

# Usefulness of Computerized Tomography Scan for the Detection and Evaluation of Acute Pancreatitis

G. Srirama Murthy<sup>1</sup>, R. Somasekhar<sup>2</sup>

<sup>1</sup>Associate Professor, Department of Radiology, Shri Sathya Sai Medical College and Research Institute, Kancheepuram District, Tamilnadu, <sup>2</sup>Assistant Professor, Department of Radiology, Shri Sathya Sai Medical College and Research Institute, Kancheepuram District, Tamilnadu, India.

**Corresponding author:** Dr. R. Somasekhar, Assistant Professor, Department of Radiology, Shri Sathya Sai Medical College and Research Institute, Kancheepuram District, Tamilnadu, India

DOI: <http://dx.doi.org/10.21276/ijcmsr.2020.5.1.27>



**How to cite this article:** G. Srirama Murthy, R. Somasekhar. Usefulness of computerized tomography scan for the detection and evaluation of acute pancreatitis . International Journal of Contemporary Medicine Surgery and Radiology. 2020;5(1):A123-A127.

## A B S T R A C T

**Introduction:** Acute pancreatitis is one of the most common diseases of the gastrointestinal tract. Imaging by CT scan helps in diagnosing severity of acute pancreatitis including the presence of pancreatic necrosis as well as local and systemic complications. Current study aimed to study the use of CT scan for the detection and evaluation of acute pancreatitis.

**Material and Methods:** A total of 110 patients diagnosed clinically with acute pancreatitis were studied for patient demographics, clinical presentation, etiology and CT scan findings.

**Results:** A total of 110 patients with age ranging from 15 years to 60 years were studied. The male to female ratio was 2.1:1. Most (59%) of the cases were in the 41 to 50 years age. Epigastric pain and vomiting were the most common clinical features. Gall stones and alcoholism were the most common etiological factors for acute pancreatitis. CT findings showed diffuse enlargement in 43.6% cases, and irregular contour in 63.6% cases. Ascites and pleural effusion were noted in 31.8% cases. Balthazar's CTSI system gave better results than the Ranson's criteria.

**Conclusion:** Acute pancreatitis commonly affects adult males. CT scan plays an important role in diagnosing acute pancreatitis and Balthazar's CTSI system is advantageous over the Ranson's criteria system. The CT modality gives information on the severity and extent of the inflammatory process and thereby helps in decision making for patient management.

**Keywords:** Acute Pancreatitis, CT Scan in Acute Pancreatitis, CT Scan in Pancreatic Necrosis

## INTRODUCTION

Acute pancreatitis is one of the most common diseases of gastrointestinal tract (GIT), leading to tremendous emotional, physical, and financial burden.<sup>1</sup>

Acute pancreatitis (AP) is a complex clinical condition with majority of patients and in approximately 20% becomes clinically very severe with significant mortality.<sup>2</sup> Clinically severe patients require admission to intensive care unit (ICU), where close monitoring and treatment with aggressive fluid resuscitation are a must.<sup>3</sup> Clinically, acute pancreatitis is diagnosed in patients with two of the following three features: (a) sudden onset of upper abdominal pain, (b) serum amylase and/ or lipase levels more than three times the upper limit of normal, and/or (c) abdominal computed tomography (CT) scan or ultrasound scan having characteristic findings.<sup>4,5</sup> Diagnosis of acute pancreatitis is made by combination of clinical presentation, laboratory investigations and imaging. Serum amylase, lipase, liver function tests, serum electrolytes with blood gas analysis are the commonly performed laboratory investigations which help to grade the severity and prognosis of acute pancreatitis based on several clinical criteria including Ranson's criteria.<sup>6</sup>

Imaging plays a major role in diagnosing severity of acute pancreatitis including the presence of pancreatic necrosis as well as local and systemic complications. It also serves as a guide for therapeutic intervention and response to therapy.<sup>7</sup> Modified CT severity index is used to detect extent of necrosis and various local and extra pancreatic complications.<sup>8</sup>

Two commonly used CT scoring systems are the CT severity index (CTSI), and modified CT severity index (MCTSI), proposed by Mortelet et al<sup>9</sup> and require the use of intravenous (IV) contrast agents to determine the presence and extent of pancreatic necrosis, as well as inflammatory changes and local and/or extrapancreatic complications.

