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Original Article

Radiology Section

Prospective Evaluation of Acute Pancreatitis in Early Diagnosis Using Modified CT Severity Index

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ABSTRACT

Introduction: Acute pancreatitis is a disease with high rate of morbidity and mortality and is known to run an unpredictable course. CT is the standard non invasive investigation to evaluate pancreatic parenchymal changes, peri pancreatic changes and complications associated with pancreatitis.

Aim: To determine the value of CT evaluation in early diagnosis of acute pancreatitis and use as baseline imaging modality. To use modified CT severity grading system to grade the severity of acute pancreatitis.

Materials and Methods: This is a prospective study conducted from January 2013 to June 2014. The study was approved by institutional review board. Patients with clinically suspected/diagnosed acute pancreatitis, altered serum amylase, serum lipase and ultrasound diagnosed cases of acute pancreatitis were included in the study.

The study was conducted using GE16 slice CT scanner standard protocol, oral and IV contrast were used. Descriptive statistics (Tabulations, graphs and charts, proportions, percentage) are used.

Results: About 60 patients were included in our study. Oedematous pancreatitis was in 28% patients and pancreatic necrosis was in 25% patients. Features like diffuse/focal pancreatic enlargement in 76%, peri pancreatic fat stranding in 63% and peri pancreatic fluid collection in 33%. Modified CT severity index was classified as mild, moderate and severe of which majority were mild (65%). The accuracy and sensitivity of serum amylase and serum lipase in diagnosing AP were 45% and 65%.

Conclusion: CT is a sensitive, non invasive imaging in early diagnosis and staging of severity of acute pancreatitis which help in prediction of prognosis of the disease. It helps to initiate the treatment at earliest in rural areas. It also helps to differentiate between oedematous and necrotising pancreatitis, as serum lipase and amylase levels do not help to differentiate the type of AP. Modified CT severity index helps in evaluating the percentage pancreatic necrosis and to predict the possibility of developing local and systemic complications and necessity of tertiary care.

Keywords: Necrosis, Pancreatic necrosis, Sevirty

INTRODUCTION

Acute pancreatitis is a disease with high rate of morbidity and mortality and is known to run an unpredictable course. The disease has got varied clinical and imaging appearance which depends when patient presents. The extent of pancreatic parenchymal necrosis can be graded with associated regional and vascular complications [1,2].

In the past decades, several prognostic scoring systems have been developed. The most widely accepted CT severity index was developed by Balthazar EJ et al., [2]. The study was based on quantification of pancreatic inflammation, extent of pancreatic necrosis and extra pancreatic inflammation [3,4]. Around 2004, a modified CTSI was proposed due to several limitations in the previous CTSI. The latter proposed MCTSI included peri pancreatic inflammation (presence or absence of peripancreatic fluid), extra pancreatic complications assessment and pancreatic parenchymal necrosis (none, ≤ 30%, or > 30%) [5,6].

The purpose of our study was to diagnose early in cases of acute pancreatitis which helps to treat the patients based on severity of disease, as this study was conducted in the rural setup hospital. The MCTSI predicts the patient outcome, with regard to length of hospital stay and development of organ failure, which is the primary determinant of outcome in the early phase of acute pancreatitis [6,7].

The treatment is primary based initially on the MCTSI, which predicts the disease outcome. There are number of laboratory investigations, which do not assess the extent of pancreatic inflammation [8]. Few clinical grading system like RANSON and APACHE II are most commonly used indicators to assess

disease severity. While RANSON score cannot be used for the first 48 hours, APACHE score is cumbersome to use [8,9].

CT is standard investigation of choice to look for extent parenchymal necrosis and complications associated with it [9]. It has advantage over ultrasound in patients which depends on body habitus and bowel gas. CT is better in providing global picture of disease, extent of involvement and complications associated with it. CT predicts the prognosis of disease process and planning for necessary intervention [10,11].

CT severity index was used initially which was popularly called Balthazar scoring system. This scoring system is based on pancreatic morphology, number of peri pancreatic fluid collections and pancreatic necrosis [11,12]. MCTSI introduces grading system for pancreatic necrosis with definitions of fluid collection depending on the stage of disease and extra pancreatic complication [13].

Thus, this study was performed to determine the value of computed tomography evaluation in early diagnosis of acute pancreatitis, differentiate between acute edematous and acute necrotising pancreatitis, grade the percentage of necrosis and to grade the disease based on modified computed tomography severity index.

