



Radio-Diagnosis

ASSOCIATION OF MODIFIED COMPUTED TOMOGRAPHY SEVERITY INDEX SCORE WITH SERUM AMYLASE AND LIPASE LEVEL IN ACUTE PANCREATITIS

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ABSTRACT

Introduction: Acute pancreatitis is an acute inflammation of the pancreas, due to auto digestion of pancreas by escape of activated proteolytic pancreatic enzymes into the pancreatic interstitium and may involve the peri-pancreatic fat or remote tissues and organs and is a major cause of acute abdomen. Imaging plays a major role in the diagnosis of acute pancreatitis, to determine the etiology and grading the severity of the disease, in identification of pancreatic, peri-pancreatic complication and guiding therapeutic interventions if required. Contrast enhanced CT is the investigation of choice for diagnosis, assessment and staging of severity of acute pancreatitis. **Objectives: Primary objective:** To assess the association between modified CT severity index score with elevated amylase and lipase levels. **Secondary objectives:** N/A **Materials and methods:** A hospital-based, Analytical study was conducted in the Department of Radiology, Pondicherry Institute of Medical sciences & Research Center (PIMS), Pondicherry between January 2021 and December 2022 on 21 patients with clinical diagnosis of acute pancreatitis referred from various clinical departments, after excluding those ineligible subjects as per exclusion criteria after obtaining their consent. The amylase and lipase levels of the patients are obtained through laboratory tests. The association between the MCTSI and the amylase, lipase values of the patients were assessed statistically. **Results:** In the current study, the mean age of the patients was 38.8 ± 12.2 years with majority (38.1%) being in the 31-40 years age group. The mean modified CT severity index score in this study was 8 ± 1.8 . The association of serum amylase and lipase values with the modified CT severity index was done using non parametric tests- Mann Whitney U test. The graphical representation of the data was expressed as pie chart, box and whisker plots. The correlation between modified CT severity index and serum amylase/ lipase levels were done using spearman rho correlation test. The correlation was also expressed as scatter plots. The predictors of modified CT severity index was found using logistic regression and expressed as Adjusted Odds Ratio (AOR). A p value of less than 0.05 was considered significant. All the independent variables except serum lipase levels were not significantly associated with the modified CT severity index. The p value for serum lipase levels is 0.047, thereby confirming that higher lipase levels is an independent predictor of modified CT severity index. **Conclusion:** The study establishes that there is a statistically significant moderate association between the MCTSI with the amylase and lipase values and higher lipase levels is an independent predictor of modified CT severity index.

KEYWORDS :

MATERIAL AND METHODS

Type of study: Analytical, hospital based study**Study area:** Pondicherry Institute of Medical sciences & Research Center (PIMS), Puducherry**Study period:** January 2021 to December 2022**Study population:** All the patients referred to the department of Radiodiagnosis, PIMS, with diagnosis of acute pancreatitis during the period of study.**Sample size:** The study units encountered during the study period who fit into the inclusion criteria were all included in the study and assuming a power of 80% with alpha error of 5% the final sample size was 21.**Study units:** All the patients referred to the department of Radiodiagnosis, PIMS, with Diagnosis of acute pancreatitis during the period of study, after excluding those ineligible subjects as per exclusion criteria.

Study participants (human, animals or both):

i. Inclusion criteria:

Patients 18 years of age and above who are clinically suspected and biochemically diagnosed as acute pancreatitis who undergo contrast enhanced CT scan when clinically indicated.

ii. Exclusion criteria:

Patients with known history of allergy to iodinated contrast agents. Patients with deranged Renal function test (serum creatinine > 1.5 mg/dl after rehydration).

Pregnant Patients

Withdrawal criteria, if any (trial-related therapy, follow-up and documentation are terminated prematurely as it is indicated to ensure safety of the participants): Patients who develop adverse reactions after the contrast is injected.

Rescue criteria, if applicable (starting symptomatic therapy either to control symptoms of disease or to overcome lack of adequate efficacy of the study drug or placebo): N/A Randomization details (for

interventional studies-intervention details with standardization techniques (drugs / devices / invasive procedures / non-invasive procedures / others): N/A

Methodology

This Analytical, hospital based study was conducted in the Department of Radiology, Pondicherry Institute of Medical sciences & Research Center (PIMS), Puducherry between January 2021 and October 2022 on 21 patients with diagnosis of acute pancreatitis referred from various departments, after excluding those ineligible subjects as per exclusion criteria. Initially permission was obtained from the Institutional Ethics Committee for the conduct of the study in the hospital.

