ORIGINAL RESEARCH

Predicting the clinical outcome of the patients with acute pancreatitis based on modified CT severity index

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ABSTRACT

Introduction- Acute Pancreatitis is defined as an acute inflammatory process of the pancreas, caused by activation of the proteolytic enzymes within the gland. The assessment of disease severity must be objective and early detection of pancreatic necrosis is the most important aspect in its management. This study was carried out to correlate the modified CT severity index with clinical outcome of the patient. **Material and methods-** The descriptive, cross sectional hospital-based study was carried out in the Department of Radiodiagnosis, St. Stephen Hospital, Tis Hazari, Delhi over a period of 18 months among 100 patients who were diagnosed with acute pancreatitis. Clinical and demographic history was taken and results were analyzed using SPSS version 25.0. **Results-** The mean age of patients was 40.68±12.99 years. There was a male preponderance seen with a male to female ratio of 2.4:1. Gallstones were the most common cause of pancreatitis in 53.33% (24/45) of the patients. there was significant positive correlation found between MCTSI and duration of hospital stay (p value = 0.019) and BISAP score (p value = 0.030). **Conclusion –** It was concluded that CT examination helps diagnose acute pancreatitis. It detects pancreatic, peripancreatic, and extra-pancreatic morphological and inflammatory alterations well. MCTSI is beneficial for screening acute pancreatitis patients, accurately classifying severity, and predicting clinical prognosis.

Keywords- acute pancreatitis, CT, outcome, pain, severity index

INTRODUCTION

Acute Pancreatitis is defined as an acute inflammatory process of the pancreas, caused by activation of the proteolytic enzymes within the gland (1). Alcoholism and biliary tract disease account for 90% of all cases of acute pancreatitis. It occurs most often in middle life. Gallstones are present in 35-60% of cases of pancreatitis and about 5% of patients with gallstones develop pancreatitis. The male to female ratio is 1:3 with biliary tract disease and 6:1 in alcoholics (2).

The clinical spectrum of acute pancreatitis varies from mild to severe disease. Organ failure is one of its main complications, which contribute to the high mortality. (3).

Clinical assessment by the clinician is poor in predicting the severity of acute pancreatitis on admission, and it fails to identify up to two-thirds of patients, who eventually develop complications or die (4).

On ultrasound, pancreatic visualization is 60-78%. Acute pancreatitis may appear as hypoechoic diffuse or focal enlargement of pancreas with dilatation of duct if head is focally involved (5). Magnetic Resonance Imaging (MRI) has not played a major role in the evaluation of pancreatitis. MRI can detect changes of pancreatitis and distinguish acute from chronic forms (6). Computed tomography (CT) scan is useful not only for the diagnosis of acute pancreatitis but also for evaluating its severity and delineating pancreatic and extra-pancreatic complications, such as, peripancreatic fluid collection, pseudocyst and pancreatic

abscess. The prognostic value of CT in acute pancreatitis has been previously investigated, mainly by correlating the presence and extent of peripancreatic fluid collection with the clinical severity of the disease, development of complications and death (7).

In the past two decades, several radiologic prognostic scoring systems have been developed. Among them, the CT severity index (CTSI), designed by Balthazar et al. in 1990, is the most widely adopted for clinical and research settings. The CTSI is a numeric scoring system that combines a quantification of pancreatic and extra- pancreatic inflammation with the extent of pancreatic necrosis (7). In 2004, a modified CTSI (MCTSI) was designed to account for several potential limitations of the CTSI. In contrast to the CTSI, the MCTSI incorporates extra-pancreatic complications in the assessment and simplifies the evaluation of the extent of pancreatic parenchymal necrosis (none, ≤ 30%, or > 30%) and peripancreatic inflammation (presence or absence of peripancreatic fluid) (8).

The treatment of acute pancreatitis depends on the accurate assessment of severity. The assessment of disease severity must be objective and early detection of pancreatic necrosis is the most important aspect in its management. This study was carried out to correlate the modified CT severity index with clinical outcome of the patient and to evaluate the complications of acute pancreatitis.

