

## Role of Modified CT Severity Index in Assessment of Acute Pancreatitis at Tertiary Care Hospital

Rehana Shaikh <sup>1</sup>, Nasreen Naz <sup>2</sup>, Sabiha Zaheer <sup>3</sup>, Zahida Qadri <sup>4</sup>, Aliya Khan <sup>5</sup>, Hina Rana <sup>6</sup>

<sup>1</sup> Assistant Professor, <sup>2</sup> Associate Professor, <sup>3,5,6</sup> Resident Radiology, <sup>4</sup> Consultant Radiologist, CT & MRI Centre (Radiology Department, Dow Medical College/Civil Hospital Karachi, DUHS)

### ABSTRACT

**Objective:** To evaluate the diagnostic role of Modified CT Severity Index (MCTSI) in terms of severity of disease process and its complication in correlation to APACHE II score.

**Patients and Methods:** This cross-sectional study was conducted in CT & MRI Centre, Dow University of Health Sciences/ Dr. Ruth K. M. Pfau Civil Hospital Karachi, from 1<sup>st</sup> July to 31<sup>st</sup> December 2017. This study includes 93 patients with clinical features of acute pancreatitis referred to our department for contrast enhanced CT of abdomen within 24 hours of presentation. Patients were selected according to the study criterion. The pancreatitis was classified into mild, moderate and severe disease in term of severity by modified CT severity index. APACHE II score was calculated within 24 hours of admission. Clinical outcome parameters in terms of any intervention, systemic infection, organ failure and mortality were also collected.

**Results:** Mean age of the patients was 39.82 ± 12.04 years in the range of 20-70 years. Majority of patients were categorized as moderate pancreatitis (45.16%) according to Modified CT severity index followed by severe pancreatitis in 36 (38.71%) patients and mild pancreatitis in 15 (16.13%). Raised APACHE II score was observed in patients of severe pancreatitis. The clinical outcome parameters in terms of need of intervention, development of infection, organ failure and death rates, were also increased in patients with higher MCTSI.

**Conclusion:** Contrast enhanced CT had an excellent diagnostic value to assess the disease extent and to grade its severity. Modified CTSI is a simplified and powerful tool with good sensitivity and specificity to assess the severe acute pancreatitis in correlation to APACHE II.

**Key words:** Acute pancreatitis, APACHE II, Complications, Modified CT Severity Index

#### Author's Contribution

<sup>1,2</sup> Conception, synthesis, planning of research and manuscript writing

Interpretation and discussion

<sup>3-6</sup> Data analysis, interpretation and manuscript writing, Active participation in data collection.

#### Address of Correspondence

Rehana Shaikh

Email: rehanawazir@hotmail.com

#### Article info.

Received: April 17, 2018

Accepted: July 10, 2018

**Cite this article.** Shaikh R, Naz N, Zaheer S, Qadri Z, Khan A, Rana H. Role of Modified CT Severity Index in assessment of Acute pancreatitis in tertiary care Hospital. JIMDC.2018; 7(3):189-194

**Funding Source:** Nil

**Conflict of Interest:** Nil

### Introduction

Acute pancreatitis is one of the most complex and clinically challenging diseases with variable outcome. Majority of patients suffered from a mild disease process that resolves without any complication, but up to 20% of patients develop severe necrotizing pancreatitis with significant mortality reaching up to 30%,<sup>1</sup> due to

development of life threatening complications like secondary bacterial contamination, multi-organ failure, disseminated intravascular coagulation and gastrointestinal hemorrhage.<sup>2,3</sup> Imaging particularly contrast enhanced CT (CECT) has main role in the diagnosis and assessment of disease severity by

detecting pancreatic necrosis and then subsequent management of pancreatic disease.<sup>1</sup> Prompt evaluation of the disease severity and recognition of high risk patients is crucial for intensive therapy and intervention to improve their prognosis and survival. Because these patients may take advantage from fluid resuscitation, proper antibiotic cover, close observation for organ failure and timely therapeutic radiological intervention.<sup>1,4</sup>

