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Original Research Article

Multidetector CT evaluation of acute pancreatitis and its complications and its correlation with clinical outcome

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Abstract

Aim: To study the role of multi-detector CT in the evaluation of acute pancreatitis and its complications by grading the severity of the disease using Modified CT scoring (MCTSI) and to correlate the CT findings with final outcome of the patient.

Introduction: Acute pancreatitis is a complex potentially severe inflammatory disease involving pancreas with an unpredictable evolution. CECT is able to depict and quantify pancreatic parenchymal injury and its complications. Modified CTSI on a scale of 1 - 10 is calculated with key criteria of the presence and extent of pancreatic necrosis and extra pancreatic complications. The patients are classified as having mild (0 – 2), moderate (4 – 6) and severe (8 to 10) pancreatitis. CT findings correlate well with the severity of the changes in pancreas and clinical outcome in terms of hospital stay, complications, need for surgery and overall morbidity and mortality.

Observations: In study of 90 patients, causes of pancreatitis could be established in 60 patients (66%). The causative factor was alcohol abuse in 42 patients and biliary calculus disease in 18 patients. According to Balthazar grading, most patients were in grade E (57 patients) and grade D (21 patients). 42 patients (73%) out of 57 of grade E and 6 of 21 patients of Grade D showed evidence of necrosis. No necrosis was seen in Grade C (9) and Grade B (3) patients. Out of 42 grade E patients with necrosis, 18 patients showed <30% and 24 patients showed >30% necrosis. Out of 6 grade D patients with necrosis, 3 patients showed <30% and 3 patients showed >30% necrosis. Out of 90 patients, MCTSI was 0 - 3 in 27, 4 - 6 in 36 patients and 8-10 in 27 patients. Out of total 90 patients, in 48 patients (53%) the recovery was uneventful, while 42 patients developed complications. The hospital stay was longest in patients with Grade E and shortest of Grade B.

Results: Our study showed the initial CT examination had 100% sensitivity and 100% specificity for diagnosing acute pancreatitis and its complications. Patients with a CTSI of 0 to 3 exhibited 11% of morbidity and no mortality, those with CTSI of 4 to 6 exhibited 42% morbidity and 8% mortality and those with CTSI of 7- 10 exhibited 89% morbidity and 44% mortality. Increased average no. of days of hospitalization was seen with more severe grades of acute pancreatitis.

Introduction

Pancreatitis is a non bacterial inflammation of pancreatic gland caused by activation and digestion of gland by its own enzymes. It varies from a mild uneventful disease to a severe life threatening illness with multisystem organ failure, hypotension with shock, renal failure, respiratory failure and death. Modalities for imaging the pancreas range from plain x-ray to contrast studies, ultrasonography, endoscopic ultrasound, endoscopic retrograde cholangio-pancreaticography, computed tomography and magnetic resonance imaging, USG and CT being most commonly used. In a study published in 1985, severity of pancreatitis was graded into five distinct groups, from A to E and CT grading was found to be correlating well with clinical follow up findings, morbidity and mortality. In our study, MDCTI was calculated as follows:-

Table No 1. Modified CT Severity Index criteria

Prognostic Indicator / Finding on CT scan	Points
Pancreatic inflammation	
Normal pancreas	0
Intrinsic pancreatic abnormalities with or without inflammatory changes in peripancreatic fat	2
Pancreatic or peripancreatic fluid collection or peripancreatic fat necrosis Pancreatic necrosis	4
None	0
30%	2
> 30%	4
Extrapancreatic complications (one or more of pleural effusion, ascites, vascular complications, parenchymal complications, or gastrointestinal tract involvement)	2

CECT is able to depict and quantify pancreatic parenchymal injury and is an indispensable integral part of new classification. The modified CTSI is a 10 point scoring system, assessing the degree of pancreatic and peripancreatic inflammation, the presence and degree of pancreatic necrosis and presence and number of peripancreatic fluid collections.

The complications arising as a sequelae of acute pancreatitis are acute fluid collections, pseudocyst formation, pancreatic abscess and vascular complications.

Aims and Objectives

To study the diagnostic role of multidetector CT in the evaluation of acute pancreatitis and its complications by CT scoring viz.

- To grade the severity of the disease using CT.
- To correlate the CT findings with final outcome of the patient.

