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The correlation with the patient outcome of modified CT severity index (MCTSI) in evaluation of patients with acute pancreatitis with the currently accepted CT severity index (CTSI)

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Abstract

Acute pancreatitis is an acute inflammatory process of the pancreas that can occur as an isolated event or relapsing episodes. Acute pancreatitis is a heterogeneous disease ranging from minimal pancreatic inflammation seen in mild interstitial pancreatitis to extensive pancreatic necrosis and liquefaction of severe attacks. Study group consists of 47 patient's selected patients who were admitted, in whom the diagnosis of acute pancreatitis is made through available investigations (clinical investigations, serum amylase & ultrasound) who have got computed tomography done for the confirmation and prognostication. According to CTSI, of these 17 patients, 10 patients had mild, 6 patients had moderate and 1 patient had severe pancreatitis. 29% of patients who had mild pancreatitis had systemic infection, whereas systemic infection was seen in 50% and 100% of patients who had moderate and severe pancreatitis respectively (p=0.180).

Keywords: MCTSI, CTSI, acute pancreatitis

Introduction

The pancreas is a compound racemose gland, analogous in its structures to the salivary glands. Its secretion, the pancreatic juice, carried by the pancreatic duct to the duodenum, is an important digestive fluid. In addition the pancreas has an important internal secretion, probably elaborated by the cells of Langerhans, which is taken up by the blood stream and is concerned with sugar metabolism. It is situated transversely across the posterior wall of the abdomen, at the back of the epigastric and left hypochondriac regions. Its length varies from 12.5 to 15 cm., and its weight from 60 to 100 gm^[1].

Acute pancreatitis is an acute inflammatory process of the pancreas that can occur as an isolated event or relapsing episodes. Acute pancreatitis is a heterogeneous disease ranging from minimal pancreatic inflammation seen in mild interstitial pancreatitis to extensive pancreatic necrosis and liquefaction of severe attacks.

Diagnosis is based on the presence at least 2 of 3 features: abdominal pain; increased pancreatic enzyme, amylase, or lipase levels to 3 times the upper limit of normal; and imaging tests showing characteristic findings of acute pancreatitis^[2].

Alcohol and gallstones are the two most common causes, but there are many less common causes. Acute pancreatitis accounts for more than 200 000 hospital admissions annually in the United States, and incidence has been increasing. Mortality from acute pancreatitis is <5% overall, but severe attacks cause longer hospitalization and significantly higher mortality. The annual relapse rate of acute pancreatitis ranges from 0.6% to 5.6%, depending on the cause, and is highest when pancreatitis results from alcohol consumption. The prevalence in India is about 1:793 that is in 1 in every 100000 individuals^[3].

Various severity scoring systems are used for assessing the prognosis of acute pancreatitis.

The CT severity index (CTSI) derived by Balthazar grading of pancreatitis and the modified CT severity index serves as the radiological scoring systems^[4].

The purpose of this study is to assess the correlation with patient outcome of modified CT severity index in evaluation of patients with acute pancreatitis compared with the currently accepted CT severity index.

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Methodology

Study group consists of 47 patient’s selected patients who were admitted, in whom the diagnosis of acute pancreatitis is made through available investigations (clinical investigations, serum amylase & ultrasound) who have got computed tomography done for the confirmation and prognostication.

Acute pancreatitis was defined as two or more of the following: characteristic severe epigastric abdominal pain, serum amylase or lipase levels three or more times the upper limit of normal and changes consistent with acute pancreatitis on cross-sectional imaging. They were subjected to contrast-enhanced CT. Appropriate clinical and laboratory data were recorded to permit correlation of clinical outcome of patient.

Imaging Technique

CT examinations were performed on a 6 slice-MDCT scanner (Volume Zoom, Philips Healthcare). Contrast-enhanced CT scans (collimation, 4 × 2.5 mm; reconstruction section thickness, 5 mm; reconstruction intervals, 5 mm) were obtained 40–50 seconds after IV injection of 80mL of non-ionic contrast, injected at a rate of 3.0 mL/s, using a mechanical power injector. Scans were done in cranio-caudal direction in arterial and venous phases; from the level of diaphragm to pubic symphysis. Images were retro reconstructed with 1.25 mm slice thickness and reformatted in sagittal and coronal planes for analysis.

Inclusion Criteria

1. Clinically diagnosed with acute pancreatitis confirmed with serological investigations who underwent contrast enhanced MDCT within three days of admission.
2. All ages.
3. Both sex.

