DOI: 10.14260/jemds/2014/4097

ORIGINAL ARTICLE

MODIFIED COMPUTED TOMOGRAPHY SEVERITY INDEX IN ACUTE PANCREATITIS

Shivanand Melkundi[1], Neha Anand[2]

HOW TO CITE THIS ARTICLE:
Shivanand Melkundi, Neha Anand. "Modified Computed Tomography Severity Index in Acute Pancreatitis". Journal of Evolution of Medical and Dental Sciences 2014; Vol. 3, Issue 74, December 29; Page: 15541-15551, DOI: 10.14260/jemds/2014/4097

ABSTRACT: 100 cases of acute pancreatitis patients were studied to evaluate the complications using MCTSI and its comparison with CTSI. Age distribution of patients varied from 11 to 79 years. Maximum patients were male. The CTSI grades are classified into mild (0-3), moderate (4-6) and severe (7-10) and MCTSI grades are classified into mild (0-2), moderate (4-6) and severe (8-10).
KEYWORDS: Modified Computed Tomography severity index (MCTSI), Computed Tomography Severity Index (CTSI), Computed Tomography.

INTRODUCTION: Pancreatitis is one of the most complex and clinically challenging of all abdominal disorders. It remains a major diagnostic challenge because its clinical manifestation is as protean as its causes.

The various causes of acute pancreatitis includes are: Alcohol ingestion (acute and chronic alcoholism), Biliary tract disease (gallstones), post-operative, Trauma, Metabolic causes like hypertriglyceridemia, hypercalcemia, renal failure, after Renal Transplantation, Infections such as mumps, viral hepatitis. Drugs: Azathioprine, thiazide diuretics, furosemide. Vascular causes like ischaemic-hypoperfusion state (after cardiac surgery), penetrating peptic ulcer. Vasculitis: Systemic lupus erythematosis.[1]

Computed Tomography Appearance of Pancreatitis: The most important contribution of CT is the detection of the primary cause of the inflammatory process so that remedial steps can be taken. The most important finding in a patient with pancreatitis is the presence of biliary or gall-bladder calculi.

1. **Acute edematous pancreatitis:** Acute pancreatitis is well suited for examination by CT because CT scanning is not impaired by gas as ultrasound scanning is. The diagnostic signs of pancreatitis include alteration of the pancreatic density, duct dilatation, morphological characteristics, contour, and peripancreatic edema and fluid collections. Edematous pancreatitis can be differentiated from necrotizing pancreatitis by the injection of contrast material. The edematous pancreatitis maintains uniform enhancement without alteration of density while necrotic areas do not enhance.

   The pancreas may increase or decrease in size, depending on the stage of inflammation. The lesser sac being immediately anterior to the gland, is the most common space involved in accumulation of the fluid. The second most common anatomical area involved by continued inflammation is the anterior pararenal fascia on either the right or left depending on the involvement of the head or the body of the gland.[2]

2. **Acute necrotisingpancreatitis**: The normal tissue shows considerable enhancement. Accepted criteria for the CT diagnosis of pancreatic necrosis have been defined as focal or diffuse zone of

DOI: 10.14260/jemds/2014/4097

non-enhanced pancreatic parenchyma depicted during an examination with intravenous bolus administration of contrast material. The extent of necrosis was further quantified to <30%, 30-50%and >50% of the pancreatic gland.[3]

3. **Emphysematous pancreatitis**: Gas forming pyogenic infection superimposed on pancreatitis can result from a variety of causes, including spontaneous colonization from gastro-intestinal fistula or secondarily from surgical procedures. CT can detect the slightest amount of gas within the pancreas.[2]

Complications of Pancreatitis: The various complications that occur during and after an episode of acute pancreatitis are responsible for a 2-10% mortality rate. The complications have been classified as: 1. Early Complications 2. Intermediate Complications and 3. Late Complications. Although there is an overlap in the timing of their occurrence early complications occur within 2-3 days of acute attack and are systemic in nature. Abdominal complication usually develops later- within a few weeks or, with decreasing frequency.[4]

1. **Early Complications:** They are early systemic complications associated with multiorgan failure. The pathogenesis is multifactorial seen mainly in patients with necrotizing pancreatitis.
   - Cardiovascular complications: ECG changes, cardiac and peripheral vascular failure: hypotension and shock.
   - Pulmonary complications: respiratory insufficiency, tachypnea, arterial hypoxemia and ARDS (Acute Respiratory Distress Syndrome).
   - Renal complications: oliguria and anuria.
   - Metabolic complications: coagulation factor abnormality, thrombosis, or bleeding (DIC), hyperglycemia, diabetic coma and hypocalcemia.