Only individuals who had satisfied the inclusion criteria were included in the study. The individuals selected for the study were explained in their local language about the procedure, its safety and confidentiality. When they were clear about the explained the details, informed consent was obtained from the participant. Biochemical values such as amylase and lipase levels were recorded using a structured proforma.

Procedure

The patients were referred from the Department of gastroenterology for evaluation of severity of acute pancreatitis. They were included in the study as per the inclusion and exclusion criteria after obtaining their consent. The amylase and lipase levels of the patients were obtained through biochemical tests

All patients presenting to the Department of Radio diagnosis for contrast enhanced CT scan abdomen, fulfilling the inclusion and exclusion criteria was evaluated in this study.



The diagnostic procedure was explained to the patient in detail and informed consent will be obtained.



Contrast enhanced CT scan were performed using PHILIPS 128 SLICE CT SCANNER.



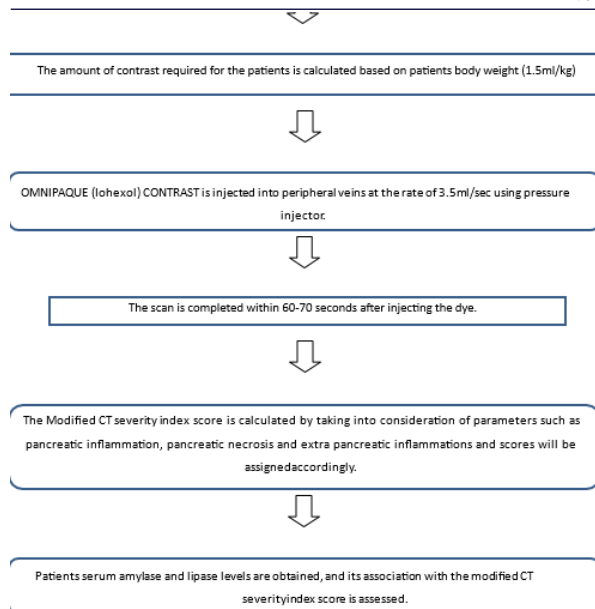


Figure 6: methodology flow chart

CECT was done using Philips Ingenuity 128 slice High resonance CT machine for all patients placed in the supine position.

Plain scan was first taken to look for any evidence of calcifications or intra ductal calculi. Iodinated contrast (omnipaque) was injected intravenously based on the body weight of the patient. (0.5-1.5 ml/kg), and contrast injected at the rate of 3ml/second.

Multi-phasic scan is acquired: arterial phase at 20 seconds, pancreatic parenchymal phase at 40 seconds and venous phase at 60 seconds Scan time: 60 seconds

All images were assessed in abdomen setting (window width: 150 HU; window level: 30 HU) Pancreatic parenchymal enhancement was assessed in the pancreatic parenchymal phase to look for inhomogenous enhancement or evidence of necrosis.

Evidence of other associated local and extra-pancreatic complications were assessed in all three phases.



Figure 7: Philips Ingenuity 128 slice CT used during the study

Study tool:

A proforma was used to obtain relevant clinical details regarding the onset of abdominal pain, any other relevant clinical history and for recording the severity based on MCTSI. The proforma is also structured to record the amylase and lipase of the patients. A written informed consent was obtained from each of the participants after explaining the content in their own local language.

The proforma includes the following:

- Demographic details
- CECT findings – morphological appearance, extent of necrosis, extra – pancreatic complications.
- Amylase and lipase values
- MCTSI grade of severity of acute pancreatitis

Images



Image 1: Axial Contrast enhanced CT demonstrating portal vein thrombosis.

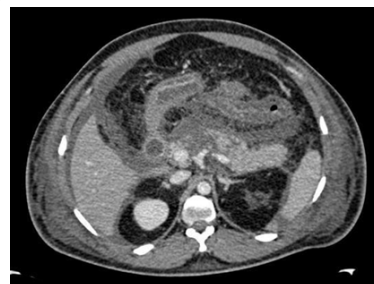


Image 2: Axial CECT demonstrating non enhancing necrotic pancreatic parenchyma with perimesentric fat stranding in a case of acute necrotising pancreatitis.