Since 1970, multi-factorial scoring systems have been used to assess the severity of pancreatitis, initially including Ranson's criteria and Acute Physiology and Chronic Health Evaluation (APACHE)-II score. APACHE-II has high priority than other systems in indicating the disease severity because it includes all main clinical parameters that affect patient's outcome.<sup>5-7</sup> Various studies reported the sensitivity and specificity of APACHE-II up to 93.8% and 100% respectively.<sup>8,9</sup> Then Balthazar developed the CT Severity Index (CTSI) in 1990 by uniting the original grading system of pancreatitis and pancreatic necrosis that show better prognostic value but it too had some drawbacks because it does not include the extrapancreatic complications like organ failure or vascular complications.<sup>10,11</sup> Due to these drawbacks, a modified and easier CT scoring system was created by Mortelet in 2004 to determine precisely the clinical outcome. The modified CTSI was simpler and closely corresponded with patient's outcome parameters like duration of hospital stay, any surgery or intervention, infection occurrence, organ failure and death as compared to the Balthazar CTSI.<sup>5,12</sup>

There is limited information regarding the data of MCTSI in Pakistan because it is not used in routine clinical practice. This study was undertaken to evaluate the diagnostic value of MCTSI in terms of the severity of disease process and its complications, that would help in the proper management of the patient and in preventing development of severe life threatening complications.

## Patients and Methods

This cross-sectional hospital based study was conducted at CT & MRI Centre of Radiology Department, Dow University of Health Sciences/ Dr. Ruth K.M Pfau Civil Hospital Karachi from July to December 2017. Patients of either gender between 20-70 years of age referred for contrast enhanced CT (CECT) of abdomen within 24

hours of presentation, having two and more features of epigastric pain radiating to back, elevated serum amylase/lipase level or ultrasound findings of acute pancreatitis like enlarged pancreas, heterogeneous echogenicity, peripancreatic collections were included in the study. Patients with diagnosed pancreatitis on follow up or pancreatic carcinomas were excluded. Pregnant females' and patients allergic to urograffin and with deranged renal function tests were also excluded from study. Sample size was calculated by Openepi Version 3 taking 60% of patients of acute pancreatitis of moderate grading according to MCTSI,<sup>13</sup> 10% confidence interval and 95% confidence level. The total calculated sample size was 93. Written informed consent was obtained from each subject and permission was sought from institutional ethical committee.

CT scan of abdomen was performed with IV contrast using 16 Slice Toshiba Activion Scanner with pancreatic protocol i.e. in the arterial (at 40 seconds) and the portal venous (at 70 seconds) phase acquisition. The scanning parameter were 120 KV, 150 mA, 1mm collimation, 1mm slice thickness for arterial phase and 3mm slice thickness for portal venous phase. Images were obtained in contiguous axial sections from xiphisternum to pubic symphysis and reformatted in sagittal and coronal planes for analysis. Severity of pancreatitis was categorized by Modified CTSI into mild (0-2), moderate (4-6) and severe (8-10) by assessing various parameters of pancreatic and peripancreatic inflammation, percentage of pancreatic necrosis and extra-pancreatic complications and each of these parameters was assigned different points (Table 1). Then APACHE-II score was calculated within 24 hours of presentation that includes 12 variables such as temperature, mean arterial pressure, heart rate, respiratory rate, PaO<sub>2</sub>, arterial Ph, serum Na, serum K, serum creatinine, Hematocrit, white blood cells and Glasgow Coma score. APACHE-II score of  $\geq$  was taken as cut off for severe pancreatitis. Clinical outcome parameters were also collected from respective referral departments for correlation including any need of intervention, evidence of developing infection or organ failure and death. Collected data was entered and Statistical analyses were carried out on SPSS version 20. Descriptive statistics of age, gender, modified CTSI, APACHE-II score and clinical outcome parameters (any intervention, systemic infection, organ failure or death) were calculated.

