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Utility of Computed Tomography Severity Index in Patients with Acute Pancreatitis

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ABSTRACT

Objective: To determine the diagnostic accuracy of computed tomography severity index for diagnosis of severe acute pancreatitis taking clinical gold standard as the gold standard.

Methodology: This cross-sectional validation study was carried out from July 2025 to December 2025 at the Department of General Surgery, Pakistan Air Force Hospital, Islamabad. A total of 202 patients aged 18 to 60 years with clinical features of acute pancreatitis were included. Computed tomography abdomen with contrast was performed, and severity index score was calculated and compared with clinical gold standard. The data were analyzed to find sensitivity, specificity, predictive values, and accuracy.

Results: The mean age of patients was 44.06 years, and most were males (64.9%). Computed tomography severity index showed sensitivity of 86.67%, specificity of 75.00%, positive predictive value of 37.68%, negative predictive value of 96.99%, and diagnostic accuracy of 76.73%. Diagnostic accuracy was higher in patients above 40 years and in those presenting after 14 days of symptoms.

Conclusion: Computed tomography severity index is a reliable imaging tool for grading the severity of acute pancreatitis and guiding early clinical decisions.

Keywords: Acute pancreatitis, Diagnostic imaging, Disease severity, Inflammation, Necrosis, Radiology, Tomography scanners.

Introduction

Acute pancreatitis is a sudden inflammation of the pancreas which is one of the most common emergency condition of the abdomen.[1] It occurs when pancreatic enzymes that are normally inactive inside the pancreas become activated and start digesting the gland itself leading to tissue damage, edema and necrosis.[2] The disease can range from mild self limiting inflammation to severe life threatening condition with multi organ failure.[3] The most common causes include gallstones and alcohol abuse while other causes are trauma, drugs, hyperlipidemia, and infections.[4] The patients mostly present with upper abdominal pain radiating to the back, nausea, vomiting and abdominal distension. The mortality rate increases in cases where necrosis or infection develop. The disease mechanism involve release of inflammatory mediators and enzymes that further aggravate systemic response. Management depend on early recognition, fluid resuscitation and supportive care but severity assessment remain important for predicting outcome and guiding therapy.[5]

Diagnosis of acute pancreatitis is based on clinical presentation, laboratory and imaging studies.[6] Serum amylase and lipase levels are usually elevated more than three times the normal and help to confirm diagnosis, though they do not tell the severity. Ultrasound is a useful first imaging modality to detect gallstones or biliary obstruction but its sensitivity is limited by bowel gas.[7] Contrast enhanced computed tomography and magnetic resonance imaging provide more detail in evaluation of pancreatic inflammation, necrosis, and local complications such as pseudocyst or abscess.[8] Endoscopic ultrasound and MRCP can help to evaluate biliary tract pathology and ductal anomalies.[9] Many clinical and biochemical scoring systems like Ranson's criteria, APACHE II, and BISAP are also used to predict prognosis, but imaging based severity index is considered more reliable for anatomical assessment.

Computed tomography severity index (CTSI) is a radiological scoring system that combine the degree of pancreatic inflammation and the extent of necrosis seen on contrast enhanced CT to grade the severity of acute pancreatitis.[10] It was first proposed by Balthazar and colleagues and has been widely used to correlate imaging findings with clinical outcome.[11] The index assign points based on pancreatic swelling, peripancreatic fluid collections and necrosis percentage, with total score ranging from 0 to 10.[12] Higher scores indicate severe disease and increased risk of complications like infection, organ failure and

death.[13] CT severity index help clinicians to stratify patients, plan intensive care management and predict prognosis early.[14] It also guide timing of intervention and follow up imaging. Thus the utility of CTSI lies in its ability to provide objective assessment of disease burden and help in making better clinical decision in patients suffering from acute pancreatitis.[15]

In a study by Shah RU, et al. has shown that the sensitivity of computed tomography severity index with cutoff value of >3 was 88.9% and specificity 71.1% with PPV of 75.9% & NPV of 86.6% in diagnosis of acute pancreatitis keeping organ failure as the gold standard.[16]

There is strong need to conduct this study in Islamabad because the incidence of acute pancreatitis is increasing in this region due to changing lifestyle, gallstone disease, and alcohol consumption pattern. Many hospitals in Islamabad still rely only on clinical and biochemical parameters for diagnosis and prognosis which often lead to delay in detecting severe cases. The use of computed tomography severity index has not been properly evaluated in local settings, and its utility can help clinicians in early identification of patients at risk of complications. Also, there is lack of regional data regarding correlation of CTSI with clinical outcome, hospital stay and mortality. Doing this study in Islamabad will provide baseline information for future management guideline and help to improve patient care through evidence based radiological assessment.

