Role of Computed Tomography in Predicting Severity of Acute Pancreatitis and its Correlation with Clinical Outcome

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ABSTRACT

Introduction: CECT is very accurate and sensitive investigation in evaluating the severity of acute pancreatitis and the associated complications.With the help of CT, we can manage the patient of acute pancreatitis by categorising them into mild, moderate and severe cases according to modified CT severity index and predict the clinical outcome as well. CT mainly detects the associated complication such as sterile or necrotic fluid collection, pseudocyst fomation, walled off necrosis, pleural effusion, liver cirrhosis mainly in chronic alcoholic patients vascular complications at early stage.

Aim: To study the role of computed tomography in predicting severity of acute pancreatitis and its correlation with clinical outcome.

Material and Methods: The Study was carried out at Department of Radio Diagnosis, Krishna Institute of Medical Science, Karad, Maharashtraamong 46 cases of acute pancreatitis.

Result: The mean age of participants in the present study was observed to be 35.95 years. Majority were males (39, 84.78%) and 7 were females (15.22%), with male: female ratio of 1:0.18. The majority of the cases (78.29%) were alcoholic while 10 cases were non alcoholic. Cases associated with Gall stones were21.73% 95.65% cases presented with abdominal pain. Based on Computed Tomography (CT) findings, we found 63% patients with acute interstitial edematous pancreatitis and 37% patients with acute necrotic pancreatitis among 46 cases. When we evaluated Modified CT Severity index among the study cases, we observed that 19.56% cases have mild index, majority (56.52% cases) have moderate index while 23.91% cases have severe index. We also found that majority of percentage of cases clinically cured and discharged i.e. 47.82 %. 19.56% of the total study subjects reported recurrence of episodes of pancreatitis, while 30.43% of the total patients turned into chronic pancreatitis.

Conclusion: Computed tomography can be used to know the extent of disease within pancreatic parenchyma and to diagnose associated complications, at early stage.It can assess severity of acute pancreatitis and forecast progress of pancreatitis.

Keywords: CT, AIEP, ANP, CTSI

severity index is used to detect extent of necrosis and various local and extra pancreatic complications.[4]

Computed tomography with contrast administration is done to evaluate the patients according to modified CT severity index. Scan is done generally after 72 hrs of onset of clinical symptoms.

In the present study, we assessed the severity of acute pancreatitis using computed tomography in correlation with clinical outcomes.

MATERIAL AND METHODS

It is Hospital analytical based study. The duration of study is18 month. It was done at Department of Radio Diagnosis, Krishna Institute of Medical Science, Karad,Maharashtra. All the cases of acute pancreatitis referred under department of radiology in a tertiary healthcare institute, and fulfils the set inclusion criteria, who consented to participate in the study were included in the present study. It was carried out among 46 indoor cases of acute pancreatitis referred under department of radiology for further diagnostic evaluation, in a tertiary healthcare teaching institute in Maharashtra during study period. Ethical Approval was taken from the college ethics committee.

Selection criteria
Inclusion criteria
All the patients diagnosed with acute pancreatitis with:
1. All the patients diagnosed with acute pancreatitis, clinically and with elevated serum amylase and lipase levels
2. Cases between 20-60 years of age

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INTRODUCTION

Acute pancreatitis (AP) is a complex clinical conductions with majority of patients approximately 20% becomes clinically severe with significant mortality.[1]

Clinically severe patients requires admission to intensive care unit (ICU), where closely monitoring and treatment with aggressive fluid resuscitation is done.[3] Modified CT

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Exclusion criteria

1. Cases with chronic calcifying pancreatitis
2. <20 years or > 60 years of age
3. Cases in whom contrast study is not possible due to renal causes

RESULTS

We found that majority of participants belonged to 31 – 40 years of age group (23 cases), followed by 12 cases in age group of 21-30 years, 7 cases in 41 – 50 years and 4 cases in

Personal History	Number of participants	Percentage
Alcoholism	36	78.26%
Non alcoholic	10	21.73%
Total	46	100%

Table-1: Distribution of participants according to their personal history

Presence of gall stones	Number of participants	Percentage
Present	10	21.73%
Absent	36	78.26%

Table-2: Distribution of participants according to presence of gall stones

Clinical features	Number of participants	Percentage
Pain in abdomen	44	95.65%
Guarding	32	69.56%
Tenderness	39	84.78%

