Original Research

Modified Computed Tomography Severity Index (MCTSI) For Evaluation Of Acute Pancreatitis And Its Clinical Outcome: A Tertiary Care Hospital Based Study.

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Abstract

Background : Acute Pancreatitis (AP) is a complex disease with a wide range of clinical implications and challenge for its optimal diagnosis. Though the majority of the patients may recover completely, 15-20% of them develop severe disease recurrence and resulting in higher mortality rate (up to 20-30%). Diagnosing the disease severity is one of the main challengeable complications in AP patients. The assessment of the severity of acute pancreatitis has a significant role in management. Mild pancreatitis responds well to the supportive therapy, whereas severe pancreatitis requires intensive monitoring and specific treatment.

Aims and Objectives: To analyze the Modified Computed Tomography Severity Index (MCTSI) for evaluation of acute pancreatitis and its clinical outcome in a tertiary care Hospital.

Materials & Methods: This is a correlative study done in the Department of Radiodiagnosis, Malla Reddy Medical College for Women,Hyderabad, India for a period of 24 months from January 2021 to December 2022. Study group consists of 52 patients selected using purposive sampling method from patients admitted to Our Hospital with clinical impression of acute pancreatitis during study period Patients admitted to the hospital with clinical impression of acute pancreatitis who underwent contrast enhanced MDCT during study period within three days of admission were included in the study.

Results and Observations: : In present study out of 52 patients, pancreas was normal in 2% cases in CT scan. Pancreatic inflammation was seen in 98% of patients.83% patients had no evidence of pancreatic necrosis on CT scan. 15% of patients had less than 30% necrosis and only 2% had more than 30% necrosis.. 56% patients had one or more extra pancreatic complications.45% patients are considered to have end organ failure. Hepatic failure is the most common system failure seen in 38% patients. 36% patients had evidence of systemic infection. 8% patients required surgical interventions. According to Modified CT Severity Index, 40% patients had mild, 43% patients had

moderate and 17% had severe pancreatitis. and according to RAC grading of pancreatitis 51% had mild ,34% had moderate, and 15% were severe

Conclusion: It was observed that both CTSI and MCTSI showed noteworthy correlation with clinical outcome parameters, as well as good concordance with grading of severity as per the revised atlanta classification. CT is an important solitary imaging modality to evaluate subjects with acute pancreatitis. Recent study showed highly significant correlation between the MCTSI score and the prediction of end organ failure, systemic infection and duration of hospital stay .and RAC grading of pancreatitis. However no significant correlation found with the need for surgical intervention. 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. Extra pancreatic complications, when included in the CT scoring system (MCTSI) were significantly correlated with end organ.

Keywords: Pancreatitis. RAC grading of pancreatitis, Modified Computed Tomography Severity Index, Computed Tomography Severity Index, Revised Atlanta classification

INTRODUCTION:

