

## Contrast enhanced computed tomography in the characterization of acute pancreatitis and related complications

Swetha Anupindi\*, Syed Younus Uz Zaman and Nagendra R. Patil

Department of Radiodiagnosis, Mahadevappa Rampure Medical College, Sedam Road, Kalaburagi-585105, Karnataka, India

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**Abstract:** *Background:* Contrast Enhanced CT (CE-CT) is considered to be the gold standard imaging modality in the evaluation of patients with acute pancreatitis. The role of imaging is not only to diagnose acute pancreatitis but also to demonstrate the presence and extent of pancreatic necrosis and complications of acute pancreatitis. *Method:* The present cross-sectional study was performed in the Department of Radio-Diagnosis, Basaveshwara Teaching and General Hospital, Kalaburagi on patients referred from the Department of General Medicine and Department of General Surgery from March 2022 to August 2022. Based on the inclusion and exclusion criteria, a total of 20 patients were included in the study after obtaining informed written consent by the patients. A plain CT abdomen scan followed by triple-phased Contrast-Enhanced CT of the abdomen after oral and IV contrast administration. *Result:* Males comprised 85% and females 15% of the study and males exceeded the number of female patients in all the age groups. In the present study, the most common etiology was found to be alcoholism (60%), cholelithiasis (25%), and other idiopathic causes (15%). 40% (8/20) of patients with acute pancreatitis had vascular complications. 25% of patients with vascular complications had Splenic Vein Thrombosis. 32% and 28% of patients with acute pancreatitis had Ascites and Pleural Effusion respectively. Acute pancreatitis is associated with a wide variety of complications. *Conclusion:* Contrast Enhanced Computed Tomography helps in the accurate detection of vascular and non-vascular complications of acute pancreatitis and guides the management decision and reduces morbidity. Timely diagnosis and management will be useful to lower morbidity and mortality.

**Keywords:** Acute Pancreatitis, Computed Tomography, Pleural Effusion, Vascular Complications.

### Introduction

Acute pancreatitis is an acute inflammatory process that is followed by complete restoration of structural and functional normalcy after the attack subsides, provided no part of the pancreas has been destroyed by necrosis [1].

MDCT of acute mild (non-necrotizing) pancreatitis - Abdominal complications and fate of fluid collections, have emphasized that, Acute Pancreatitis is a common disease in the developing world that is characterized by a diffuse inflammatory process affecting the pancreas leading to extravasation of proteolytic enzymes. Acute pancreatitis leads to a wide range of local and systemic pathophysiologic alterations and large variability in the clinical manifestation and prognosis [2]. The diagnosis is usually established by the detection of elevated levels of

pancreatic enzymes in blood, urine, or both [3]. Once the clinical diagnosis of acute pancreatitis is made, treatment depends on the initial assessment of the disease stage and severity.

Acute pancreatitis is classified into acute interstitial edematous and acute necrotizing pancreatitis. Acute interstitial edematous pancreatitis is characterized by pancreatic inflammation with variable degrees of peri-pancreatic edema and ischemia that can resolve or progress to necrosis. Acute necrotizing pancreatitis is characterized by increasing necrosis, infection, and persistent multi-organ involvement. Contrast Enhanced CT (CE-CT) is considered to be the gold standard imaging modality in the evaluation of patients with acute pancreatitis [4]. The role of imaging is not only to diagnose acute

pancreatitis but to demonstrate the presence and extent of pancreatic necrosis and the complications of acute pancreatitis. Ideally, doing CECT after 48-72 hours of the onset of an acute attack increases the chances of picking the necrotizing pancreatitis [5].

Vascular complications like a superior mesenteric artery, gastroduodenal artery, splenic artery pseudo aneurysms, portal and splenic vein thrombosis, and Non-vascular complications like pancreatic and peripancreatic necrosis, pseudocyst formation, pleural effusion, ascites, splenic infarct, bowel infarcts, common bile duct, and main pancreatic duct dilatation are all complications that can be diagnosed by both US and CT [6-9].

Therefore, considering the above facts, the present study was undertaken to evaluate the role of Contrast-Enhanced Computed Tomography in the diagnosis of acute pancreatitis and its complications.

*Aims and Objectives:* To assess the role of Contrast-Enhanced Computed Tomography in the diagnosis of acute pancreatitis and its complications.

### Material and Methods

The present cross sectional study was performed in the Department of Radio-Diagnosis, Basaveshwara Teaching and General Hospital, Kalaburagi on patients referred from the Department of General Medicine and Department of General Surgery from March 2022 to August 2022. Based on the inclusion and exclusion criteria, a total of 20 patients were included in the study after obtaining the informed written consent by the patients.

#### *Inclusion criteria:*

1. Known cases of acute pancreatitis
2. In suspected cases of acute pancreatitis with an increase in serum amylase and serum lipase levels.

