

# International Journal of Radiology and Diagnostic Imaging



E-ISSN: 2664-4444  
P-ISSN: 2664-4436  
[www.radiologypaper.com](http://www.radiologypaper.com)  
IJRDI 2021; 4(3): 45-51  
Received: 05-04-2021  
Accepted: 11-06-2021

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## Efficacy of transabdominal sonography and contrast enhanced multidetector CT in the evaluation of pancreatitis and its complications

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DOI: <http://dx.doi.org/10.33545/26644436.2021.v4.i3a.219>

### Abstract

**Purpose:** Pancreatitis is associated with a broad spectrum of findings causing significant morbidity and mortality and substantial use of health care resources. Optimal management of pancreatitis requires meticulous imaging protocol. Ultrasonography (USG) and Computed Tomography (CT) has afforded rapid, accurate and non-invasive evaluation of pancreatitis & complications. Both of these offer modalities offer advantages of their own at different stages.

**Material and Methods:** 50 consecutive patients referred with clinical suspicion of pancreatitis were subjected to USG and contrast enhanced CT scan. The findings of acute and chronic pancreatitis and their complications' on both the modalities were tabulated and correlated.

**Results:** CT had overall excellent visualisation of pancreas in all the cases and better delineation of per pancreatic inflammatory changes. Extrapancreatic and vascular complications were readily identifiable on CT. Ultrasound had better visualisation of pancreas as compared to the previous studies. However, the gland was not completely visualised in all the cases due to interference from the bowel gas. Ultrasound also proved to be more effective in the evaluation of gall stones, in the characterisation of contents within the per pancreatic collections & guiding interventions.

**Conclusion:** Ultrasonography is non-invasive, quick, inexpensive widely available screening tool in the early diagnosis and follow up of pancreatitis. It has certain limitation due to bowel gas which may hinder the visualization of Pancreas. CT has a role in firmly establishing the diagnosis of pancreatitis and its complications. Thus it is seen that both USG and CT have complementary roles to play in the early diagnosis and follow up of patients of pancreatitis.

**Keywords:** Pancreatitis, ultrasonography, computed tomography, peripancreatic collections, complications of pancreatitis

### 1. Introduction

Pancreatitis is a defined as an acute inflammatory disease of pancreas, typically presenting with abdominal pain and associated with raised levels of pancreatic enzymes in the blood or urine. The incidence of acute pancreatitis (AP) is 0.005% to 0.01% in the general population [1]. Pancreatitis by itself is a disease, which is unique, protean and extrudes into the diagnostic arena. Nevertheless, pancreatitis can also be a part of the alternative diagnosis of acute abdominal conditions. The clinical findings along with laboratory & imaging findings allow an accurate diagnosis of pancreatitis in these patients. It cannot be too strongly emphasized that the primary treatment of acute pancreatitis is conservative only, but it is the Pandora's Box of manifestations, with its inherent complications that imaging comes into play as diagnostic, prognostic and therapeutic endeavour. Ultrasonography (USG) has yielded quick, correct and non-invasive evaluation of the pancreas. Ultrasound provided the earliest dependable and duplicable details of pancreatic gland. Its applicability is decreased in patients with obesity and in patients with huge amounts of viscus gas [2]. With continuing improvements in the resolution of images and various software to overcome these hurdles, USG plays a key role not only in the early screening of patients with acute pancreatitis but also in guided interventions & repeated follow up of patients with complications. Multi detector CT (MDCT) as a diagnostic modality is faster and provides high resolution images with thinner sections which enables to perform three dimensional reformations to identify the extent of inflammation and complications [2].

With use of iodinated contrast media in different phases of study, it helps to diagnose vascular and non-vascular complications of acute pancreatitis. However, CT is costly, involves risk of ionizing radiation and would have trouble in defining tissue planes in thin patients.