Image 3: Acute necrotic collection in a case of necrotising pancreatitis.

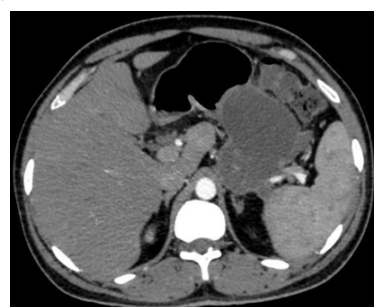


Image 4: Pseudocyst of pancreas in a case of acute pancreatitis.



Image 5: Bilateral Pleural effusion in a case of acute pancreatitis.

RESULTS

Statistical Analysis

The data collected from the patients was collected from Microsoft Excel and analysed using SPSS version 25. The numerical variables such as age, modified CT severity index, serum amylase and serum lipase levels were summarized as mean and standard deviation for

normally distributed variables and median and Inter-quartile range for skewed distribution variables. The categorical variables such as age category were summarized as frequency and percentage.

Since both serum amylase and lipase levels were skewedly distributed, their association with the modified CT severity index was done using nonparametric tests- Mann Whitney U test. The graphical representation of the data was expressed as pie chart, box and whisker plots. The correlation between modified CT severity index and serum amylase/ lipase levels were done using Spearman Rho correlation test. The correlation was also expressed as scatter plots. The predictors of modified CT severity index was found using logistic regression and expressed as Adjusted Odds Ratio (AOR). A p value of less than 0.05 was considered significant.

RESULTS

Table 8: Age distribution of the patients (n=21)

Age	Mean	38.8
	Standard Deviation	12.18
	Median	36
	Percentile 25	30
	Percentile 75	50

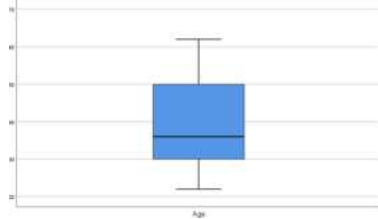


Figure 8: Graphical representation of the age distribution of the patients (n=21)

The mean age of the patients was 38.8 ± 12.2 years.

Tables 9: Age category of the patients (n=21)

Age category	Number	Percentage
≤ 30 years	6	28.6%
31- 40 years	8	38.1%
41- 50 years	3	14.3%
> 50 years	4	19.0%

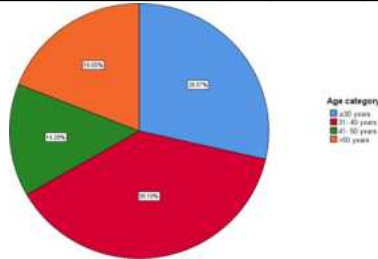


Figure 9: Graphical representation of the age category of the patients (n=21)

Majority of the patients (38.1%) were in the age group of 31-40 years followed by patients with less than 30 years (28.6%).

Table 10: Gender distribution of the patients (n=21)

Gender	Count	Column N %
Male	17	81.0%
Female	4	19.0%

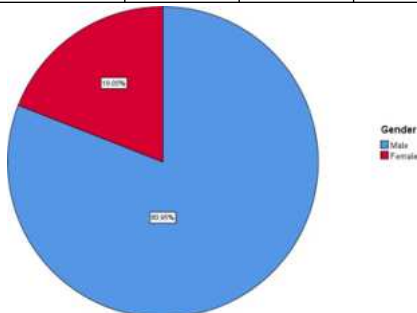


Figure 10: Graphical representation of the gender distribution of the patients (n=21)

Most of the patients were males (81%) and 19% were females.

