Evaluation of Modified Computed Tomography Severity Index in Acute Pancreatitis

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ABSTRACT

Introduction: Acute pancreatitis is a severe inflammatory process involving pancreas which may remain localised within the pancreas or spread to regional tissues, involving adjacent or remote organs and may run a highly unpredictable clinical course with variable outcome. Contrast enhanced Computed Tomography (CT) scan is the gold standard technique for accurate depiction of pathology and complications of pancreatitis. Modified CT Severity Index (MCTSI) helps in evaluating the pancreatic inflammation and necrosis and it is also used for assessment of extrapancreatic complications of acute pancreatitis.

Aim: To evaluate the severity of acute pancreatitis and to correlate MCTSI with clinical outcome and hospital stay.

Materials and Methods: A hospital based prospective study was done in Department of Radiodiagnosis of tertiary care hospital for a period of two years from November 2015 to October 2017 on 30 patients with findings suggestive of acute pancreatitis. The outcome parameters like length of hospital stay, development of infection and organ failure were studied.

Results: A total of 30 patients, 23 males and 7 females were included. Mean age of the patients was 42.1±2.5 years. Alcohol was found to be the most common aetiological factor in male patients for acute pancreatitis. Most common site for peripancreatic inflammatory change was anterior pararenal space. Overall the mortality rate noted in study was 3.3%. A total of 7 (23.3%) patients underwent surgical or percutaneous interventions. Patients were characterised as mild 15 (50%), moderate 10 (33.3%) and severe pancreatitis 5 (16.7%) respectively. A significant correlation was seen between the modified severity index score and the development of organ failure, presence of infection, need for the surgical procedure and length of hospital stay.

Conclusion: MDCT is an effective modality for imaging pancreas. Grading of acute pancreatitis according to the severity of the disease in the form of MCTSI helps to predict the clinical outcome of the disease and guide the clinician who needs interventions.

INTRODUCTION

Acute pancreatitis is an acute, severe, inflammatory process of pancreas occurring due to exudation of pancreatic fluid containing proteolytic enzymes, with subsequent autodigestion of pancreatic parenchyma, interstitial fat necrosis and necrotising vasculitis. It has a highly unpredictable clinical course with many variable outcomes. The course in majority (80%) of patients is mild, self-limiting and calls for a short hospital stay. However, in approximately 20% of the patients it may become severe and result in various complications [1]. This may result in prolonged hospital stay or even death of the patient. By starting the treatment early, in the patients with severe acute pancreatitis, morbidity and mortality can be reduced. For this it is essential to identify the patients with severe disease accurately and as early as possible. Therefore, determining and stratifying the severity of acute pancreatitis at the time of admission is necessary to allow triage, determine the prognosis of disease, decide treatment, and allocate resources. Contrast enhanced computed tomography is the gold standard technique not only for its accurate depiction of the pathology and complications but also for its non-invasive nature [2].

The diagnosis of acute pancreatitis requires two of the following features [3]:

i. Acute abdominal pain and tenderness in the upper abdomen

ii. Elevated pancreatic enzyme levels in serum, urine or ascitic fluid

iii. Ultrasonographic (US) or radiologic abnormalities characteristic of acute pancreatitis

Acute pancreatitis is related to alcohol or biliary tract stone disease in 80% of cases. The remaining 10% is related to metabolic factors, drugs or other conditions and 10% are idiopathic [4,5]. India is a developing country, where pancreatitis is more common among alcoholics, there is a need for a severity scoring system which can predict the severity of disease at the time of presentation. Early recognition of severe disease would enable the clinician to consider more aggressive intervention so that potential adverse outcomes can be prevented.

CT Severity Index (CTSI) popularly called 'Balthazar scoring system' (1990) is based on morphology of pancreas, number of peri-pancreatic fluid collections and necrosis of pancreas [1]. Modified Computed Tomography Severity Index (MCTSI) which was proposed by Mortele KJ et al., has been introduced which differs from the CTSI by the presence of extra pancreatic complications and grading of the peripancreatic fluid collection by their presence or absence, instead of the number of fluid collections [5]. This system is also different in the terms of grading of necrosis.