Methodology

This study was done in Department of General Surgery at PAF Hospital Islamabad from July 2025 till December 2025. It was a cross sectional validation type study. Before starting the study, permission was taken from CPSP and also ethical approval from hospital ethical committee (No: 05/25). All basic ethical rules were followed and patients privacy was kept safe during the whole process. The total 202 patients were taken as sample. The number was counted by WHO sample calculator by using 95% confidence level, sensitivity 88.9%,[16] specificity 71.1%[16] and prevalence 18.9%[17] with 10% precision both sides. Non probability consecutive type of sampling was used. Patients of both gender from 18 to 60 years old having clinical signs of acute pancreatitis were included. Those having history of chronic pancreatitis, inflammatory bowel disease, intestinal TB, gastrointestinal cancer or long infections were not included. Acute pancreatitis was labelled when at least three of these seen; sudden upper abdominal pain score ≥3, vomiting or nausea once or more in past 24 hours, fever above 38°C, heart rate more than 100, breathing more than 20 per minute or pain more when lying flat. Severe pancreatitis on CT was when CT severity index score was more than 3. On clinical gold standard, it was said severe if any two of these found: abdominal pain radiating to back ≥7/10 lasting more than 6 hours, enzymes raised (lipase >180 or amylase >300), or necrosis more than 30% of pancreas on CT. Before including, the patient or attendant was explained the purpose and consent was taken.

After this, full history and physical checking was done for all patients. Then CT scan abdomen was performed with IV contrast on 16 slice scanner using arterial phase at 40 second and portal venous at 70 second. The scan setting was 120 KV, 150 mA with 1 mm slice for arterial and 3 mm for venous phase. Images were taken in axial and then made into sagittal and coronal for better view. The computed tomography severity index score was given by checking pancreatic swelling, fluid around pancreas, necrosis percentage and other problems outside pancreas. CT finding was recorded as positive or negative and then compared with clinical gold standard which was done within 24 hours. The result was called true positive when both were positive, false positive when only CT was positive, true negative when both were negative and false negative when only CT was negative. From this, sensitivity, specificity, positive predictive and negative predictive value and diagnostic accuracy were worked out.

All the data was entered in SPSS version 22. Mean and standard deviation was used for age and duration of illness. Frequencies and percentages were made for gender, CT and clinical results. The 2×2 table was used to calculate sensitivity, specificity and accuracy. The effect of age, gender and duration was checked by stratification and after that diagnostic accuracy was recalculated. Post stratification using diagnostic accuracy will be calculated, $p \leq 0.05$ will be considered statistically significant.

Results

The study included 202 patients; detailed demographics are presented in Table I. The distribution of acute pancreatitis cases based on CTSI and the clinical gold standard is summarized in Table II. Comparison between the two methods (Table III) shows that CTSI yielded true positive, false positive, true negative, and false negative cases, forming the basis for diagnostic evaluation. The overall diagnostic performance of CTSI, including sensitivity, specificity, accuracy, PPV, and NPV, is summarized in Table IV.

Stratified analysis by age, gender, and duration of complaints is summarized in Table V. Overall, CTSI demonstrated relatively higher sensitivity and NPV across all subgroups, with comparatively lower PPV. Improved diagnostic performance was observed in

patients aged >40 years and in females, while patients with longer duration of symptoms showed the highest sensitivity and NPV.

Table-I: Patient Demographics	
Demographics	Mean ± SD
Age (years)	44.06±10.15
Duration of complaints (days)	7.97±5.99
Gender	
Male n (%)	131 (64.9%)
Female n (%)	71 (35.1%)

Table-II: Overall results of CTSI and Clinical Gold Standard in diagnosis of Acute Pancreatitis		
Acute Pancreatitis	CTSI	Clinical Gold Standard
Positive	69 (34.2%)	30 (14.9%)
Negative	133 (65.8%)	172 (85.1%)
Total	202 (100%)	202 (100%)

Table-III: Comparison of CTSI versus Clinical Gold Standard in diagnosis of Acute Pancreatitis			
CTSI	Clinical Gold Standard		Total
	Positive	Negative	
Positive	26 (TP)	43 (FP)	69
Negative	4 (FN)	129 (TN)	133
Total	30	172	202