Table 11: Distribution of the Modified CT severity Index score among the patients (n=21)

Modified CT Severity Index	Mean	8
	Standard Deviation	1.8
	Median	6
	Percentile 25	6
	Percentile 75	10

Table 12: Distribution of the Modified CT severity Index category among the patients (n=21)

Modified CT Severity category	Count	Column N %
Mild	0	0.0%
Moderate	11	52.4%
Severe	10	47.6%

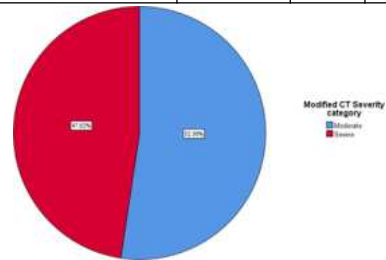


Figure 11: Graphical representation of the Modified CT severity Index category among the patients (n=21)

The mean Modified CT severity Index category among the patients was 8 ± 1.8 . The range of the score was from minimum 6 to maximum 10. When categorized, more than half of the patients (52%) had moderate CT severity category and about 48% had severe CT severity index.

Table 13: Distribution of the serum amylase and lipase levels of the patients (n=21)

Serum Amylase	Mean	582.0
	Standard Deviation	603.38
	Median	320
	Percentile 25	145
	Percentile 75	754
Serum Lipase	Mean	943.4
	Standard Deviation	895.26
	Median	740
	Percentile 25	209
	Percentile 75	1480

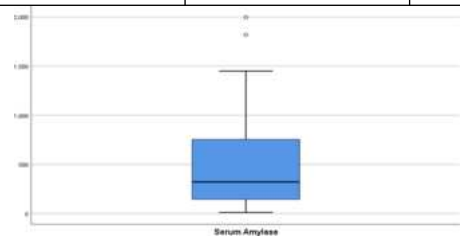


Figure 12: Graphical representation of serum amylase levels among the patients (n=21)

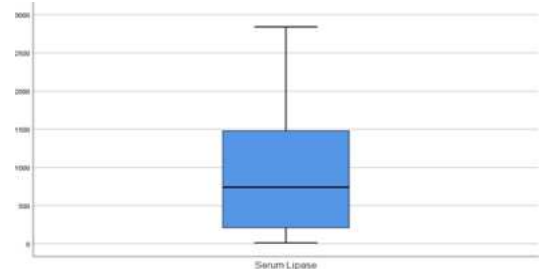


Figure 13: Graphical representation of serum lipase levels among the patients (n=21)

The median serum amylase levels were 582.0 ± 603.38 Units/ litre. The median value was 320 unit/ litre and ranged from 12 to 1995 U/L among the participants.

The median serum lipase levels were 922.9 ± 944.57 Units/ litre. The median value was 550 unit/ litre and ranged from 11 to 2840 U/L among the participants.

Table 14: Correlation between modified CT severity index and serum amylase level (n=21)

			Serum Amylase
Spearman's rho	Modified CT Severity Index	Correlation Coefficient	0.446*
		Sig. (2-tailed)	0.043^
		N	21

*non-parametric correlation using Spearman's rho correlation coefficient; ^p<0.05

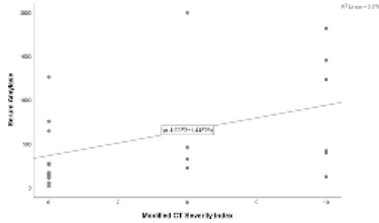


Figure 14: Scatter plot between modified CT severity index and serum amylase level (n=21)

The non-parameter correlation between modified CT severity index and serum amylase level yielded a spearman rho correlation coefficient value of 0.446 with a p value of 0.043. This means that there is a low positive significant correlation between modified CT severity index and serum amylase level. Higher the modified CT severity index, higher will be the serum amylase level.

Table 15: Correlation between modified CT severity index and serum lipase level (n=21)

			Serum Lipase
Spearman's rho	Modified CT Severity Index	Correlation Coefficient	0.781*
		Sig. (2-tailed)	<0.001^
		N	21

*non-parametric correlation using Spearman's rho correlation coefficient; ^p<0.05

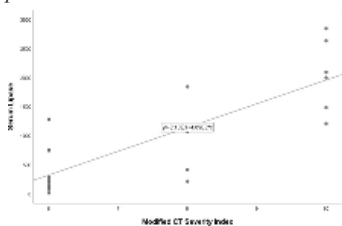


Figure 15: Scatter plot between modified CT severity index and serum lipase level (n=21)

The non-parameter correlation between modified CT severity index and serum lipase level yielded a spearman rho correlation coefficient value of 0.781 with a p value of <0.001. This means that there is an excellent significant positive correlation between modified CT severity index and serum lipase level. Higher the modified CT severity index, higher will be the serum lipase level.