This study was done in Krishna district of Andhra Pradesh, which is situated in South eastern part of India, where alcohol habituation is moderate compared to other population. Cholelithiasis is less common in Andhra Pradesh, as compared to North India. In view of geographical and cultural backgrounds, alcoholic habituation and prevalence of cholelithiasis, there are very few studies which have radiologically evaluated acute pancreatitis, disease complications and graded the severity of disease using MCTSI in this area (Krishna district). Therefore, present study was undertaken to assess the MCTSI in evaluating the severity of acute pancreatitis and to correlate MCTSI with clinical outcome and hospital stay in this area.

MATERIALS AND METHODS

This was a hospital based prospective study done in a tertiary care hospital for a period of two years from November 2015 to October 2017 on 30 patients who were referred to Department of Radio

diagnosis, from the various departments of hospital, with either clinical/laboratory/ultrasonography findings suggestive of acute pancreatitis. Ethical approval was taken from the Institutional Ethical Committee, (PG/73/2015) and written informed consent was taken from all participants included in the study.

Patients with age 18 years and above and of both genders with clinical suspicion of acute pancreatitis in whom abdominal ultrasound examination was suggestive of pancreatitis were included in the study. Any symptoms like pain in abdomen, nausea, vomiting, and fever with duration, physical examination (local and systemic) including pulse rate, blood pressure, respiratory rate, temperature and icterus and any history suggestive of possible aetiology such as gallstone disease, alcohol abuse, trauma to abdomen, drug intake, metabolic disorder or any recent surgical intervention or procedure was recorded. The term pancreatic necrosis refers to nonviable pancreatic tissue [6].

Patients with normal CT imaging findings, patients on whom CT scan cannot be performed due to ionizing radiation hazard (such as during pregnancy), those cases requiring immediate medical or surgical attention, in patients with past history of contrast allergy, medical renal disease and those who did not come for the follow-up during the study were excluded.

CT examination was performed on multidetector CT SIEMENS SOMATOM 16-slice CT (Kvp= 130 Mas= 60). CT pressure injector MEDRAD VISTRON CT injection system was employed for IV contrast material administration. All patients were kept nil by mouth for minimum of 4 hours before scan. Iodinated contrast diluted with water was used as oral contrast so as to distend the stomach and small bowel. Approximately, 1000 mL of this was given 1 hour prior to the CT scan examination. CT examination was carried out in supine position. A preliminary scout film was taken after which 5 mm thin nonenhanced CT scan was obtained in all cases. Later I.V Contrast enhanced scan was performed in all cases. This included 5 mm sections from the level of xiphisternum to the level of iliac crest with a scan delay of 25 seconds. A nonionic contrast Iopromide (Ultravist 370) of about 80-100 cc was used with a dose of 1.5-2.0 ml/kg at injection rate of 3-3.5 mL/sec injected via 18G intravenous catheter into the antecubital vein. Image matrix used was 512x512. All images were viewed at window width-300 HU, window level-40 HU with a wide and narrow window setting as and when deemed necessary. CT scans were independently reviewed on the workstation by primary investigator and the findings were confirmed by experienced abdominal radiologist who was unaware of presenting signs and symptoms or of patient outcomes. The severity of pancreatitis was scored using MCTSI and classified into mild, moderate and severe categories [Table/Fig-1]. Using this MCTSI, the severity of acute pancreatitis for each patient was then categorised as mild (0-2 points), moderate (4-6 points), or severe (8-10 points). The outcome parameters that were studied were length of the hospital stay (in days), need for surgical intervention, need for percutaneous intervention (aspiration and drainage), evidence of infection in any organ system and evidence of organ failure.

Prognostic Indicators	Points
Pancreatic inflammation (CT Grade) • Normal pancreas • Intrinsic pancreatic abnormalities with or without inflammatory changes in peripancreatic fat • Pancreatic or peripancreatic fluid collection or peripancreatic fat necrosis.	0 2 4
Pancreatic necrosis None ≤30% >30%	0 2 4
Extra pancreatic complications (one or more of pleural effusion, ascites, vascular complications, parenchymal complications, or gastrointestinal tract involvement)	2

[Table/Fig-1]: Modified CT severity index [5].