As both the modalities have inherent limitations, there is a need for recommendation regarding the use of these modalities in order to substantiate the use of medical resources that would result in reduction of the associated morbidities and mortalities.

## 2. Materials and Methods

It is a prospective study of 50 consecutive patients conducted in the Department of Radiodiagnosis, JSS Medical College, JSS Academy Of Higher Education And Research, Mysuru, Karnataka, to compare the efficacy of USG & MDCT in evaluation of pancreatitis and its complications in all the patients suspected/diagnosed of pancreatitis based on clinical and/or laboratory findings (serum amylase & serum lipase) after obtaining approval by the ethical clearance committee. Patients of all age groups who were referred to the department of radio diagnosis during the time period of November 2019 to May 2020 with clinical suspicion or diagnosed cases of pancreatitis were included. Patients who have undergone single imaging modality, patients with pancreatic neoplasm or pancreatic trauma, those with impaired renal function and allergy to iodinated contrast media were excluded from the study.

The clinical details recorded were demographic data, detailed clinical history with presenting symptoms like pain abdomen, nausea, vomiting and fever with duration, physical examination (local and systemic) and any history suggestive of possible aetiology such as gallstone disease, alcohol abuse, trauma to abdomen, drug intake, metabolic disorder or any recent surgical intervention or procedure. All patients were detailed about the purpose of study. A brief account of the procedure was explained to the patient with emphasis on reassuring the patient prior to the procedure. Informed and written consent was taken from the patient in writing both in English and Vernacular. The patients were then subjected to ultrasound and MDCT examination.

Ultrasonography of abdomen was done in PHILIPS HD11XE and PHILIPS iU22 equipment, using a curvilinear probe followed by the linear probe for better evaluation of superficial structures. Linear probe with wide beam was better utilized to assess the per pancreatic region in thin patients and in paediatric population. Each examination was interpreted in real time. Doppler ultrasound was used for evaluation of vessels. In cases when pancreas was not adequately visualized, changing the patient into right lateral decubitus position or a fluid filled stomach aided in the evaluation by providing a better acoustic window. Similarly, the spleen was used as an acoustic window in the evaluation of the tail.

During each sonographic examination the measurements of the head, body and tail of pancreas taken at right angles to the long axis of the gland followed by echogenicity of gland, presence of parenchymal or ductal calcifications and necrosis were noted. Per pancreatic inflammatory changes and collections were observed. Extrapancreatic vascular and non-vascular complications were noted.

Contrast enhanced MDCT of the abdomen was done using PHILIPS 128 slice MDCT SCANNER. Oral positive

contrast was administered for patients who can consume fluids. Plain study was performed followed by enhanced study after administering the iodinated contrast media (300 mg of iodine/ ml) with pressure injector at the dose of 1.5- 2 ml/kg body weight in pancreatic (35 seconds) and portal venous phases (60 seconds). Images were viewed in soft tissue and bone windows. Reformations were done from the axial sections for better delineation of anatomy and extent of pathology. All the features mentioned above in the sonographic examination were carefully looked for.

The results were tabulated. Data was analysed using SPSS version 22.0. Considering the CT as gold standard for diagnosing the variables associated with pancreatitis sensitivity of USG in diagnosing the pancreatitis was calculated. McNemar Chi squared test was performed to compare the two modalities for variables of pancreatitis with P value <0.05 for the significance.

## 3. Results

The current study included 50 patients suspected/ suffering from pancreatitis referred to the department of radiodiagnosis over a period of 18 months. Out of 50 patients, 44 were male and 6 were female patients. 34 cases were diagnosed as acute pancreatitis with males being affected in 85 % of cases. Rest 16 cases of chronic pancreatitis predominantly affected the male population (94%). Mean age for acute pancreatitis was 38 years whereas for chronic pancreatitis it was 43.5 years. Acute pancreatitis was observed predominantly in the age group of 20 to 40 years accounting for 61% of the cases, whereas chronic pancreatitis was observed significantly in the 5th decade accounting for 31 % of the cases.