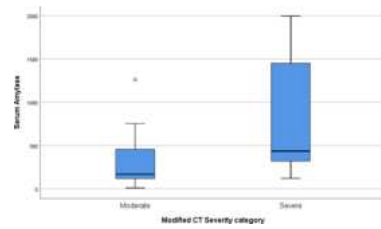
Table 16: Comparison of serum amylase levels among the modified CT severity index categories (n=21)

		Modified CT Severity category		p value*
		Moderate	Severe	
Serum Amylase	Mean	345.4	842.3	0.043^
	Standard Deviation	384.51	707.83	
	Median	168	436	
	Percentile 25	106	320	
	Percentile 75	643	1450	

*p value by Mann-Whitney U test; ^p<0.05

Figure 16: Graphical representation of serum amylase levels among

the modified CT severity index categories (n=21)



The median serum amylase levels were 168 (106-643) U/L among the moderate category and was 436 (320-1450) U/L among the severe categories. Mann Whitney test yielded a p value of 0.043, thereby confirming significant association between serum amylase levels and modified CT severity index categories. Higher serum amylase levels was found among severe modified CT severity index category.

Table 17: Comparison of serum lipase levels among the modified CT severity index categories (n=21)

		Modified CT Severity category		p value*
		Moderate	Severe	
Serum Lipase	Mean	367.3	1577.2	<0.001^
	Standard Deviation	389.90	871.87	
	Median	209	1660	
	Percentile 25	116	1070	
	Percentile 75	740	2090	

*p value by Mann-Whitney U test; ^p<0.05

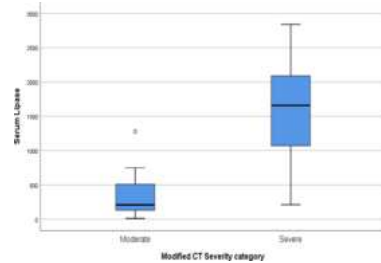


Figure 17: Graphical representation of serum lipase levels among the modified CT severity index categories (n=21)

The median serum lipase levels were 279 (116-1205) U/L among the moderate category and was 810 (222-2630) U/L among the severe categories. Mann Whitney test yielded a p value of <0.001, thereby confirming significant association between serum lipase levels and modified CT severity index categories. Higher serum lipase levels was found among severe modified CT severity index category.

Table 18: Predictors of modified CT severity index among the patients using logistic regression (n=21)

Logistic Regression

	B	S.E.	Wald	p value	AOR	95% CI	
						Lower	Upper
Age	-.223	.167	1.770	0.183	.800	.576	1.111
Gender(Male)	-5.524	3.909	1.997	0.158	.004	.000	8.480
Serum Amylase	-.002	.002	1.147	0.284	.998	.993	1.002
Serum Lipase	.006	.003	3.952	0.047^	1.006	1.000	1.012

AOR- Adjusted Odds ratio; ^p<0.05

Logistic regression yielded no significant predictors for modified CT severity index. All the independent variables except serum lipase levels were not significantly associated with the modified CT severity index. The p value for serum lipase levels is 0.047, thereby confirming that higher lipase levels is an independent predictor of modified CT severity index.

DISCUSSION

Computed tomography is inevitable in identifying morphological changes and complications of any disease process and is of importance in identifying the expected complications of the disease process.

In acute pancreatitis, contrast enhanced computed tomography plays an important role in identifying the type of pancreatitis, to differentiate between the interstitial edematous type and necrotizing pancreatitis. It

also plays a major role in identification of the commonly associated complications like pleural effusion, ascites, vascular complications, peripancreatic collection, pseudocyst, walled off necrotic collections.⁽²⁾ Although Magnetic resonance imaging has been proposed as an alternative imaging tool without the harmful effects of radiation, contrast enhanced Computed tomography remains indispensable due to its easy availability, lesser cost and reduced scan time.