Modified Computed Tomography Severity Index (MCTSI) has been introduced which differs from the Computed Tomography Severity Index (CTSI) by including the presence of extra pancreatic complications and grading the peripancreatic fluid collection in terms of presence or absence instead of the number of fluid collections. The grading of necrosis is also different in this system.<sup>9</sup>

In the cases with acute pancreatitis, CT examination should be performed if the clinical diagnosis is uncertain, clinical findings suggest severe acute pancreatitis (Ranson score  $\geq 3$ , APACHE II score  $\geq 8$ ), or there is suspicion of necrotizing

pancreatitis, and for patients who do not improve clinically within 72 hours of the initial conservative medical therapy or for patients who demonstrate improvement during the initial medical therapy but then manifest acute change in clinical status with fever, pain, decrease in hematocrit or hypotension, and also when any complication is suspected.<sup>10,11</sup>

CT findings of acute pancreatitis depend on the severity and extent of the inflammatory process. A CT scan which is performed within the first 48 hours of the onset of symptoms may be completely normal. CT findings of acute pancreatitis include enlargement of the pancreas (localised or diffuse), ill defined parenchymal contours, decrease in density and inhomogeneity of the pancreatic parenchyma and there may also be fluid collections in the peripancreatic region. The inflammatory reaction can produce increased attenuation of the peripancreatic adipose tissue commonly described as "stranding".<sup>12-14</sup>

Current study aimed to study the use of CT scan for the detection and evaluation of acute pancreatitis.

## MATERIAL AND METHODS

Permission was taken from the institutional ethical committee.

Informed consent was taken from all the patients included in the study.

This was a prospective observational study done on 110 patients diagnosed with acute pancreatitis. Study was conducted in the department of Radiodiagnosis at Shri Sathya Sai Medical College and Research Institute, Kancheepuram district, Tamilnadu, India for one year, ie, from March 2018 – April 2019

### Inclusion criteria

- Patients willing to participate in the study
- Both the genders
- Patient age between 10 to 60 years
- Clinically diagnosed cases of acute pancreatitis
- History of Trauma
- Laboratory findings suggestive of acute pancreatitis
- Normal serum creatinine level

### Exclusion criteria

- Patients not willing to participate in the study
- Age below 10 years and above 60 years
- Pregnant women
- High serum creatinine level where contrast can not be given

All the cases included in the study were from the out patient department of General Surgery and indoor admitted patients under department of General Surgery. Once the patients were clinically diagnosed as acute pancreatitis, then they were referred to department of Radiology for Imaging studies as part of patient work-up.

A thorough clinical examination was done including history taking, onset of symptoms, past history of similar complaints, history of cholelithiasis, alcohol intake, or smoking. Local and systemic examination was done. Laboratory investigations were requested from the primary consulting physician and included hemogram, urine analysis, serum amylase, serum lipase, serum creatinine level, lipid profile (mainly triglyceride), and random blood glucose. All the patients were

subjected to USG abdomen and findings were noted. All the patients were subjected to CT scan and the following points were noted: the pancreatic parenchyma affection (bulky, edematous, necrotic, focal, or diffuse); peripancreatic region (stranding, single peripancreatic collections, or pseudocysts); GB or common bile duct stones; biliary and pancreatic ducts; masses in the pancreas or ampulla; and extrapancreatic ascites, pleural effusion lung bases, and intestinal loops.

In the department of Radiodiagnosis, the procedure was explained to the patients beforehand. The mean duration between onset of symptoms and CT scan procedure was 7 days (and within 15 days) as by that time necrosis can be detected very well.

**Equipment used:** The CT machine that was used is Toshiba Aquilion (160 slices). The contrast used was water soluble and nonionic (Omnipaque) administered at 300 mg/ml through intravenous injection.

After collecting all data from CT, we made grading of acute pancreatitis into five grades (A, B, C, D, and E), and this grading was done according to the texture of pancreas and peripancreatic fluid in the abdomen.

Grading of Acute Pancreatitis with CT by Balthazar's system<sup>9</sup> as given below was done:

- Grade A Laboratory and clinical evidence of pancreatitis with normal pancreas (score 0).
- Grade B Showed bulky pancreas (focal or diffuse) with no peripancreatic changes (score 1).
- Grade C Showed peripancreatic stranding (score 2).
- Grade D Showed single peripancreatic fluid (score 3).
- Grade E Showed two or more than two pockets of fluid collection or gases on the retroperitoneal space (score 4).