Table 1: Modified CT Severity Index <sup>5</sup>		
Prognostic Indicators/Parameters		Points
Pancreatic inflammation	Normal pancreas	0
	Intrinsic pancreatic abnormalities with or without inflammatory changes in peripancreatic fat	2
	Pancreatic or peripancreatic fluid collection or peripancreatic fat necrosis	4
Pancreatic necrosis	None	0
	≤ 30%	2
	>30%	4
Extrapancreatic complications	One or more of pleural effusion, ascities, vascular complications, parenchymal complications, or gastrointestinal tract involvement	2

Table 2: MCTSI and APACHE II Score				
MCTSI	Patients (n)	APACHE II Score		p-value
		<8	≥ 8	
0-2	15	15(100%)	0	<0.001
4-6	42	17 (40.48%)	25 (59.52%)	
8-10	36	0	36 (100%)	
Total	93	32 (34.4%)	61(65.6%)	

Table 3: MCTSI and Patient's outcome parameters				
Patient Outcome Parameter	Modified CT Severity Index (MCTSI)			p-value
	Mild	Moderate	Severe	
Patients (n)	15	42	36	<0.001
Intervention	0	5 (5.4%)	16 (17.2%)	
Infection	0	2 (2.1%)	17 (18.3%)	
Organ failure	0	3 (3.2%)	14 (15.1%)	
Death	0	0	3 (3.2%)	

## Results

Ninety-three patients were enrolled to assess the diagnostic value of modified CT severity index in terms of severity of pancreatitis and its complications. The patients were in the range of 20-70 years with mean age of  $39.82 \pm 12.04$  years and maximum patients were between 31-40 years (38.7%). Out of 93 patients, 66 (71%) patients were males and 27 (29%) patients were females (figure 1). Cholelithiasis was the most common etiological factor for pancreatitis, seen in 47.3% cases. Majority of patients were categorized as having moderate pancreatitis (45.16%) according to MCTSI, while 36 patients (38.71%) were categorized into severe pancreatitis and 15 patients (16.13%) as mild pancreatitis. All patients of mild pancreatitis (100%) had APACHE II score of less than 8. Out of 42 patients of moderate pancreatitis, 17 patients (40.48%) had APACHE II score less than 8 while 25 patients (59.52%) had APACHE II score equal/more than 8. All patients with severe pancreatitis (100%) had APACHE II score equal/more than 8; none had APACHE II score less than 8 (Table 2). Pancreatic and peripancreatic inflammatory changes (78.5%) were the commonest findings on CT followed by pancreatic abnormality only (19.3%). Forty-five patients (48.4%) had pancreatic necrosis with 16 of them having >30% necrosis. No necrosis was noted in patients with MCTSI 0-2.

The commonest extra-pancreatic complication was pleural effusion in this study, seen in 48 (51.6%) patients. Pleural effusion was common on left side and found in 28 patients (30.1%) and bilateral in 20 (21.5%) patients.

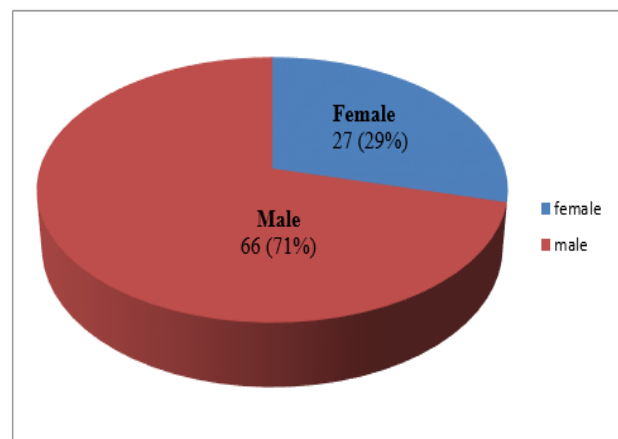
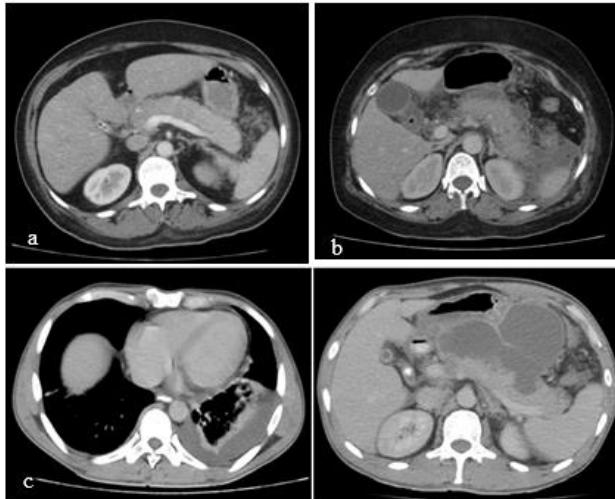


