Print ISSN: 2321-6379
Online ISSN: 2321-595X
DOI: 10.17354/ijss/2018/138

Original Article

Modified Computed Tomography Severity Index in Acute Pancreatitis - Its Correlation with Patient Morbidity (A Study of 40 Cases)

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Abstract

Background: In the past two decades, several radiologic prognostic scoring systems have been developed. This study was aimed to study the correlation of modified computed tomography severity index (MCTSI) with patient's morbidity and comparison of the CTSI with the MCTSI and to evaluate necrosis as a predictor of patient morbidity.

Methods: The patients clinically suspected to have acute pancreatitis subjected to contrast-enhanced computed tomography (CECT) abdomen. The morphologic severity of pancreatitis was assessed using the CTSI, developed by Balthazar and the MCTSI. CTSI and MCTSI were compared in their ability to individually predict hospital stay, the development of local complications, systemic complications, a fatal outcome and their ability to pick up patients who eventually had severe disease. Necrosis on CECT was evaluated as a separate index in its usefulness in the prediction of severe course of the disease and mortality.

Results: Both the indices CTSI and MCTSI did not show an association with duration of hospital stay or the need of surgery or intervention in a patient. Both indices (CTSI and MCTSI) showed association with the development of local complications and organ failure. MCTSI showed better sensitivity than CTSI and shows good specificity, positive, and negative predictive values as a predictor of local complications and organ failure. Necrosis showed an association with patient morbidity (development of local complications) with high positive and negative predictive values (84.6% and 81.4%, respectively) and sensitivity of 68.7 % and specificity of 91.6%.

Conclusions: MCTSI is more accurate index to predict the development of local complications or organ failure. However, both are less accurate in their ability to predict the need for surgical intervention and longer hospital stay. Necrosis as an independent index is a useful marker for predicting the development of local complications.

Key words: Acute pancreatitis, Complications, Computed tomography severity index, Modified computed tomography severity index

INTRODUCTION

Acute pancreatitis is a common and typically mild, self-limiting disease with only minimal or transient systemic manifestations.[1] However, approximately 15–20% of patients develop clinically severe acute pancreatitis with local and systemic complications.[2] A number of clinical and laboratory prognostic scoring systems have been designed for the early identification of patients at greatest risk of developing clinically severe acute pancreatitis. Overall, these scoring systems have an accuracy varying between 70% and 80%.[3] Imaging by computed tomography (CT) or magnetic resonance imaging in the assessment of acute pancreatitis is useful not only for diagnosis but also for detecting local pancreatic complications and guiding interventional procedures.

In the past two decades, several radiologic prognostic scoring systems have been developed. Among them, the CT severity

Access this article online

www.ijss-sn.com

Month of Submission : 03-2018
Month of Peer Review : 04-2018
Month of Acceptance : 04-2018
Month of Publishing : 05-2018

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index (CTSI), designed by Balthazar *et al.*,[4] 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 extrapancreatic inflammation with the extent of pancreatic necrosis. In 2004, a modified CTSI (MCTSI) was designed to account for several potential limitations of the CTSI.[5] In contrast to the CTSI, the MCTSI incorporates extrapancreatic 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). The present study evaluates the accuracy of Modified CTSI (MCTSI) as a predictor of patient morbidity. This study was aimed to characterize appearance of pancreatitis and its complications on CT, to study correlation of MCTSI with patient's morbidity, to compare CTSI with the MCTSI, and study evaluation of necrosis as a predictor of patient morbidity.

METHODS

This was a prospective observational study was carried out on a total of 40 patients in our department. Ethical committee approval from the institution was obtained, and the criteria of selection of cases were as follows:

- The patients clinically suspected to have acute pancreatitis subjected to contrast-enhanced computed tomography (CECT) abdomen.

Relevant history of each patient was taken regarding alcohol abuse. All CT examinations were obtained using 16-slice multidetector CT scanner (GE, BRIGHT SPEED).

Tube voltage was 120 kVp and tube current was in the range of 150–300 mA. Each scan was obtained in a single breath hold from the domes of the diaphragm to pubic symphysis using a 1.5 mm collimation.

A written informed consent was taken from all patients, and they were given intravenous contrast typically 60–70 ml of non-ionic iodinated contrast material at 3–5 ml/s with a scan delay of 70 s for the acquisition of portal venous phase. All three phases (arterial, portal venous phase, and delayed phase) were taken.

Axial, coronal, and sagittal reformatted images were analyzed and imaging characteristics were recorded in all patients.

Image Analysis

Pancreatic findings

- Pancreatic enlargement (Figure 1 and 2)
- Presence and extent of areas lacking enhancement (Figure 8 and 9)

Peripancreatic findings

- Peripancreatic fat stranding (Figure 1).
- Presence and number of collections (Figures 2,4,6,7 and 13)

Extrapancreatic complications

Ascites (Figure 6, 10 &13)
Pleural effusion (Figure 10)
Pericardial effusion,
Vascular complications

- Hemorrhage (Figure 14)
- Venous thrombosis (Figure 15 &16)
- Arterial pseudoaneurysm formation

Gastrointestinal complications

- Adynamic ileus or mechanical obstruction
- Signs of ischemia
- Marked bowel-wall thickening (Figure 7 &18)
- Perforation
- Intramural fluid collection

Extrapancreatic parenchymal complications

- Infarction
- Hemorrhage
- Subcapsular fluid collection (Figure 17)

The morphologic severity of pancreatitis was assessed using the CTSI, developed by Balthazar *et al.*[4] and the MCTSI, developed by Mortele *et al.*[5]

CT Severity Index[4]

Prognostic indicator	Score
Pancreatic inflammation	
Grade A: Normal pancreas	0
Grade B: Focal or diffuse enlargement of the pancreas	1
Grade C: Intrinsic pancreatic abnormalities with inflammatory changes in peripancreatic fat	2
Grade D: Single, ill-defined fluid collection or phlegmon	3
Grade E: Two or more poorly defined collections or presence of gas in or adjacent to the pancreas	4
Pancreatic necrosis	
None	0
≤30%	2
<30–50%	4
≥50%	6

0–3 points: Mild pancreatitis, 4–6 points: Moderate pancreatitis, 7–10 points: Severe pancreatitis

Modified Computed Tomography Index[5]

Prognostic indicator	Points
Pancreatic inflammation	
Normal pancreas	0
Intrinsic pancreatic abnormalities with or without inflammatory changes in par pancreatic fat	2
Pancreatic or peripancreatic fluid collection or peripancreatic fat necrosis	4
Pancreatic necrosis	
None	0
<30%	2
≥30%	4

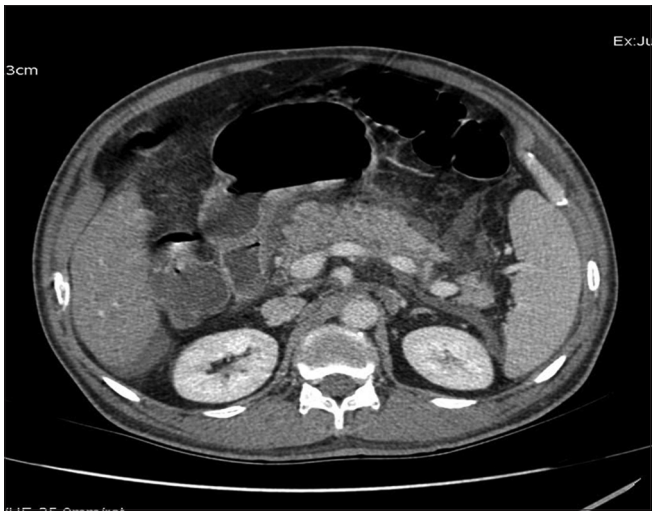


Figure 1: Bulky pancreas with peripancreatic fluid, fat stranding, and fluid in Morrison's pouch