#### *Exclusion criteria:*

1. Cases of chronic pancreatitis.
2. Patients with deranged renal function tests.
3. Patients who are allergic to contrast material administration.

*Data collection procedure:* A plain CT abdomen scan followed by triple-phased Contrast-Enhanced CT of the abdomen after oral and IV contrast administration.

The study consists of patients with pancreatitis who were diagnosed using clinical details like upper abdominal pain, vomiting, epigastric tenderness along with raised serum amylase, and lipase, who were sent directly for CT examination as well as the patients in whom abdominal ultrasound examination was suggestive of pancreatitis. CT examination was carried out in a supine position, and both unenhanced and enhanced study was done with intravenous iodinated contrast agents. After assessing pancreatitis and its local complications, a thorough examination of blood vessels adjacent to the pancreas was made for mass effect, thrombosis, and abnormal dilatation.

Pre-procedure preparation required that the patients should be nil per oral for about six hours before conducting the study with normal renal function tests. Scans were obtained in the arterial, portal-venous, and venous phases.

*Statistical analysis:* Descriptive statistics such as mean, SD and percentage was used to present the data. Data analysis was performed by using statistical software SPSS v20.0

### Results

The age groups ranged from 15 to 60 years. Maximum patients were in the age group of 31 to 40 years. Thus, it was mostly young male adults who were suspected or diagnosed with acute pancreatitis.

There were 17 males and 3 females in this study. Males comprised 85% and females 15% of the study and males exceeded the number of female patients in all the age groups. The cause for pancreatitis in 12 (60%) patients was alcohol intake, in 5 (25%) patients was the presence of gall stones and the cause was not known (idiopathic) for 3 (15%) patients (Table-1).

Table-1: Basic characteristics		
Characteristics	Number	Percentage (%)
<b>Age (years)</b>		
15-20	1	5
21-30	5	25
31-40	9	45
41-50	2	10
51-60	3	15
<b>Sex</b>		
Male	17	85
Female	3	15
<b>Etiology</b>		
Alcoholic	12	60
Gall stones	5	25
Idiopathic	3	15

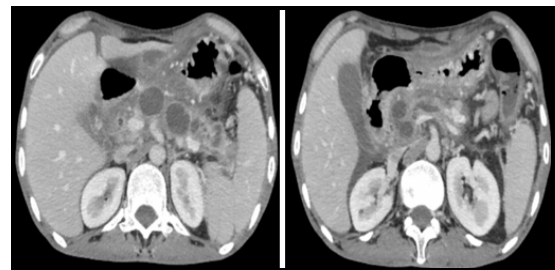
25 % of the patients with acute pancreatitis indicated bulky pancreas with 50% indicating other changes (Table-2).

Table-2: Distribution on Size of Pancreas		
Pancreatic size	Number	Percentage
Normal	5	25
Bulky	5	25
Other changes (complications)	10	50

30% of patients diagnosed with acute pancreatitis experienced acute necrotizing pancreatitis, while 20% developed walled-off necrosis, and 35% developed pseudocysts. Additionally, 5% were affected by acute intestinal pancreatitis, and 10% had peripancreatic fluid collections (Table-3) (Fig.:1-3).

Table-3: Distribution of Complications in Pancreatitis		
Complications	Number	Percentage
Peripancreatic fluid collections	2	10
Pseudocyst	7	35
Walled of necrosis	4	20
Acute necrotizing pancreatitis	6	30
Acute interstitial pancreatitis	1	5

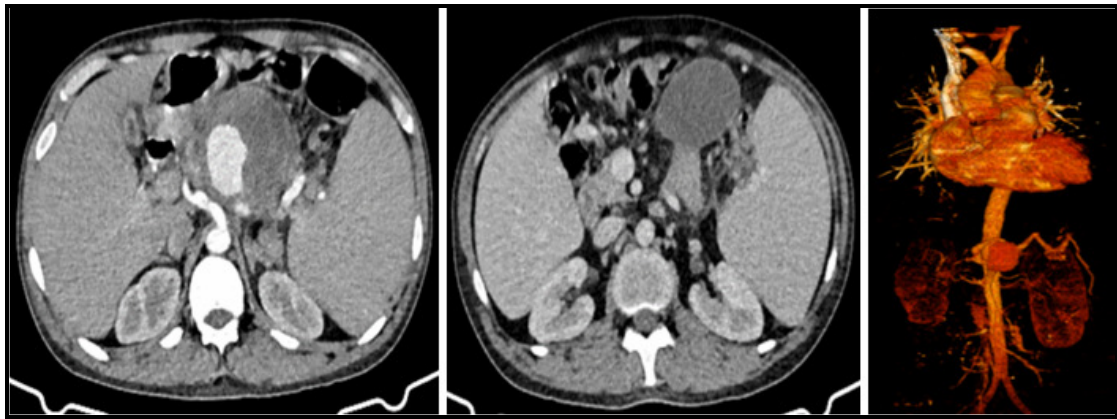
**Fig-1:** Axial CECT images of a 39yr old male pt show multiple pseudocysts of pancreas with dilated main pancreatic duct and short segment splenic vein thrombosis.