Among the clinical symptoms epigastric pain radiating to the back was most common followed by nausea, vomiting and fever. Elevation of plasma levels of pancreatic enzymes greater than ten standard deviations above the laboratory normal were considered to indicative of Acute Pancreatitis.<sup>3</sup> Following evaluation with detailed history, laboratory data or imaging findings, the following were the aetiologies suggested (Table 1). The patients, for whom no cause could be found, were termed as idiopathic. Among the aetiologies, alcoholism topped the list followed by the gall stones.

**Table 1:** Distribution of cases of Pancreatitis on aetiology.

Cause	No. of cases
Alcoholism	23
Gallstones	7
Hyperlipidemia	4
Drug-induced	3
Autoimmune	2
Idiopathic	11

### 3.1. Observations on Ultrasonography

Out of the 50 patients evaluated for pancreatitis, pancreas was completely visualized in 44 patients. In rest of the patients either the body or tail region or both were obscured by bowel gas shadows or large peripancreatic collections. The following AP measurements of the normal gland were considered to assess the size of the gland: head, 23 (+3) mm; neck, 19 (+3) mm; body, 20(+3) mm; tail 15(+3) mm.<sup>4</sup> In 23 cases of acute pancreatitis, the gland was enlarged and in 11 cases, it was normal in size. In 12 cases of chronic pancreatitis, the gland appeared atrophied in size. In one patient of chronic pancreatitis, the pancreas was enlarged

and normal in remainder of the cases. In acute pancreatitis, 59% of cases showed hypoechoic pancreas (Fig. 1), 9% of cases showed heterogenous

pancreas whereas in 32% of cases echogenicity of pancreas was normal. All cases of chronic pancreatitis showed heterogeneous echo texture.



**Fig 1:** A 34 year old male patient presenting with epigastric pain and clinical suspicion of acute pancreatitis, transabdominal sonography shows diffuse enlargement of pancreas with decreased echogenicity and minimal peripancreatic fat stranding.

Pancreatic duct dilatation was noted in 94% cases of chronic pancreatitis whereas in 91% of acute pancreatitis cases it was normal. Out of 50 cases only 3 showed pancreatic parenchymal necrosis and all cases were of acute pancreatitis (Fig. 2). 62% cases of chronic pancreatitis showed ductal and parenchymal calcifications.

**Table 2:** Distribution of peripancreatic changes on ultrasonography

Peripancreatic Changes	Acute Pancreatitis (n= 34)	Chronic Pancreatitis (n= 16)
Free Fluid	14 patients (41%)	2 patients (13%)
Fat stranding	9 patients (26%)	4 patients (25%)
Fascial Thickening	5 patients	1 patient (6%)



**Fig 2:** A 28 year old male patient presenting with diffuse abdominal pain & severe bouts of vomiting and clinical suspicion of acute pancreatitis, transabdominal sonography shows large collection with irregular walls and mobile internal echoes in relation to the body and tail of pancreas in the lesser sac. Few hypoechoic areas likely necrotic regions are seen in the body of the gland.

Peripancreatic findings in the form of peripancreatic free fluid, adjacent fat stranding and adjacent fascial thickening was observed in both acute and chronic pancreatitis and findings were tabulated (Table 2).

Of the peripancreatic collections seen in 15 patients, echogenic debris with fluid-fluid levels was present in 5 of these collections, suggestive of acute necrotic collections. Dirty shadowing suggestive of air foci was seen in one of these collections (Fig. 3).



**Fig 3:** A 40 year old male patient presenting with severe epigastric pain followed by systemic shock, transabdominal sonography depicts bulky pancreas with interspersed heterogenous areas of necrosis and adjacent large collection with mobile internal echoes and air foci following diagnostic aspiration.