MATERIAL AND METHODS

The descriptive, cross sectional hospital-based study was carried out in the Department of Radiodiagnosis, St. Stephen Hospital, Tis Hazari, Delhi over a period of 18 months. Patients who were diagnosed with acute pancreatitis were recruited from medical and surgical departments after taking a proper written informed consent. Ethical clearance was taken from institutional ethical committee before commencement of study.

Sample size- Through convenient sampling every consecutive patients with a diagnosis of acute cancreatitis undergoing CECT abdomen were taken and total sample size finalized was 45 patients (limited due to COVID19 pandemic). Patients were selected on the basis of following inclusion and exclusion criteria.

Inclusion Criteria – Patient with acute pancreatitis who underwent CECT abdomen and were willing to participate in the study.

Exclusion criteria- Patients admitted with clinical suspicion of acute pancreatitis having normal findings on contrast enhanced MDCT and patients with pancreatitis due to trauma.

Methodology- After taking a thorough history of allergy, chronic obstructive pulmonary disease (COPD), diabetes mellitus and hypertension, the patients were kept nil orally overnight prior to the CT scan to avoid complications while administering the contrast medium. The weight of the patient was taken to calculate the dose of intravenous contrast medium.

Technique- All scans were done using 128 slice Philips incisive MDCT. 2ml/kg of 350mg/ml nonionic iodinated contrast was injected using pressure injector at the rate of 3-4ml/sec. Threshold set at 120 Hounsfield units (HU) and delay of 3 seconds was given after the attainment of threshold for arterial phase. Venous phase was acquired after a delay 60 seconds from the time of contrast injection. Scanning was done in cranio-caudal direction in arterial and venous phases; from the base of lung to aortic bifurcation in the arterial phase and from the base of lung to the level of pubic symphysis in the venous phase. Images were retro reconstructed with 1.25 mm slice thickness and reformatted in sagittal and coronal planes for analysis. Other relevant hematological and biochemical investigations were done.

Scoring-The severity of pancreatitis was scored using modified CT severity index and was classified into three categories (mild, moderate and severe). The modified index is a 10 point scoring system derived by assessing the degree of pancreatic inflammation (0 to 4 points) pancreatic necrosis (0 to 4 points) and extra-pancreatic complications (0 or 2 points). Modified CT severity index was calculated by combining the peripancreatic inflammation, degree of necrosis and extra-pancreatic complications. On the basis of MCTSI, patients were divided into three categories i.e. Mild (0-2), Moderate (4-6) and Severe (8-10) (8). Clinical severity was measured using BISAP score.

Outcome - Clinical outcome parameters included the length of hospital stay, the need for surgical intervention, infection and the occurrence of systemic complications and death.

Statistical analysis- All data were analyzed with SPSS software version 22.0. The data was presented as mean±SD for continuous variables and as frequency or percentage for categorical variables. Chi Square test or Fisher‘s exact test was used for statistical comparison of qualitative variables and Student‘s t test for parametric variables. Correlation between different parameters was assessed by Pearson product moment correlation coefficient. ―P values of less than 0.05 were considered statistically significant.

RESULTS

Out of 45 patients, the maximum number of the patients were in the age group of 26- 35 (31.11%) and 36-45 years (31.11%), followed by