Ranson's clinical criteria were followed to categorize the cases and both systems of Ranson's criteria and Balthazar's CTSI grading were compared.

## RESULTS

There were a total of 110 patients in the study. The male to female ratio was 2.1:1. The patient age ranged from 10 years to 60 years. The youngest patient was 15 years and the oldest patient was 60 years old (table-1).

In the present study age group distribution included from 10

Age in years distribution	No. of cases	Percent (%)
10-20	01	0.9%
21-30	03	2.7%
31-40	21	19.0%
41-50	65	59.0%
51-60	20	18.1%
Total	110	100%

**Table-1:** Showing age distribution

Gender	No. of cases	Percent (%)
Males	75	68.1%
Females	35	31.8%
Total	110	100%

**Table-2:** Showing gender-wise distribution of the cases

Clinical features	No. of cases	Percent (%)
Epigastric pain	30	27.2
Epigastric pain + vomiting	45	40.9
Nausea	20	18.1
Vomiting	10	9.0
Tenderness	05	4.5
Total	110	100%

**Table-3:** Showing clinical features

CT signs of acute pancreatitis	No. of cases	Percent (%)
<b>Gland</b>		
Normal	20	18.1%
Diffuse enlargement	48	43.6%
Focal enlargement	42	38.1%
<b>Contour</b>		
Regular	40	36.3%
Irregular	70	63.6%
<b>Density</b>		
Isodense	12	10.9%
Focal hypodensity	70	63.6%
Generalized hypodensities	20	18.1%
Distorted architecture	8	7.2%
<b>Necrosis</b>		
<30	32	29.0%
30-50	12	10.9%
>50	12	10.9%
Ascites	35	31.8%
Pleural effusion	35	31.8%

**Table-4:** Showing CT signs of acute pancreatitis

Etiology of acute pancreatitis	No. of cases	Percent (%)
Gall stones	35	31.8%
Alcoholism	30	27.2%
Trauma	04	3.6%
Idiopathic	22	20%
Drug induced	15	13.6%
Hyperlipidemia	04	3.6%
Total	110	100%

**Table-5:** Showing etiology of acute pancreatitis

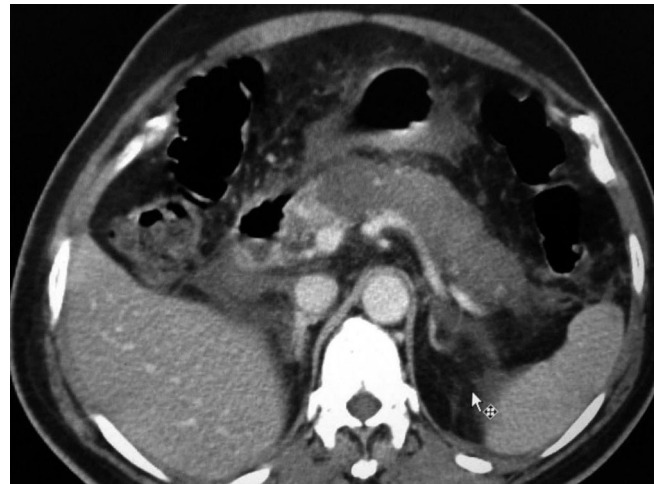
Grade	Points	Necrosis		Severity index
		Percent	Additional points	
A	0	0	0	0
B	1	0	0	1
C	2	<30	2	4
D	3	30-50	4	7
E	4	>50	6	10

**Table-6:** Balthazar's Grading of Acute Pancreatitis and CT severity index

years to 60 years. Majority of patients were among 41 to 50 years having (65/110) 59.0% cases, Next common age group was that of 31-40 years with 19%

Balthazar's CT grade	CTSI		Total
	Mild	Severe	
B	17	11	28
C	29	13	42
D	18	7	25
E	11	4	15
Total	75	35	110

**Table-7:** Comparison between Balthazar's CT Grading and CTSI Correlation



**Figure-1:** CT post contrast study shows acute pancreatitis with > 80% necrosis

(21/110) cases. In the present study majority of the patients were males 68.1% (75/110) as compared to females 31.8% (35/110). The male to female ratio was 2.1:1 (table-2).

In the present study most common clinical presentation was of epigastric pain and vomiting seen in 40.9% (45/110) cases, followed by epigastric pain only in 27.2% (30/110) cases (table-3).