Figure 1: Gender distribution of study population (n=93)



**Figure 2: Axial images of CECT abdomen show (a) Enlarged pancreas with peripancreatic fat stranding (MCTSI 2/10). (b) Enlarged pancreas with heterogeneous enhancement, peripancreatic fat stranding and collections (MCTSI 4/10). (c) Left sided pleural effusion, enlarged pancreas, peripancreatic fat stranding and collections (MCTSI 6/10)**

None of patients showed isolated right side pleural effusion. The next common extra-pancreatic complication was ascites found in 30 patients (32.2%). Venous thrombosis was the common vascular complication found in 4 patients (3 in portal vein as well as superior mesenteric artery and 1 in splenic vein) followed by pseudoaneurysm in 2 patients (one in splenic artery and other in superior pancreaticoduodenal artery). More than one complication was present in patients having severe pancreatitis. Majority of patients who required interventional procedure or who developed infection or organ failure were in the group of severe pancreatitis. Sixteen out of 21 patients required intervention, 17 out of 19 developed infections and 14 out of 17 patients developed organ failure were in this group (Table 3). Death was seen in 3 patients (3.2%), who also belonged to this group. Figure 2 shows Axial images of CECT abdomen.

## Discussion

Acute pancreatitis is a common condition resulting in emergency visits all over the world due to unpredictable clinical course and outcome.<sup>1,14</sup> Early evaluation and diagnosis of severe pancreatitis is essential for its proper management and identifying those patients who may

benefit from early intensive therapy, but it's very difficult to assess clinically alone the severity of pancreatitis in most of the cases.<sup>4,5,15,16</sup> Computed Tomography (CT) has an important role not only in the disease diagnosis, but also for evaluation of disease severity as well as its complications and in subsequent disease management.<sup>2,14</sup> The modified CT severity index is a simple and easy way to assess the inflammation and necrosis of pancreas along with extra-pancreatic complications.<sup>14</sup> When severe pancreatitis occurs it is usually observed at beginning and it's very uncommon to observe the slow progression of disease from mild to severe grade. Therefore, early evaluation is a crucial concern for its management and prognosis.<sup>4</sup> APACHE II scoring has a clinically significant value as falling score usually is associated with mild attack while rising score with clinical deterioration. This score is also helpful in monitoring the disease course and response to treatment.<sup>17</sup>

This study was done to evaluate the acute pancreatitis on CECT and to determine the diagnostic value of modified CT severity index (MCTSI) in terms of severity of disease process and its complications that helps in assessing the prognosis of patient. This study consisted of 93 patients with mean age of  $39.82 \pm 12.04$  years. This was in concurrent with study done by Parhi et al.<sup>16</sup> Out of 93, 66 (71%) were male and 27 (29%) female with male to female ratio of 2:1, this was comparable with studies by Chnad *et al*<sup>13</sup> and Kim *et al*<sup>18</sup> in which 73.3% and 70% were males respectively. In our study, cholelithiasis was the most common etiological factor (47.3%). Raghuvanshi *et al*<sup>11</sup> noted gall stones in 42% as a causative factor of acute pancreatitis in his study done over 50 patients.