Acute pancreatitis is a common cause of acute abdominal emergency which can take an indolent or fulminant course and may result in long-term medical as well as surgical complications often leading to poor prognosis without timely intervention. There is no particular age group which is vulnerable for pancreatitis. Bhimwal RK et al in 2017 studied the clinical and radiological features of acute pancreatitis and reported that 32.5% were in the 30-39 years age group, followed by 25% in the 50-59 years age group. The mean age of the patients in their study was

42.2 years and the male to female ratio was 1.7:1⁽³⁾ In the current study, the mean age of the patients was 38.8 ±12.2 years with majority (38.1%) being in the 31- 40 years age group. Males and females were not equally distributed in this study, the majority (81%) of the study population consisted of males and only 19% of them were females.

The CT studies were evaluated and each case was scored based on modified CT severity index. Based on the Modified CT severity scores of each index the patients were graded as having mild, moderate and severe pancreatitis. In 1990, Balthazar et al,⁽⁴⁾ graded the cases of acute pancreatitis based on the CT severity score which correlated well with the patient's outcome in terms of hospital stay, presence of infection and need for surgical intervention. Mortelet et al, in 2004 conducted a study in 266 patients and applied both the modified CT severity index grading system and CT grading systems to assess the correlation between them and the patient outcome.

Bollen et al,⁽⁵⁾ in 2011 conducted a study to do a comparative evaluation between the CT severity index and modified CT severity index in assessing the severity of acute pancreatitis. 397 cases were evaluated of which 34% were attributed to biliary stones, 22% belonged to alcohol induced pancreatitis category, 13 % were idiopathic and the rest were attributed to drugs, miscellaneous causes. In this study the etiological factors were assessed and showed majority of the cases were alcohol induced pancreatitis comprising of 37% (n=17), followed by the cholelithiasis comprising 32.6% (n=15) of the study population.

The CT severity index and modified CT severity index have been widely accepted to grade the severity of acute pancreatitis based on morphological appearance, percentage of necrosis. The modified CT severity index also takes into account the presence of extra-pancreatic as a part of the scoring system. The difference between the two CT severity indices was attributed to the extra parameter that is included in the modified CT severity index and the simplification of the scoring system by eliminating subjective observations of necrosis.⁽⁶⁾

The contrast enhanced CT of the study population were graded into mild, moderate and severe pancreatitis based on the modified CT severity indices. The mean modified CT severity index score in this study was 8±1.8. Majority of the study population 52% were graded into the moderate grade by modified CT severity index.

The serum amylase and lipase levels of the patients were assessed using biochemical tests.

There was significant association between the Modified CT severity indices with serum amylase and lipase values (p value : 0.043 and 0.047 respectively).

The modified CT severity score showed statistically significant correlation with the amylase and lipase level (p<0.001). This was similar to the studies by Cho et al.⁽¹⁾ which showed good correlation of CT severity score and amylase and lipase levels in patients with pancreatitis.

The predictors of modified CT severity index was found using logistic regression and expressed as Adjusted Odds Ratio (AOR). A p value of less than 0.05 was considered significant. This showed a statistically significant correlation between the modified CT severity index and the amylase and lipase values and higher lipase levels is an independent

predictor of modified CT severity index.

CONCLUSION

- 1) The study establishes that there is a statistically significant association between the MCTSI and the amylase and lipase values.

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Ethical Consideration:

This article followed all ethical standards for carrying out research. Data availability statement: The authors confirm that the data supporting the findings of this study are available within the article.

Disclaimer:

The views and opinions expressed in this article are those of the authors and do not necessarily reflect the official policy or position of any affiliated agency of the authors.

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. Arvanitakis M, Delhaye M, Maertelaere VDE, Bali M, Winant C, Coppens E, et al. Computed Tomography and Magnetic Resonance Imaging in Gastroenterology. 2004;715-23.
3. Bhimwal RK, Makwana M, Panwar RR, Lal K. A prospective study of clinical , biochemical and radiological features in pancreatitis. *Int J Adv Med*. 2017;4(5):1386-93.
4. Balthazar E, Robinson D. acute pancreatitis: value of CT in establishing prognosis. *Radiology*. 1990;(174):331-6.
5. 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. *Am J Roentgenol*. 2011;197(2):386-92.
6. Melkundi S, Anand N. Modified Computed Tomography Severity Index in Acute Pancreatitis. *J Evol Med Dent Sci [Internet]*. 2014;3(74):15541-51.