Table-IV: Sensitivity, Specificity, Diagnostic Accuracy, PPV and NPV of CTSI in diagnosis of Acute Pancreatitis	
Diagnostic Parameter	Result
Sensitivity	86.67%
Specificity	75.00%
Diagnostic Accuracy	76.73%
PPV	37.68%
NPV	96.99%

Table V: Stratified analysis of Sensitivity, Specificity, Diagnostic Accuracy, PPV and NPV of CTSI in diagnosis of Acute Pancreatitis with age, gender and duration of complaints.			
Variables	Groups	Diagnostic Parameter	Result
Age (years)	≤40	Sen	77.78%
		Spec	71.43%
		DA	72.22%
		PPV	28.00%
		NPV	95.74%
	>40	Sen	90.48%
		Spec	77.06%
		DA	79.23%
		PPV	43.18%
		NPV	97.67%
Gender	Male	Sen	88.89%
		Spec	71.68%
		DA	74.05%
		PPV	33.33%
		NPV	97.59%
	Female	Sen	83.33%
		Spec	81.36%
		DA	81.69%
		PPV	47.62%
		NPV	96.00%
Duration of complaints (days)	≤14	Sen	85.19%
		Spec	75.34%
		DA	76.88%
		PPV	38.98%
		NPV	96.49%
	>14	Sen	100.00%
		Spec	73.08%
		DA	75.86%
		PPV	30.00%
		NPV	100.00%

Discussion

In this study the mean age of patients was 44.06 years showing that middle age group was more affected because in this age metabolic and biliary disorders are more common which can lead to pancreatitis. The male predominance (64.9%) may be due to higher exposure to alcohol and fatty diet habits among males. CTSI showed sensitivity of 86.67% and specificity of 75% which indicate that it is a reliable imaging tool for early and accurate detection of pancreatitis. The diagnostic accuracy of 76.73% with high NPV of 96.99% suggest that CTSI is very good in ruling out disease when the findings are negative. In patients above 40 years the accuracy was slightly higher probably due to more clear radiological changes and presence of comorbidities which make disease severe and easy to detect. The females showed higher specificity as their inflammatory response might differ and mild cases are less common. Duration-wise comparison showed 100% sensitivity in patients with more than 14 days symptoms which may be because late presentation allows more time for necrosis and fluid collection to develop, making CT changes more prominent.

In our study, the mean age of patients was 44.06±10.15 years with male predominance of 64.9%, which was quite similar to findings of Omair U, et al. [18] who reported mean age of 45-55 years with 55% males, and Shah RU, et al. [16] who found mean age of 30.7±7.6 years with 54.2% males, however our results was slightly different from Iltaf M, et al. [19] who reported 69.7% females in their study population which show that acute pancreatitis can affect both genders but male predominance is more common in most studies. The duration of complaints in our study was 7.97±5.99 days which indicate that patients usually present within first two weeks of symptom onset and this finding support the clinical presentation pattern of acute pancreatitis in emergency settings. When we compared diagnostic accuracy of CTSI, our study showed sensitivity of