Similarly, extrapancreatic non-vascular and vascular complications were screened and findings were tabulated (Table 3 & 4). Vascular complication in the form of chronic portal vein thrombosis with intra-abdominal collaterals was observed in only in one patient of Chronic Pancreatitis. Acute Portal vein thrombosis extending into its confluence and SMV was seen on Doppler examination in one patient of acute necrotising pancreatitis. In the same patient, there was evidence of thrombus in the abdominal aorta and left renal artery. Pseudoaneuerysm was not observed in any of these patients by Ultrasound Examination.

**Table 3:** Distribution of extra pancreatic complications on Ultrasonography

Extrapaneacretic complications	Acute Pancreatitis (n= 34)	Chronic Pancreatitis (n= 16)
Pseudocyst	11 patients (32%)	4 patients (25%)
Ascites	11 patients (32%)	3 patients (19%)
Pleural Effusion	10 patients (29%)	2 patients (13%)

**Table 4:** Distribution of vascular complications on ultrasonography.

Vascular Complications	Frequency
SMV thrombosis	1 Patient (2%)
Portal Vein thrombosis	2 Patients (4%)
Splenic Vein thrombosis	0 Patients
Pseudoaneuerysm	0 Patients

Additional observations were also made on ultrasonography like fatty liver (8), cholelithiasis (6), thrombus in abdominal aorta (1), chronic parenchymal liver disease (5) and intestinal obstruction (1).

**3.2. Observations on CE MDCT**

Similar observations were made on CECT like size of the gland, density of the gland, ductal dilatation, parenchymal & ductal calcifications, peripancreatic findings, extra pancreatic non vascular and vascular complications and other additional findings (Fig 4 & 5).



**Fig 4:** A 38 year old male patient of acute pancreatitis presenting with falling hemoglobin levels, axial arterial phase CT sections shows saccular aneurysm arising from the splenic artery in relation to the peripancreatic collection in the tail region of the pancreas.



**Fig 5:** A 50 year old male patient of acute pancreatitis presenting with fever and hypotension, axial CT sections depicts enlarged pancreas with necrotic areas and multiple air foci within suggestive of emphysematous infection.

The findings recorded during the contrast enhanced CT were as tabulated below (Table no. 5)

**Table 5:** Distribution Of findings on MDCT examination

Findings	Acute (n =34)	Chronic (n=16)	Total
Normal size	0	1(6%)	1(2%)
Atrophic	0	12(75%)	12(24%)
Bulky	34(100%)	3(19%)	37(54%)
<b>CT Attenuation</b>			
Heterogenous	14 (41%)	0	13(26%)
Homogenous	20 (59%)	16(100%)	37(74%)
Duct dilation	6 (17%)	13(81%)	19(38%)
Necrosis	14 (41%)	0	14(28%)
Calcifications	0	14(87%)	14(28%)
Pseudocyst	14(41%)	6(38%)	20(40%)
Ascites	21(62%)	4(25%)	25(50%)
Pleural Effusion	20(59%)	4(25%)	24(48%)
Venous Thrombosis	2(6%)	3(19%)	5(10%)
Pseudoaneurysm	1(3%)	0	1(2%)
Fatty Liver	8(24%)	1(6%)	9(18%)
Gall stones	3(9%)	0	3(6%)
Intestinal Obstruction	2 (6%)	1(6%)	3 (6%)
Chronic liver disease	1(3%)	0	1 (2%)

14 patients of Acute Pancreatitis had associated acute peripancreatic fluid collections. Small pockets of air within the collections suggestive of infection were seen in three patients of acute pancreatitis. One of these collections showed differential density and was associated with severe necrosis of the pancreatic tissue and hence considered as acute necrotic collection. Lesser sac, left anterior pararenal space and left paracolic gutter were the most common sites of extrapancreatic collections. In one patient, collections were seen extending into the mediastinum. 6 patients of Chronic Pancreatitis had pseudocysts in relation to the pancreas.