MATERIALS AND METHODS

This was a prospective study which was conducted in Department of Radiodiagnosis in rural hospital in South India, between the study period of January 2013 to June 2014. The study comprised 60 cases of acute pancreatitis who have undergone CT abdomen and pelvis. Permission was obtained from institutional ethical clearance. The patients were selected based on clinical suspicion/diagnosis of acute pancreatitis (vomiting, epigastric pain radiating to back), elevated serum amylase, serum lipase and ultrasonography diagnosed acute pancreatitis, were taken up for included in our study.

The patient's clinical presentation, clinical scoring system (APACHE), personal habits and laboratory investigation was recorded. CT was reported by two clinical radiologists with 5-8 years experience in abdominal radiology. Imaging features like enlargement of gland, peri pancreatic inflammation/fluid collection, pancreatic parenchymal necrosis (none, ≤ 30%, or > 30%) and extra pancreatic complications were recorded in the patient database. After analysing the imaging findings, disease severity was graded using MCTSI which included based on Grade 2, 4, 6, 8 and 10.

Inclusion Criteria

i) All the patients who are suspected/diagnosed of acute pancreatitis based on clinical and laboratory findings (serum amylase and serum lipase).

ii) Patients who are diagnosed acute pancreatitis on USG.

Exclusion Criteria

Chronic pancreatitis, congenital pancreatic lesion, pancreatic carcinoma, metastasis, trauma.

Procedure

Plain and post-contrast series of the abdomen and pelvis were taken. Acquisition of contiguous axial sections, of thickness 5 mm of abdomen and pelvis, 3 mm in region of interest in the cranio-caudal direction from the level of the xiphisternum to pubic-symphysis before and after administration of oral and intravenous iodinated contrast of 80-100 mL.The parameters used in the CT were 125 kV and 150 mA. All images were viewed in the PACS.

The patient was explained prior to the procedure and written consent was taken from the patient/bystander. The patient was asked to be in overnight fasting status. Serum creatinine values were recorded before the procedure, to avoid the contrast induced nephropathy. Patient was given oral and IV contrast.Patient identity was not revealed in any circumstances during the study.

RESULTS

60 cases of acute pancreatitis cases were included in the study. These patients underwent CT abdomen and pelvis, later images were reviewed by radiologist. The mean age of patients in the study was 37.18±11.45 years. The maximum patients were in the age group of 25 to 35 years [n=22 (36.6%)], followed by 36 to 45 years group [n= 16 (26.6%)]. The minimum age of patients was 17 years and maximum age was 62 years with a minimum number of patients seen below the age of 20 years.

Majority group of patients were male (85%). No association of age and gender was noted with severity of pancreatitis in our study [Table/Fig-1]. Total 17 cases (28.3%) patients had oedematous pancreatitis. Total 15 (25%) patients showed evidence of pancreatic necrosis out of which 7 had <30 of necrosis and 8 had >30 of necrosis [Table/Fig-2]. The common CT findings in our study was peri pancreatic fat stranding was seen in 38 patients, diffuse/focal enlargement of gland was seen in 76.6% and acute fluid collection was seen in 33% [Table/Fig-3].

Alcohol was the most common cause of AP seen in 52 (86.6%) patients, 6 (10%) patients were having GB/CBD calculi and 3 (5%) patients were having hyperlipidaemia. Out of this one patient had both alcohol and CBD calculus. The extra

Gender	Number of Patients	Percentage (%)
Male	51	85
Female	9	15
Total	60	100

[Table/Fig-1]: Distribution of patients with acute pancreatitis.

Types of Acute Pancreatitis	Present in Number of Patients		%
Edematous pancreatitis	17		28.3
Necrotising pancreatitis	7	Total= 15	25
<30			
>30	8		

[Table/Fig-2]: Acute pancreatitis is divided into edematous and necrotising pancreatitis depending on the basis of morphology and pancreatic parenchyma.

CT-Findings	No. of Patients		%
	Present	Absent	
Peri pancreatic fat stranding	38	22	63.3
Diffuse/focal pancreatic enlargement	46	14	76.6
Acute fluid collection	20	40	33.3

[Table/Fig-3]: CT findings seen in cases of AP.