Exclusion Criteria

1. All admitted with chronic pancreatitis and its complications.
2. Patients admitted with clinical suspicion of acute pancreatitis who did not undergo contrast enhanced MDCT.
3. Pancreatitis due to trauma.

Results

Modified CT Severity index was calculated by adding points assigned to each parameter. The severity of pancreatitis is classified into three categories: mild (0-3 points), moderate (4-6 points) and severe (7-10 points). According to the Modified CT Severity Index, the patients were graded into mild (n=18), moderate (n=21) and severe (n=8) i.e. 38.3% patients had mild, 44.7% patients had moderate and 17% had severe pancreatitis.

The severity of pancreatitis is scored using CT severity index and classified into three categories (mild, moderate and severe). The CTSI is a 10 point scoring system derived by assigning points to the degree of pancreatic inflammation (0 to 4 points) and pancreatic necrosis (0 to 6 points). According to the CT Severity Index, the patients were graded into mild (n=34), moderate (n=12) and severe (n=1). 72% patients had mild, 25% patients had moderate and only 2% patients had severe pancreatitis as per CTSI score.

Table 1: Frequency and percentage distribution of patients according to MCTSI and CTSI

Patients Condition	MCTSI		CTSI	
	Frequency	Percentage	Frequency	Percentage
Mild	18	38.3	34	72.3
Moderate	21	44.7	12	25.5
Sever	8	17.0	1	2.1
Total	47	100.0	47	100.0

Table 2: Frequency and percentage distribution of patients according to organ failure

EOF	MCTSI(CTSI)			P-value
	Mild	Moderate	Severe	
Present	6(11)	7(9)	8(1)	0.003(0.02)
Absent	12(23)	14(3)	0(0)	
Total	18(34)	21(12)	8(1)	

21 of 47 patients (45%) are found to have end organ failure. Hepatic failure was seen in 18 (38%) patients is the most common system failure in patients with acute pancreatitis in our study. Cardiac failure seen in 6 (13%), Renal failure in 5 (10%) patients. Respiratory failure and CNS failure failure each seen in 1 (2%) patient. One patient developed raise in hematocrit value.

Of these 21 patients who developed end organ failure, 6 patients had mild, 7 patients had moderate and 8 patients had severe pancreatitis according to the MCTSI. 32% of patients who had mild pancreatitis had end organ failure, whereas end organ failure is seen in 35% and 100% of patients who had moderate and severe pancreatitis respectively(p=0.003).

According to CTSI, of these 21 patients, 11 patients had mild, 9 patients had moderate and 1 patient had severe pancreatitis. 32% of patients who had mild pancreatitis had end organ failure, whereas end organ failure is seen in 75% and 100% of patients who had moderate and severe pancreatitis respectively (p=0.02).The above statistics shows that, highly significant correlation exists between the prediction of end organ failure with the classification according to the MCTSI (p=0.003) than CTSI (p=0.02).

Table 3: Frequency and percentage distribution of patients according to infection

Infection	MCTSI(CTSI)			P-value
	Mild	Moderate	Severe	
Present	2(10)	9(6)	6(1)	0.005(0.180)
Absent	16(24)	12(6)	2(0)	
Total	18(34)	21(12)	8(1)	

A total of 17 (36%) patients who had fever and leukocytosis were considered to have systemic infection. Of these 17 patients, 2 patients had mild, 9 patients had moderate and 6 patients had severe pancreatitis according to the MCTSI. 10% of patients who had mild pancreatitis had systemic infection, whereas systemic infection is seen in 40% and 88% of patients who had moderate and severe pancreatitis respectively (p=0.005).

According to CTSI, of these 17 patients, 10 patients had mild, 6 patients had moderate and 1 patient had severe pancreatitis. 29% of patients who had mild pancreatitis had systemic infection, whereas systemic infection was seen in 50% and 100% of patients who had moderate and severe pancreatitis respectively (p=0.180).

With above statistical values, it can be concluded that, there is a highly significant correlation between the prediction of systemic infection with the classification according to the MCTSI ($P=0.005$), compared to the classification according to CTSI which is not statistically significant ($p=0.180$).

Table 4: Patient outcomes and duration of hospitalization in severity based on Modified CT Severity Index

Mctsi	Mild	Moderate	Severe
Total no.of.Patients	18	21	08
Mean duration	6.1	9.6	14.3
Sug Int.	00(0%)	02(10%)	02(25%)
Infection	02(11%)	09(43%)	06(75%)
End organ failure	06(33%)	07(33%)	00(0%)

Table 5: Patient outcomes and duration of hospitalization in severity based on CT Severity Index.