Acute Pancreatitis (AP) is a complex disease with a wide range of clinical implications and challenge for its optimal diagnosis. Though the majority of the patients may recover completely, 15-20% of them develop severe disease recurrence and resulting in higher mortality rate (up to 20-30%). Diagnosing the disease severity is one of the main challengeable complications in AP patients. Presently, the disease severity has been classified in to two main phases. In first phase, the onset of systemic inflammatory response syndrome lead to the development of Multiple Organ Dysfunction Syndromes (MODS) accompanied with severe pancreatic inflammation and/or necrosis. About, 50% deaths were recorded by this type worldwide in first week of disease attack. Usually, the second phase occurred if there is no halt or immune modulation after the first phase. It is characterized by the development of compromised pancreatic necrosis or fluid aggregation with potential progression to sepsis, MODS and death. Meanwhile, the data analysis on the patients revealed that the half of pancreatic necrosis patients develops the localized organ failure and their severities normally do not affect the remote organ complications [1]. Showed that the infection rate was increased with severity and time course of the disease. Their study showed that nearly 24% patients develop infection on surgery at first week and followed by 46% and 71% on their second and third weeks respectively. It was also showed that the increase in organ failures reflected on higher mortality rates (30-100%) based on the variation in MODS [2]. Acute pancreatitis is a process of acute inflammation of pancreas usually caused by biliary stone, alcohol ingestion, metabolic factors and drugs. Abdominal painis the major symptom of acute pancreatitis. It is generally classified into mild and severe forms. Mild pancreatitis, also called as interstitial or edematous pancreatitis is associated with minimal organ failure and an uneventful recovery.[3,4] Severe pancreatitis also called as necrotizing pancreatitis occurs approximately in 20% of the patients and is associated with organ failure or local complications, including necrosis, infection or pseudocyst formation.[5,6] The diagnosis is usually established by leukocytosis, elevated serum amylase, serum lipase. A computed tomography (CT) scan confirms the clinical impression of acute pancreatitis. The assessment of the severity of acute pancreatitis has a significant role in management.[6,7] Mild pancreatitis responds well to the supportive therapy, whereas severe pancreatitis requires intensive monitoring and specific treatment. The aim of this study is to determine whether early CT is effective in assessing the severity of acute pancreatitis and in predicting the prognosis and clinical outcome in these patients.

MATERIALS AND METHODS:

This is a correlative study done in the Department of Radiodiagnosis, Malla Reddy Medical College for Women,Hyderabad, India for a period of 24 months from January 2021 to December 2022. Study group consists of 52 patients selected using purposive sampling method from patients admitted to Our Hospital with clinical impression of acute pancreatitis during study period Patients admitted to the hospital with clinical impression of acute pancreatitis who underwent contrast enhanced MDCT during study period within three days of admission were included in the study. All scans were done using GE Bright speed 16 - slice MDCT with 120. KVp and 300 mAs with 5 mm slice thickness. Bolus tracking method is used for post contrast scan with the tracker placed in the descending aorta at the level of dome of diaphragm. 70-80 ml of 350mg/ml non ionic iodinated contrast (IOHEXOL) was injected using pressure injector at the rate of 3- 4ml/sec. Threshold set at 150 Hounsefield units(HU) and delay of 3 seconds was given after the attainment of threshold for arterial phase. Venous phase acquired after a delay 60 seconds from the time of contrast injection. Scanning was done in craniocaudal direction in arterial and venous phases; from the level of diaphragm to aortic bifurcation in the arterial phase and from the level of diaphragm to the level of pubic symphysis in the venous phase. Images were retro reconstructed with 1.25 mm slice thickness and reformatted in sagittal and coronal planes for analysis. The severity of pancreatitis was scored using modified CT severity index and classified into three categories (mild, moderate and severe). The modified index is a 10 point scoring system derived by assessing the degree of pancreatic inflammation (0 to 4 points) pancreatic necrosis (0 to 4 points) and extrapancreatic complications (0 or 2 points). Clinical outcome parameters included the length of hospital stay, the need for surgical intervention and the occurrence of infection, organ failure and death. Collected data were analyzed by frequency, percentage and Chi square test to assess the statistical significance.

Inclusion Criteria: Patients admitted with clinical suspicion of acute pancreatitis who underwent contrast enhanced MDCT within three days of admission.

Exclusion Criteria: Patients admitted with clinical suspicion of acute pancreatitis who did not undergo contrast enhanced MDCT, Pancreatitis due to trauma.

RESULTS AND OBSERVATIONS:

The study comprised of a total of 52 patients. In the present study, out of 52 cases, 39 (74.5%) were male and 13 (25.5%) were females with a male to female ratio of 3: 1.

Table 1 Age distribution.