2. **Intermediate Complications:**
   (i) **Pseudocysts:** Pseudocysts are typically located in the pancreas and in the peri-pancreatic region.[5] Gas in a pseudocyst suggests fistula formation, gas forming infection, post surgically internal cystostomy or combination of these.[6]
   (ii) **Pancreatic abscess:** the appearance of fluid on CT study is indistinguishable from a typical case of suppurative or hemorrhagic pancreatitis.[2]
   (iii) **Vascular problems:** This includes thrombotic occlusion of vessels commonly the splenic artery and vein, and pseudoaneurysms commonly in the splenic and gastroduodenal arteries.[2]
   (iv) **Gastrointestinal and biliary complications:** include gastric wall edema, thickened mucosal folds of the stomach, duodenal sweep, dilatation of duodenum and or transverse colon, spastic duodenum, jejunal or colonic segment.

3. **Late Complications:** include vascular and hemorrhagic complications. Autodigestive action of extravasated pancreatic enzymes in the pancreatic and peripancreatic vascular structure produce pathological changes responsible for the development of vascular and hemorrhagic complications. Vascular morphological changes affecting the major arteries and veins,

DOI: 10.14260/jemds/2014/4097

including inflammation, perivascular fibrosis with narrowing and obstructing strictures, thrombosis, and vascular erosions leading to pseudo aneurysm and massive hemorrhage and splenic vein thrombosis develop in 1-3% patient following pancreatitis. Arterial luminal compromise can lead to segmental colonic or proximal small bowel ischemia and infarction.[4]

Prognostic Indicator	Points
Normal pancreas	0
Focal or diffuse enlargement of the pancreas	1
Intrinsic pancreatic abnormalities with inflammatory changes in peripancreatic fat	2
Single, ill-defined fluid collection or phlegmon	3
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

Table 1: CT Severity Index

The index focuses on the presence and degree of pancreatic inflammation and necrosis on a 10 point severity scale, points are awarded for the presence or absence of fluid collection, in combination with an assessment of the presence and degree of pancreatic necrosis. Although this system has been successfully used to predict overall morbidity and mortality in patients with acute pancreatitis, it has limitations. The index does not significantly correlate with subsequent development of organ failure, extra pancreatic complications, or peripancreatic vascular complications.[7]

Modified CT severity index was introduced to overcome the problems of CT severity index and studies conducted to know its efficacy.

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

Table 2: Modified CT SeverityIndex

DOI: 10.14260/jemds/2014/4097

A study was conducted on 266 patients over a year to assess the correlation with patient outcome and interobserver variability of a modified CT severity index in the evaluation of patients with acute pancreatitis compared with the accepted CT severity index. 66 patients underwent contrast enhancement MDCT within 1 week of the onset of symptoms. The patients were independently scored using both currently accepted and modified CT severity indexes. The modified index included a simplified assessment of pancreatic inflammation and necrosis as well as an assessment of extra pancreatic complications. Outcome parameters included the length of hospital stay, need for surgery or percutaneous intervention, and the occurrence of infection, organ failure and death. It was concluded in the study that modified CT severity index correlates more closely with patient outcome measures than the currently accepted CT severity index.[7]

AIMS AND OBJECTIVES:

- To evaluate the pancreatic complications using computed tomography severity index.
- Comparison between MDCTSI and CTSI.