In the present study, CT findings showed diffuse enlargement in 43.6% cases, and irregular contour in 63.6% cases. Ascites and pleural effusion were noted in 31.8% cases (table-4). In our study, amylase level was raised in 59% cases, whereas lipase level was raised in 80% cases (fig-1).

In the present study, most common etiological factor was gall stones and was seen in 31.8% (35/110) cases, next common factor was alcoholism and was seen in 27.2% (30/110) cases (figure-5).

A CT Severity index (CTSI) of less than 5 is taken as mild acute pancreatitis and CTSI of > 5 is considered as severe degree of acute pancreatitis (figure-6).

In our study, there were 75 cases of mild acute pancreatitis as per Balthazar's CTSI system. Out of 75 cases, 64 cases (85.3%) correlated well for Ranson's criteria for mild severity. Remaining 11 (14.6%) cases were graded as severe as per Ranson's criteria but were actually mild category on CTSI score (figure-7).

In our study, 35 (31.8%) cases were in severe category as per Balthazar's CTSI system. Of these 35 cases, 29 (82.1%) correlated well with Ranson's criteria for severe disease process. The remaining 6 (17.1%) cases which were

considered as severe by CTSI were thought of as mild on Ranson's criteria.

**Duration of hospital stay:** The median duration of hospital stay was 8 days (range was from 3 to 71 days), and 43.3% cases had a hospital stay of more than 10 days. Seventeen (40.0%) patients had clinical evidence of infection, whereas only 3 out of these 17 showed radiological evidence of infection. Intervention was required in 15 (25%) cases. Out of 60 patients, 53 recovered while 7 died. All the patients who died had evidence of infection. Moreover, of all the patients with evidence of infection, 7/17 (41%) cases died.

There was a significant association ( $P < 0.001$ ) between evidence of infection and mortality. All the patients who died had persistent organ failure.

## DISCUSSION

**Comparative studies based on sample size:** The present study included 110 cases with clinical diagnosis of acute pancreatitis. Bader HA et al<sup>15</sup> in their study included 100 patients. In the study by Tripathi BN et al<sup>16</sup> there were a total of 91 patients. In the study by Jeevangi BA et al<sup>17</sup> there were 53 cases of acute pancreatitis.

**Comparative studies based on age distribution:** In the present study, the patient age distribution was from 10 years to 60 years. Majority of the patients were among 41-50 years ie, 59.0% (65/110). Next common age group were among 31 to 40 years ie 19% (21/110).

In Bader HA et al<sup>15</sup> study, age ranged from 9 to 83 years, with a mean of 41.89 years. The highest prevalence was among 40 to 50 years age group.

In Tripathi BN et al<sup>16</sup> study, the youngest patient was 12 years old and the oldest was 84 years old. Majority of the patients were between the ages of 21 to 40 years.

In Jeevangi BA et al<sup>17</sup> study, the mean age group was 44 years and most of the patients belonged to the age group 31-40 years.

Sawarkar K et al<sup>18</sup> found that majority of participants belonged to 31 to 40 years of age group (23 cases), followed by 12 cases in age group of 21-30 years, 7 cases in 41 to 50 years and 4 cases in 51 to 60 years of age group. In the present study, most of our cases belonged to the 41 to 50 years age group.

Our findings compare well with those of the above authors.

**Gender distribution:** In the present study, majority of the patients were males 68.1% (75/110) as compared to females 31.8% (35/110) and the male to female ratio was 2.1:1.

In Bader HA et al<sup>15</sup> study, 80% were males and 20% were females and the male to female ratio was 4:1. In Tripathi BN et al<sup>16</sup> study, there were 61 male and 30 female patients. The male:female ratio was approximately 2:1.

In Jeevangi BA et al<sup>17</sup> study, there were 39 (73.6%) males and 14 (26.4%) female patients. Sawarkar K et al<sup>18</sup> also observed in a similar study that majority were male patients (39, 84.78%) and there were only 7 (15.22%) females patients.

Acute pancreatitis is more common in males and our observations are in concordance with those of the above authors.

**Clinical symptoms:** In the present study, the most common clinical presentation was that of pain in epigastrium with vomiting and was seen in 40.9% (45/110) cases, followed by epigastric pain alone which was seen in 27.2% (30/110) cases. In the study by Raghuwanshi S et al<sup>19</sup> symptoms and signs in patients of acute pancreatitis were a triad of epigastric pain, nausea and vomiting that was present in 75% of the patients. In the study by Sahu B et al<sup>20</sup> the most common clinical presentation was of epigastric pain in 47 (78.3%) patients, followed by vomiting in 46 (76.7%) cases.