Patient records were reviewed for the presence or absence of dysfunction in six separate organ systems as defined by Fagon JY et al., for an average period of 30 days [6].

STATISTICAL ANALYSIS

Statistical analysis was done using SPSS version 2017. Subgroup analysis was done according to age, gender, aetiology, CTSI scores. Pearson correlation test and chi-square tests were used to determine the correlation values.

RESULTS

The age of the patients in the study group was in the range of 20 to 70 years. Mean age of patients being 42.1±2.5 SD. Maximum patients were in the age group 41-60 years. Out of 30 patients, 23 patients were males and 7 patients were females [Table/Fig-2].

Age limit (years)	Male patients	Female patients
20-40	9	3
41-60	11	3
61≥70	3	1

[Table/Fig-2]: Age distribution in the study.

Alcohol was found to be most common aetiological factor in male patients for acute pancreatitis with [Table/Fig-3].

| Aetiology	No of males (%)	No of females (%)
Alcohol	18 (78%)	0
Biliary (gall stones,CBD stones)	3 (13%)	2 (29%)
Others (Metabolic disorders, Autoimmune, Infectious and Others)	2 (9%)	5 (71%)

[Table/Fig-3]: Aetiological factors for acute pancreatitis according to gender (n=30).

Acute fluid collections were observed in 12 of 30 patients. Most common site for peripancreatic inflammatory change was anterior pararenal space [Table/Fig-4].

[Table/Fig-4]: Image shows bulky edematous pancreas with peripancreatic fluid collections.

Inflammatory changes were observed in 20 of 30 patients which was about 66.6% of total study population. Pancreatic necrosis was noted in 8 patients (26.6%), of which five patients (62.5%) had less than 30%; three patients (37.5%) had more than 30%. All patients with necrosis more than 30% had severe pancreatitis and among 5 patients with less than 30% necrosis, 2 patients had severe pancreatitis and 3 patients have moderate pancreatitis. Patients with mild pancreatitis did not have necrosis. Among 8 patients with necrotizing pancreatitis, necrosis was sterile in 6 (75%) patients (5 with <30% of necrosis and 1 with >30% necrosis) and infected in 2 (25%) patients among which all of them had >30% necrosis. [Table/Fig-5].
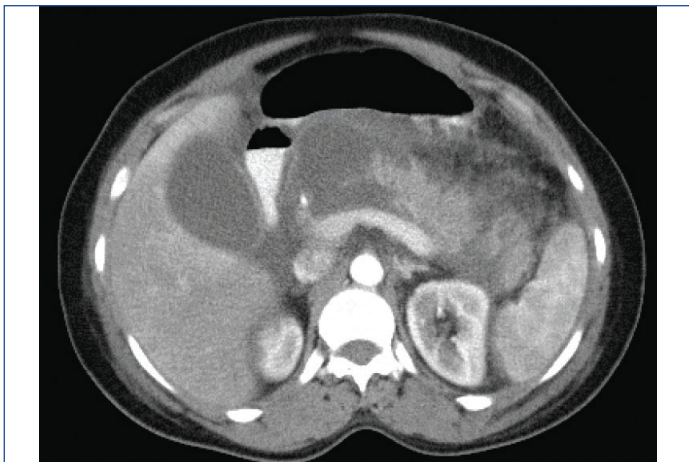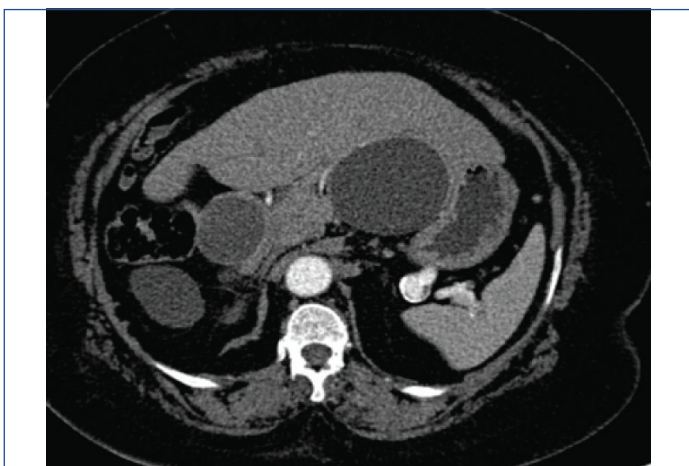
[Table/Fig-5]: Image showing severe necrotizing acute pancreatitis (50% of necrosis).