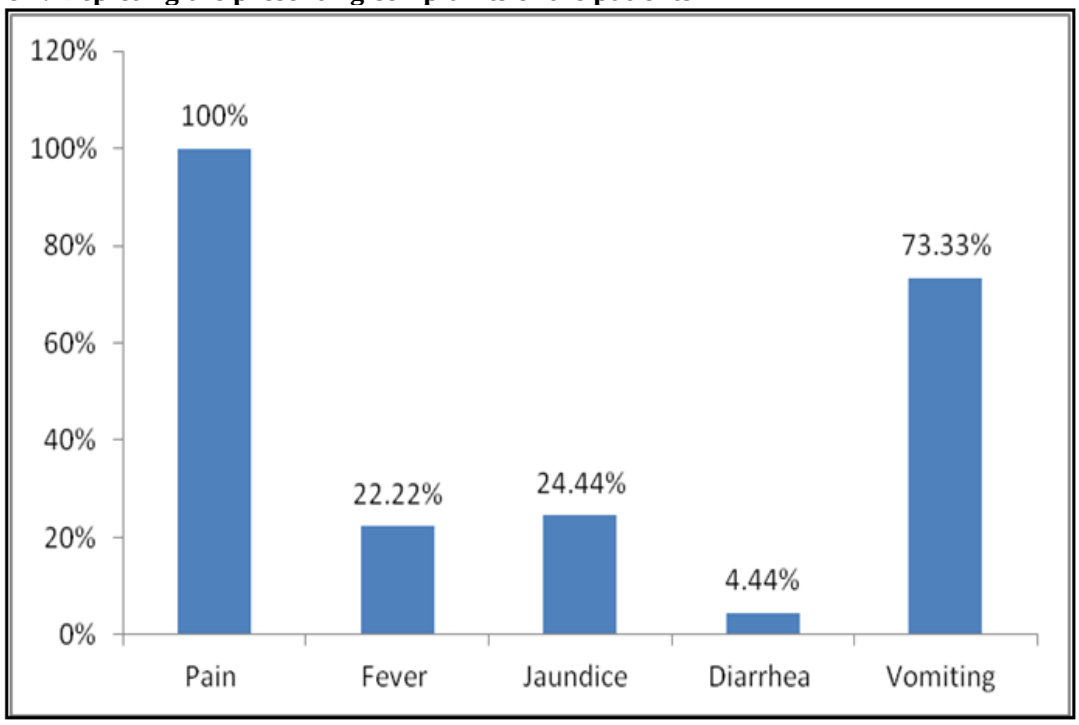
15.55% patients in the age group of 46-55 yrs. Minimum age was 18 years and maximum age was 85 years with the mean age being 40.68±12.99 years. The study group consisted of 32 male and 13 female patients (n=45). There was a male preponderance seen with a male to female ratio of 2.4:1 as shown in table 1.

Table 1 Distribution of patients according to age and gender

Variable		N (%)
Age Group	15 – 25	5 (11.11)
	26 – 35	14 (31.11)
	36 – 45	14 (31.11)
	46 – 55	7 (15.55)
	56 – 65	4 (8.88)
	66 – 75	0
	> 75	1 (2.22)
Gender	Male	32 (71.1)
	Female	18 (28.2)

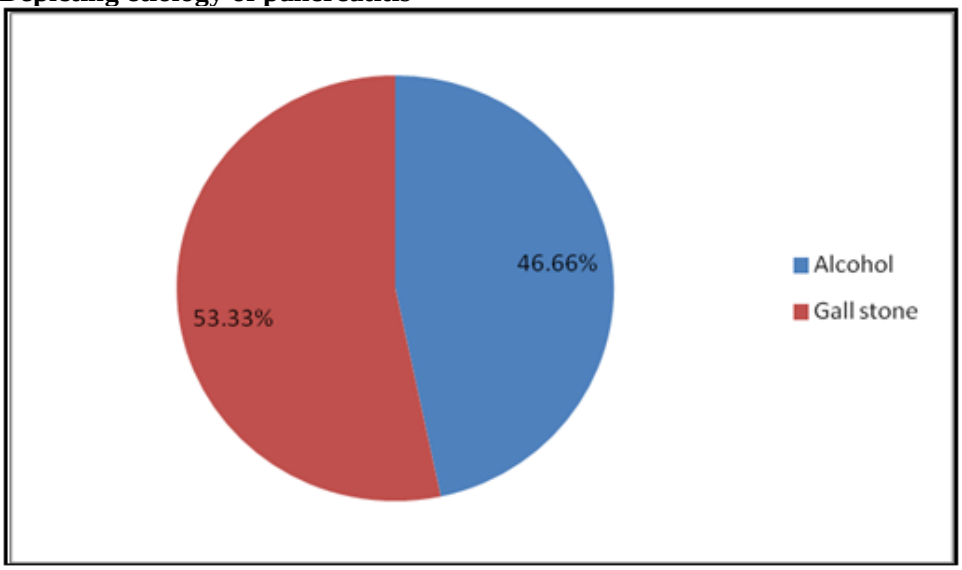
The most common presenting complaint was abdominal pain (45/45) followed by vomiting (33/45). 10 patients presented with fever and 11 patients presented with jaundice. Diarrhoea was the least common presenting complaint as shown in figure 1.