Table-3: Distribution of participants according to their clinical presentation

Blood investigations	Parameter	Number of participants	Percentage
Hemoglobin	<10	13	28.26%
	>10	33	71.73%
Total leucocyte counts	< 12000	35	76.08%
	>12000	11	23.91%

Table-4: Blood investigations observations

Diagnosis on CT	Number of participants	Percentage
AIEP	29	63.04%
ANP	17	36.95%
Total	46	100%

Table-5: Diagnosis of acute pancreatitis based on CT findings

CT Findings of AIEP		Number of participants	Percentage
Bulky pancreas		20	68.96%
Pseudocyst		11	37.93%
Peri-pancreatic fluid		9	13.04%
Pleural effusion	Right	0	0
	Left	4	13.79%
	Bilateral	3	10.34%
Vascular complications		0	0

Table-6: CT characteristics of AIEP

ANP CT findings		Number of participants	Percentage
Bulky pancreas		6	35.28%
Necrosis		11	64.7%
Atrophy		0	0
Wall-off Necrosis		4	25.52%
Necrotic fluid collections		12	70.58%
Pleural effusion	Right	0	0
	Left	1	5.88%
	Bilateral	3	17.64%
Ascites		4	23.53%
Vascular complications		1	5.88%

Table-7: CT characteristics of Acute necrotic pancreatitis

Acute pancreatitis type	Duration	Fluid collection type	Number of cases	%
AIEP	< 4 weeks	Hypodence fluid collection	9	45%
	> 4 weeks	Pseudocyst	11	55%
ANP	< 4 weeks	Necrotic fluid collection	11	64.70%
	> 4 weeks	Walled off necrosis	6	35.29%

Table-8: Collection of fluid around pancreas

Percentage of necrosis	Score	Number of cases	Percentage
None	0	0	0
<30%	2	9	52.94%
>30%	4	8	47.05%
Total		17	100%

Table-9: Distribution of Pancreatic Necrosis

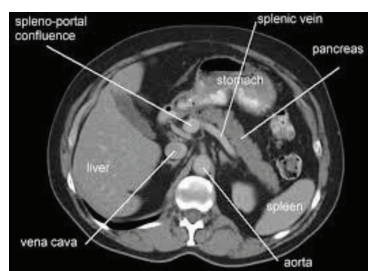| Class	Score	Number of cases	Percentage
Mild	0-2	9	19.56%
Moderate	4-6	26	56.52%
Severe	8-10	11	23.91%
Total		46	100%

Table-10: Classification of cases according to Modified CT Severity index

Clinical outcome	Number of cases	Percentage
Clinically well	22	47.82%
Recurrence	9	19.56%
Chronic	14	30.43%
Death	1	2.1%
Total	46	100%

Table-11: Clinical outcome of study participants

Organ Failure	Number of patients	Percentage
Hepatic	4	8.69%
Respiratory	1	2.17%

Table-12: Distribution of study subjects according to presence of organ failure

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Illustration-1: Axial Post contrast CT image showing pancreas, splenic vein, spleen and surrounding structure.
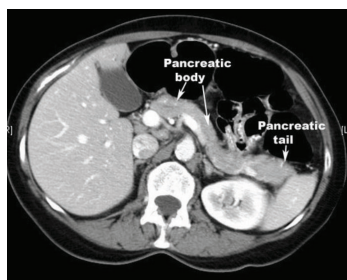
Illustration-2: Axial Post contrast CT image showing pancreas, splenic vein, spleen and surrounding structure.
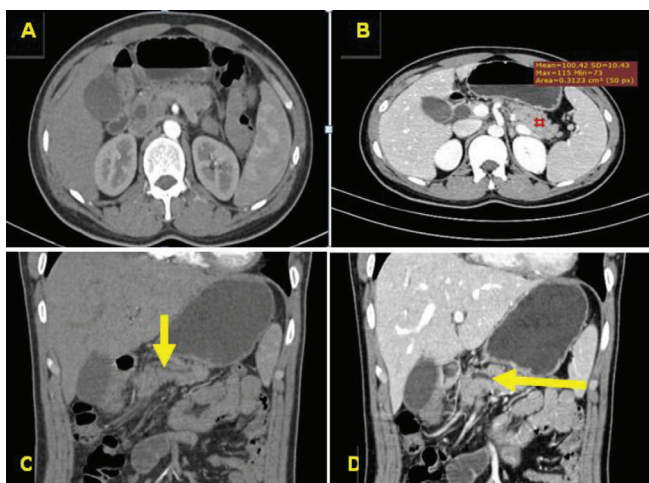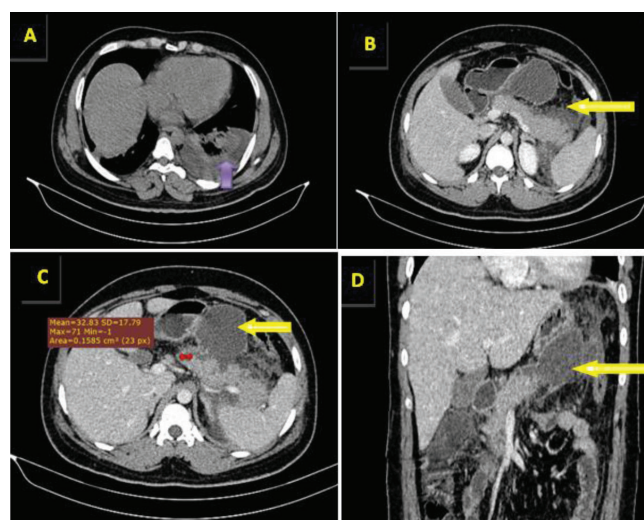