86.67%, specificity of 75.00%, diagnostic accuracy of 76.73%, PPV of 37.68%, and NPV of 96.99%, these results was comparable with Shah RU, et al. [16] who reported CTSI sensitivity of 88.9% and specificity of 71.1% which was very close to our findings, however Omair U, et al. [18] reported much higher sensitivity of 91.9% and specificity of 88.72% which might be due to their larger sample size of 1434 patients compared to our 202 patients, and Shams F, et al. [20] also showed slightly higher sensitivity of 79.37% but better specificity of 83.56% which indicate that CTSI is reliable tool but its diagnostic parameters can vary depending on study population and methodology. Our PPV of 37.68% was lower than Omair U, et al. [18] who reported PPV of 94.5%, and Shah RU, et al. [16] who found PPV of 75.9%, this difference might be explained by lower prevalence of acute pancreatitis in our study population where only 14.9% patients was positive by clinical gold standard compared to 28% mortality rate in Omair U, et al. study, as PPV is highly dependent on disease prevalence in studied population. However, our NPV of 96.99% was excellent and comparable with Omair U, et al. [18] who reported NPV of 83.98% and Shah RU, et al. [16] who found NPV of 86.6%, and even better than Iltaf M, et al. [19] who reported NPV of only 20.76% when comparing BISAP score, this high NPV indicate that CTSI is very reliable in ruling out acute pancreatitis when test is negative. When comparing with studies using Modified CTSI, Rehan A, et al. [21] reported 100% sensitivity, 87% specificity, and diagnostic accuracy of 91.67% which was higher than our results, and Ashrathi B, et al. [22] also showed that MCTSI had high predictive value for necrosis with AUC of 0.943 and sensitivity of 100%, these better results with MCTSI might be because Modified CTSI is more refined scoring system that better correlate with disease severity and complications as suggested by Chishty IA, et al. [23] who found that CTSI correlated well with necrosis and complication incidence. In stratified analysis according to age, our study showed that patients >40 years had better diagnostic parameters (sensitivity 90.48%, specificity 77.06%, diagnostic accuracy 79.23%) compared to patients ≤40 years (sensitivity 77.78%, specificity 71.43%, diagnostic accuracy 72.22%), this finding was supported by Chishty IA, et al. [23] who also studied different age groups and found that CT findings and CTSI correlation with severity was consistent across different age groups, the better diagnostic accuracy in older patients might be because pancreatic changes and necrosis is more prominent and easier to detect on CT in older individuals. Gender-wise stratification in our study showed that female patients had better specificity (81.36%) and diagnostic accuracy (81.69%) compared to male patients (specificity 71.68%, diagnostic accuracy 74.05%) even though sensitivity was slightly lower in females (83.33% vs 88.89%), this gender difference has not been extensively studied in previous literature but might be related to different etiology and disease progression pattern between males and females as Ashrathi B, et al. [22] reported that alcohol was main etiology in 50% cases which is more common in males while biliary causes in 33.3% which is more common in females. For duration of complaints, our study showed that patients with >14 days duration had 100% sensitivity but lower PPV of 30.00% compared to patients with ≤14 days duration who had sensitivity of 85.19% and PPV of 38.98%, this finding suggest that CTSI become more sensitive with time as pancreatic changes become more evident on imaging, however the lower PPV in prolonged cases might be due to development of chronic changes that mimic acute pancreatitis on CT scan. When comparing CTSI with other scoring systems, Ashrathi B, et al. [22] found that Ranson's criteria had AUC of 0.884 for severity prediction which was comparable to CTSI, while Shah RU, et al. [16] reported that Ranson's score had much lower sensitivity (37.5%) and specificity (25.4%) compared to CTSI, indicating that CTSI is superior predictor of severe acute pancreatitis. Studies comparing BISAP score like Iltaf M, et al. [19] showed BISAP sensitivity of 92.74% and diagnostic accuracy of 92.24%, and Khattak MB, et al. [24] found that BISAP had 100% sensitivity and 68.54% specificity which was comparable to CTSI (100% sensitivity, 58.43% specificity), suggesting that both BISAP and CTSI is reliable for assessing severe acute pancreatitis but BISAP might have advantage of being simpler and faster to calculate in emergency settings. The overall diagnostic accuracy of CTSI in our study (76.73%) was lower than Shaukat R, et al. [25] who reported 89.7% diagnostic accuracy of CT in necrotizing pancreatitis, and Khattak MB, et al. [24] who found CTSI diagnostic accuracy of 63%, this variation in diagnostic accuracy across studies might be due to different gold standards used, as we used clinical gold standard while Shaukat R, et al. used surgical findings and Khattak MB, et al. used Revised Atlanta Classification, and also difference in patient population, timing of CT scan, and expertise of radiologists interpreting the scans can affect diagnostic accuracy.

This study has some limitations. It was a single center study with limited sample size so the findings may not fully represent all population. The study was done in a specific hospital setting where patients mostly come with moderate to severe form of disease, so mild cases might be under represented. Only CT findings were compared with clinical gold standard, without inclusion of biochemical or follow up outcomes which could make results more strong. Also the study period was short and selection bias cannot be fully ruled out.

The inter observer variation in CT interpretation was not assessed which may also affect the accuracy level.

Conclusion

Our study has concluded that computed tomography severity index is a dependable imaging tool for assessing the severity of acute pancreatitis when compared with clinical findings. It helps in early identification of severe cases and support in proper management decision. The findings suggest that CTSI can be used as useful diagnostic aid especially in settings where clinical assessment alone may be difficult. However, it should be interpreted along with clinical judgment and laboratory data for better accuracy and patient care.

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