In addition to above listed findings, post contrast enhancement of pancreatic gland was assessed. Pancreatic homogenous enhancement was noted in 35 out of 50 cases (70%). Necrosis identified as patchy non enhancing areas (<30 HU) and was observed in 14 patients of which all were diagnosed as acute necrotising pancreatitis (Fig. 6). However, necrosis was not seen in any of the patients of chronic pancreatitis.



**Fig 6:** A 36 year old male patient presenting with epigastric pain and clinical suspicion of acute pancreatitis, axial venous phase CT sections shows enlarged pancreas with non-enhancing necrotic areas.

Table no.6 provides the comparison of variables of pancreatitis diagnosed by CT and ultrasonography.

**Table 6:** Comparison of findings on Ultrasound Examination & MDCT

Findings	Ultrasound	Computed Tomography	McNemar Chi squared test – P value
Normal size	14 (28%)	1(2%)	-
Atrophic	12 (24%)	12(24%)	-
Bulky	24 (48%)	37(54%)	0.000527
Duct dilation	18 (36%)	19(38%)	0.617075
Necrosis	3 (6%)	14(28%)	0.001546
Calcifications	10 (20%)	14(28%)	0.080118
Pseudocyst	16 (32%)	20(40%)	0.080118
Ascites	14 (28%)	25(50%)	0.001546
Pleural Effusion	12 (24%)	24(48%)	0.000901
Venous Thrombosis	3(6%)	5(10%)	0.288844
Pseudoaneurysm	0	1(2%)	0.617075
Fatty Liver	8 (16%)	9(18%)	0.617075
Gall stones	6 (12%)	3(6%)	0.617075
Intestinal Obstruction	1 (2%)	3 (6%)	0.157299
Chronic liver disease	5 (10%)	1 (2%)	0.045500

**4. Discussion**

Detection of pancreatitis has posed unique challenges to the clinician and radiologist. Although several authors have reported the extremely good accuracy of CT in the diagnosis of pancreatitis in the previous studies, there has been considerable technological improvements in USG recently to improve the visualisation of pancreatitis.

Compared to USG where visualisation of the pancreas is rendered difficult by the overlying structures, CT has emerged as a far superior technique for demonstration of pancreas and its pathologies with respect to delineating the exact dimensions, locations of the lesion & tissue planes and its relations to surrounding structures. The present study was undertaken to evaluate pancreatitis and its complications by Ultrasonography and Computed Tomography.

The present study comprised of 50 patients which included 44 males and 6 females. The distribution of acute pancreatitis was predominant in the male gender contributing to 85% of the cases. Similar pattern of gender distribution was seen in cases of chronic pancreatitis (94% in males). We observed that female patients of acute pancreatitis were slightly elder (35.8 years) in comparison to the males (32.8 years). Silverstein *et al.* studied that males suffering from acute pancreatitis were elder (mean age 41 years) to the females (mean age 32 yrs). The same study also stated that males suffering from acute pancreatitis were elder (mean age 41 yrs) than females (mean age 32 years) [5]. Mean age of patients of chronic pancreatitis was observed to be 54.3 yrs and 47 yrs in the study done by Luetmer *et al.* and by Alpern *et al.* respectively [6, 7].

Alcohol consumption and cholelithiasis topped the list of aetiologies for pancreatitis in the current study. Studies performed by Hill MC *et al.* and Balthazar *et al.* also showed similar results [8, 9].

Ultrasonography is plagued with difficulty of visualising the pancreas due to overlying gas filled bowel loops. In the current study complete visualization of pancreatic gland was

observed in 88% of cases which is much better yield than the study performed by Calleja *et al.* where the gland was obscured in 40% of the cases of acute pancreatitis.<sup>10</sup> The increase in yield in our study is likely due to advancements in the present day machines, decubitus position and also the use of tissue harmonic imaging.