Illustration-3: 31 yrs old male patient diagnosed as acute interstitial edematous pancreatitis shows following imaging features.
A) On plain study, axial CT image shows bulky pancreas in head and tail region with no areas of calcification or surrounding fluid collection.B) On axial post contrast CT image, pancreatic parenchyma shows normal post contrast enhancement (100-120 HU).C) Sagittal section precontrast and D) Post contast CT image shows Pancreatic duct in the body part appears dilated, however no e/o calculi within the duct.

51-60 years of age group.

In the present study, Out of 46 study participants, Majority were males (39, 84.78%) and 7 were females (15.22%) Here we observed that male participants outnumbered the female participants.

When we compared their blood investigation reports (hemogram) of study participants, we found that 13 cases presented with hemoglobin less than 10 mg/dl (anemia), while 33 cases were having hemoglobin more than 10 mg/


Illustration-4: 20 yrs old male patient with complains of pain abdomen shows acute necrotising pancreatitis with walled off necrosis and left sided pleural effusion as seen in following images. (A)Axial CT Images shows hypodense fluid collection in the left pleural cavity suggestive of pleural effusion (B) Axial post contrast CT Image shows non enhancing fluid collection seen around the tail region of pancreas (C) Axial post contrast CT Images shows non enhancing hypodense areas areas seen involving the body and neck region of pancreas suggestive of areas of necrosis. (D) Sagittal post contrast CT Images shows loculated necrotic fluid collection with thin wall mainly around the body and tail region suggestive of wall of necrosis.
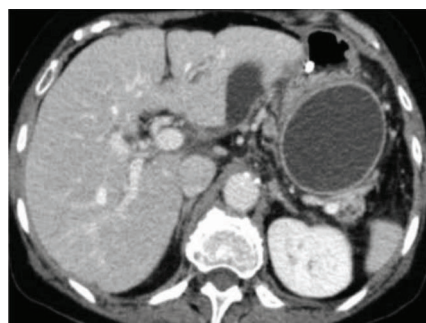
Illustration-5: 44 yrs old female patient showing features of acute interstitial pancreatitis with pseudocyst formation in following images.
Axial post contrast CT image in pancreatic phase show loculated hypodense collection in the tail region of the pancreas with thin enhancing wall suggestive of pseudocyst formation.
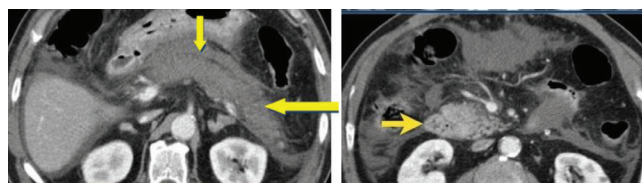

Illustration-6: 30 yrs old female patient diagnosed as acute necrotising pancreatitis shows following imaging features.
A) Axial Post contast CT image shows no enhancement in body and tail region of pancreas suggestive of necrosis. B) Axial Post contast CT image in pancreatic phase images shows normal post contrast enhancement in the head region.