Materials and Methods

The present study was conducted on 90 patients with clinical diagnosis of acute pancreatitis referred from various departments of GMC Amritsar. Complete clinical examination, haematological and biochemical analysis was done. CT scan was done in all patients and based on CT findings; the pancreatic inflammation was divided into five grades (Balthazar et al. 1994)

A – Normal pancreas

B – Focal / diffuse enlargement of pancreas, it includes

1)   Contour irregularity
2)   Non-homogenous attenuation of gland
3)   Dilatation of pancreatic duct
4)   Foci of small fluid collection within the gland

C – Intrinsic pancreatic abnormalities associated with haziness and streaky densities representing inflammatory changes in peripancreatic fat.

D – Pancreatic abnormalities with single ill-defined fluid collection.

E – Two or more fluid collections or gas in or adjacent to pancreas.

Modified CTSI was calculated by combining the peri-pancreatic inflammation and degree of necrosis. For calculation of CTSI, on a scale of 1 – 10, patients were assigned points as A = 0, B = 1, C = 2, D = 3, E = 4. To this 2 or 4 points were added if CT showed less than 30%, and more than 30% necrosis respectively. Extra-pancreatic complications were given 2 points.

On the basis of Modified CTSI patients were divided into three categories:

Mild (0-3),
Moderate (4-6) and
Severe (8-10) pancreatitis.

The findings of CT examination were correlated with clinical observations as uneventful recovery or patients who developed various complications and were followed for outcome of conservative treatment or operative findings.

Observations

The present study was carried out on 90 patients who presented with strong clinical and biochemical suspicion of acute pancreatitis. All these patients underwent CECT scan of abdomen. Causes of pancreatitis could be established in 60 patients (66%). The causative factor was alcohol abuse in 42 patients and biliary calculus disease in 18 patients.

Table No. 2: Distribution of Patients According to the Balthazar Grade

Grade	Patients	% age
A	0	0
B	3	3.3%
C	9	10 %
D	21	23.3 %
E	57	63.4%
Total	90	100 %

Depending upon the morphological / inflammatory changes in pancreatic, peripancreatic and extra-pancreatic regions on CT scan, the patients were categorized according to Balthazar's grading system into five grades i.e. A, B, C, D and E.

Table No.3: Correlation of CT Grade (Balthazar) and Necrosis

Grade	Patients	No. of Patients with Necrosis	% age
A	0	_	_
B	3	_	_
C	9	_	_
D	21	6	28 %
E	57	42	73%
Total	90	48	53 %

There were 57 patients of grade E. Out of these 42 patients (73%) showed evidence of necrosis. Pancreatic necrosis was present in 6 of 21 patients of Grade D and no necrosis was seen in Grade C (9) and Grade B (3) patients.

Table No.4: Correlation of Modified CT Grade with degree of necrosis in 48 patients

Grade	No. of patients Necrosis	< 30%	>30 %
A	0		
B	0		
C	0		
D	6	3	3
E	42	18	24
Total	48	21 (44%)	27(56%)

The extent of pancreatic necrosis in 48 patients was as described in above table.

Table No. 5: Modified CT Severity Index

Number of patients	MCTSI score	% age
27	0 – 3	30
36	4 – 6	40
27	8 – 10	30
Total 90	0 – 10	100

In 27 patients Modified CTSI was 0 – 3 (mild), in 36 patients it was 4 – 6 (moderate) and in 27 patients it was 8 – 10 (severe).

Out of total 90 patients, in 48 patients (53%) had uneventful recovery, while 42 patients developed complications.

We observed that 3 patient out of 21 patients of grade D expired showing 14% mortality. However 12 patients (21%) out of 57 patients of grade E showed mortality. Overall out of 90 patients included in this study pancreatitis proved to be fatal in 15 patients (17%).

It was observed that, the hospital stay was longest in patients with Grade E and the average number of days for the patients of Grade E was 33 days. The hospital stay was shortest of Grade B i.e. 8 days. Average stay for the patients of Grade D was 28 days and that of Grade C was 11days.

Out of 42 patients with complications 27 patients were operated and 15 were not operated. Out of these 15 patients 12 patients had multiple organ failure and 3 patient with pseudocyst recovered conservatively.