Figure 1: Depicting the presenting complaints of the patients



Gallstones were the most common cause of pancreatitis in 53.33% (24/45) of the patients. In the remaining 46.66% of patients (21/45), the causative factor was alcohol abuse as shown in figure 2 .

Figure 2: Depicting etiology of pancreatitis



Most of the patients included in this study were having biochemical abnormalities in the form of raised serum amylase and serum lipase levels. The serum amylase showed a very wide range from mild elevation to very high levels. 20% patients had serum amylase ranging from 100-200 U/L. Markedly elevated serum amylase levels more than 4000U/L was seen only in one patient. The serum lipase also showed a wide range from mild elevation to very high levels. 21 patients had lipase levels ranging from 100-200 U/L whereas 19 patients had lipase levels of less than 100U/L. None of the patients had lipase values of more than 1000U/L as shown in table 2.

Table 2 level of serum amylase and lipase

Levels (U/L)	No. of Cases			
	Amylase	%	Lipase	%
< 100	7	15.55%	19	42.22%
100 – 200	9	20%	21	46.66%
201 – 500	8	17.77%	4	8.88%
501 – 1000	9	20%	1	2.22%
1001 – 2000	6	13.33%	0	0%
2001 – 3000	5	11.11%	0	0%
3001 – 4000	0	0%	0	0%
> 4000	1	2.22%	0	0%
Total	45	100%	45	100%

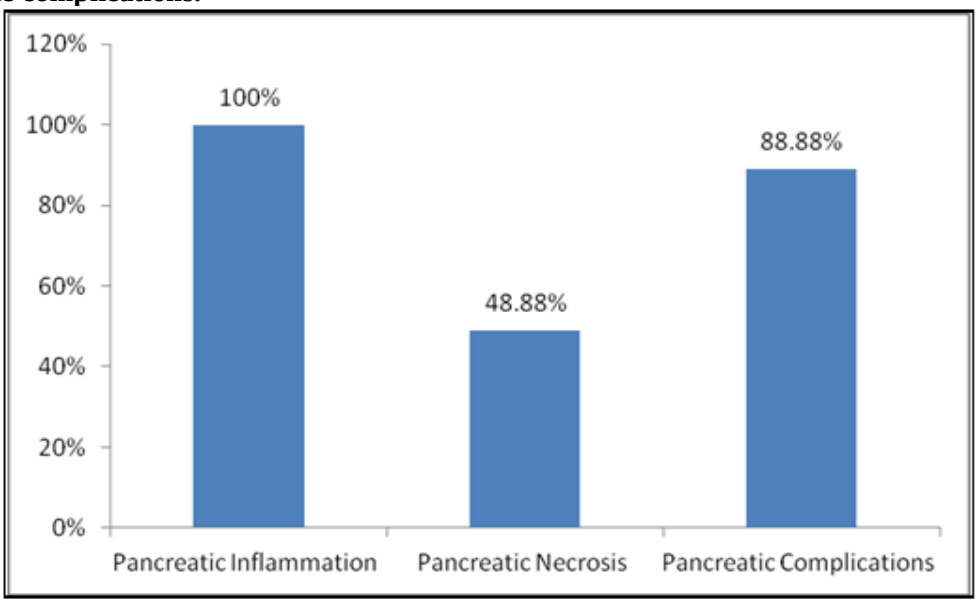
In our study majority of the patients were in the moderate category which constituted 25 out of 45 patients (55.55%). Only 3 patients belonged to mild category that constituted 6.66% of the patients. The remaining 17 patients (37.77%) belonged to the severe category as shown in table 3.

Table 3: Distribution of patients according to Modified CT Severity Index

MCTSI	No. of Cases	Percentage
Mild (0 – 2)	3	6.66%
Moderate (4 – 6)	25	55.55%
Severe (8 – 10)	17	37.77%

All of the patients (100%) with acute pancreatitis showed evidence of pancreatic inflammation, pancreatic complications were seen in 40 patients (88.88%) however only 22 patients (48.88%) showed evidence of pancreatic necrosis as shown in figure 3.