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Illustration-7: Axial post contrast image of 37 yrs old male in pancreatic phase shows an heterogenous attenuation of pancreas with necrotic fluid collection surrounding it suggestive of acute necrotising pancreatitis with necrotising fluid collection.
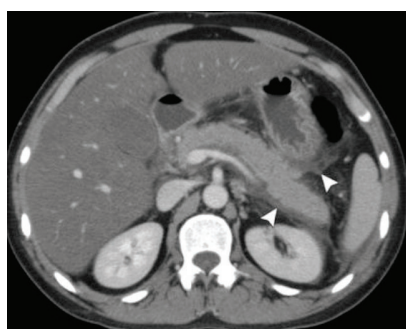
Illustration-8: Axial post contrast study in acute necrotising pancreatitis patient shows loculated necrotic fluid collection around the tail region and non enhancing filling defect in the splenic vein suggestive of splenic vein thrombosis. The portal vein is seen well opacified with contrast with no evidence of filling defect.

dl. In 11 cases presented with AP, raised TLC was observed (more than 12000), same cases were presented with fever. Rest of the cases were having TLC less than 12000. Serum lipase and serum amylase levels were found to be elevated in all of cases, which is considered to be suggestive of pancreatitis (Table 1-5).

All the study cases were having raised serum lipase and serum amylase levels, as all were the diagnosed cases of acute pancreatitis, as per our inclusion criteria.

We also observed 7 cases of pleural effusion associated with cases of AIEP. Out of them, 4 cases belonged to Left Pleural effusion and 3 cases belonged to Bilateral Pleural effusion. No patients were having Right Pleural effusion, Ascites and Vascular complications. Respective percentages of patients for each category are also given according to CT characteristics (table-6).

As we assessed the diagnosis of the study subjects, of acute pancreatitis based on Computed Tomography (CT) findings, we found 29 patients with AIEP and 17 patients with ANP among 46 cases. Table 7 shows their respective percentages for number of patients.

Table 8 shows results of CT characteristics of AIEP. We observed bulky pancreas among 20 cases, 11 cases of Pseudocyst, 9 cases of Peri-pancreatic fluid were observed.

Table 7 shows results of CT characteristics of Acute necrotic pancreatitis. We found Bulky pancreas among 6 cases, 11 cases of pancreatic Necrosis, 4 cases of walled off necrosis, 12 cases of Peri-pancreatic fluid.

In ANP, we observed total 4 cases of pleural effusion, out of them 1 case of Left Pleural effusion, 3 cases of Bilateral Pleural effusion. 4 cases reported with ascites in the present study.

We also reported 1 case of Vascular complications among acute necrotic pancreatitis case, with necrotic effusion.

No patients reported pancreatic Calcification, Atrophy, Right Pleural effusion and Ascites. Respective percentages of patients for each category are also given according to CT characteristics.

Table 8 shows Collection of fluid around pancreas for AIEP and ANP types of Acute pancreatitis each for the durations < 4 weeks and > 4 weeks. Hypodence fluid collection is found in 9 cases while Pseudocyst collection is found in 11 cases in AIEP. Necrotic fluid collection is found in 6 cases while Walled off necrosis was found in 11 cases. Table also shows the percentages of each fluid collection cases for total 46 cases.

Among total 17 cases of Acute Necrotic Pancreatitis. Table 9 shows distribution of these cases according to the Percentage of necrosis along with the score. 9 cases were having <30% of necrosis, while 8 cases were having percentage >30% of necrosis.

Total 46 cases were classified according to CT Severity index as shown in table 10. The index ranges from 0 to 10. To make the severity of acute pancreatitis clear, we classified the cases into mild moderate and severe as shown in the table, and grouped under 3 classes as Mild with index 0-2, Moderate with index 4-6 and Severe with index 8-10. 9 cases have mild index, majority (26 cases) have moderate index while 11 cases have severe index.

In the present study, we found that majority of percentage of cases clinically cured and discharged i.e. 47.82 %. 19.56% of the total study subjects reported recurrence of episodes of pancreatitis, while 30.54% of the total patients turned into chronic pancreatitis. 1 case of acute necrotic pancreatitis with infected necrotic fluid died (table-11).

Diagnostic accuracy of ct severity index against clinical outcome

In the present study, we analyzed the diagnostic accuracy of CT severity index in predicting the outcome of acute pancreatitis, by comparing CTSI for cases of acute pancreatitis with their clinical outcomes (table-12).

We applied Spearman's rank correlation methods, to compare two ordinal parameters. In this statistical method, we ranked the observations and then calculated Spearman's correlation coefficient. After comparison we found that the differences in observations are statistically significant. ($r = 0.896$).