Figure 2: Bulky pancreas with homogenous enhancement. There is peripancreatic fat stranding and a collection in lesser sac without a well-defined wall

Figure 3: Acute pancreatitis secondary to gallstones

Extrapancreatic complications (one or more of pleural effusion, ascitis, vascular complication, parenchymal calcification, or gastrointestinal tract involvement)	2

0–2 points: Mild disease, 4–6 points: Moderate pancreatitis, 8–10 points: Severe pancreatitis

Figure 4: Thickening of bilateral Gerota's fascia and lateroconal fascia with fluid collection in bilateral anterior pararenal space. There is mesenteric and retroperitoneal fat stranding

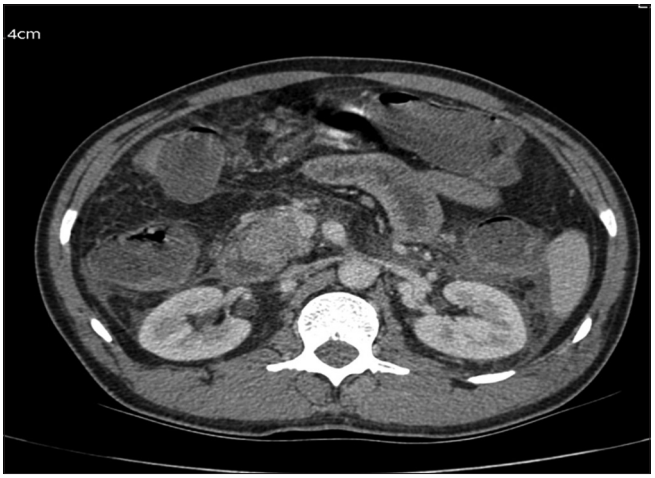


Figure 5: Mesenteric and retroperitoneal fat stranding

Figure 6: Right posterior pararenal space collection with fat stranding and ascites (arrow)

Analysis of Accuracy of CTSI and MCTSI as Prognostic Indicators and Comparison between the Two Indices

CTSI and MCTSI were calculated in the patients on the single scan. Patients with MCTSI score ≥8, and those with CTSI score ≥7 were graded as having severe pancreatitis.

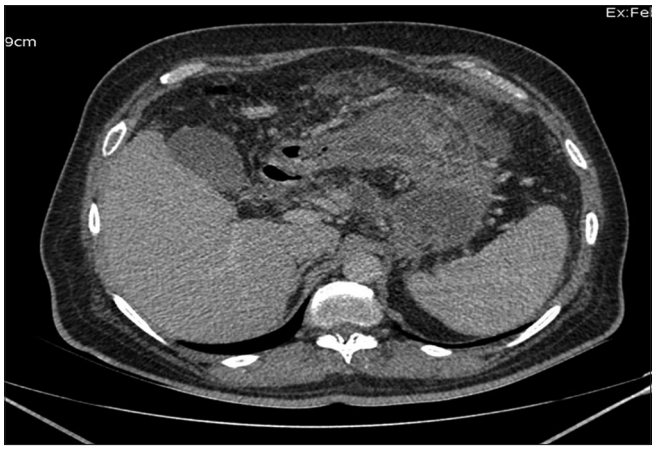


Figure 7: There is edematous symmetrical thickening of the wall of the stomach with ill-defined fluid collection in lesser sac

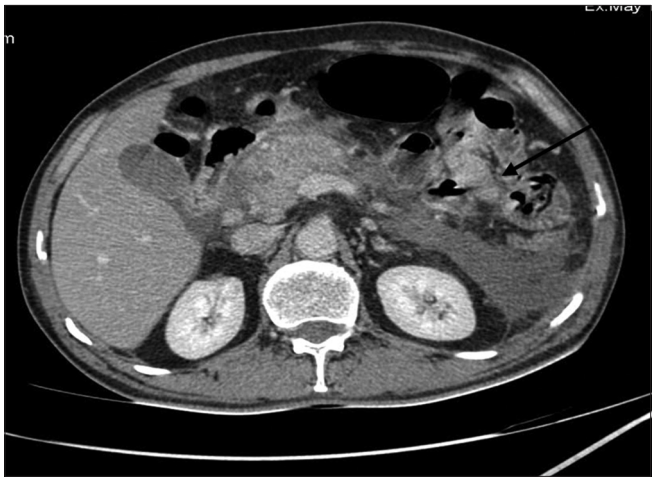


Figure 8: A nonenhancing area in the region of head of pancreas (arrow) suggesting <30% necrosis. There is peripancreatic fat stranding and a fluid collection in left anterior pararenal space

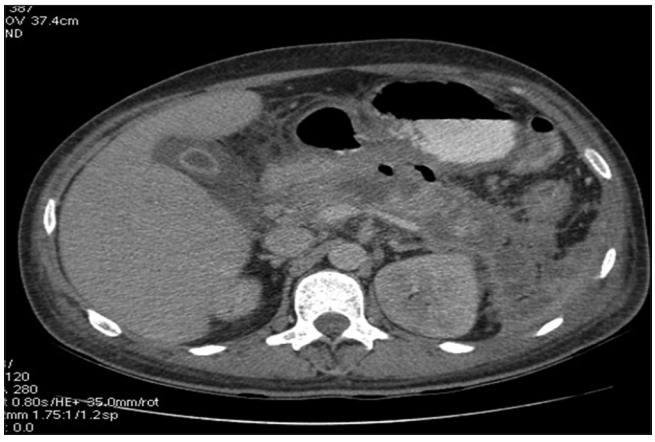


Figure 9: A case of necrotizing pancreatitis. There are nonenhancing areas in body and tail >30% necrosis with thickening of the posterior wall of body of stomach. Thickening of left Gerota's fascia and later oconal fascia with fluid collection in left anterior pararenal space

Figure 10: Bilateral pleural effusions and ascitis

Figure 11: There are two well-defined thin walled pseudocysts in the head and tail region of pancreas. Note the inflammatory thickening of the transverse colon

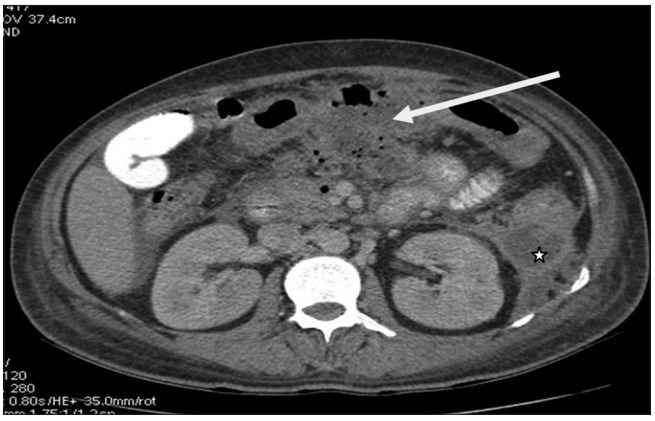


Figure 12: A fluid collection in the transverse mesocolon with ill-defined enhancing wall with air foci and surrounding fat stranding within suggesting infection (arrow). Another collection with enhancing wall is noted in the left paracolic gutter (asterisk)

Patients who developed any local and/or systemic complication (organ failure) were taken to have complicated pancreatitis.