All 15 patients of pancreatic abscess were operated and all of them recovered. In 6 patients with infected pancreatic necrosis necrosectomy was done, 3 of the patients expired and the other 3 recovered.

All of 12 patients with Multi-organ failure expired. The sensitivity and specificity of CT severity index in predicting the multi-organ dysfunction are 95 % & 89.5% respectively (Kumar et al 2017).

Out of 42 patients with necrosis 36 patients had morbidity in the form of long hospital stay, development of complications in the form of pancreatic abscess, pseudocyst, infected pancreatic necrosis and multiple organ failure.

Table No 6: Correlation of Modified CT Severity Index with Morbidity

| MCTSI	Patients	Uneventful recovery	Complications / morbidity	% age of morbidity
0 - 3	27	24	3	11
4 - 6	36	21	15	42
8 -10	27	3	24	89
Total	90	48	42	47

The above table shows the correlation of MCTSI with morbidity in patients.

Table No. 7: Correlation of Modified CTSI with Mortality

| MCTSI	Patients	Mortality	% age of mortality
0 – 3	27	0	0
4 – 6	36	3	8
8 -10	27	12	44
Total	90	15	17

The above table shows the correlation of MCTSI with mortality in patients.

Case No. 1
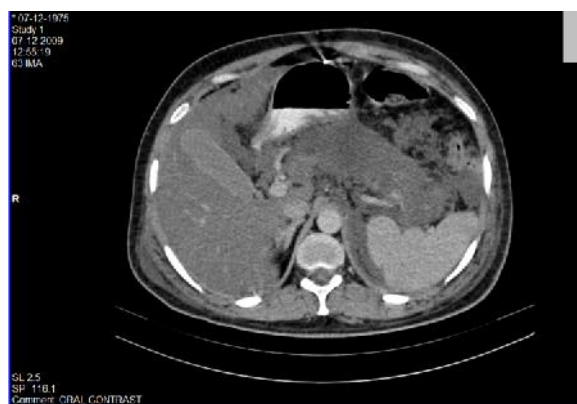
Axial CECT reveals diffusely enlarged pancreas with irregular border in the tail region. There is no enhancement of pancreas representing necrosis. Peripancreatic fat stranding and fluid is present.
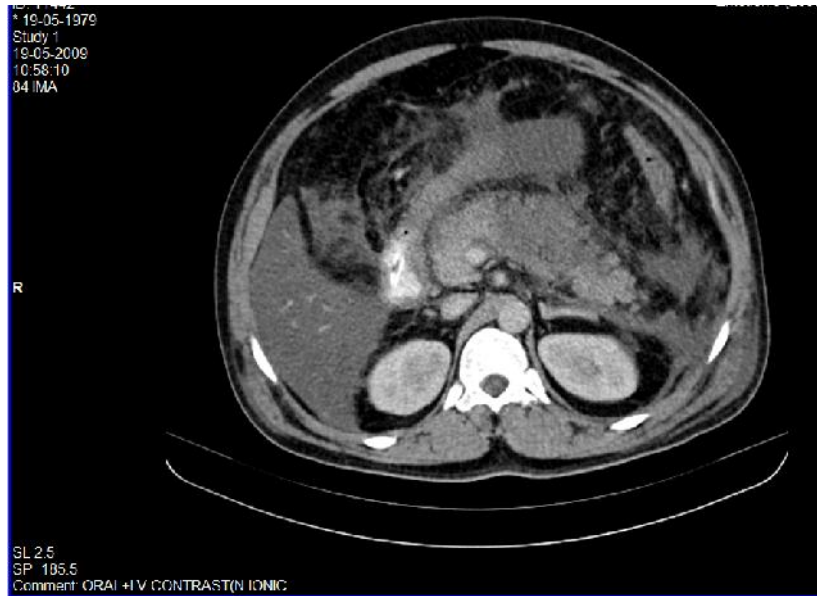
Case No 2
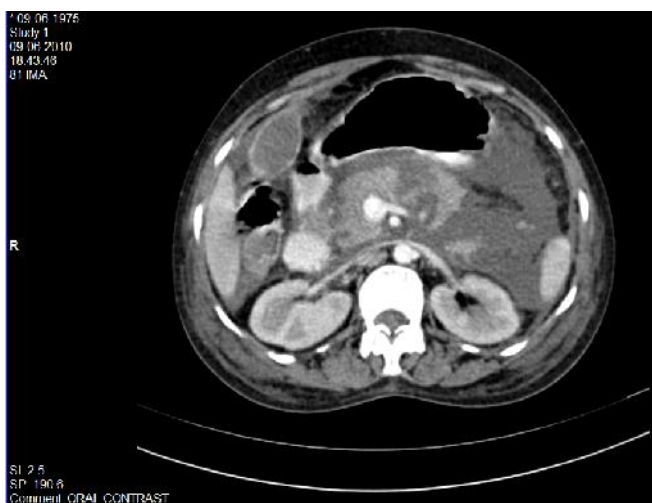
Axial CECT reveals diffusely enlarged pancreas with non-enhancing area in the body and tail region. Fluid is seen in the lesser sac bilateral anterior pararenal spaces. Thickening of bilateral Gerota's fascia and left lateroconal fascia is seen