MATERIAL & METHODS: The study was conducted on 100 patients with clinical suspicion of acute pancreatitis, altered biochemical parameters (serum amylase, serum lipase) in favor of acute pancreatitis, ultrasonography suggestive of acute pancreatitis and complications known case of chronic pancreatitis with features of acute symptoms who were referred to the department of radiodiagnosis, Basaveshwar teaching & General Hospital, Gulbarga attached to M.R. Medical college, Gulbarga during the period of December 2012 to September 2014.

Technique: All patients were called with at least 6 hours of fasting before the scan. A written consent was obtained from each patient after explaining the possibility of contrast reaction. About600-800ml oral contrast (20ml omnipaque diluted in 1 liter of water) was administered to the patient 45 minutes prior to the scan. About 5ml of intravenous contrast was given as test dose 10mins before starting the scan.

The patient was placed in the gantry table in the supine position with both arms above the head. Non-enhanced 5mm sections were obtained throughout the abdomen. Contrast scans were obtained by injecting 60ml-80ml intravenous nonionic contrast at a rate of 3 ml per second using a pressure injector through an 18G cannula placed in the antecubital vein.

RESULTS AND OBSERVATIONS: According to the Modified CT Severity Index, the patients were graded into mild, moderate and severe i.e. 26% patients had mild, 63% patients had moderate and 11% had severe Pancreatitis.

According to the CT Severity Index, the patients were graded into mild, moderate and severe. 48% patients had mild, 41% patients had moderate and only 11% patients had severe pancreatitis as per CTSI score.

In CTSI scoring system, 48 patients (48%) belonged to mild category, 41(41%) patients belonged to moderate and only 11(11%) patients belonged to severe pancreatitis. But in MCTSI scoring system 26(26%) patients were found to have mild pancreatitis, 63 (63%) patients were found to have moderate and 11(11%) patients had severe pancreatitis. The discrepancy is attributed

to the inclusion of extra pancreatic complications in MCTSI scoring system. Hence, two extra points were added to the severity index in addition to the pancreatic inflammation and necrosis findings.

DISCUSSION: The CTSI are classified into mild (0-3), moderate (4-6) and severe (7-10) and MCTSI grades are classified into mild (0-2), moderate (4-6) and severe (8-10).

In our study all patients had pancreatic inflammation, 52 patients were given 2 points while 48 patients were given 4 points.

Extra-pancreatic complications were seen in 53 patients in our study. GIT complications were seen in 52 patients, Ascites was seen in 11 patients and pleural effusion in 16 patients.

According to, CTSI maximum patients were seen to fall in mild category 48 and minimum patients 11 were seen in the severe category while moderate category had 41 patients.

According to, MCTSI maximum patients were seen to fall in the moderate category 63 and minimum patients 11 were seen in the severe category while mild category had 26.

According to the study by Bollenet al[8] the morphologic severity of pancreatitis was graded as mild in 86 (44%), moderate in 75 (38%), and severe in 35 (18%) cases. The study had patients with severe pancreatitis as the minimum number of patients which is similar to our study.

Patients who had extrapancreatic complications had more severity score according to the MCTSI than CTSI, thereby increase in the number of patients having moderate pancreatitis according to the MCTSI when compared to the CTSI. This resulted in the more closely association with the patient outcome in MCTSI. Study done by De Waeleetal[9]showed similar results and concluded that, extrapancreatic inflammation assessed by abdominal CT scan allows accurate estimation of disease severity and mortality within 24 h of admission.

CONCLUSION: Extra pancreatic spread of inflammation and vascular complications may not be picked up by Ultrasonography. These limitations are overcome with the use of CT which yields more diagnostic information in the evaluation of acute pancreatitis. CT is a confirmative investigation in diagnosis and staging of Acute pancreatitis and its complications.

There was significant correlation of grades of severity of acute pancreatitis based on MCTSI with patient outcome parameters than grades of severity of acute pancreatitis based on CTSI.MCTSI is a very useful tool for the screening of patients with acute pancreatitis for the classification of severity accurately and to predict the clinical outcome.