Extrapancreatic Complications	No. of Patients	%
Ascites	38	63.3
Bilateral pleural effusion	10	16.6
Left pleural effusion	9	15
Right pleural effusion	2	3.3
Splenic vein thrombosis	3	5
Portal vein thrombosis	1	1.6
None	17	28.3

[Table/Fig-4]: Extrapancreatic complications in AP.

	Positive	Negative	Accuracy/Sensitivity
Serum amylase	27	33	45%
Serum lipase	39	21	65%
CT	60	0	100%

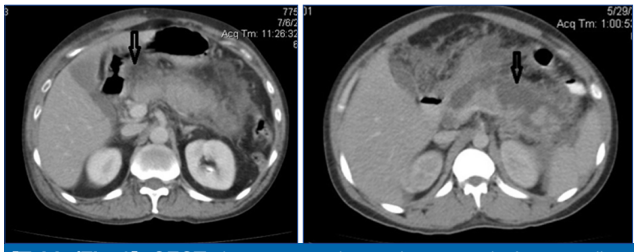
[Table/Fig-5]: Accuracy of serum amylase, serum lipase with CT findings.

MCTSI Scores	Number of Patients (n=60)	Pancreatic Necrosis (n=60)
2 & 4 (mild)	37	5
6 (moderate)	15	3
8 &10 (severe)	8	7

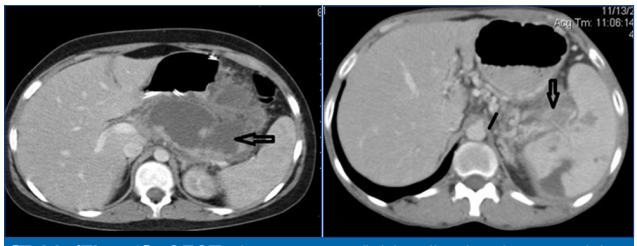
[Table/Fig-6]: Distribution of CT grading and percentage of necrosis.

Age Group	No. of Patients in MCTSI Total Scores				
	2	4	6	8	10
<25	2	4	2	1	0
25-35	4	10	4	3	1
36-45	0	8	5	3	0
46-55	4	3	1	0	0
> 55	1	1	3	0	0

[Table/Fig-7]: Distribution of patient according to MCTSI total scores according to age groups.



[Table/Fig-8]: CECT shows extensive peri pancreatic fat stranding in acute edematous pancreatitis. **[Table/Fig-9]:** CECT shows non-enhancing areas are seen within the pancreatic parenchyma suggestive of necrosis. Peri pancreatic fat stranding is also seen.



[Table/Fig-10]: CECT shows acute fluid collection in necrotising pancreatitis. **[Table/Fig-11]:** CECT shows, Splenic vein thrombosis (arrowhead) sequel to acute on chronic pancreatitis with multiple collaterals (bold line) around splenic hilum.

pancreatic complications were seen in 43 patients (71.6%) in our study. Pseudocyst was seen in 21 patients (35%) in our study [Table/Fig-4]. Infected necrosis was detected in 2 patients (3.3%). The total percentage of patients developing local complications in the study was 36.6%. No mortality due to pancreatitis was observed in our study.

The accuracy and sensitivity of serum amylase in diagnosing AP is 45%. The accuracy and sensitivity of serum lipase in diagnosing AP is 65%. The samples were taken at the time of CECT and follow-up serum amylase/lipase levels were not included in this study [Table/Fig-5].

According to modified CT grading of pancreatitis, 37/60(61.6%) patients were seen inscore of 2 and 4 which were large group of patients in our study, 23/60 (13.3%) patients were seen in Grade 8 and 10 [Table/Fig-6,7].

DISCUSSION

Acute pancreatitis is a life threatening condition with significant morbidity and mortality. The treatment depends on the accurate assessment of severity [14]. The mortality rate associated with edematous pancreatitis is less than 1% which rises to >2015 in necrotising pancreatitis.The majority of complications are associated with necrotising pancreatitis, which include secondary infection and multi-organ failure, however secondary infection results inhigher mortality rate than pancreatic necrosis [15-18].

CT plays an important role in differentiating edematous and necrotising form of AP, since clinical assessment alone cannot predict the severity of disease [19]. A study by Mortele KJ et

al., identified necrosis in 18 % and 15 % of patients with AP respectively. They concluded by saying that necrosis almost always occurs within 48 hours after onset of symptoms. Glandular necrosis is an important feature for determining prognosis and guiding treatment in patients with AP [20].