Figure 13: Acute on chronic pancreatitis. Calcifications in pancreatic parenchyma with a pseudocyst in the region of uncinate process. There is also a peripancreatic fluid collection with ascitis

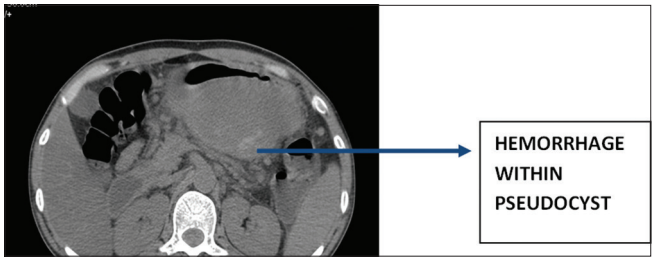


Figure 14: Non-enhanced computed tomography showing high attenuation areas within pseudocyst suggesting hemorrhage

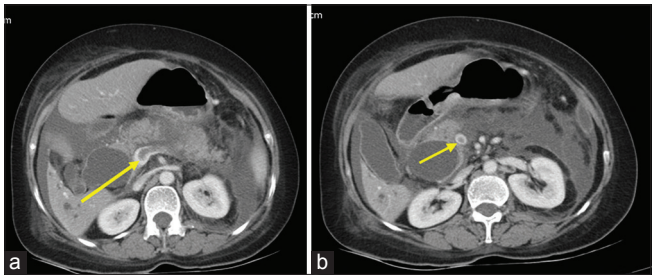


Figure 15: (a) A case of necrotizing pancreatitis with peripancreatic fluid and fat stranding and dilated common bile duct with gradual narrowing at its distal end. There is filling defect in the splenic vein, portal venous confluence (arrow in fig a), and superior mesenteric vein (shown by arrow in figure b below) suggesting thrombosis. (b) A case of necrotizing pancreatitis with filling defect in superior mesenteric vein (thick yellow arrow).

CTSI and MCTSI were compared in their ability to individually predict hospital stay, the development of local complications, systemic complications, a fatal outcome, and their ability to pick up patients who eventually had severe disease.

Outcome Parameters

For mortality

In hospital death.

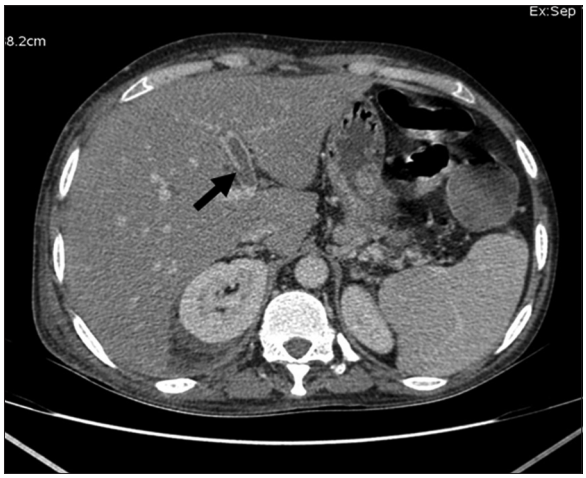


Figure 16: Multiple vascular channels noted at splenic hilum replacing splenic vein suggesting collaterals - a complication of splenic vein thrombosis following acute pancreatitis. There is filling defect in the left branch of the portal vein (yellow arrow) and right perinephric fat stranding

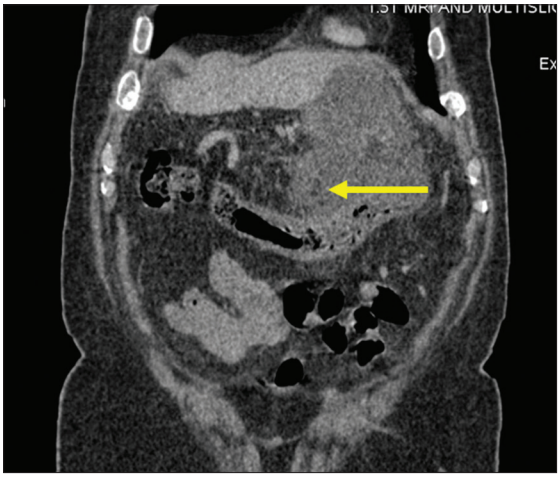


Figure 17: A subcapsular collection indenting the surface of liver suggesting a pseudocyst (shown by *asterisk)

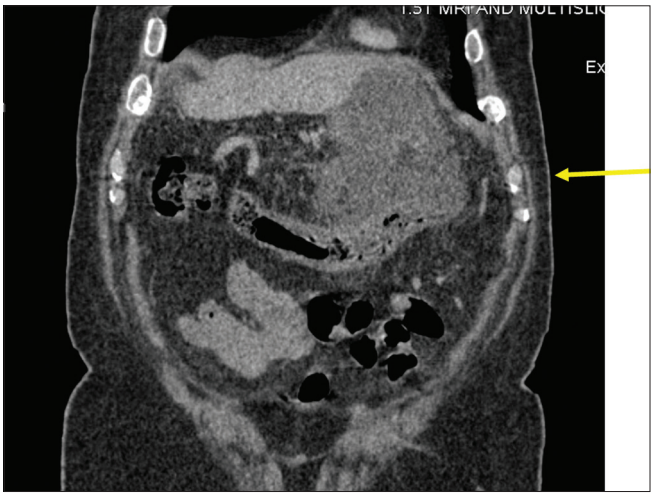


Figure 18: Inflammatory thickening involving mid and distal transverse colon with fluid collection and fat stranding in transverse mesocolon (yellow arrow)

For morbidity

- Length of the hospital stay (in days): A study by Mortele *et al.* 2004 had shown that the average duration of hospital stay in most patients predicted to have a severe clinical course was 12 days. However, these figures are arbitrary and do not define severity in the true sense. The cutoff 10 taken in the present study is arbitrary
- Development of local complications (pseudocyst, hemorrhage within pseudocyst, infected necrosis, ileus, hematemesis, splenic vein/portal vein/superior mesenteric vein thrombosis, pseudoaneurysm, and splenic infarct)
- Need for surgical intervention/percutaneous intervention (aspiration and drainage)
- Evidence of infection in any organ system (positive results on a Gram stain or culture or the combination of a fever >100°F, and an elevated white blood cell [WBC] >11,000/mm^3), and
- Evidence of organ failure patient records was retrospectively reviewed for the presence or absence of dysfunction in six separate organ systems as defined by Fagon *et al.*[7]

i. Respiratory failure was defined as a PaO_2 of <60 mm Hg or by the need for ventilatory support.
ii. Cardiovascular system failure was defined as a systolic blood pressure of <90 mm Hg in the absence of hypovolemia with signs of peripheral hypoperfusion or by the need for a continuous infusion of vasopressor or inotropic agents to maintain a systolic blood pressure of more than 90 mm Hg.
iii. Renal failure was defined as either a serum creatinine level >1.4 mg/dl or need for hemodialysis or peritoneal dialysis.
iv. Central nervous system failure was defined poor Glasgow coma scale score in the absence of sedation or by the sudden onset of confusion or psychosis.
v. Hepatic failure was defined as serum bilirubin levels >1.2 mg/dl or alkaline phosphatase levels >3 times the upper limit of the normal range.
vi. Hematologic system failure was defined as a hematocrit level of <20%, WBC of <2,000/mm^3, or platelet count of <40,000/mm^3.