**Fig-2:** Axial CECT images of a 45yr old male showing acute necrotizing pancreatitis with walled of necrosis, peripancreatic, mesenteric and left perinephric fat stranding and reactive bowel wall thickening of duodenum and proximal jejunal loops



**Fig-3:** Axial CECT images of 30yr of male showing large pseudo aneurysm of splenic artery with eccentric thrombosis and pseudocyst of pancreas in greater sac.



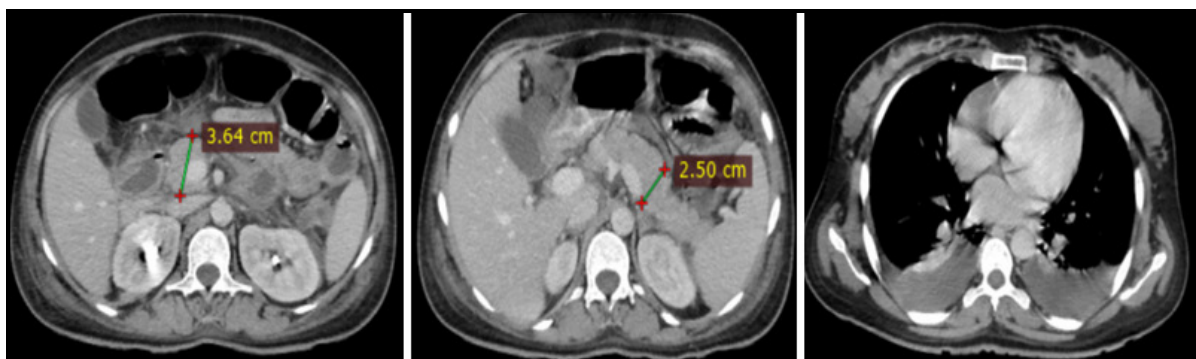
Out of 20 patients diagnosed with acute pancreatitis, 8 patients (40%) developed vascular complications. Among those with vascular complications, 25% had splenic vein thrombosis. Additionally, 12.5% of patients with vascular complications developed at least one of the following complications: splenic artery pseudoaneurysm, portal vein thrombosis, portal cavernoma, superior mesenteric artery thrombosis, celiac artery thrombosis, or aortitis (Table-4).

Complications	Number	Percentage
Splenic artery pseudoaneurysm	1	12.5
Portal vein thrombosis	1	12.5
Splenic vein thrombosis	2	25
Portal cavernoma	1	12.5
SMA thrombosis	1	12.5
Celiac artery thrombosis	1	12.5
Aortitis	1	12.5

Among patients diagnosed with acute pancreatitis, 33.3% developed ascites, 25% had pleural effusion, and the same percentage had reactive bowel wall thickening. Additionally, 8.3% of patients with acute pancreatitis exhibited dilatation of the common bile duct (CBD) or the main pancreatic duct (MPD) (Table-5) (Fig.-4).

Complications	Number	Percentage
Ascites	4	33.3
Pleural effusion	3	25.0
CBD dilatation	1	8.3
MPD dilatation	1	8.3
Reactive bowel wall thickening	3	25.0

**Fig-4:** Axial CECT images of 30yr old females patients show mildly bulky Head and body of pancreas with bilateral pleural effusion



## Discussion

The current study was conducted to assess the role of Contrast Enhanced Computed Tomography in characterizing Acute Pancreatitis and its associated complications. In this study, there were 17 male participants and 3 female participants. Males constituted 85% of the study population, while females made up 15%. Moreover, males outnumbered females across all age groups. This observation aligns with previous studies which have also reported a higher prevalence of Acute Pancreatitis in males. These results are consistent with those reported by Manupratap Narayana et al., who found that 51 males (85%) and 9 females (15%) were included in their study [10]. Further, Ramlal Prajapati et al, also reported as 74 males (74%) and 26 females (26%) [11]. Sheethal Gonapat et al reported as 30 males (62.5%) and 18 females (37.5%) [12]. Furthermore, our study observed that males outnumbered females across all age groups, indicating a potential gender-related susceptibility to Acute Pancreatitis.

The age range in this study was from 15 to 60 years, with the highest number of patients falling within the 31 to 40-year-old age group. In a study conducted by Manupratap Narayana et al., the age range was from 2 to 68 years, with the most affected age group being the second and third decades (ages 10 to 39), accounting for 43.3% of cases, while the age group less than 20 years was the least affected [10]. Sheethal Gonapat et al reported as, the age of the patients included in the study ranged between 21-65 years with the majority (28 patients; 58.33%) in 41 to 50 years [12].