Correlation between	Correlation coefficient	Correlation
CTSI and clinical outcome	$r = 0.896$	Strong positive

DISCUSSION

The present study was carried out among 46 cases of acute pancreatitis admitted under department of general medicine in a KIMS hospital, Karad, with the aim to study the role

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of computed tomography in predicting severity of acute pancreatitis and its correlation with its clinical outcome. The participants fulfilling the inclusion criteria of acute pancreatitis were enrolled in the study after taking their due consents.

Demographic characteristics

We found that majority of participants belonged to 31 – 40 years of age group (23 cases), followed by 12 cases in age group of 21-30 years. The mean age of participants in the present study was observed to be 35.95 years.

Out of 46 study participants, Majority were males (39, 84.78%) and 7 were females (15.22%), with male:female ratio of 1:0.18. Like other studies, we observed that male participants outnumbered the female participants.

Mohd Altaf MIR et al[2], observed that the majority of their patients were in the age range of 41-60 years; the average age of male patients was 47.71 years and of female patients was 51.48 years. Females were predominant, with a male: female ratio of 1: 1.38. In the study of Sameer Raghuwanshi et al[28], consisted of 35 male and 15 female patients with a male: female sex ratio of 2:1. Irshad Ahmad Banday et al[19], in their study observed that the maximum patients were in the age group 40-50 years (42.0%). The mean age was 42.32 years. 66% were male and 34% were females with a male to female ratio of 2:1

Parameters	Present study	Reference study
Mean age	35.95 ± 9.18 years	Chenyang Chen, et al[24]:47.5±14.3 years Irshad Ahmad Banday et al[19]: 42.32 years
Male:Female ratio	1:0.18	Mohd Altaf MIR et al[2]: 1: 1.38
Aetiology	Alcohol: 78.26% Gall stones: 21.73%	Sameer Raghuwanshi et al[38]: cholelithiasis (42%) alcoholism (38%)

Aetiology of acute pancreatitis

Out of all the possible aetiologies of acute pancreatitis, we observed that majority of the cases (78.26%) were alcoholic, while 10 Cases (21.73%) presented with Gall stones.

Sameer Raghuwanshi et al[38], most common aetiological factors were cholelithiasis (42%) and alcoholism (38%) followed by idiopathic (24%), trauma (2%) and drug induced (2%). According to Steinberg et al[39], biliary calculi and alcohol together constituted about 80-90% of causes of acute pancreatitis. Irshad Ahmad Banday et al[19], Alcoholic pancreatitis was seen in 36% of cases. Together cholelithiasis and alcoholism accounted for 76% of cases. In males, alcohol was found to be most common aetiological agent accounting for 54.54% of cases. In females, cholelithiasis was found to be most common aetiological agent accounting for 70.58% of cases. Chenyang Chen, et al[24] in their study observed 208 patients of biliary tract stones (n=97), alcohol abuse (n=30), and idiopathic acute pancreatitis.

Clinical presentation

In the present study, Almost all patients (95.65%) with acute pancreatitis presented with abdominal pain (95.65%), whereas 69.56% cases presented with guarding and 84.78% with tenderness.

Irshad Ahmad Banday et al[19] epigastric pain was present in all the patients. Triad of epigastric pain, nausea and vomiting was present in 75% of patients. Jaundice was noted in only in 1 case. While Block et al[40], observed Triad of epigastric pain, nausea and vomiting was present in 75% of patients.

Laboratory parameters

In the present study, we found that 13 cases presented with hemoglobin less than 10 mg/dl (anemia), while 33 cases were having hemoglobin more than 10 mg/dl. In 11 cases presented with AP, raised TLC was observed (more than 12000), same cases were presented with fever. Rest of the cases were having TLC less than 12000.All the study cases were having raised serum lipase and serum amylase levels, as all were the diagnosed cases of acute pancreatitis, as per our inclusion criteria.

Computed tomography findings

We found 63% patients with acute interstitial edematous pancreatitis and 37% patients with acute necrotic pancreatitis among 46 cases. We observed bulky pancreas among 26 cases (56.52%), 11 cases (36.95%) of pancreatic Necrosis, 11 cases of Pseudocyst, 9 cases of Peri-pancreatic fluid were observed.

In the present study, Among total 17 cases of Acute Necrotic Pancreatitis. 9 cases (52.94%) were having <30% of necrosis with score 2, while 5 cases (47.05%) were having percentage ranging between 30-50% of necrosis with score 4 and only 3 cases were having >50% of necrosis with score 6.

In the study conducted by Biswanath Sahu et al,[4] they observed 25% cases presented with >30% necrosis, 23.33% cases presented with >30% pancreatic necrosis and 51.66% cases did not have necrosis.