Necrosis on CECT was evaluated as a separate index in its usefulness in the prediction of the severe course of the disease and mortality.

Data Analysis

Age- and sex-wise analysis of patients was done.

Mean hospital stay of patients with different severity (mild, moderate, severe as per the CTSI, and MCTSI) was calculated. Patients were divided into appropriate disease groups as having either mild, moderate, or severe acute pancreatitis.

Correlation between the severity of pancreatitis and the patient outcome measures was obtained with Fisher's exact test.

For correlation between the two indices (CTSI and MCTSI) as a predictor of patient morbidity parameters, McNemar's test was applied.

RESULTS

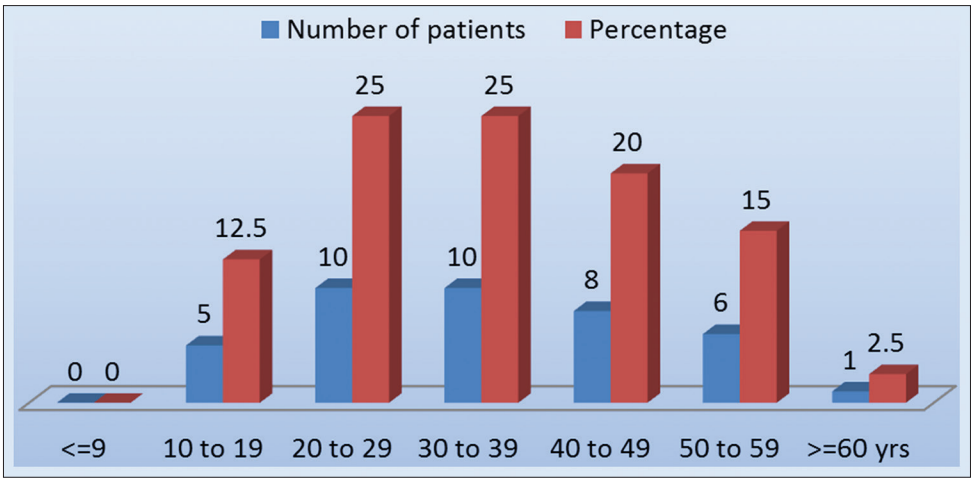
The study included patients from all age groups, youngest patient was aged 11 years, and the eldest was 71 years. The mean age was 35 years. The highest number of patients belonged to 20–29 and 30–39 age group. Thus, the maximum number of patients was in the range of 20–50 years [Graph 1]. Present study showed a male predominance (male:female ratio as 9:1) [Graph 2]. The most common etiology of acute pancreatitis was alcohol (75%) followed by the idiopathic cause [Graph 3]. The most common presenting symptom was an epigastric abdominal pain (100%) followed by distension (75%) and nausea (50%) [Graph 4]. All the patients showed epigastric tenderness and 37 patients showed abdominal guarding as the most common sign [Graph 5]. Majority of patients had peripancreatic fat stranding (87.5%) and irregular pancreatic margins (80%) followed by gland enlargement (70%) [Graph 6]. 27 of 40 had interstitial pancreatitis [Graph 7 and Table 1]. Ratio of interstitial:necrotizing pancreatitis = 2:1. 67.5% of patients had no necrosis [Table 2]. Ascitis and pleural effusion were most common extrapancreatic complication (77.5 and 70%, respectively) followed by vascular and gastrointestinal complications [Graph 7]. The length of the hospital stay ranged from 5 to 25 days (mean, 13.9 days). Majority of patients had hospital stay between 11 and 15 days followed by ≤10 days [Graph 8]. As per CTSI, the highest mean duration of hospital stay was in the mild disease (14.6 days) followed by moderate and severe disease [Table 3]. As per MCTSI, the mean duration of

Table 1: Types of pancreatitis

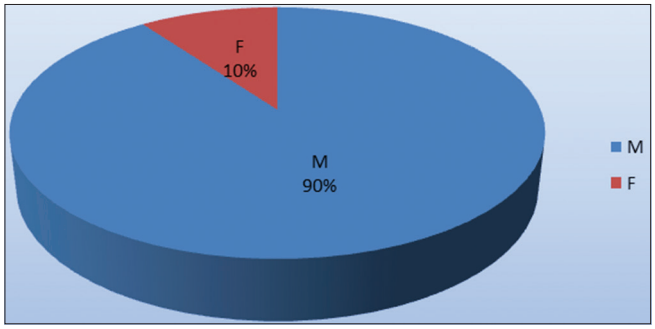
Types of pancreatitis	No. of patients (%)
Interstitial pancreatitis	27 (67.5)
Necrotizing pancreatitis	13 (32.5)

Table 2: Incidence of necrosis

Necrosis	Number of patients (%)
None	27 (67.5)
<30%	11 (27.5)
>=30%	2 (5)



Graph 1: Age distribution



Graph 2: Sex distribution

hospital stay was highest (14.8 days) in moderately severe disease followed by that in severe disease [Table4]. As per CTSI, 24 patients, i.e., 60% patients had moderately severe disease followed by mild disease (11 patients, i.e. 27.5%) [Table 5 and Graph 9]. As per MCTSI, majority patients had the moderately severe disease (26 patients, i.e., 65%) followed by severe disease (13 patients, i.e., 32.5%) [Table 6 and Graph 10]. There was no mortality during the hospital stay of 40 patients. Since there was not a significant number of patients who died, the severity indices could not be studied as a predictor of mortality as outcome only one patient of 40 developed organ failure signs of liver dysfunction [Table 7 and Graph 11]. 5 of 40 underwent surgical/other intervention. One underwent laparoscopic cholecystectomy for gallstones [Figure 3], one underwent nasogastric jejunal feeding tube insertion, two underwent cystogastrostomy, and one underwent surgical debridement for infected necrosis [Graph 12 and Figure 12].

Correlation of CTSI and MCTSI was done with respect to the following morbidity parameters:

1. Duration of hospital stay
2. Development of local complications
3. Development of complicated pancreatitis
4. Incidence of surgical intervention.

Table 3: Mean duration of hospital stay according to severity by CTSI

Severity according to CTSI	Mean duration of hospital stay (days)
Mild	14.6
Moderate	14
Severe	13.1

CTSI: Computed tomography severity index

Table 4: Mean duration of hospital stay according to severity by MCTSI

Severity according to MCTSI	Mean duration of hospital stay (days)
Mild	10
Moderate	14.77
Severe	12.33

MCTSI: Modified computed tomography severity index

Table 5: Severity according to CTSI

Severity	No. of patients (%)
Mild	11/40 (27.5)
Moderate	24/40 (60)
Severe	5/40 (12.5)