REFERENCES:

1. Greenberger N. J., P.P. Toskes, and K. J. Isselbacher—Acute and Chronic Pancreatitis Harrison Principal of Internal Medicines. Fauci A.S. et al Ed. McGraw-Hl, 6t edition 2005; 1895-1906.
2. Haaga J.R. Ed, —Computed Tomography and Magnetic Resonance Imaging of the Whole Body Missouri, Mosby, 2003; 1426-1447.
3. Balthzar E.J RSNA 2002 —Acute pancreatitis: assessment of severity with clinical and CT evaluation Radiology 2002; 223: 603-613.
4. Balthzar E.J —Complication of acute pancreatitis clinical and CT evaluation‖ Radiol Clin NAm 2002; 40: 1211-1227.
5. Kourtesis G, Wilson S.E, William R.A, the clinical significance of fluid collection in acute pancreatitis. Am surg 1990; 56: 769-799.

DOI: 10.14260/jemds/2014/4097

6. Freeny P.C. —The Pancreas|| Chapters 61 in Grainger and RG and Allison's Diagnostic radiology: A Text book of medical imaging, Grainger RG and David Allison Ed, London: Churchill Livingstone 2001; 1346-1354.
7. Koenraad J. M., Walter Wiesner, Lisaintriere, shridhar Shankar, Kelly H.Z. Babek N. K., Alex Perez et al, A Modified CT Severity Index for Evaluating Acute Pancreatitis: improved correlation wirh patient outcome AIR 2004; 183: 1261- 1265.9.
8. Mortele K, Wiesner W, Intriere L, Shankar S, Kelly H. A Modified CT Severity Index for Evaluating Acute Pancreatitis: Improved Correlation with Patient Outcome. AJR. 2004 Nov; 183(5): 1261-1265.
9. De Waele JJ, Delrue L, Hoste EA, De Vos M, Duyck P, Colardyn FA. Extra pancreatic inflammation on abdominal computed tomography as an early predictor of disease severity in acute pancreatitis: evaluation of a new scoring system. Pancreas. 2007 Mar; 34(2): 185-90.

Pancreatic inflammation: In our study, 52 patients had intrinsic pancreatic abnormalities with or without inflammatory changes in peripancreatic fat, to whom 2 points were assigned. Remaining 48 patients had pancreatic or peripancreatic fluid collection or peripancreatic fat necrosis, to whom 4 points were assigned.

	No. of patients (n=100)	%
Pancreatic Inflammation		
Peri-Pancreatic Inflammation [Value 2]	52	52
Fluid Accumulation [Value 4]	48	48

Table 3: Pancreatic Inflammation

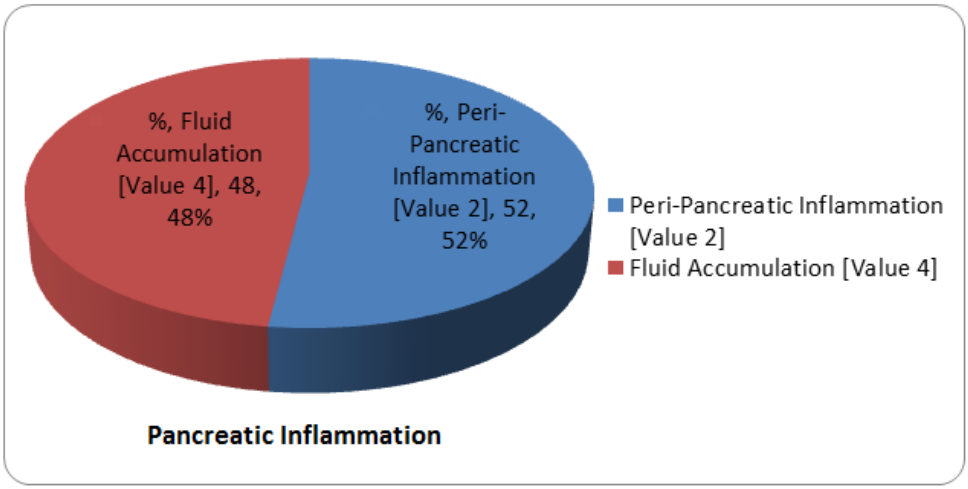

Fig. 1: Pie Chart Showing Pancreatic Inflammation

DOI: 10.14260/jemds/2014/4097

Pancreatic necrosis: A total of 82 patients had no evidence of pancreatic necrosis on CT scan. 7 patients had less than 30% necrosis to which 2 points were assigned. 11 Patients had more than 30% necrosis, to which 4 points were assigned.