In our study, 42 (45.16%) patients were graded as having moderate pancreatitis, 36 (38.71%) having severe pancreatitis and 15 (16.13%) as mild pancreatitis according to MCTSI. This result was somewhat similar to studies by Banday *et al* who graded pancreatitis as 38%, 44% and 18% and by Chnad *et al* as 60%, 30% and 10% respectively.<sup>13,14</sup> Otherwise most studies showed more frequency of mild pancreatitis.<sup>16,18</sup> This study showed higher number of patients with moderate and severe pancreatitis because our hospital is a tertiary care centre so very sick patients of pancreatitis were referred to us. In

the present study, all patients (100%) of mild pancreatitis (MCTSI 0-2) had APACHE II score of less than 8. Out of 42 patients of moderate pancreatitis (MCTSI 4-6), 17 patients (40.48%) had APACHE II score less than 8 while 25 patients (59.52%) had APACHE II score equal/more than 8. All patients (100%) with severe pancreatitis (MCTSI 8-10) had APACHE II score equal/more than 8; none had APACHE II score less than 8. So we have found that the patients having higher MCTSI score also have raised APACHE II score. This is also observed by Cho *et al*<sup>1</sup> and Kumar *et al*<sup>4</sup> in their studies in predicting the acute severe pancreatitis.

This study showed pancreatic and peri-pancreatic inflammatory changes (78.5%) as most common CT findings followed by pancreatic abnormality only (19.3%). Forty-five patients (48.4%) had necrosis of the pancreas. Twenty-nine (64.4%) out of 45 patients had less than 30% and 16 (35.6%) had more than 30% pancreatic necrosis. These CT findings were comparable to a study conducted by Raghuwanshi *et al*.<sup>11</sup> Pleural effusion was the commonest extra-pancreatic complication in this study, seen in 48 (51.6%) patients, more common on left side. Raghuwanshi *et al*<sup>11</sup> and Balthazar *et al*<sup>20</sup> reported in their studies, the left sided pleural effusion as the commonest finding. Ascites was found to be second most common extra-pancreatic complication in our study present in 30 patients (32.2%) which is similar to the studies conducted by Raghuwanshi *et al*<sup>11</sup> (34%) and by Banday *et al*<sup>14</sup> (36%). Vascular complications were found in 6 patients (6.45%). Among these, venous thrombosis was most common seen in 4 (4.4%) patients (3 in portal as well as superior mesenteric veins and 1 in splenic vein), similar to Raghuwanshi *et al*.<sup>11</sup>

The patients who required interventional procedure or who developed infection or organ failure mostly fell in the severe pancreatitis group, as observed by various studies.<sup>11,14,19</sup> During the study duration, death was recorded in 3 (3.2%) patients due to multiple organ failure who were categorized as having severe pancreatitis according to MCTSI. Jeevangi *et al* and Singh *et al* found almost similar mortality (3.7% and 3.5% respectively) in their studies.<sup>5,21</sup> This study showed that modified CTSI had highest accuracy for assessing severity of pancreatitis in terms of pancreatic and peripancreatic inflammation, pancreatic necrosis, extra-pancreatic

complications, need for intervention and organ failure which was comparable to APACHE II scoring. Kumar *et al* showed comparable accuracy between the modified CTSI and APACHE II score in his study.<sup>4</sup>

## Conclusion

Contrast enhanced CT is an excellent diagnostic modality for the staging of the severity of pancreatitis. It shows the severity of inflammatory processes, extent of pancreatic necrosis and the local complications. The modified CT severity index is a simpler scoring system that showed quite good correlation with severity of pancreatitis and patients outcome parameters especially for assessing the loco-regional complications, organ failure and mortality.