Figure 3: Percentage of the patients with Pancreatic inflammation, necrosis and extra pancreatic complications.



In our study there were 17 patients with severe pancreatitis; all of these patients showed evidence of necrosis (100%), however pancreatic necrosis was present only in 5 out of 25 patients (20%) with moderate category while none of the patients had evidence of necrosis with mild pancreatitis. All the patients of our study group showed evidence of pancreatic inflammation on MDCT that included 3 patients in mild, 25 patients in moderate and 17 patients in severe pancreatitis group as per MCTSI.As far as extra pancreatic complications are concerned, all the 17 patients (100%) having severe pancreatitis and 22 patients (88%) having moderate pancreatitis had one or other extra pancreatic complication, whereas 1 patient (33.33%) with mild pancreatitis showed evidence of extra pancreatic complication as shown in table 4.

Table 4: Correlation of Modified CT Severity Index with pancreatic necrosis, pancreatic inflammation and extra pancreatic complications

	Mild	Moderate	Severe
Pancreatic necrosis	0	5 (20%)	17 (100%)
Pancreatic Inflammation (n=45)	3 (100%)	25(100%)	17(100%)
Extra Pancreatic Complications (n=40)	1 (33.33%)	22 (88%)	17 (100%)

Correlation was determined keeping MCTSI as dependent variable and duration of hospital stay, BISAP score, TLC, serum amylase, lipase, LDH, creatinine and bilirubin as predictor variables; there was significant positive correlation found between MCTSI and duration of hospital stay (p value = 0.019) and BISAP score (p value = 0.030), however there was no statistically significant correlation seen with TLC (p value = 0.634), serum amylase (p value = 0.07), serum lipase (p value = 0.993), serum LDH (p value = 0.746), Serum creatinine (p value = 0.252)and serum bilirubin (p value = 0.219) as shown in table 5.

Table 5: Showing correlation between MCTSI and duration of hospital stay, BISAP score, hematological and biochemical markers or disease severity

Predictor variables	Dependent variable MCTSI	
	r value	p value
Duration of hospital stay	0.350	0.019
BISAP score	0.324	0.030
TLC	-0.73	0.634
Serum amylase	-0.266	0.07
Serum lipase	-0.001	0.993
Serum LDH	0.050	0.746
Serum Creatinine	0.174	0.252
Serum Bilirubin	0.187	0.219

DISCUSSION

Initial clinical assessment of the progression of acute pancreatitis alone has been inadequate in identifying patients who develop a severe disease. Identifying severe cases is important and can play a significant role in management decision and in reducing the morbidity and mortality associated with severe acute pancreatitis. None of the scoring systems or individual biochemical markers are proven to be the precise indicators of the adverse clinical outcome.

During the last two decades, management of severe acute pancreatitis has changed from a more aggressive surgical intervention towards a more conservative approach, except when infected necrosis has been confirmed. Hence it is very important from the treatment aspect to assess the severity of acute pancreatitis and the presence of necrosis by CECT.

The study was carried out on 45 patients who presented with strong clinical suspicion of acute pancreatitis with raised S. amylase and S. lipase levels. All were indoor patients admitted in St. Stephen‘s Hospital, Delhi.

The present study included patients between the age of 18 to 85 years. Mean age of presentation is 40.68 years in our study population. 62.22% patients were between the age group of 26-45 years. The higher incidence of acute pancreatitis could be attributed to the fact that there is high prevalence of alcoholism. This study is in concordance conducted by Khanna et al in 2013 showed the mean age of presentation was 40.5 years (9).

Male: Female ratio in our study was 2.4:1 with 32 male patients and 13 female patients which constituted 71.11% and 28.88% patients respectively. Study conducted by Balthazar et al in 1985 showed 75% patients were male (10). Another study conducted by Kim et al in 2008 showed the similar prevalence of acute pancreatitis among males (70%) (11). The present study shows results in concordance with these previous studies.

In our study, biliary calculi were the most common causative factor for acute pancreatitis (53.3%). Alcohol was responsible for 46.66% cases of acute pancreatitis.