Age(in years)	Patients	%
15-25	5	11
26-35	20	38
36-45	10	19
46-55	8	15
>55	9	17
Total	52	100

Study included patients between the age group ranging from 15 years to 79 years with a mean age of 40 yrs. Maximum number of patients was seen in the age group of 26- 35 years of age group which consisted of 20 (38.3%) patients.
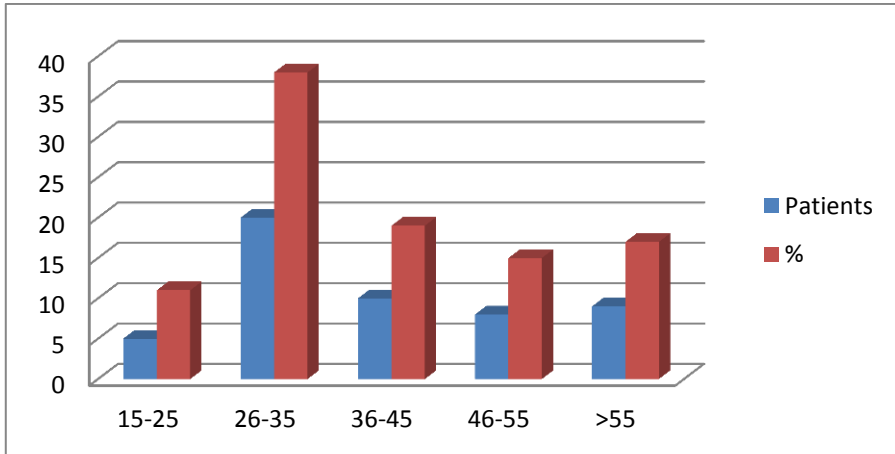
Figure 1: Patients segregation in the groups.

In the present study, 30 of 52 patients were alcoholic comprising of 57%, 18 (35%) patients had gall stones and remaining patients were grouped as others which consisted of 4 patients, diagnosed as pancreatic carcinoma (n=1) and idiopathic (n=3).

Table 2: Mode of clinical presentation of acute pancreatitis.

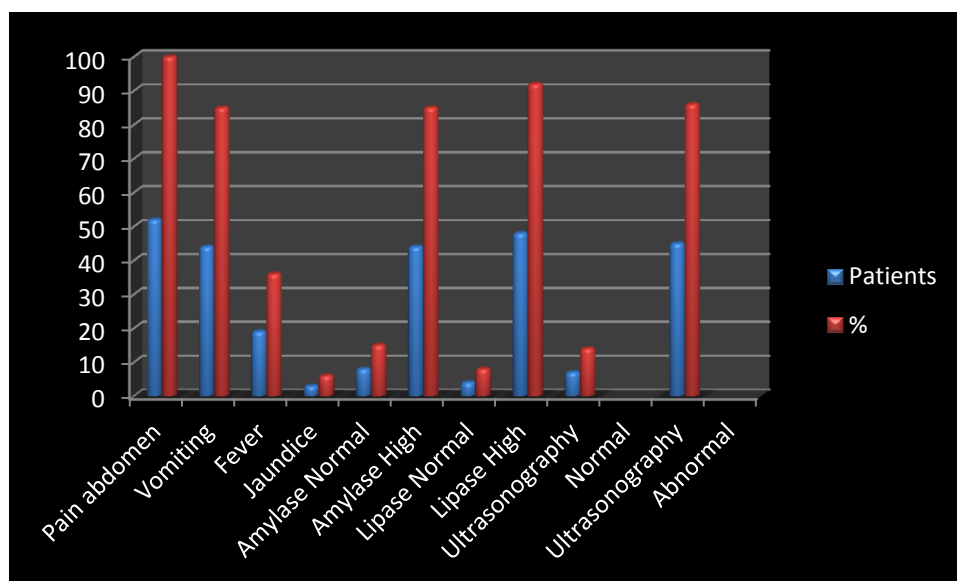| Clinical presentation	Patients	%
Pain abdomen	52	100
Vomiting	44	85
Fever	19	36
Jaundice	3	6
Lab diagnosis		
Amylase Normal	8	15
Amylase High	44	85
Lipase Normal	4	8
Lipase High	48	92
UltrasonographyNormal	7	14
Ultrasonography Abnormal	45	86