CTSI: Computed tomography severity index

Table 6: Severity according to MCTSI

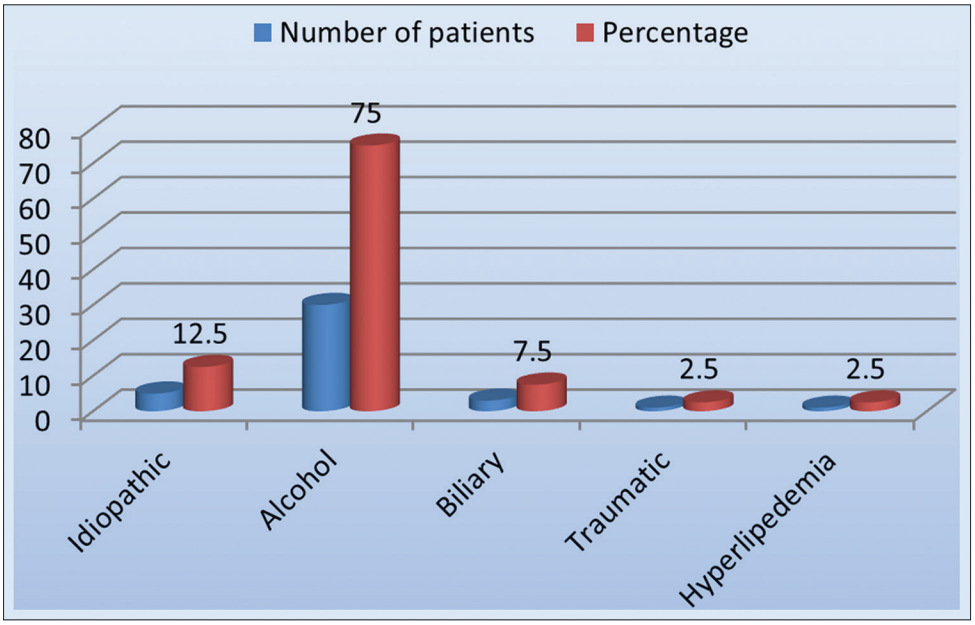
Severity	Number of patients (%)
Mild	1/40 (2.5)
Moderate	26/40 (65)
Severe	13/40 (32.5)

MCTSI: Modified computed tomography severity index

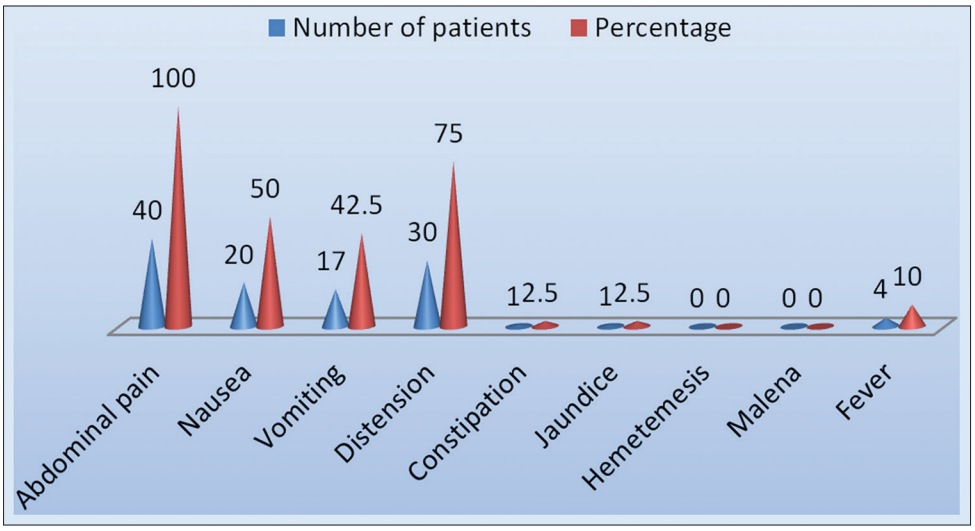
Table 7: Outcome: Recovery and death

MCTSI	Expired	Recovered (%)
≥8	0	11 (27.5)
<8	0	29 (72.5)

MCTSI: Modified computed tomography severity index



Graph 3: Etiological analysis



Graph 4: Symptomatology

No association could be found either between CTSI and longer duration of hospital stay or between MCTSI and duration of hospital stay [Tables 8 and 9]. Both CTSI and MCTSI show poor sensitivity as a predictor of longer duration of hospital stay in this study [Table 10]. On comparing CTSI and MCTSI in their ability to predict a longer duration of hospital stay, they were found to be discordant [Table 11].

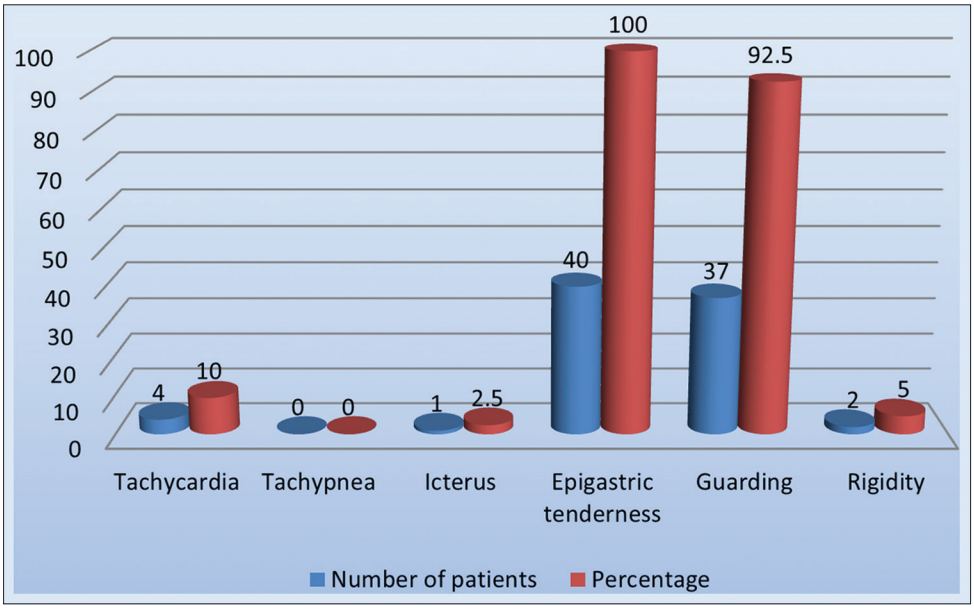
Both CTSI and MCTSI showed an association with the development of local complications [Tables 12 and 13]. MCTSI showed better sensitivity than CTSI and showed good specificity, positive and negative predictive values as a predictor of local complications [Table 14]. On applying McNemar's test for comparison between CTSI and MCTSI, the two were found to be discordant [Table 15].

Table 8: CTSI as a predictor of duration of hospital stay

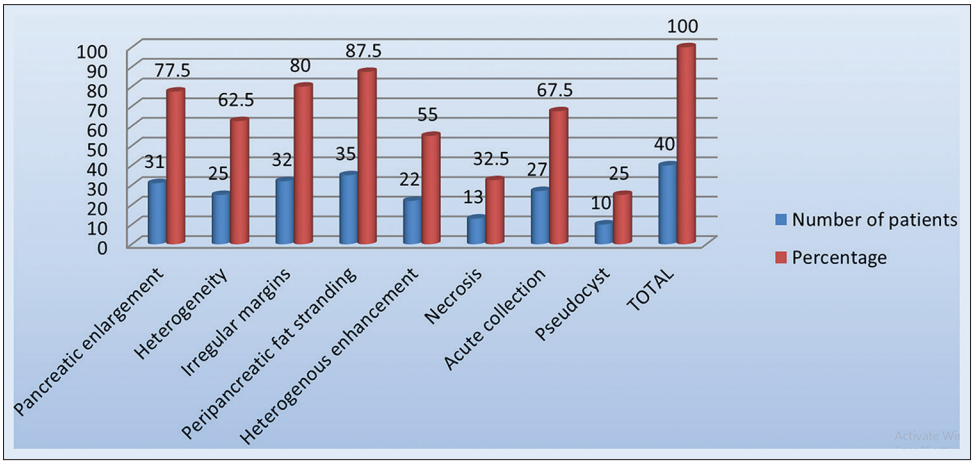
CTSI	Duration of hospital stay >10 days	Duration of hospital stay ≤10 days
≥7	2	2
<7	25	11
P value	0.583926 (not significant)	