Interstitial oedema causes enlargement of the pancreas. In our study, pancreas was enlarged in 23 cases on USG (67%). This number was higher than that stated by Jeffrey Jr. *et al.* according to whom the gland was bulky in 1/3rd of the cases of acute oedematous pancreatitis<sup>[11]</sup>. On CT, the pancreas was bulky in all 34 patients (100%), out of which 22 (64%) patients showed diffuse enlargement of pancreas and 12 (36%) showed focal enlargement. We feel that CT is far superior to USG in evaluation of size alterations which is supported by the study conducted by the Silverstein *et al.*<sup>[5]</sup> Ultrasound suffers from logistic problems such as poor acoustic window, observer variation, poorly defined peripancreatic fat planes due to inflammation, even and inability to reproduce same measurements a second time.

Characteristic feature of an oedematous pancreatitis is an enlarged gland which is diffusely hypoechoic in echogenicity. This finding is not always appreciable. We observed that the pancreas was homogeneously hypoechoic in 59% cases of acute pancreatitis which was in congruence with study conducted by Freise *et al.*<sup>[12]</sup>

Intraglandular necrosis is the hallmark of acute necrotising pancreatitis. Necrotic areas appeared as hypoechoic areas on USG and showed lack of contrast enhancement (<30 HU) on CT. Study conducted by Stylinski *et al.* and current study showed similar sensitivity and specificity for diagnosing acute necrotizing pancreatitis on USG & CT, where CT is considered as a superior modality to detect parenchymal necrosis<sup>[13]</sup>.

The most common per pancreatic finding in cases of acute pancreatitis are accumulation of per pancreatic free fluid followed by fat stranding, both of which were better demonstrated on CT better than ultrasonography in the current study. This makes CT a better modality for diagnosing early cases of acute pancreatitis.

The incidence of pancreatic collections in our study were 11 & 14 on USG & CT respectively in cases of Acute Pancreatitis. CT was not only able to identify smaller peripancreatic collections but also precisely localise the extension of these collections even in the mediastinum. CT was also able to pick up small pockets of air foci in three cases suggestive of abscess formation which were unnoticeable on Ultrasonography. On contrary ultrasonography was able to characterise the contents within the collections more accurately than CT by identifying the echogenic debris which helped in further decision regarding the choice of drainage of these collections. Ultrasonography was also the guiding modality for draining these collections & follow up scans.

Ascites was the second most common extrapancreatic complication on USG. Free intraperitoneal fluid representing pancreatic ascites was seen in 11 patients (32%) & 21 patients (62%) on USG & CT respectively which was more than that reported by EJ Balthazar (7%)<sup>[14]</sup>.

On USG, 10 patients had Pleural effusions & 20 patients on CT which was also more than that reported by EJ Balthazar<sup>[14]</sup>. Predominant left sided effusions were more common than predominant right sided or bilateral effusions.

The vascular complications were identified in 4 patients of

acute necrotising pancreatitis. Ultrasonography was able to identify Portal vein & SMV thrombosis but failed to identify splenic artery pseudoaneurysm which was diagnosed on CECT with accuracy which helped timely embolization as a life saving procedure in this patient. Pitkranta P *et al.*<sup>[15]</sup> had detected 1 case pseudoaneurysm out of 10 cases of pancreatitis which was detected on CT and negative on USG.

USG had an upper hand in the identification of gall stones and echotexture of liver in chronic liver diseases. Whereas, CT had an added value in identifying the fatty infiltration of liver, choledocholithiasis and intestinal obstruction. Increased incidence of fatty liver and chronic parenchymal liver disease correlated with history of chronic alcohol ingestion.