Figure 2: clinical presentation of acute pancreatitis in the patients

As in table 2 and figure 2, all 52 patients (100 %) presented with pain abdomen. 44 patients (85%) had vomiting, 19(36%) patients had fever and 3(6%) of patients had jaundice at the time of admission. Amylase was elevated in 44 (85%) patients at presentation. Lipase was elevated in 48(92%) patients at presentation. In 7 (14%) patients' ultrasound was normal. 45 (86%) patients had abnormal ultrasound findings such as bulky pancreas with altered echogenicity, peripancreatic fat stranding, fluid collection, ascites or pleural effusion. After diagnosing Acute Pancreatitis based on the clinical presentation, biochemical parameters and ultrasonography, patients were subjected to CT scan of the abdomen according to the standard protocol. The severity of the pancreatitis was assessed by assigning point system by using Modified CT Severity Index and 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 extra pancreatic complications (0 or 2 points). All patients were graded into mild (score 0-2), moderate (score 4-6) or severe (score 8-10).

Table 3: Modified CT severity index scoring.

Pancreatic Inflammation	Patients	%
0 score	2	4
2 score	27	52
4 score	23	44
Total	**52**	**100**
pancreatic necrosis		
0 score	43	83
2 score	8	15
4 score	1	2
Total	**52**	**100**
Extra pancreatic complications		
0 score	23	44
2 score	29	56
Total	**52**	**100**

In the present study, pancreas was normal in 2 (4.3%) patients. 27 (52%) patients had intrinsic pancreatic abnormalities with or without inflammatory changes in peripancreatic fat, to whom 2 points were assigned. Remaining 23 (44%) patients had pancreatic or peripancreatic fluid collection or peripancreatic fat necrosis, to whom 4 points were assigned A total of 43 (83%) patients had no evidence of pancreatic necrosis on CT scan. 8(15%) patients had less than 30% necrosis to which 2 points were assigned. only 1 patient had more than 30% necrosis, to which 4 points were assigned. Out of 52 patients, 23 (44%) patients had no evidence of extra pancreatic complications. 29 (56%) patients had one or more extra pancreatic complications such as pleural effusion, ascites, vascular complications, parenchymal complications, or gastrointestinal tract involvement. In the present study, 22 patients (85%) had both ascites and pleural effusion. 4 patients (20%) had only isolated ascites. None of the patients had isolated pleural effusion. One patient is found to have splenic vein aneurysm and another found to have portal vein thrombosis. 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.

Table 4: Patient outcomes and duration of hospitalization in severity based on Modified CT Severity Index and CTSI.

MCTSI	MILD	MODERATE	SEVERE
Total number of patients	21	22	9
Mean duration of hospitalization	6	9	14
Surgical intervention	0	2(10%)	2(25%)
Infection	**2(10%)**	**9(40%)**	**8(88%)**
End organ failure	7(32%)	8(35%)	9(100%)
CTSI			
Total number of patients	37	13	2
Mean duration of hospitalization	7	14	3
Surgical intervention	**1(3%)**	**2(17%)**	**2(100%)**
Infection	11(29%)	7(50%)	**2(100%)**
End organ failure	12(32%)	10(75%)	**2(100%)**