CTSI: Computed tomography severity index

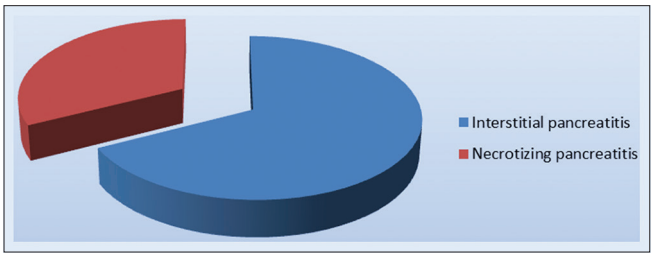
Both CTSI and MCTSI showed an association with the development of complicated disease [Tables 16 and 17]. MCTSI showed greater sensitivity compared to CTSI in the prediction of complicated disease [Table 18]. On applying McNemar's test for comparison between CTSI and MCTSI, the two were found to be discordant [Table 19].



Graph 5: Signs



Graph 6: Imaging findings



Graph 7: Types of pancreatitis

Table 9: MCTSI as a predictor of hospital stay

MCTSI	Duration of hospital stay >10 days	Duration of hospital stay ≤10 days
≥8	8	3
<8	22	7
P value	1.0 (not significant)	

MCTSI: Modified computed tomography severity index

Table 10: Comparison of accuracy for duration of hospital stay

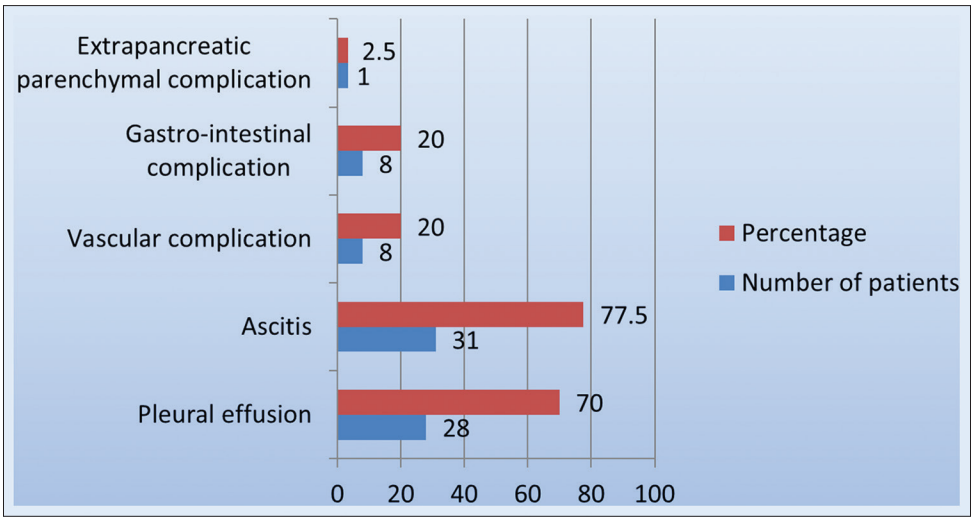
Statistical Measure	Percentage	
	CTSI	MCTSI
Sensitivity	7.4	26.6
Specificity	85	70
PPV	50	73
NPV	30	24
P values	1	1

CTSI: Computed tomography severity index, MCTSI: Modified computed tomography severity index, PPV: Positive predictive value, NPV: Negative predictive value

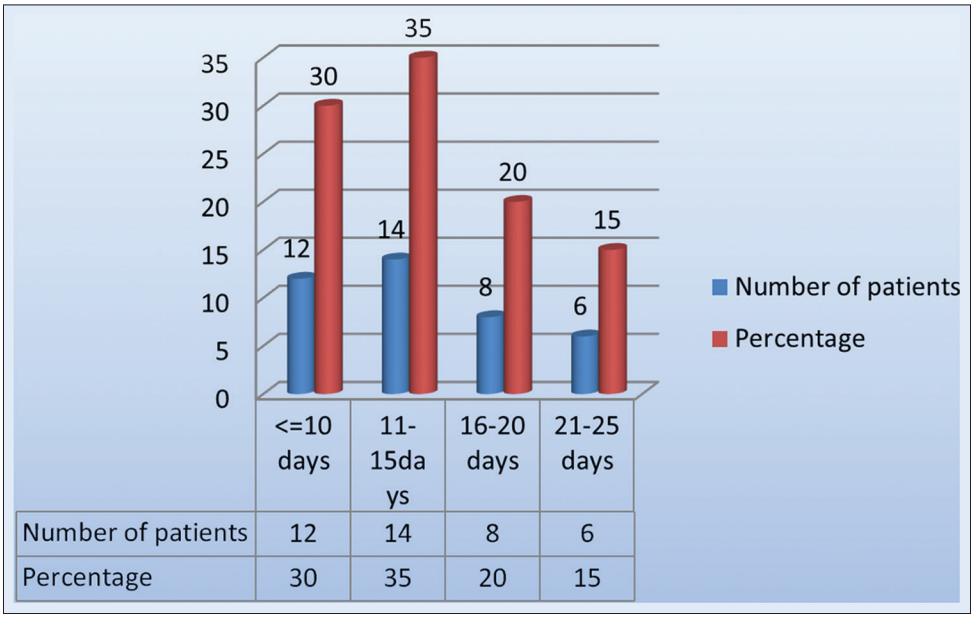
Table 11: CTSI versus MCTSI in the prediction of duration of hospital stay

MCTSI	CTSI ≥7	CTSI <7
≥8	3	7
<8	0	18

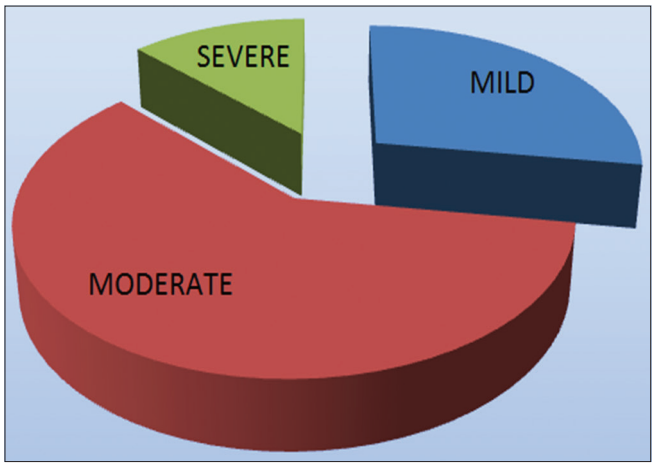
McNemar's test: *P*=0.01. CTSI: Computed tomography severity index, MCTSI: Modified computed tomography severity index