[Table/Fig-8]: Image showing thrombosis of portal vein and splenic vein.

As shown in the [Table/Fig-6], this study showed pancreatic inflammation of score 2 in 60% cases and score 4 in 40% cases. No pancreatic necrosis was detected in majority (73.5%) of cases, less than 30% necrosis was found in 16.6% cases and >30% necrosis was found in 10% cases. Extrapancreatic complications were found in 16.6% cases. Vascular complications like pseudoaneurysms and venous thrombosis [Table/Fig-7,8] were found in 3.3% cases. In present study, pleural effusion was the most common extra pancreatic complication, noted in 5 patients (16.6%). Left pleural effusion was more common than right, isolated right pleural effusion. Ascites was noted in 4 cases [Table/Fig-9].

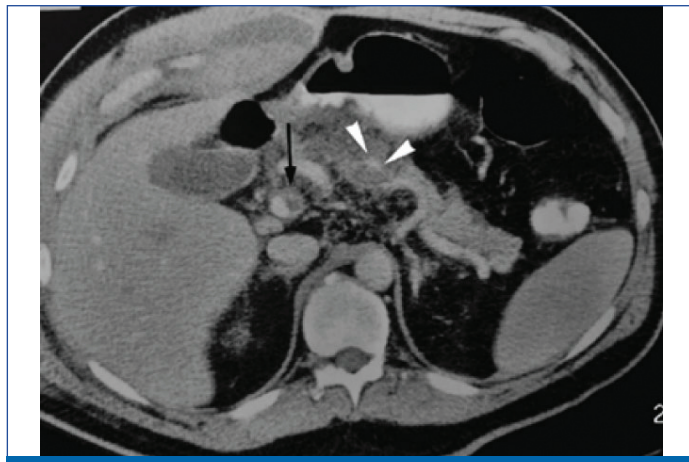| Grade	Points	No of patients (%)
Pancreatic inflammation	0	0
	2	18 (60%)
	4	12 (40%)
Percentage of necrosis	0	22 (73.5%)
	2	5 (16.6%)
	4	3 (10%)
Extra pancreatic complications	2	5 (16.6%)

[Table/Fig-6]: Distribution of number of patients according to prognostic indicators of modified CT severity index. (n=30)

[Table/Fig-7]: Image showing splenic artery pseudoaneurysm.

In this study, 15 (50%) patients were characterised as mild pancreatitis, 10 (33.3%) patients as moderate and 5 (16.7%) patients as severe pancreatitis.

This study showed that duration of stay in the hospital, need for surgical interventions and presence of infection and CTSI have strong positive correlation and also showed high statistical significance [Table/Fig-10]. The length of the hospital stay for the entire study ranged from 1 to 35 days (with an average duration of 10.3 days). A total of 7 (23.3%) patients underwent surgical or percutaneous

Extra pancreatic complications	No of patients	Percentage (%)
Pleural effusion		
Left only	3	10%
Right only	1	3.3%
Bilateral	1	3.3%
Total	5	16.6%
Ascites	4	13.3%
Extra pancreatic abnormalities		
Infarction	1	3.3%
Hemorrhage	0	0
Sub capsular collections	3	10%
Vascular complications		
Venous thrombosis	1	3.3%
Pseudo aneurysm	1	3.3%
Gastrointestinal involvement	3	10%

[Table/Fig-9]: Extra pancreatic complications.

interventions. Infection was observed in 10 (30%) patients. Organ system failure was present in 5 patients (16.6%), including failure of the heart (n=2), pulmonary system (n=1), central nervous system (n=1), and kidneys (n=1) as shown below in [Table/Fig-11]. Two patients had more than one organ system failed. Of these majority of patients fall under severe grade pancreatitis.

Overall the mortality rate noted in study was 3.3% (1 case in total 30 patients). The death occurred in patient with necrotizing pancreatitis and multiorgan failure.