As in table 4, Modified CT Severity index was calculated by adding points assigned to each parameter. The severity of pancreatitis is classified into three categories: mild (0-2 points), moderate (4-6 points) and severe (8-10 points). According to the Modified CT Severity Index, the patients were graded into mild (n=21), moderate (n=22) and severe (n=9) i.e. 40% patients had mild, 43% patients had moderate and 17% had severe pancreatitis. In CTSI scoring system, 37 patients (72%) belonged to mild category, 13 (25%) patients had moderate and only two patients belonged to severe pancreatitis. But in MCTSI scoring system 21 (40%) patients found to have mild pancreatitis and 22 (43%) patients found to have moderate and 9 (17%). Out of 52 patients, as per the RAC grading 26 patients were classified under mild category , 18 were moderate and 8 were severe, 51% are mild ,34%are moderate, and 15% were severe. 23 of 52 patients (45%) are found to have end organ failure. Hepatic failure was seen in 20 (38%) patients is the most common system failure in patients with acute pancreatitis in our study. Cardiac failure seen in 7 (13%), Renal failure in 5 (10%) patients. Respiratory failure and CNS failure failure each seen in 1 (2%) patient. One patient developed raisein hematocrit value. Of these 24 patients who developed end organ failure, 7 patients had mild, 8 patients had moderate and 9 patients had severe pancreatitis according to the MCTSI. 32% of patients who had mild pancreatitis had end organ failure, whereas end organ failure is seen in 35% and 100% of patients who had moderate and severe pancreatitis respectively(p=0.002). According to CTSI, of these 24 patients, 12 patients had mild, 10 patients had moderate and 2 patients had severe pancreatitis. 32% of patients who had mild pancreatitis had end organ failure, whereas end organ failure is seen in 75% and 100% of patients who had moderate and severe pancreatitis respectively (p=0.012).The above statistics shows that, highly significant correlation exists between the prediction of end organ failure with the classification according to the MCTSI (p=0.002) than CTSI (p=0.012). A total of 19 (36%) patients who had fever and leukocytosis were considered to have systemic infection. Of these 19patients, 2 patients had mild, 9 patients had moderate and 8 patients had severe pancreatitis according to the MCTSI. 10% of patients who had mild pancreatitis had systemic infection, whereas systemic infection is seen in 40% and 88% of patients who had moderate and severe pancreatitis respectively (p=0.001). According to CTSI, of these 20 patients, 11 patients had mild, 7 patients had moderate and 2patient had severe pancreatitis. 29% of patients who had mild pancreatitis had systemic infection, whereas systemic infection was seen in 50% and 100% of patients who had moderate and severe pancreatitis respectively (p=0.172). With above statistical values, it can be concluded that, there is a highly significant correlation between the prediction of systemic infection with the classification according to the MCTSI (P=0.001), compared to the classification according to CTSI which is not statistically significant (p=0.172). Surgical intervention was required in 4 (8%) patients. Three patients who underwent laprotomy or USG guided aspiration had infected pseudocyst. One patient underwent surgical necrosectomy and subsequently that patient expired. In our study, none of the patients who had mild

pancreatitis according to MCTSI scoring underwent surgical intervention. Two patients (4%) had infected pseudocyst belonged to group of moderate pancreatitis, underwent surgical intervention. Two patients who had severe pancreatitis underwent surgical intervention, of them one had infected pseudocyst and another had necrosectomy. The statistical p value 0.117 is not significant. One patient, who had mild pancreatitis according to CTSI scoring, had infected pseudocyst and underwent surgical intervention. Two patients (4%) had infected pseudocyst belonged to group of moderate pancreatitis, underwent surgical intervention. One patient who had severe pancreatitis underwent surgical intervention, necrosectomy. The statistical p value 0.017 is significant. Above statistical analysis shows significant correlation between CTSI scoring system (p=0.017) and surgical intervention as compared to the MCTSI scoring system (0.117). Duration of hospital stay in our study was ranging from 2 to 23 days with mean duration of 9 days. The mean duration of hospitalization in mild, moderate and severe classes of Acute Pancreatitis according to Modified CT Severity Index was 6, 9 and 14 days respectively. Whereas it was 7, 14 and 3 days respectively as per the CT Severity Index. The above values shows that mean duration of hospitalization correlates well with the severity classification based on the MCTSI than CTSI. One patient who had severe pancreatitis (score 10) based on both classification died due to multiple organ failure. The same patient underwent surgical necrosectomy and died on 3rd day of hospitalisation. Mortality rate in our study was 2%.

