NLR) exhibited strong connections with the Revised Atlanta Classification (RAC) for severity grading.

The MCTSI demonstrated exceptional predictive ability for moderately severe and severe cases, with a sensitivity of 100% and a positive predictive value (PPV) of 84%, compared to the RAC method. However, its predictive capability for mild cases was more modest, with a specificity of 65.22% and a negative predictive value (NPV) of 100%. In contrast, the NLR method showed comparable effectiveness to the RAC, with a sensitivity of 90.48% and a PPV of 92.68% for severe cases, and a specificity of 86.96% and NPV of 83.33% for mild cases. This positions NLR as an efficient and resource-effective alternative for predicting AP severity, particularly in resource- limited settings. This was in concurrence with studies done by Bhanou NM *et al*.,[1] Kokulu *et al*.[7] and Sahu *et al*.[13]

Overall, the accessibility and effectiveness of NLR make it a valuable tool for early diagnosis and timely treatment initiation in various healthcare environments, potentially reducing morbidity, and mortality rates associated with AP.

The study had few limitations. Notably, it did not include a comparison between CT severity grading and clinical severity scoring systems, such as APACHE. In addition, the small sample size, constrained by time limitations, may have impacted the statistical significance of our findings.

Conclusion

The MCTSI is a well-established tool for assessing the severity of AP, demonstrating ease of calculation and a close correlation with clinical outcomes. Our study confirmed that MCTSI has superior predictive ability for moderately severe and severe cases, showing high sensitivity (100%), and PPV (65.22%). More adverse outcomes were observed in moderate and severe grades compared to mild cases.

In addition, the NLR emerged as a promising predictor of disease severity, showing good concordance with both MCTSI and RAC. NLR demonstrated superior predictive capability for moderately severe and severe cases with high sensitivity (90.48%) and PPV (92.68%) and it provided increased prediction accuracy for mild cases with high specificity (86.96%) and NPV (83.33%). This makes NLR a more efficient and resource-effective method, particularly beneficial in settings with limited resources. Its use can facilitate early diagnosis and prompt treatment, thereby reducing morbidity and mortality rates.

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Conflicts of interest

There are no conflicts of interest.

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