Out of 50 patients, 16 cases were diagnosed as cases of chronic pancreatitis. The size of the pancreatic gland may not always correlate with the chronicity of the pathology. In our study the pancreas was atrophied in 12 patients, bulky in 1 patient and a normal in 3 patients on USG. Contrary to the findings on USG, CT showed atrophic pancreas in 12 patients, a bulky pancreas in 3 patients and a normal sized pancreas in 1 patient. Hence we could conclude size was not the sole criteria to establish the diagnosis of chronic pancreatitis. MB Alpern *et al.*<sup>[7]</sup> and L. Bolondi *et al.*,<sup>[16]</sup> have shown in their studies that size variations cannot confirm the diagnosis the of chronic pancreatitis. Luetmer *et al.*<sup>[6]</sup> evaluated chronic pancreatitis by CT and concluded that parenchymal atrophy was present in 30 patients (54%). As per Bolondi *et al.*,<sup>[16]</sup> USG depicted atrophic pancreas in 6% of their patients of chronic pancreatitis.

In this study, USG was able to pick dilatation of main pancreatic duct in 94% cases of chronic pancreatitis probably due to clear distinction of the duct as an anechoic tubular structure in the background of hyperechoic pancreas. Pasanen PA *et al.*<sup>[17]</sup> reported the incidence of abnormal PD on USG as 60%. On further evaluation with CT, we observed pancreatic duct dilatation in 13 (81%) patients of chronic pancreatitis as compared with 18 out of 30 (60%) patients by Pasanen PA *et al.*<sup>[17]</sup>

Calcifications appeared as clumps of high-level echoes within the parenchyma and/or within the dilated duct. Ultrasound was successful in picking up calcification in 62% of cases of chronic pancreas in our study. On further evaluation by CT, it revealed a further 4 cases which were missed by USG. This is similar to the results concluded by Pasanen PA *et al.*<sup>[17]</sup> where calcification was detected in 70% patients by ultrasound & 86.6% by CT.

Peripancreatic collections could be demonstrated in 4 on USG and 6 patients on CT in chronic pancreatitis cases. Pancreas could be visualised even in the presence of large cysts using reformatted images on CT. All the cysts detected in cases of chronic pancreatitis were clear cyst with no contents within. These findings were similar to the study by Pasanen PA *et al.*<sup>[17]</sup> who reported peripancreatic collections in 23 % on ultrasound and 35% of cases respectively on CT.

No significant difference was obtained on detection of ascites and pleural effusions on USG and CT modalities in cases of chronic pancreatitis.

Approximately 10% of cases with pancreatitis are complicated by vascular complications.<sup>18</sup> Prompt recognition of the bleeding manifestations in such patients is crucial for the management of such patients. Splenic vein

and portal vein obstruction are common in patients with chronic pancreatitis [19]. CT showed better detection rates for portal and superior mesenteric vein thrombosis than USG. Ultrasonography and CT were equally sensitive for identifying far vascular thrombosis, namely in the abdominal aorta and left renal artery in one patient.

From above detailed discussion we can come to conclusion that CT with multiplanar reformations is better in delineation of pancreatic size, calcifications, per pancreatic collections, extent of collections, necrosis and vascular complications. Even though USG can detect all the above findings it is hindered by the bowel gas shadows. However owing to its non-ionising properties, ultrasound were readily used for follow up scans.

## 5. Conclusion

Ultrasound is usually the first investigation of choice to satisfactorily exclude other causes of pain abdomen and confirm the clinical diagnosis of pancreatitis. To some extent it can provide useful information on non-vascular and vascular extra pancreatic complications of pancreatitis. On other hand MDCT is most beneficial in diagnosing equivocal cases and best for depicting the severity and extent of the disease. Life threatening complications of pancreatitis are best demonstrated and diagnosed on contrast enhanced MDCT either vascular or non-vascular. However, USG takes upper hand in deciding outcome of percutaneous drainage of collections depending on echogenicity. Due to its non-ionising nature USG is always preferred for follow up imaging than CT. Since both modalities have their own pros and cons it is the responsibility of the referring clinician and the radiologist to use them preferentially depending on the situation.