DISCUSSION

Acute pancreatitis is commonly found in patients with the changed life style such as smokers, alcoholics etc., Hospitalization was also one the main criteria for determining its severity. The present study was aimed to analyse the disease severity using two basic methods *viz.*, CTSI and MCTSI with their clinical outcomes based on RAC. The study showed that the presence of the substantial correspondence between the methods related with the outcome parameters including mean duration of hospital stay, manifestation of persistent of, evidence of infection, need for intervention, and mortalit. Pancreatitis is classified as acute unless there is CT, MRI, or endoscopic retrograde cholangiopancreatography (ERCP) findings of chronic pancreatitis when pancreatitis is classified as chronic pancreatitis, and any episode of acute pancreatitis is considered an exacerbation of inflammation superimposed on chronic pancreatitis. Initial clinical assessment of the progression of acute pancreatitis alone has been inadequate in identifying patients who develop a severe disease. Identifying severe cases are important and can play a significant role in management decision and in reducing the morbidity and mortality associated with severe acute pancreatitis. Ranson score, Glasgow score, APACHE II, Marshall and SOFA (Sepsis-related organ failure assessment) scoring system are different severity scoring system studied in the past and proven to be indicators of the clinical severity. But, none of the above scoring system are proven to be the precise indicators of the adverse clinical outcome. Age incidence Mean age of presentation is 40 years in our study population. It is concurrent with study done by Thomas et al.[8] , Jauregui et al.[10] , and others. The prevalence of chronic alcohol abuse and biliary stones are common in fourth and fifth decades explain the high incidence of the acute pancreatitis in this age group. Sex distribution: M: F ratio in our study is about 3:1. Similar results are seen by Freeny et al..[6] As alcohol was the most common etiological factor in our study which is common in males, a high M: F ratio was observed. Etiology Chronic alcohol abuse is the most common etiological factor in our study constituting 53% of cases. Similar results were observed by Dugernier T L[11] and Freeny et al.[6] In contrary, studies done by Bollen T L et al. [9] and Jauregui et al.[10] showed biliary stones as the predominant etiological agent. Correlation of CT Scoring Indexes With patient outcome parameters Present study showed a significant correlation of grades of severity of pancreatitis based on both MCTSI and CTSI with patient outcome parameters. However MCTSI was more closely associated with patient outcome than CTSI in our study. Several studies reported a strong correlation between the CT evaluation and the clinical severity of acute pancreatitis and some studies have not corroborated these findings.