A statistically significant correlation was found between the modified CTSI score and the length of hospital stay (p <0.001) for all severity groups [Table/Fig-11].

Parameters	p-value	r value
Duration of stay	0.00236	0.8398
Intervention/Surgery	0.00321	0.6432
Infection	0.00432	0.7864
Organ failure	0.0021	0.6543

[Table/Fig-10]: Correlations between parameters and MCTSI.

DISCUSSION

The majority of male patients (78%), who were diagnosed of having acute pancreatitis, gave history of alcohol abuse and which supposedly was the cause of pancreatitis. This finding was similar to previous study by Banday IA et al., in which alcohol was the cause of pancreatitis in 18 patients and all of them were male [3].

Present study showed that 24 of 30 patients (80%) of acute pancreatitis had diffuse enlargement of gland and 6 of 30

Outcome factor	Modified CT severity index			Chi square
	MILD (0-2 points)	Moderate (4-6 points)	Severe (8-10 points)	
No of patients	15	10	5	
Length of hospital stay (days)	5	11	15	p-value 0.00236 (significant)
Intervention or surgery	1 (6.6%)	3 (30%)	3 (60%)	Chi-square=6.34 df=2 p-value 0.00321 (significant)
Infection	2 (13.3%)	5 (50%)	3 (60%)	Chi-square= 7.80 df=2 p-value 0.00432 (significant)
Organ failure	0	2 (20%)	3 (60%)	Chi-square=9.84 df=2 p-value <0.0021 (significant)

[Table/Fig-11]: Patient outcomes using modified CT severity index.

patients (20%) have focal enlargement suggestive of oedematous pancreatitis. This correlates with Brooke JR et al., [7] study, in which 31 of 36 patients (86.1%) showed diffuse enlargement and 2 (7%) patients showed focal enlargement.

In present study pleural effusion was the most common extra pancreatic complication. Effusion was most common on left side. This observation is in agreement with Mortele KJ et al., who also found that the most common extra pancreatic abnormality was left pleural effusion [5].

In present study, according to MCTSI 15 patients had mild pancreatitis,10 patients had moderate pancreatitis and 5 patients had severe pancreatitis which were comparable to Mortele J et al., who reported mild in 34 (52%), moderate in 22 (33%), and severe pancreatitis in 10 (15%) out of 66 patients [5].

The strong relationship between the MCTSI and the patient outcome in present study is in agreement with the results of Mortele KJ et al., [5].

This study is also in agreement with the study done by Banday IA et al., who concluded that MCTSI is a simpler scoring tool and more accurate than the Balthazar CT severity index. In their study, the average duration of hospital stay in patients with severe pancreatitis was 14.2 days, when the MCTSI was applied, none of the patients categorised as mild pancreatitis had an adverse or fatal outcome. The majority (80%) of patients requiring interventional procedure fell in the severe pancreatitis group. Likewise, 9 out of 10 patients who developed infection and 7 out of 8 patients who developed organ

failure belonged to the severe pancreatitis group and mortality was also only reported in this group [3].

LIMITATION

Our study has few limitations. It was a prospective study with a small-sized sample. From the consecutive patient cohort diagnosed with acute pancreatitis in our institution, we analysed only the subgroup of patients who underwent contrast-enhanced CT within 1 week of the onset of symptoms. Therefore, to establish the true prognostic value of the MCTSI, the index probably has to be tested prospectively in all patients with acute pancreatitis at the time of presentation.

Some patients with clinically severe pancreatitis having renal failure are unable to undergo a contrast-enhanced CT study. All patients with acute attacks of pancreatitis were included in study irrespective of whether first attack or relapse of pancreatitis. Hence difference between first attacks and relapses could not be interpreted.

CONCLUSION

Contrast enhanced CT serves as an excellent diagnostic modality to demonstrate and characterise acute pancreatitis which helps in staging the severity of the inflammatory process, for the detection of pancreatic necrosis and for depicting the local complications and grading the severity of acute pancreatitis. The MCTSI correlates very well with all the parameters studied-length of the hospital stay, development of organ failure, infection and intervention.

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