## 8. Acknowledgements

I would like to express my very great appreciation to all the staff for their valuable and constructive suggestions.

## 9. References

1. Russo MW, Wei JT, Thiny MT, Gangarosa LM, Brown A, Ringel Y. Digestive and liver diseases statistics, 2004. *Gastroenterology*. 2004;126(5):1448-53.
2. Bhatt A, Tiparse A, Patel A, Gandhi B. USG and CT scan evaluation of patients of acute and chronic pancreatitis- a cross-sectional, comparative study. *Int J Res Med Sci* 2017;5(8):3713-3716.
3. Freeny PC. Classification of pancreatitis. *Radiologic Clinics of North America* 1989;27(1):1-3.
4. Meyers MA. *Dynamic radiology of the abdomen: normal and pathologic anatomy*. Springer Science & Business Media, 2006.
5. Silverstein W, Isikoff MB, Hill MC, Barkin J. Diagnostic imaging of acute pancreatitis: prospective study using CT and sonography. *American Journal of Roentgenology* 1981;137(3):497-502.
6. Luetmer PH, Stephens DH, Ward EM. Chronic pancreatitis: reassessment with current CT. *Radiology* 1989;171(2):353-7.
7. Alpern MB, Sandler MA, Kellman GM, Madrazo BL. Chronic pancreatitis: ultrasonic features. *Radiology* 1985;155(1):215-9.
8. Hill MC, Barkin J, Isikoff MB, Silverstein W, Kalsner M. Acute pancreatitis: clinical vs. CT findings. *American Journal of Roentgenology* 1982;139(2):263-

9. Balthazar EJ, Ranson JH, Naidich DP, Megibow AJ, Caccavale R. Acute pancreatitis: prognostic value of CT. *Radiology* 1985;156(3):767-72.
10. Calleja GA, Barkia JS. Acute Pancreatitis. *Medical Clin North Am* 1993;77(5):1037-1055.
11. Jeffrey JR. Sonography in acute pancreatitis. *Radiologic Clinics of North America* 1989;27(1):5-17.
12. Freise J. Evaluation of sonography in the diagnosis of acute pancreatitis. In *Acute pancreatitis*. Springer, Berlin, Heidelberg 1987, 118-131.
13. Styliński R, Misiuna P, Paździor M, Ciechański A, Cwik G, Madro P. Comparison of the usefulness of ultrasonography and computed tomography in diagnosis of acute necrotizing pancreatitis. *Wiadomoscilekarskie (Warsaw, Poland: 1960-97;50:86-8*.
14. Balthazar EJ. Complications of acute pancreatitis: clinical and CT evaluation. *Radiologic Clinics* 2002;40(6):1211-27.
15. Pitkäranta P, Haapiainen R, Kivisaari L, Schroder T. Diagnostic evaluation and aggressive surgical approach in bleeding pseudoaneurysms associated with pancreatic pseudocysts. *Scandinavian journal of gastroenterology* 1991;26(1):58-64.
16. Bolondi L, Li SB, Gaiani S, Barbara L. Sonography of chronic pancreatitis. *Radiologic clinics of North America* 1989;27(4):815-33.
17. Pasanen PA, Partanen KP, Pikkarainen PH, Alhava EM, Janatuinen EK, Pirinen AE. A comparison of ultrasound, computed tomography and endoscopic retrograde cholangiopancreatography in the differential diagnosis of benign and malignant jaundice and cholestasis. *The European journal of surgery Acta chirurgica* 1993;159(1):23-9.
18. Boudghene, L. Hermine C, Bigot JM. Arterial complications of pancreatitis: diagnostic and therapeutic aspects in 104 cases. *J Vasc Interv Radiol* 1993;4:551-558.
19. Bernades P, Baetz A, Levy P. Splenic and portal venous obstruction in chronic pancreatitis: a prospective longitudinal study of a medical-surgical series of 266 patients. *Dig Dis Sci* 1992;37:340-346.