This difference in statistical significance between CTSI and MCTSI in our study may be attributed to the inclusion of extrapancreatic complications in the MCTSI system. We assume that the presence of ascites and pleural fluid may be responsible for the improved correlation with MCTSI, because they may be early indicators of organ dysfunction. Another important difference between the MCTSI and CTSI is that, MCTSI differentiates only between presence and absence of acute fluid collections and, therefore does not require a count of the collections as in case of CTSI. Similar study was done by Mortele K J et al.[7] In his study, when applying the modified index, the severity of pancreatitis and the following parameters correlated more closely than when the previously established CTSI was applied: the length of the hospital stay, the need for surgical or percutaneous procedures, and the occurrence of infection. Significant correlation between the severity of pancreatitis and the development of organ failure was seen only using the MCTSI (p = 0.0024), not the CTSI (p = 0.0513). Our study resulted in almost similar findings except that CTSI score showed statistically significant correlation with prediction of surgical intervention than MCTSI score. This difference is due to the presence of infected pseudocyst in two patients who presented with relapse of pancreatitis but had different scores in both indexes. In contrary to present study results, Bollen T L et al.12 showed no statistically significant differences between the two CT scoring systems with regard to all the studied severity parameters. The differences observed may be due to differences in criteria for organ failure and clinically severe AP (the present study used criteria in accordance with the Marshall criteria of end organ failure). In present study, for the MCTSI and CTSI to detect severe pancreatitis, sensitivity was 40% vs. 34%, negative predictive value was 67% vs. 56% respectively, specificity and positive predictive value of 100% for both indexes. Hence MCTSI is more useful for the screening in patients with severe acute pancreatitis than CTSI. Jauregui et al.9 found similar results, stating that for the MCTSI and CTSI, to detect severe pancreatitis, sensitivity was 61% vs. 38%, specificity 66% vs. 100% and positive predictive value of 81% vs. 100%, respectively. Correlation of CT scoring indexes with RAC grading of acute pancreatitis Present study showed significant correlation between MTCSI and RAC grading of acute pancreatitis . MTCSI grading was concordant with RAC grading in 42 cases CTSI was concordant with RAC grading in 37 cases and both MCTSI ,CTSI were concordant with RAC grading in 32 cases . Thus MTCSI showed significant correlation with RAC grading of severity.Role of Extrapancreatic Complications In Assessment Of Severity In a study done by Mole D J et al.[12] showed that extrapancreatic complications are associated more closely with the multi organ failure than presence of infection. In our study extrapancreatic complications were significantly associated with adverse outcome. Patients who had extrapancreatic complications had more severity score according to the MCTSI than CTSI, thereby increase in the number of patients having moderate and severe 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 Waele et al.[13] 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. Prediction of pancreatic infection and correlation with patient outcome In present study, 36% of patients were found to have evidence of systemic infection. However, the presence of infection was not confirmed in our study. Beger H G et al.[14] did clinical study on 114 patients with acute necrotizing pancreatitis, found 23.8% to have infection by bacterial contamination of the pancreatic necrosis confirmed by laparotomy. Hence it can be stated that, presence of fever and leukocytosis is the sensitive indicator of presence of the infection. Furthermore, evidence of infection is seen in 40% and 88% of patients with moderate and severe pancreatitis respectively as compared to only 10% of patients with mild pancreatitis. Hence classifying the patients according to the MCTSI may yield a better prediction of pancreatic infection. Also, the mean duration of hospital stay was more than those without evidence of infection. Role of Pancreatic Necrosis in Prediction of Outcome In present study 8 patients had severe pancreatitis and all patients had evidence of necrosis on CECT. All these patients had adverse clinical outcome when compared to the patients who had mild or moderate pancreatitis. Similar results seen in study done by Dugernier T L et al. where all patients

with acute severe pancreatitis had necrosis on CT scan. There is no significant correlation between presence of necrosis and need of surgical intervention in our study. Similar results were seen in study done by Freeny et al.[6] . This can be explained as patients presented with relapse and having pseudocyst and mild severity of pancreatitis but required surgical intervention.It was observed in our study that no significant association exists in different subgroups of necrosis when using the CT severity index (between patients who have 30– 50% necrosis and patients who have more than 50% necrosis) and clinical outcome. Similar results were seen by Balthazar et al.. [15] This is an important limitation of the CTSI as it is cumbersome and technically difficult to quantify the necrosis as 30-50% or above 50%. This limitation is not observed in MCTSI as patients having more than 30% necrosis are grouped together and assigned 4 points. In present study 2% of mortality rate was observed, Lescence et al. observed 6% mortality in their study.[16] The mean annual mortality rate for acute pancreatitis in the population was 1.3 per 100,000. Study done by Chamisa, T et al.[17] showed difference in mortality rate in gallstone pancreatitis and alcohol induced pancreatitis which was 6.5% and 3.1% respectively. Therefore, the aim of the present study was to assess the severity of AP using CTSI and MCTSI in patients admitted to bharath institute of higher education and research, Chennai for correlating clinical outcome measures, and to concord disease severity using Revised Atlanta Classification (RAC) method.

CONCLUSION

It was observed that both CTSI and MCTSI showed noteworthy correlation with clinical outcome parameters, as well as good concordance with grading of severity as per the revised atlanta classification. CT is an important solitary imaging modality to evaluate subjects with acute pancreatitis. Recent study showed highly significant correlation between the MCTSI score and the prediction of end organ failure, systemic infection and duration of hospital stay .and RAC grading of pancreatitis. However no significant correlation found with the need for surgical intervention. 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. Extra pancreatic complications, when included in the CT scoring system (MCTSI) were significantly correlated with end organ

CONFLICT OF INTERESTS:

None

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None

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