Graph 8: Extrapancreatic complications



Graph 9: Duration of hospital stay



Graph 10: Severity according to computed tomography severity index

Table 12: CTSI correlation with local complications

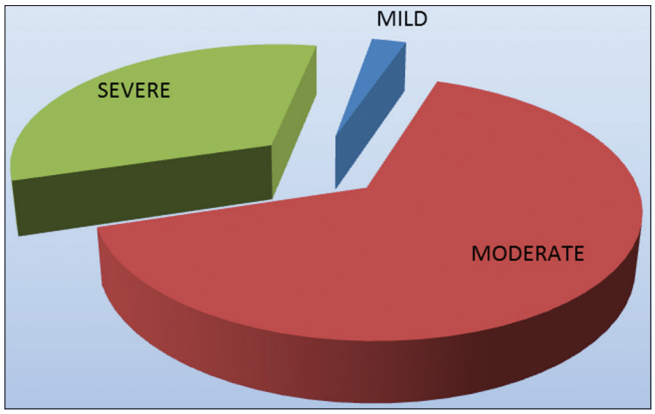
CTSI	Local complications present	Local complications absent
≥7	5	0
<7	11	24
P value	0.006 (Significant)	

CTSI: Computed tomography severity index

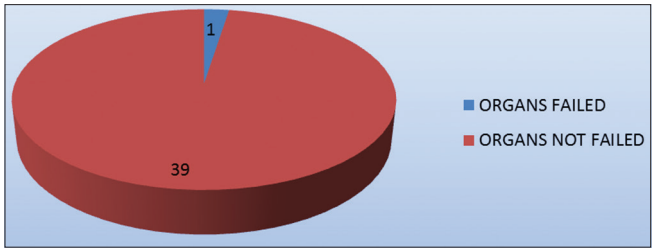
Table 13: MCTSI correlation with local complications

MCTSI	Local complications present	Local complications absent
≥8	11	2
<8	5	22
P value	0.0001 (Significant)	

MCTSI: Modified computed tomography severity index



Graph 11: Severity according to modified computed tomography severity index



Graph 12: Incidence of organ failure

Table 14: Comparison of accuracy of the two indices for local complications

Statistical Measure	Percentage	
	CTSI	MCTSI
Sensitivity	31	68.7
Specificity	100	91.6
PPV	100	84.6
NPV	66.6	81.4
P values	0.006	0.0001

CTSI: Computed tomography severity index, MCTSI: Modified computed tomography severity index, PPV: Positive predictive value, NPV: Negative predictive value

Table 15: CTSI versus MCTSI in the prediction of local complications

Statistical measure MCTSI	CTSI ≥7	CTSI <7
≥8	5	6
<8	0	5

McNemar's test: *P* value=0.03. CTSI: Computed tomography severity index, MCTSI: Modified computed tomography severity index

Table 16: CTSI correlation with complicated pancreatitis

CTSI	Complicated disease	Uncomplicated disease
≥7	5	0
<7	12	23
P value	0.049 (Significant)	

CTSI: Computed tomography severity index

Table 17: MCTSI correlation with complicated pancreatitis

MCTSI	Complicated disease	Uncomplicated disease
≥8	11	2
<8	6	21
P value	0.00036 (Significant)	

MCTSI: Modified computed tomography severity index

Table 18: Comparison of accuracy of the two indices for complicated disease

Statistical Measure	Percentage	
	CTSI	MCTSI
Sensitivity	29.4	64.7
Specificity	100	91.3
PPV	100	84.6
NPV	65.7	77.7
P values	0.049	0.00036

CTSI: Computed tomography severity index, MCTSI: Modified computed tomography severity index, PPV: Positive predictive value, NPV: Negative predictive value

Table 19: CTSI versus MCTSI in the prediction of complicated disease

Sex Distribution MCTSI	CTSI ≥7	CTSI <7
≥8	5	6
<8	0	6
P value	0.03	

CTSI: Computed tomography severity index, MCTSI: Modified computed tomography severity index

Table 20: CTSI correlation with surgical intervention

CTSI	Surgical Intervention	No Surgical Intervention
≥7	1	4
<7	4	31
P value	1 (Not significant)	

CTSI: Computed tomography severity index

Table 21: MCTSI Correlation With Surgical Intervention

MCTSI	Surgical intervention	No surgical intervention
≥8	2	11
<8	3	24
P value	1 (Not significant)	

MCTSI: Modified computed tomography severity index

Table 22: Necrosis as a predictor of local complications

Necrosis	Local complication	No local complication
Necrosis present	11	2
No necrosis	5	22
P value	0.0001 (Significant)	

Both CTSI and MCTSI did not show any association with incidence of surgical intervention [Tables 20 and 21]. An association was found between necrosis and development of local complications [Table 22]. Sensitivity and specificity of necrosis as an independent predictor of local complication were 68.7% and 91.6%, respectively [Table 23].

Table 23: Comparison of accuracy of necrosis for predicting local complications

Statistical Measure	Percentage
Sensitivity	68.7
Specificity	91.6
PPV	84.6
NPV	81.4
P value	0.0001 (Significant)

PPV: Positive predictive value, NPV: Negative predictive value

Table 24: Age range

	Mortele *et al*.[5]	Present study
Age range	19–87 years	11–71 years

Table 25: Mean age

	Baig *et al.*	Mortele *et al*.[5]	Present study
Mean age	30 years	49.2 years	34.97 years

Table 26: Sex distribution

Statistical measure	Baig *et al*.[8]	Mortele *et al*.[5]	Present study
Number of males (%)	33/45 (73.4)	29/66 (43.9)	36/40 (90)
Number of females (%)	12/45 (26.6)	37/66 (56)	4/40 (10)
Male:female ratio	2.7:1	0.78:1	9:1

Except as noted, data are numbers of patients with their percentages in parenthesis

Table 27: Etiology

Etiology	Birgisson[9] (%)	Bollen *et al*.[6] (%)	Present study (%)
Alcohol	16/50 (32)	43/196 (22)	30 (75)
Biliary	21/50 (42)	66/196 (34)	3 (7.5)
Idiopathic	1 (2)	26/196 (13)	5 (12.5)
Post ERCP	-	16/196 (8)	0
Drug-induced	-	14/196 (7)	0
Misce.	12 (24)	31/196 (16)	2 (5)

ERCP: Endoscopic retrograde cholangiopancreatography

Table 28: Symptoms

Symptom	Malfertheiner And Kemmer[10] (%)	Corsetti and Arvan[11] (%)	Present study (%)
Abdominal pain	90	95	100
Nausea, vomiting	70	75	67.5
Abdominal distension	60	-	75
Jaundice	30	15	2.5
Neurological symptoms	10	-	0
Hematemesis	-	10	0

DISCUSSION

The present study included patients over a wide age range as in studies by Mortele *et al.* [Table 24]. The mean age in the present study is comparable to Baig *et al.* but is slightly lower than the study by Mortele *et al.* [Table 25].[5]

The present study showed alcohol to be the most common etiology followed by an idiopathic group [Table 26]. The study by Birgisson *et al.*[9] and Bollen *et al.*[6] showed biliary cause to be the most common followed by alcohol [Table 27]. The reason for the discrepancy could be because alcohol abuse is very common in the low socioeconomic

Table 29: Signs

Abdominal guarding	Malfertheiner and Kemmer[10] (%)	Corsetti and Arvan[11] (%)	Present study (%)
	80	50	92.5

Table 30: Types of pancreatitis

Type	Mortele *et al*.[5] (%)	Present study (%)
Interstitial	161/196 (82)	27 (67.5)
Necrotizing	35/196 (18)	13 (32.5)

Table 31: Incidence of extrapancreatic complications

Extrapancreatic complication	Number of patients (%)	
	Mortele *et al*.[5]	Present study
Pleural effusion	69 (35)	28 (70)
Ascites	80 (41)	31 (77.5)
Vascular complication	16 (8)	8 (20)
Gastro-intestinal complication	10 (5)	8 (20)
Extrapancreatic parenchymal complication	3 (2)	1 (2.5)