Case No.3

Axial CECT reveals pancreas with irregular margins, enlarged in size with a focal non enhancing area representing necrosis.

Discussion

The study was carried out on 90 patients with strong clinical and biochemical suspicion of acute pancreatitis. 70% of patients in our study were males. This can be explained by prevalence of alcohol among males in our series. This is in comparison to study by Balthazar et al (1985) in which there were 75% male patients.

The present study included patients between the age of 24 to 70 years. 60% patients were between the age group of 21 to 40 years. The higher incidence of acute pancreatitis in younger age group could be attributed to the high incidence of alcoholism in the younger age group. This is in comparison to study by Balthazar et al (1985) in which the average age was 45 years.

Depending on pancreatic and peripancreatic inflammation on CT scan patients were categorized into 5 Grades, A to E (Balthazar's grades). In this study there are 3.3% patients in grade B, 10% patients in grade C, 23.3% patients in grade D, 63.4% patients in grade E and there are no patients in grade A in our study. Study by Balthazar et al (1985) showed that there were 14.5% patients in grade A, 19% in grade B,

20.5% in grade C, 14.5%in grade D and 27.7% in grade E.

The presence of higher no. of patients (63.4%) of grade E in our study can be explained by the fact that our hospital being a tertiary hospital, patients having severe pancreatitis were referred to us. Kivisaari et al (1984) reported that pancreatic necrosis was found at surgery in all patients who showed lack of enhancement on CECT. In our study on the basis of non-enhanced area on CECT the diagnosis of pancreatic necrosis was made in 48 patients (53%). Balthazar et al (1990) reported 23% incidence of pancreatic necrosis whereas Bradley et al (1999) reported that nearly 20% of patients with acute pancreatitis developed pancreatic necrosis.

Bradley (1982) reported that likelihood of occurrence of pancreatic necrosis increases with the clinical severity of the pancreatitis. Balthazar et al (1990) reported that higher the grade of pancreatic and peripancreatic inflammation, more was the extent of pancreatic necrosis. In this study out of total 48 patients with pancreatic necrosis, 42 patients were in grade E and 6 patients were in grade D. No pancreatic necrosis was seen in patients with grade A, B and C.

27 patients out of 48 patients with pancreatic necrosis had more than 30% necrosis and 24 these patients were in grade E, while 3 patients were in grade D and in 21 patients necrosis was less than 30%.

In 27 patients pancreatitis was mild (Modified CTSI 0-3), in 36 patients it was moderate (Modified CTSI 4-6) and the remaining 27 patients had severe pancreatitis (Modified CTSI 8 -10).

In our study out of total 90 patients, 48 patients (53%) had an uneventful recovery while 42 patients (47%) developed complications in the form of long hospital stay, pancreatic abscess, infected pancreatic necrosis, formation of pseudocysts and multiple organ failure. Patients with grade A, B and C exhibited uneventful recovery, while 6 out of 21 patients with grade D developed complications and 3 of them expired. All remaining deaths and complications occurred in patients with grade E. In 15 patients (17%) the pancreatitis proved to be fatal.

In this study we noted a steady trend towards an increased average no. of days of hospitalization with more severe grades of acute pancreatitis. Patients with grades A and B pancreatitis were discharged on an average of less than 2 weeks time, while the average stay of hospitalization of patients of grade D and E pancreatitis were 28 and 33 days respectively.