## References

1. Cho JH, Kim TN, Chung HH, Kim KH. Comparison of scoring systems in predicting the severity of acute pancreatitis. *World J Gastroenterol* 2015; 21(8):2387-94.
2. Chishty IA, Bari V, Pasha S, Burhan D, Haider Z, Rafique Z. Role of Computed Tomography in Acute Pancreatitis and its Complications among Age Groups. *J Pak Med Assoc.* 2005; 55(10):431-5.
3. O'Connor OJ, McWilliams S, Maher MM. Imaging of acute pancreatitis. *American Journal of Roentgenology.* 2011; 197(2): W221-5.
4. Kumar AH, Griwan MS. A comparison of APACHE II, BISAP, Ranson's score and modified CTSI in predicting the severity of acute pancreatitis based on the 2012 revised Atlanta Classification. *Gastroenterology Report.* 2017, 1–5 doi: 10.1093/gastro/gox029
5. Jeevangi BA, Yeli RK, Borugadda R, Pyadala N. Management of Acute pancreatitis by using Modified Computed Tomography Severity Index. *International Journal of Contemporary Medicine Surgery and Radiology.* 2018;3(1):91-5.
6. Mofidi R, Patil PV, Suttie SA, Parks RW. Risk assessment in acute pancreatitis. *Br J Surg* 2009; 96(2):137-50.
7. Rehan A, Shabbir Z, Riaz O, Shaikat A. Diagnostic Accuracy of Modified CT Severity Index in Assessing Severity of Acute Pancreatitis. *J Coll Physicians Surg Pak.* 2016; 26 (12): 967-70.
8. Kulkarni SV, Naik AS, Subramanian N Jr. APACHE II scoring system in perforative peritonitis. *Am J Surg* 2007; 194(4):549-52.
9. Freire P, Romaozinho JM, Amaro P, Ferreira M, Sofia C. Prognostic score in a gastroenterology intensive care unit. *Rev Esp Enferm Dig* 2010; 102(10):596-600.
10. Balthazar EJ, Freeny PC, Van Sonnenberg E. Imaging and intervention in acute pancreatitis. *Radiology.* 1994;193(2):297–306.

11. Raghuwanshi S, Gupta R, Vyas MM, Sharma R. CT Evaluation of Acute Pancreatitis and its Prognostic Correlation with CT Severity Index. *J Clin Diagn Res.* 2016; 10(6): TC06–11.
12. Mortelet KJ, Mergo PJ, Taylor HM, et al. Peripancreatic vascular abnormalities complicating acute pancreatitis: contrast-enhanced helical CT findings. *Eur J Radiol.* 2004;52(1):67–72.
13. Chnad P, Pahuja V, Singh G, Singh P, Kumar V. Assessment of the severity of acute pancreatitis by Ranson's criteria and modified CT severity index. *International Journal of Contemporary Medical Research* 2017;4(6):1280-2.
14. Banday IA, Gattoo I, Khan AM, Javeed J, Gupta G, Latief M. Modified Computed Tomography Severity Index for Evaluation of Acute Pancreatitis and its Correlation with Clinical Outcome: A Tertiary Care Hospital Based Observational Study. *J Clin Diagn Res.* 2015;9(8):TC01-5
15. Suvarna R, Pallipady A, Bhandary N, Hanumanthappa. The Clinical Prognostic Indicators of Acute Pancreatitis by APACHE II Scoring. *Journal of Clinical and Diagnostic Research.* 2011. 5(3): 459-63.
16. Parhi AP, Nisa S, Panda BB, Dash B, Bhagat S. Correlation of Modified Computed Tomography Severity Index with Complications of Acute Pancreatitis. *JMSCR.* 2016; 4 (11): 13868-72.
17. Yeung YP, Lam BY, Yip AW. APACHE system is better than Ranson system in the prediction of severity of acute pancreatitis. *Hepatobiliary Pancreat Dis Int.* 2006; 5(2):294–9.
18. Kim YS, Lee BS, Kim SH, Seong JK, Jeong HY, Lee HY. Is there correlation between pancreatic enzyme and radiological severity in acute pancreatitis? *World J Gastroenterol.* 2008; 14(15):2401-05.
19. 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(2):386-92.
20. Balthazar EJ. Acute Pancreatitis: Assessment of Severity with Clinical and CT Evaluation. *Radiology.* 2002; 223(3):603–13.
21. Singh VK, Wu B, Bollen TL, Repas K, Maurer R, Johannes RS et al. A prospective evaluation of the Bedside Index for Severity in Acute Pancreatitis score in assessing mortality and Intermediate marker of severity in acute pancreatitis. *Am J Gastroenterol* 2009;104(4):966–71.