**CT findings:** In our study, the most common CT findings were of diffuse enlargement in 43.6% cases. In 63.6% cases there was irregular contour and focal hypodensity. Necrosis of <30% parenchyma was seen in 29% cases.

In Bader HA et al<sup>15</sup> study, the CT data classified acute pancreatitis into two types: interstitial edematous pancreatitis, which was recorded in 80 (80%) patients, and as necrotizing pancreatitis with or without peripancreatic necrotic fluid, which was recorded in 20 (20%) patients. Three patients with interstitial edematous acute pancreatitis changed to necrotic type in the follow-up.

In Raghuwanshi S et al<sup>19</sup> study, most common CT findings were peri-pancreatic inflammatory changes in mesentery, greater omentum and transverse mesocolon (88%). Second most common CT finding was of pancreatic contour irregularity (80%). Twenty five patients (50%) had necrosis of the pancreas with 14 of them having more than 50% necrosis.

**Etiology of acute pancreatitis:** In the present study, most common etiological factor was of gall stones and was seen in 31.8% (35/110), and the next common factor was alcoholism seen in 27.2% (30/110).

In Bader HA et al<sup>15</sup> study, the first leading cause of acute pancreatitis was of gall bladder stones (biliary), found in 48 (48%) patients, and second cause was alcohol abuse in 25 (25%) patients, and the third cause was hyperlipidemia in 22 (22%) patients and post-endoscopic retrograde cholangiopancreatography (ERCP) in five (5%) patients.

In Jeevangi BA et al<sup>17</sup> study, the most common cause of pancreatitis was attributed to chronic alcohol abuse in 32 cases.

In Raghuwanshi S et al<sup>19</sup> study, most common etiological factors encountered were cholelithiasis (42%) and alcoholism (38%) followed by idiopathic (24%), trauma (2%) and drug induced (2%).

In the study by Sahu B et al<sup>20</sup> chronic alcohol abuse was the most common cause of acute pancreatitis ( $n = 30, 50.0\%$ ), followed by gallstone disease ( $n = 15, 31\%$ ).

**Biochemical investigations:** In our study, amylase level was elevated in 59% cases, whereas, lipase level was elevated in 80% cases.

In Bader HA et al<sup>15</sup> study, amylase level less than or equal to 210 U/l was seen in 29 (29%) patients and more than 210 U/l in 71 (71%) patients, whereas lipase level less than or equal to 180 U/l in 20 (20%) patients and more than 180 U/l in 80 (80%) patients was seen. Sawarkar K et al<sup>18</sup> in their study observed elevated serum lipase and serum amylase levels in all the cases.

### Correlation between Ranson's criteria and Balthazar's

**CTSI:** In our study, there was a slight discordance between the results of Ranson's criteria and Balthazar's CTSI system. This discordance could be attributed to the fact that with CT scan images one can actually visualize the anatomic changes and also extension of the disease process within the pancreatic parenchyma and even into extrapancreatic tissues. This gives the advantage to CTSI imaging over Ranson's criteria. Similar observations were reported by Tripathi BN et al<sup>16</sup> and Leung TK et al.<sup>21</sup>

**Complications of acute pancreatitis:** In the present study, Ascites and Pleural effusion was noted in 31.8% cases each. In Raghuwanshi S et al<sup>19</sup> study, pleural effusion was the most common extra-pancreatic complication with left pleural effusion being more common.

Sahu B et al<sup>20</sup> observed that the most common complication in their study population was pleural effusion, seen in 30/60 (50%) cases, followed by ascites. Venous thrombosis (involving splenoportal axis) was the most common vascular complication, seen in 16/60 (27%) patients.

## CONCLUSION

Acute pancreatitis commonly affects adult males. CT scan plays an important role in diagnosing acute pancreatitis and Balthazar's CTSI system is advantageous over the Ranson's criteria system. The CT modality gives information on the severity and extent of the inflammatory process and thereby helps in decision making for patient management.