In early pancreatitis, gland is enlarged with homogenous enhancement and surrounding fat stranding [21] [Table/Fig-8]. Local oedema is a common finding and may extend along the mesentery, mesocolon, and hepatoduodenal ligament and into peritoneal spaces. Oedema and fluid collections are differentiated from each other by presence of normal fat tissue within the edematous fluid [22].

Another study reported an abnormal ultrasound findings are seen in 33-90% of patients with AP. Edematous pancreatitis was depicted on ultrasound as an enlarged hypoechoic gland. Thus, the main role of ultrasound in the imaging of AP is limited to the detection of etiology (cholelithiasis and choledocholithiasis) and identification of fluid collections. CT helps in early diagnosis of acute pancreatitis by showing inflammatory changes. It also says that early imaging plays important role in overall detection rate of 90% with 100% sensitivity [23].

The accuracy and sensitivity of serum amylase in diagnosing AP is 45%. The accuracy and sensitivity of serum lipase in diagnosing AP is 65%. The samples were taken at the time of CECT and follow-up serum amylase/lipase levels were not included in these study. When compared with CT findings of these patients, it showed 100% accuracy and sensitivity which helps in early diagnosis and predicting the severity of AP. Bollen TL et al., says that early overall detection rate of 90% with 100% sensitivity [23].

In the early phase of acute necrotising pancreatitis, pancreatic necrosis appears as an area of decreased or absent enhancement of the pancreatic parenchyma on contrast-enhanced CT. The area of pancreatic and/ or peripancreatic necrosis undergoes progressive liquefaction with development of a pancreatic and/or peripancreatic fluid collection [23]. In situation were dilemma exists to differentiate between peripancreatic fluid collections from extrapancreatic fat tissue necrosis, it's better to consider as heterogeneous pancreatic collections. Necrosis develops between 24 and 48 hours after the onset of acute pancreatitis [24] [Table/Fig-9].

When the fluid collection becomes organized and walled-off, it is called organized pancreatic necrosis or possibly a better term is Walled-Off Pancreatic Necrosis (WOPN) [Table/Fig-10]. Well-circumscribed peripancreatic/ intraparenchymal fluid collection with a fibrous wall occurring greater than 4 weeks after diagnosis of acute pancreatitis is termed pseudocyst [24].

The Grades are classified into 2, 4, 6, 8 and 10 according to the MCTSI. We further classified the Grades into mild (Grade 2 and 4), moderate (Grade 6) and severe (Grade 8 and 10). The previous studies by Bollen TL et al., 47 and Mortele KJ et al., 46 have classified Grade 2 as mild, Grade 4 and 6 as moderate and Grade 8 and 10 as severe [20,23].

These observations was similar to that of a study conducted by Ju S et al., on 602 patients of acute pancreatitis which showed no correlation between age, gender with severity of acute pancreatitis [21]. The study also showed the maximum incidence of acute pancreatitis in age group 31 to 40 years similar to our study.

Extrapancreatic complications such as ascites, bilateral pleural effusion, splenic vein thrombosis [Table/Fig-11], portal vein thrombosis and pseudoaneurysm develops in vessels near the pancreas [25,26]. According to Bollen TL et al. The MCTSI accurately correlated with extrapancreatic complication and the need for intervention compared with clinical score indices (APACHE II) [23]. CT is the modality of choice for detecting the local complications.

LIMITATION

The limitations of the study were non-randomized study, samples were taken soon after the patient developed symptoms and follow-up serum amylase/lipase levels were not included in this study and late complication were not evaluated due to early CECT.

Recommendations

i. We would propose that CECT can be used in early stages of AP and be supplemented by MCTSI to evaluate development of complications to further manage the patients.

ii. As patients with moderate and severe Grade of AP have a higher possibility of local complications a follow up study with ultrasound / CT may be considered in these patients.

iii. The grading of AP can be classified as mild (Grade 2 and Grade 4), moderate (Grade 6) and severe (Grade 8 and 10) contrary to other previous studies which classified it into mild (Grade 2), moderate (Grade 4 and Grade 6) and severe (Grade 8 and 10).

CONCLUSION

CECT helps in differentiating between oedematous and necrotising pancreatitis. Serum lipase and amylase levels do not help to differentiate the type of AP. Modified CT severity index can be used to predict the possibility of developing local and systemic complications and necessity of tertiary care. MCTSI grading correlates directly with the development of local and systemic complications. Modified CT severity index can predict the need for interventions.

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