No other cause of acute pancreatitis could be established in the cases studied. Our study was in comparison to the study conducted by Bohidar et al in the year 2003 with 48% patients having pancreatitis due to biliary disease and 28% due to alcohol abuse (12). Similar studies done by Bollen T L et al (13) and Jauregui et al (14) showed biliary stones as the predominant etiological factor.

Simmons et al reported 72% incidence of pancreatitis due to alcohol abuse, 16% due to biliary disease and 12% due to idiopathic causes (15).

Kim et al found that out of total 119 patients of acute pancreatitis, 41.2 % patients had biliary pancreatitis and 38.6% patients had alcoholic pancreatitis. Cause of pancreatitis was idiopathic in 17.6% cases and it was drug induced in 2.6% patients (16).

Hence the respective incidence of various etiological factors was different in each study. This may be attributed to geographical distribution and the prevalence of gall stone disease or alcohol abuse in the population studied.

On the basis of MCTSI patients were divided into three categories i.e. mild (0–2 scores), moderate (4–6 scores) and severe (8–10 scores). In the present study, in 3 patients, pancreatitis was mild and CTSI was between 0-2, in 25 patients MCTSI was 4-6 indicating pancreatitis to be of moderate severity. In remaining 17 patients MCTSI was 8-10, indicating severe pancreatitis. Thus, majority of the patients were in the moderate category which constituted 25 out of 45 patients (55.55%). Only 3 patients belonged to mild category that constituted 6.66% of the patients. The remaining 17 patients (37.77%) belonged to the severe category. These results were contrary to the studies conducted by Mortele et al (08) in 2004 and Bollen et al in 2011(13) which showed 51.5 % and 43.3% in mild category, 33.3% and 38.2% in moderate category whereas 15.2% and 17.8% in severe category respectively.

Our study had different subset of patients in mild, moderate and severe categories according to MCTSI in comparison to the studies done by Mortele et al (08**)** in 2004 and Bollen et al (13) in 2011, with lesser number of patients with mild pancreatitis and a greater number of patients in moderate and severe pancreatitis. The explanation to this can be that our hospital being a tertiary centre, a greater number of severe cases were referred to us.

Keeping in mind the role of Pancreatic Necrosis in Prediction of clinical Outcome; in the present study, diagnosis of pancreatic necrosis was made on CECT as non- enhancing areas and it was found in 22 patients (48.8 %). Nagar and Gorelick in 2005 found that necrosis occurred in 6-20% cases of pancreatitis (17). In another study Khanna et al reported that 23.6% patients of pancreatitis had evidence of necrosis on CECT (9). The higher incidence of pancreatic necrosis in this study can be attributed to large number of patients with moderate and severe pancreatitis.

On applying bivariate correlation keeping MCTSI as dependent variable and duration of hospital stay, BISAP score, TLC, serum amylase, lipase, LDH, creatinine and bilirubin as predictor

variables, we also found that there was significant positive correlation observed between MCTSI and duration of hospital stay (p value = 0.019) and BISAP score (p value = 0.030). Long duration of hospital stay as an indicator of clinical severity and poor clinical outcome was well correlated with high MCTSI score seen in severe pancreatitis. Mortele et al (08), Bollen et al (13**)** and Raghuvanshi et al (18) in their respective studies also concluded that patients having severe Pancreatitis as per MCTSI required longer hospital stays.

BISAP score is a validated tool for clinical severity and outcome in patients with acute pancreatitis; it was positively correlated with MCTSI in our study which is suggestive of the fact that MCTSI can very well predict the patient outcome and clinical severity in acute pancreatitis. Similar results were also found by Manoharan et al, who concluded that BISAP and MCTSI were correlated well for mortality with high positive value of 0.904 which is highly significant (0.01) (19).

Our study had couple of limitations; the sample size was inadequate due to COVID 19 pandemic to evaluate mortality and morbidity prediction based on CT criteria. The patients with both alcohol and gall stone pancreatitis were included although patients with alcoholic pancreatitis have poorer prognosis.

CONCLUSION

We concluded that CT examination is very helpful in establishing or confirming the clinical diagnosis of acute pancreatitis. It is very sensitive in depicting morphological and inflammatory changes in pancreatic, peripancreatic and extra- pancreatic region. 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.

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