	No. of patients (n=100)	%
Necrosis		
-	82	82
+	7	7
++	11	11

Table 4: Pancreatic Necrosis

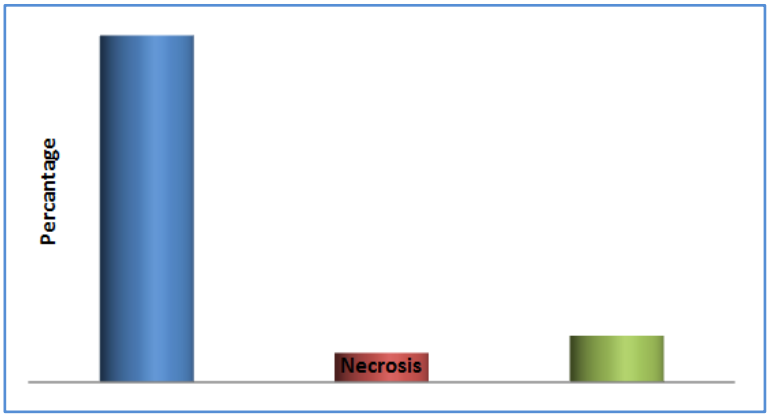

Fig. 2: Bar Graph Showing Pancreatic necrosis

EXTRAPANCREATIC COMPLICATIONS: Out of 100 patients, 47 patients had no evidence of extra pancreatic complications. 53 patients had one or more extra pancreatic complications such as pleural effusion, ascites or gastrointestinal tract involvement.

	No. of patients (n=100)	%
Pleural Effusion		
• Negative	84	84.0
• Positive	16	16.0
Ascites		
• Negative	89	89.0
• Positive	11	11.0
GIT Complications		

DOI: 10.14260/jemds/2014/4097

• Negative	48	48.0
• Positive	52	52.0
Vascular Complications		
• Negative	100	100.0
• Positive	0	0.0