This is in comparison to the study by Balthazar et al (1985, 1990) in which average stay of hospitalization was less than two weeks in patients with grades A and B and 30 and 52 days for the patients of grades D and E respectively.

The diagnosis of infected pancreatic necrosis was made in 6 patients. All patients underwent necrosectomy. Three of the operated patients died while the other three recovered. The mortality associated with infective complications of necrotizing pancreatitis is 100% without intervention. Therefore in most centers, the commonest indication for surgery is the documentation of infected necrosis Beger et al (1996).

Pancreatic abscesses developed in 15 (17%) of our 90 patients. Mendez et al (1980) reported 11 cases of pancreatic abscesses in a retrospective study of 102 patients. Balthazar et al (1985) reported 21.6% cases of pancreatic abscesses. All the 15 patients in our study were operated and all recovered. In our study 9 patients (10%) developed pseudocysts. Out of 9

patients, 6 were treated by cystogastrostomy and all recovered. In 3 patients pseudocyst resolved spontaneously with conservative treatment. Almost similar incidence of pseudocyst formation was reported by Mendez et al (1980) they reported incidence of 8% (8 cases) of pseudocysts in their retrospective study of 102 patients of acute pancreatitis. However Balthazar et al (1990) observed slight low incidence of pseudocyst formation i.e. approximately 4% in their study of 88 patients of acute pancreatitis.

Patients with a Modified CTSI of 0 to 3 exhibited 11% of morbidity and no mortality. Those with a Modified CTSI of 4 to 6 exhibited 42% morbidity and 8% mortality. The incidence of morbidity and mortality was very high in patients with Modified CTSI of 7-10. They exhibited 89% morbidity and 44% mortality.

The higher incidence of morbidity and mortality in our patients can be explained that most of our patients were having severe pancreatitis and presented to us slightly late. (within one week of onset of symptoms)

From the above it is seen that there is significant and continuous increase in morbidity and mortality with increase in the Modified CTSI. Thus Modified CTSI is a good prognostic indicator in predicting the final outcome in acute pancreatitis.

Summary

The present prospective study was conducted to assess the role of multi-detector CT in evaluation of acute pancreatitis and its complications and its correlation with clinical outcome.

The study included 90 patients who presented with strong clinical and biochemical suspicion of acute pancreatitis. CT was positive for all patients included in the study. Thus initial CT examination had 100% sensitivity and 100% specificity for diagnosing acute pancreatitis in our study. On the basis of degree of inflammation on CT examination patients were categorized into five grades (Balthazar grading) ; A (score - 0), B (score -1), C (score-2), D (score -3), E (score -4). Depending upon the extent of pancreatic necrosis, patients were divided into two categories; less than 30% (score - 2), more than 30 (score 4) and 2 points were given for extrapancreatic complications.

Combining the inflammatory changes and extent of necrosis CT severity index was calculated. On a scale of 1 – 10, the patients were then classified as having mild (0 – 3) 27 patients, moderate (4 – 6) 36 patients and severe (8 to 10) 27 patients pancreatitis.

Recovery was uneventful in 48 patients while 42 patients developed complications. No complication was seen in patients with grade A, B and C pancreatitis. No vascular complication was seen in this study.

The length of hospitalization correlated well with the severity of pancreatitis on initial CT examination.

In our study 78 (86 %) patients had acute fluid collections in peritoneal recesses. Pleural effusion was seen in 54 (60%) out of 90 patients. Pleural effusion is the most common extra-pancreatic complication (56%) followed by ascites (Banday et al 2015). Pancreatic abscesses were seen in 15 patients, infected pancreatic necrosis in 6 patients and pseudocyst in 9 patients. 48 patients developed necrosis. Patients with necrosis had 75% morbidity and 31% mortality while patients without necrosis had only 14% morbidity and no mortality.

Patients with a Modified CTSI of 0 – 3 exhibited 11% morbidity and no mortality while patients with Modified CTSI of 4 – 6 exhibited 42% morbidity and 8% mortality. Patients with modified CTSI of 8 – 10 exhibited 89% morbidity and 44% mortality.

Conclusion

CT was found to be useful in grading of pancreatitis and CT findings correlated well with the severity of the changes of pancreas and clinical outcome of the patients in terms of hospital stay, incidence of complications, incidence for need for surgery and overall morbidity and mortality.

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Conflict of interest: None declared

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