Table 32: Mean hospital stay

Severity	Mortele *et al*.[5]	Present study
Mild	3	10
Moderate	8	14.77
Severe	14	12.33

Table 33: Mortality

Number of patients died	Mortele *et al*.[5] (%)	Present study (%)
	1/66 (1.5)	0

Table 34: Surgical intervention

Number of patients	Mortele *et al*.[5] (%)	Present study (%)
	10/66 (15)	5/40 (12.5)

Table 35: Outcome

Outcome	Mild (0–3)		Moderate (4–6)		Severe (≥8)	
	Mortele *et al.*[5] (%)	Present study (%)	Mortele *et al.*[5] (%)	Present study (%)	Mortele *et al.*[5] (%)	Present study (%)
Number of patients	34	1	22	28	10	11
Hospital stay	3	10	8	14.8	10	12
Intervention/Local complication	3	0	2	3	5	2
Organ failure	2	0	0	1	5	0
Mortality	0	0	0	0	1	0

Table 36: Outcome

Outcome parameters	MCTSI as a outcome predictor	
	Mortele *et al.*[5] (60 patients) *P* values	Present study (40 patients) *P* values
Length of hospital stay	0.0054–0.0714	1
Intervention/surgery/local complications	0.0112	0.0001
Organ failure	0.0024	-

MCTSI: Modified computed tomography severity index

Table 37: Necrosis as a predictor of local complications

Statistical Measure	Casas *et al.*[12]	Present study
Sensitivity	53.3%	68.7%
Specificity	90.2%	91.6%

group to which the patients enrolled in the present study belonged. The frequency of the symptoms in the present study is comparable to previous studies. In all the three series, abdominal pain was the most common symptom followed by nausea vomiting and distension [Table 28]. The present study showed a higher number of patients with abdominal guarding [Table 29]. The present study had a higher number of patients with necrotizing pancreatitis compared to study by Mortele *et al.*[5] [Table 30]. There is a higher frequency of most of the extrapancreatic complications in this study compared to study by Mortele *et al.* [Table 31]. The mean hospital stays for mild and moderate disease are higher in the present study [Table 32]. No patient died during hospital stay [Table 33]. The reason for this is the small sample size in the present study.

The incidence of surgical intervention is comparable with other studies [Table 34]. *P* values relating to the development of local complications/need for intervention obtained in the present study and that obtained by Mortele *et al.*[5] (0.0001 and 0.0112, respectively) are comparable [Tables 35 and 36]. This present study showed an association between MCTSI and development of local complications. *P* value relating to hospital stay are not comparable thus showing that there was no association between duration of hospital stay and modified CT severity index [Table 37]. The reason for this could be the difference in the treatment protocols of the different units of the surgery department of the hospital in which the study is performed. The policies or the protocols followed by the treating consultants could be different. Moreover, the point to be noted is that duration of hospital stay is not in real indicator of patient's severity of illness. In both the studies, the sensitivity and specificity of necrosis as a predictor of local complications are comparable.

SUMMARY AND CONCLUSION

Following findings are drawn from the study.

The majority of patients with acute pancreatitis were in the range of 20–50 years. Mean age of presentation was 35 years. Alcohol was the leading cause of pancreatitis. It was followed by idiopathic group. Acute pancreatitis showed male predominance. All the patients presented with epigastric pain and majority patients had a complaint of distension and nausea. Epigastric tenderness and guarding were the most common signs. Most common imaging feature was peripancreatic fat stranding followed by irregular pancreatic margins and gland enlargement. Majority patients have interstitial pancreatitis. The most common extrapancreatic complication was ascites followed by pleural effusion. The majority of patients had hospital stay between 11 and 15 days.

Mild and moderately severe disease was more common than severe disease.

Both the indices CTSI and MCTSI did not show an association with duration of hospital stay or the need for surgery or intervention in a patient.

Both indices (CTSI and MCTSI) showed association with the development of local complications and organ failure.

MCTSI showed better sensitivity than CTSI and shows good specificity, positive and negative predictive values as a predictor of local complications and organ failure.

Necrosis showed an association with patient morbidity (development of local complications) with high positive and negative predictive values (84.6% and 81.4%, respectively) and sensitivity of 68.7 % and specificity of 91.6%.

Thus, CE CT is useful modality in assessing the severity of acute pancreatitis and both the CT severity indices serve as an accurate index to predict the development of local complications or organ failure. And among the two, MCTSI is more accurate. However, both are less accurate in their ability to predict the need for surgical intervention and longer hospital stay. Necrosis as an independent index is a useful marker for predicting the development of local complications.

REFERENCES

1. Bradley EL 3rd. A clinically based classification system for acute pancreatitis. Summary of the international symposium on acute pancreatitis, Atlanta, GA, September 11 through 13, 1992. Arch Surg 1993;128:586-90.
2. Forsmark CE, Baillie J. AGA Institute technical review on acute pancreatitis. Gastroenterology 2007;132:2022-44.
3. Papachristou GI, Whitcomb DC. Predictors of severity and necrosis in acute pancreatitis. Gastroenterol Clin North Am 2004;33:871-90.
4. Balthazar EJ, Robinson DL, Megibow AJ, Ranson JH. Acute pancreatitis: Value of CT in establishing prognosis. Radiology 1990;174:331-6.
5. Mortele KJ, Wiesner W, Intriere L, Shankar S, Zou KH, Kalantari BN, *et al.* A modified CT severity index for evaluating acute pancreatitis: Improved correlation with patient outcome. AJR Am J Roentgenol 2004;183:1261-5.
6. Bollen TL, Singh VK, Maurer R, Repas K, van Es HW, Banks PA, *et al.* Comparative evaluation of the modified CT severity index and CT severity index in assessing severity of acute pancreatitis. AJR Am J Roentgenol 2011;197:386-92.
7. Fagon JY, Chastre J, Novara A, Medioni P, Gibert C. Characterization of intensive care unit patients using a model based on the presence or absence of organ dysfunctions and/or infection: The ODIN model. Intensive Care Med 1993;19:137-44.
8. Baig SJ, Rahed A, Sen S. A prospective study of the aetiology, severity and outcome of acute pancreatitis in Eastern India. Trop Gastroenterol 2008;29:20-2.
9. Birgisson H, Möller PH, Birgisson S, Thoroddsen Á, Ásgeirsson KS, Sigurjónsson SV, *et al*. Acute pancreatitis: A prospective study of its incidence, aetiology, severity, and mortality in Iceland. Eur J Surg 2002;168:278-82.
10. Malfertheiner P, Kemmer TP. Clinical picture and diagnosis of acute pancreatitis. Hepatogastroenterology 1991;38:97-100.
11. Corsetti JP, Arvan DA. Acute pancreatitis. In: Black ER, Bordley DR, Tape TG, Panzer RJ, editors. Diagnostic Strategies for Common Medical Problems. 2nd ed. Philadelphia: American College of Physicians; 1999. p. 205.
12. Casas JD, Díaz R, Valderas G, Mariscal A, Cuadras P. Prognostic value of CT in the early assessment of patients with acute pancreatitis. Am J Roentgenol 2004;182:569-74.

How to cite this article: Lokwani M, Patel NA. Modified Computed Tomography Severity Index in Acute Pancreatitis – Its Correlation with Patient Morbidity (A Study of 40 Cases). Int J Sci Stud 2018;6(2):4-17.

Source of Support: Nil, **Conflict of Interest:** None declared.