Table 5: Extrapancreatic Complications

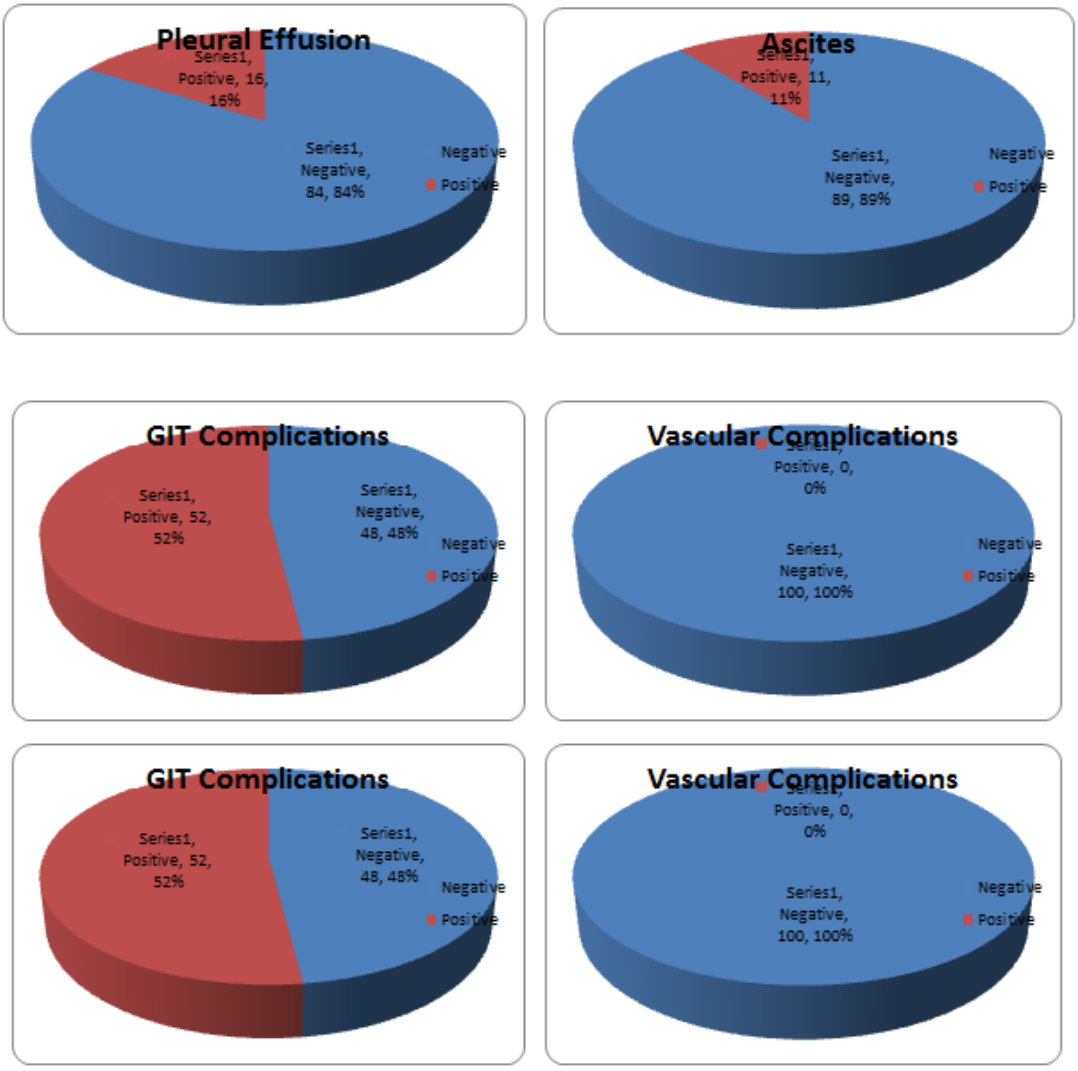

Fig. 3: Pie charts showing extrapancreatic complications

MODIFIED CT SEVERITY INDEX: The modified index is a 10 point scoring system derived by assigning points to the degree of pancreatic inflammation (0 to 4 points) pancreatic necrosis (0 to 4 points) and extrapancreatic complications (0 or 2 points). All patients were graded into mild (score 0-3), moderate (score 4-6) or severe (score 7-10).

DOI: 10.14260/jemds/2014/4097

Modified CT severity Index	No. of patients	%
Mild	26	26.0
Moderate	63	63.0
Severe	11	11.0
Total	100	100.0

Table 6: Modified CT severity Index

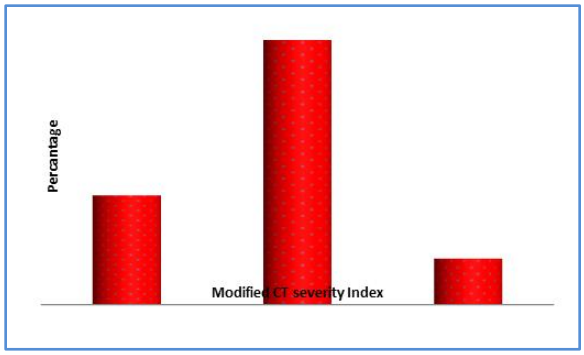

Fig. 4: Pie charts showing extrapancreatic complications

According to the Modified CT Severity Index, the patients were graded into mild, moderate and severe i.e. 26% patients had mild, 63% patients had moderate and 11% had severe Pancreatitis.

CT SEVERITY INDEX: The severity of pancreatitis is scored using CT severity index and classified into three categories (mild, moderate and severe). The CTSI is a 10 point scoring system derived by assigning points to the degree of pancreatic inflammation (0 to 4 points) and pancreatic necrosis (0 to 6 points).

According to the CT Severity Index, the patients were graded into mild, moderate and severe. 48% patients had mild, 41% patients had moderate and only 11% patients had severe pancreatitis as per CTSI score.