## REFERENCES

1. Tenner S, Baillie J, DeWitt J, Vege SS. American College of Gastroenterology guideline: management of acute pancreatitis. *Am J Gastroenterol* 2015; 108(1):1400–1415.
2. Shuji Isaji TT, Kawarada Y, Koichi Hirata TM, Yoshida M, Sekimoto M, Hirota M, et al. JPN Guidelines for the management of acute pancreatitis: Surgical management. *J Hepatobiliary Pancreat Surg*. 2006;13(5):48–55.
3. Balthazar EJ, Freeny PC vanSonnenberg E. Imaging and intervention in acute pancreatitis. *Radiology* 1994;193(3):297–306.
4. Bharwani N, Patel S, Prabhudesai S. Acute pancreatitis: the role of imaging in diagnosis and management. *Clin Radiol* 2015; 66(2):164–175.
5. Banks PA, Conwell DL, Toskes PP. The management of acute and chronic pancreatitis. *Gastroenterol Hepatol* 2015; 6(6):1–16.
6. Cho JH, Kim TN, Chung HH, et al. Comparison of scoring systems in predicting the severity of acute pancreatitis. *World J Gastroenterol* 2015;21(8):2387–2394.
7. Zaheer A, Singh VK, Qureshi RO, Fishman EK. The revised Atlanta classification for acute pancreatitis: updates in imaging terminology and guidelines. *Abdom Imaging* 2016;38(4):125–136.
8. Sahu B, Abbey P, Anand R, Kumar A, Tomer S, Malik E. Severity assessment of acute pancreatitis using CT severity index and modified CT severity index: Correlation with clinical outcomes and severity grading as per the Revised Atlanta Classification. *Indian J Radiol Imaging* [Internet]. 2017;27(5):152–60.
9. Morteale KJ, Weisner W, Intriore L, Shankar S, Zou K, Kalantari BN, et al. A modified CT severity index for evaluating acute pancreatitis: improved correlation with patient outcome. *AJR*. 2004; 183(5): 1261–65.
10. Balthazar EJ. Acute pancreatitis: assessment of severity with clinical and CT evaluation. *Radiology* 2002;223(3):603–13.
11. Balthazar EJ. Staging of acute pancreatitis. *Radiol Clin North Am* 2002;40(1):1199–209.
12. Merkle EM, Görlich J. Imaging of acute pancreatitis. *Eur Radiol* 2002;12(6):1979–92.
13. Mendez Jr G, Isikoff MB, Hill MC. CT of acute pancreatitis: interim assessment. *AJR Am J Roentgenol* 1980;135(4):463–9.
14. Trout AT, Elsayes KM, Ellis JH, Francis IR. Imaging of acute pancreatitis: prognostic value of computed tomographic findings. *J Comput Assist Tomogr* 2010;34(2):485–95.
15. Badera HAM, Abd El Azeem AS. Role of computed tomography in diagnosis, follow-up, and minimally invasive treatment of acute pancreatitis. *Sci J Al-Azhar Med Fac Girls* 2018;2(1):52–57.
16. Tripathi BN, Sethi R, Pandey S. CT evaluation is must for prognosis prediction in acute pancreatitis; results of a two year prospective study. *J. Evid. Based Med. Healthc* 2018;5(28):2105–2109.
17. 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):91–95.
18. Sawarkar K, Shaha P, Narayan R, Chavan D, More D, Biyani A. Role of Computed Tomography in Predicting Severity of Acute Pancreatitis and its Correlation with Clinical Outcome. *International Journal of Contemporary Medical Research* 2019; 6(2):45.
19. Raghuwanshi S, Gupta R, Vyas MM, Sharma R. CT Evaluation of Acute Pancreatitis and its Prognostic Correlation with CT Severity Index *Journal of Clinical and Diagnostic Research* 2016;10(6):TC06–TC11.
20. Sahu B, Abbey P, Anand R, Kumar A, Tomer S, Malik E. Severity assessment of acute pancreatitis using CT severity index and modified CT severity index: Correlation with clinical outcomes and severity grading as per the Revised Atlanta Classification. *Indian Journal of Radiology and Imaging* 2017;27(6):152–60.
21. Leung TK, Lee CM, Lin SY, et al. Balthazar computed tomography severity index is superior to Ranson criteria and APACHE II scoring system in predicting acute pancreatitis outcome. *World J Gastroenterol* 2005;11(38):6049–6052.

**Source of Support:** Nil; **Conflict of Interest:** None

**Submitted:** 30-12-2019; **Accepted:** 25-01-2020; **Published online:** 24-02-2020