In the present study, the most common etiology was found to be alcoholism (60%), cholelithiasis (25%), idiopathic (15%), these findings are in agreement with numerous studies that have reported similar etiological patterns. Study conducted by Desai Sanjay et. al., in which alcoholism was 48.9%, cholelithiasis was 12.7% trauma 14.89 %, remaining 23.4 % patients had other etiological factors [13]. Further, Ramlal Prajapati et al, also reported as alcoholism (64%), gallstone (28%), idiopathic (8%) [11]. The high prevalence of alcoholism as a causative factor underscores the significance of lifestyle-related risk factors in the development of AP.

In this study the most common presenting symptoms include epigastric pain followed by nausea, vomiting. All patients in study had increased serum amylase and serum lipase levels. Furthermore, 25% of patients had normal pancreas on contrast enhanced computed tomography, 25% of patients had bulky pancreas and 50% of patients had bulky pancreas with other complications. Similar findings are reported by Sawarkar K et.al., bulky pancreas among 26 cases (56.52%), 11 cases (36.95%) of pancreatic Necrosis, 11 cases of Pseudocyst, 9 cases of Peri-pancreatic fluid were observed [14]. This finding is consistent with previous research indicating that necrotizing pancreatitis is a common complication of acute pancreatitis.

Additionally, 24% of patients were found to have walled-off necrosis, while 33% developed pseudocysts. These findings highlight the diverse spectrum of complications that can arise from acute pancreatitis, ranging from localized necrosis to the formation of pseudocysts. We observed that 9% of patients with acute pancreatitis had acute intestinal pancreatitis, while 5% presented with peripancreatic fluid collections. These findings underscore the importance of assessing not only pancreatic involvement but also adjacent structures for potential complications.

40% (8/20) of patients with acute pancreatitis had Vascular complications. 25% of patients with Vascular complications had Splenic Vein Thrombosis. 12.5% of patients with Vascular complications had at least one of the complications like Splenic Artery Pseudoaneurysm, Portal Vein Thrombosis, Portal Cavernoma, SMA Thrombosis, Celiac Artery Thrombosis and Aortitis respectively.

Similar findings were reported as, Splenic vein thrombosis is quiet common in those cases of pancreatitis with pseudocyst and collections [15]. Portal vein rupture and pancreaticopotal fistula are very rare [16]. Similar findings also reported by Sheethal Gonapat et al, three cases (6.25%) were found to have venous thrombosis (portal vein) which was found to be the most common vascular complication [12].

A study done by Manupratap Narayana et. Al., had similar findings which in SVT was seen in 39 cases (65%) and was the most common vascular complication, followed by PV thrombosis in 17 patients (28.3%), SMV thrombosis in 14 patients (23.3%), and arterial pseudo-aneurysms was seen in 3 patients (5%) [10]. 33.3% and 25% of patients with acute pancreatitis had Ascites and Pleural Effusion respectively. A study conducted by Raghuwanshi et al., had similar findings of pleural effusion and ascites were found to be the most common extra-pancreatic complications [17]. Similar findings were also reported by Sheethal Gonapat et al, Pleural effusion present in 47.91%, Ascites present in 33.33% and infection was present in 18.75 % patient [12].

25% of patients with acute pancreatitis had Reactive Bowel Wall Thickening. Study done by Banday et al., stated that ascites (36%) was the second most common extra-pancreatic complication followed by GI involvement (26%) [18]. 8% of patients with acute pancreatitis had CBD or MPD Dilatation. Acute pancreatitis is associated with wide variety of complications. It can affect the pancreatic parenchyma, main

pancreatic duct, common bile duct, surrounding tissues and vasculature.

**Limitations:** This study has no follow-up goals to determine the consequences of these issues or to determine how to intervene and manage the condition. However, important discoveries were found. In addition, because the research was carried out in a single institute, it was restricted to a patient population that was less representative. Even more comprehensive multicenter research can be done on the diagnostic imaging tools and prevalence of vascular problems in patients with acute pancreatitis.

### Conclusion

Contrast Enhanced Computed Tomography is the modality of choice that accurately detects vascular and non-vascular complications of acute pancreatitis, guides the management decision, and reduces morbidity. Accurate and timely diagnosis and management of acute pancreatitis will be useful to lower associated morbidity and mortality.

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\*All correspondences to: Dr. Swetha Anupindi, Junior Resident, Department of Radiodiagnosis, Mahadevappa Rampure Medical College, Sedam Road, Kalaburagi-585105, Karnataka, India. E-mail: swethaanupindi15@gmail.com