CT Severity index	No. of patients.	%
Mild	48	48
Moderate	41	41
Severe	11	11
Total	100	100

TABLE 7: CT Severity Index

DOI: 10.14260/jemds/2014/4097

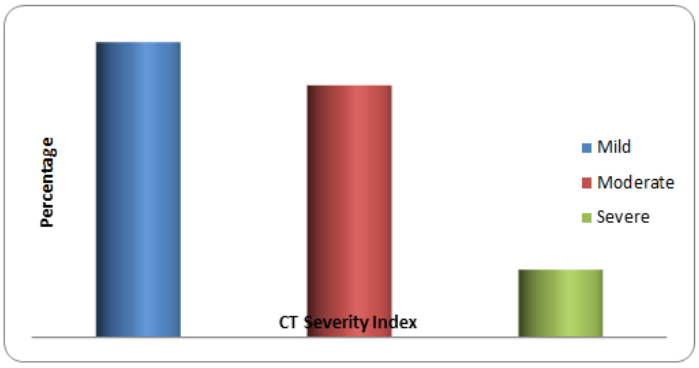

Fig. 5: Pie Chart Showing CT Severity Index

	Mild	Moderate	Severe	Total
CT severity Index	48 (48%)	41 (41%)	11(11%)	100 (100%)
Modified CT severity Index	26 (26%)	63 (63%)	11 (11%)	100 (100%)

Table 8: Comparision of CTSI and Modified CTSI

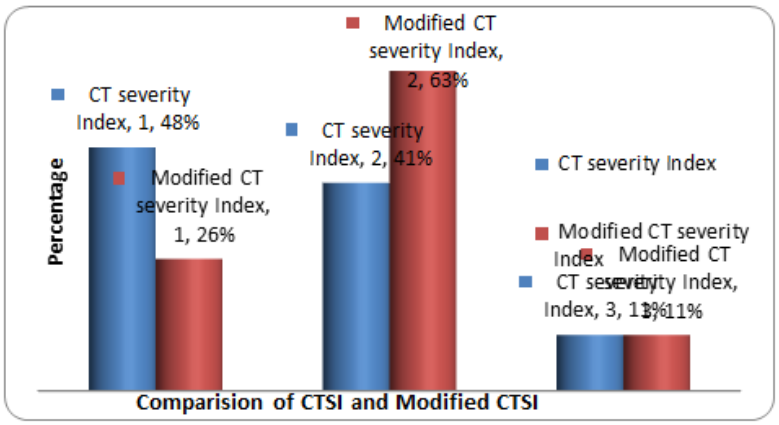

Fig. 6: Bar graph showing comparision between CTSI and MCTSI

Figure clearly depicts the distribution of patients in each category. In CTSI scoring system, 48 patients (48%) belonged to mild category, 41 (41%) patients had moderate and only 11(11%) patients belonged to severe pancreatitis. But in MCTSI scoring system 26 (26%) patients found to have mild pancreatitis, 63 (63%) patients found to have moderate and 11 (11%) patients severe pancreatitis. The discrepancy is attributed to the inclusion of extrapancreatic complications in MCTSI scoring system. Hence, two extra points were added to the severity index in addition to the pancreatic inflammation and necrosis findings.

DOI: 10.14260/jemds/2014/4097

ORIGINAL ARTICLE

AUTHORS:

1. Shivanand Melkundi
2. Neha Anand

PARTICULARS OF CONTRIBUTORS:

1. Associate Professor, Department of Radiodiagnosis, Mahadevappa Rampure Medical College.
2. 3rd Year Post Graduate, Department of Radiodiagnosis, Mahadevappa Rampure Medical College.

NAME ADDRESS EMAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Shivanand Melkundi,
Associate Professor,
Department of Radiology,
Basaveshwar Hospital,
Sedam Road, Gulbarga – 585105,
Karnataka.
E-mail: drshivanandmelkundi@gmail.com

Date of Submission: 06/11/2014.
Date of Peer Review: 07/11/2014.
Date of Acceptance: 19/12/2014.
Date of Publishing: 27/12/2014.