CTSI	Mild	Moderate	Severe
Total no.of.Patients	34	12	08
Mean duration	7.4	14.3	3.0
Sug Int.	00(0%)	02(17%)	02(25%)
Infection	10(29%)	06(50%)	01(13%)
End organ failure	11(32%)	09(75%)	01(13%)

Duration of hospital stay in our study was ranging from 2 to 23 days with mean duration of 9 days. The mean duration of hospitalisation in mild, moderate and severe classes of Acute Pancreatitis according to Modified CT Severity Index was 6, 9 and 14 days respectively. Whereas it was 7, 14 and 3 days respectively as per the CT Severity Index. The above values shows that mean duration of hospitalisation correlates well with the severity classification based on the MCTSI than CTSI.

Discussion

Our study showed a significant correlation of grades of severity of pancreatitis based on both MCTSI and CTSI with patient outcome parameters. However MCTSI was more closely associated with patient outcome than CTSI in our study. Several studies reported a strong correlation between the CT evaluation and the clinical severity of acute pancreatitis and some studies have not corroborated these findings. This difference in statistical significance between CTSI and MCTSI in our study may be attributed to the inclusion of extrapancreatic complications in the MCTSI system.

We assume that the presence of ascites and pleural fluid may be responsible for the improved correlation with MCTSI, because they may be early indicators of organ dysfunction. Another important difference between the MCTSI and CTSI is that, MCTSI differentiates only between presence and absence of acute fluid collections and, therefore does not require a count of the collections as in case of CTSI.

Similar study was done by Mortelet K J *et al.* [5] In his study, when applying the modified index, the severity of pancreatitis and the following parameters correlated more closely than when the previously established CTSI was applied: the length of the hospital stay, the need for surgical or percutaneous procedures, and the occurrence of infection. Significant correlation between the severity of pancreatitis and the development of organ failure was seen only using the MCTSI ($p = 0.003$), not the CTSI ($p = 0.02$). Our study resulted in almost similar findings except that CTSI score

showed statistically significant correlation with prediction of surgical intervention than MCTSI score. This difference is due to the presence of infected pseudocyst in two patients who presented with relapse of pancreatitis but had different scores in both indexes.

In contrary to our study results, Bollen T L *et al.* [6] showed no statistically significant differences between the two CT scoring systems with regard to all the studied severity parameters. The differences observed may be due to differences in criteria for organ failure and clinically severe AP (the present study used criteria in accordance with the Marshall criteria of end organ failure).

In our study, for the MCTSI and CTSI to detect severe pancreatitis, sensitivity was 40% vs. 34%, negative predictive value was 67% vs. 56% respectively, specificity and positive predictive value of 100% for both indexes. Hence MCTSI is more useful for the screening in patients with severe acute pancreatitis than CTSI. Jauregui *et al*⁷ found similar results, stating that for the MCTSI and CTSI, to detect severe pancreatitis, sensitivity was 61% vs. 38%, specificity 66% vs. 100% and positive predictive value of 81% vs. 100%, respectively.

In our study 8 patients had severe pancreatitis and all patients had evidence of necrosis on CECT. All these patients had adverse clinical outcome when compared to the patients who had mild or moderate pancreatitis. Similar results seen in study done by Dugernier T L *et al.* [8] where all patients with acute severe pancreatitis had necrosis on CT scan.

There is no significant correlation between presence of necrosis and need of surgical intervention in our study. Similar results were seen in study done by Freeny *et al*⁹. This can be explained as patients presented with relapse and having pseudocyst and mild severity of pancreatitis but required surgical intervention.

The present study showed no correlation between the presence of necrosis and prediction of end organ failure (EOF). Pancreatic necrosis was present in 38% patients without any evidence of EOF, and there was no evidence of necrosis on CT scan in 61% patients with EOF. All patients who have evidence of necrosis had EOF. Study done by Mole D J *et al.* [10] showed similar results. Hence the presence of necrosis and the occurrence of EOF favour association but not cause in AP.

It was observed in our study that no significant association exists in different subgroups of necrosis when using the CT severity index (between patients who have 30– 50% necrosis and patients who have more than 50% necrosis) and clinical outcome.

Conclusion

1. Extrapaneatic complications, when included in the CT scoring system (MCTSI) were significantly correlated with end organ failure and adverse clinical outcome. Hence MCTSI may be more useful scoring system than CTSI.
2. MCTSI is a very useful tool for the screening of patients with acute pancreatitis for the classification of severity accurately and to predict the clinical outcome when use within three days of symptom onset.

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