Mohd Altaf MIR et al[2], The most common finding on CECT was that of peripancreatic fluid collection, noted in 308 (88%) patients, and infective necrosis, was seen in 14 (4%). The mean CTSI observed was 5.9. Mortality was found to be highest in 14 (16.67%) patients. Similar findings concluded in a study by Irshad Ahmad Banday et al[19] Infected necrosis occurred in 4 cases (8%) in this study Chishty IA et al[20], In 17 patients with mild pancreatitis, 5 had necrosis involving one-third of pancreas. In 13 patients with severe pancreatitis, 8 had necrosis involving more than half of the pancreas and 5 had necrosis involving half of the pancreas.

Complications

We observed 7 cases of pleural effusion associated with cases of acute interstitial edematous pancreatitis. Out of them, 4 cases belonged to Left Pleural effusion and 3 cases belonged to Bilateral Pleural effusion. No patients were having Right Pleural effusion, Ascites and Vascular complications. In acute necrotic pancreatitis, we observed total 4 cases of pleural effusion, out of them 1 case of Left Pleural effusion, 3 cases of Bilateral Pleural effusion and 4 cases of ascites. Mohd Altaf MIR et al[2] observed that the most common extrapulmonary complication was pleural effusion, in 42

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(12%) of the cases, which was also reported by Wongnai Anchalee et al. Beger et al,[30] noted pancreatic edema (71%) as the most common complication. Sameer Raghuwanshi et al[38], in their study, reported that the pleural effusion was the most common extra-pancreatic complication with left pleural effusion being the more common (46% of the cases with left pleural effusion). Among vascular complications, venous thrombosis was the most common in portal vein and 1 in splenic vein). Balthazar et al.[3], also found left pleural effusion to be the most common abnormality (43% of the cases) which is similar to the present study.

Modified CT Severity Index
Total 46 cases are classified according to modified CT Severity index. 19.56% cases have mild index, majority (56.52% cases) have moderate index while 23.91% cases have severe index. Table also gives the percentages for each class of index.

Balthazar et al[3], who noted morbidity of 0% in patients with CTSI of 0-1, 8% in patients with CTSI of 2-3, 35% in patients with CTSI of 4-6, and 92% in patients with CTSI of 7-10. Irshad Ahmad Banday et al[19]., in their study observed 18%, 38% patients as mild and moderate pancreatitis. Majority of the cases included in severe category according to CTSI (44%), followed by moderate (38%) followed by mild (18%).

Parameters	Present study	Reference study
Bulky pancreas	56.52%	Silverstein et al. [19]: 68%
Necrosis	36.95%	Silverstein et al. [19]:10.5% Irshad Ahmad Banday et al[19]: 8%

Clinical outcome
In present study, majority of cases was clinically cured and discharged i.e. 47.82 %. 19.56% of the total study subjects reported recurrence of episodes of pancreatitis, while 30.54% of the total patients turned into chronic pancreatitis. 1 case of acute necrotic pancreatitis with infected necrotic fluid died.

Chishty IA et al[20], observed that out of total 40 cases of acute pancreatitis, Thirty patients had complications, 8 had mild CTSI, 9 had moderate CTSI and 13 patients had severe CTSI. Irshad Ahmad Banday et al[19], reported that the pleural effusion was the most common extra-pancreatic complication, Among vascular complications, venous thrombosis was the most common (3 in portal vein and 1 in splenic vein). Two cases of pseudoaneurysm were found, both in splenic artery.

We observed that majority of the subjects had hospital stay between 8-14 days (50%), followed by hospital stay less than 7 days among 23.91% cases, 19.56% cases with stay of 15-21 days and 6.52% cases with stay of more than 22 days. We also observed that majority of the study subjects had hepatic failure (8.69%), followed by respiratory failure among 2.17% cases.

Diagnostic accuracy of CT Severity Index against clinical outcome
We applied Spearman's rank correlation methods, to compare two ordinal parameters. In this statistical method, we ranked the observations and then calculated Spearman's correlation coefficient. After comparison we found that the differences in observations were statistically significant. (R=-0.896) (p-value <0.005).

Mohd Altaf MIR et al[2], in their study found the Spearman rank correlation between CT Severity Index and Modified CT Severity Index was +0.815 with significance value of 0.01.

CONCLUSION
Computed tomography can be used to know the extent of disease within pancreatic parenchyma and to diagnose associated complications, at early stage.It can assess severity of acute pancreatitis and forecast progress of pancreatitis.

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