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Comparative Evaluation of Ultrasonography and Computed Tomography in Pancreatic Lesions

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Abstract

Background: *Aims and Objectives - 1) to do a comparative evaluation of ultrasonography and computed tomography in pancreatic lesions and assess their role as a useful diagnostic tool. 2) To correlate the USG and CT findings with fine needle aspiration cytology (FNAC)/ histopathological findings/ laboratory tests / therapeutic follow up wherever performed,*

Material and Methods: *The present study was carried out in the Department of Radio-diagnosis, Maharishi Markandeshwar Institute of Medical Sciences and Research, Mullana, Ambala. Thirty patients presenting with signs and symptoms of suspected pancreatic lesions referred from various wards and outpatient departments were included in the study.*

Results: *On USG, inflammatory lesions were diagnosed in 15 cases (50%), and on CT scan, the diagnosis was made in 18 patients (60%). Combining the USG & CT findings of inflammatory lesions, the provisional radiological diagnosis of focal pancreatitis was made in 1 case but it was proven to be adenocarcinoma on FNAC. Provisional diagnosis of adenocarcinoma was made in 8 cases, lymphoma in 2 cases, macrocystic adenoma in 1 case and cystadenocarcinoma in 1 case on both USG and CT scan. However on FNAC, adenocarcinoma was proved in 10 patients, lymphoma was found in one case. Thus the provisional radiological diagnosis was correct in 28 patients (93.7%).*

Conclusion: *Sonography detected pancreatic pathology in 27 cases (90%) but CT scan detected pancreatic lesions in all the 30 patients (100%). Present study had been undertaken to do a comparative evaluation of ultrasonography and computed tomography in pancreatic lesions and correlated the findings with fine needle aspiration cytology (FNAC) / HPE / laboratory tests / therapeutic follow up wherever performed. A need thus exists for multiple studies to produce significant in – road towards the appropriate imaging diagnosis of pancreatic pathologies as despite the rapid advances in imaging techniques, the overall impact of these modalities on the management and outcome of patients is still debatable.*

Keywords: *Pancreatitis; tumors; Ultrasonography; CT; Pathology.*

Introduction:

Pancreatic lesions are a difficult diagnostic and therapeutic challenge owing to the deep seated location of pancreas. Acute or chronic pancreatitis may be associated with pancreatic calcification, pseudocysts, extrapancreatic phlegmons, hemorrhage and pancreatic necrosis/ abscess formation which can help the radiologist make an accurate diagnosis.[1] Ultrasonography (USG) is a good modality because of its low cost, real time interactions, lack of bio-effects and wide availability. It can provide information about size, site and characteristics of pancreas, pancreatic lesion, diameter of the biliary and pancreatic ducts and site of obstruction. The presence or absence of lymph nodes or liver metastases can also be determined. More recently the use of echo enhanced Doppler sonography (Doppler after injection of contrast agent) has increased the sensitivity and specificity of this diagnostic modality.[2]

USG is operator dependent and has a limitation in obese patients and those with large amount of bowel gas. Computed tomography (CT) is a reliable modality and provides good definition of lesions and facilitates visualization of the entire extent of pancreatic pathology. Multiplanar three-dimensional reconstruction techniques including volume rendering, maximum intensity projection and shaded surface display provide comprehensive information about the relationships and possible involvement of vascular structures

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and demonstrating local extension.[3] But CT is expensive, exposes patient to ionizing radiation, may require long waiting periods for examination and may have difficulty in defining fat planes in lean patients. In addition USG-guided invasive manipulations of cystic pancreatic lesions /guided fine needle aspiration cytology (FNAC) of pancreatic masses are also easy to perform, quick and effective diagnostic methods but in some cases punctures and biopsies under CT control appear to be the imaging modality of choice. CT and USG are the most common utilized imaging modalities for evaluation of pancreatic pathologies.[4] Hence USG should be used as screening procedure and CT should be used when USG is not helpful. Minniti S, et al performed a prospective study to compare sonography with helical CT in identification and staging of the ductal adenocarcinoma of the pancreas. The diagnostic imaging examinations were performed for presence of tumor, involvement of the peripancreatic vessels, any metastases in the liver and the resectability. Findings were compared with surgical findings. USG was more accurate in identification of adenocarcinoma than helical CT but CT was more accurate for resectability. The authors concluded that USG was more reliable than CT in identifying pancreatic adenocarcinoma but accuracy is similar in staging to CT.[5] There is still a need to find a method which combines the accuracy of CT with similar availability and cost-effectiveness of USG.

Materials and methods:

The present study was carried out in the department of Radio-diagnosis, Maharishi Markandeshwar Institute of Medical Sciences and Research, Mullana, Ambala. Thirty patients presenting with signs and symptoms of suspected pancreatic lesions referred from various wards and outpatient departments were included in the study. A complete history of patients was taken and detailed clinical examination performed after obtaining the written informed consent in all the cases. Relevant laboratory investigations as mentioned in the proforma were done. Following this patients were subjected to sonography followed by computed tomography examination. All findings were recorded as per proforma attached.

Equipment:

Ultrasonography (USG)

- Machine - Logiq 500 Pro (GE)
- With a 2.5-3.5MHz convex transducer

Computed tomography (CT)

- Machine - Somatom Emotion Scanner (Siemens) - single slice spiral CT scanner

Sonography - Overnight fasting was preferred. The patient was made to lie down on the couch. A coupling agent was applied liberally to patient's skin to act as acoustic window removing the air between transducer and patient's skin surface and allow swift movement of the transducer. A general abdominal survey was done with a 3.5 MHz convex transducer with transverse, longitudinal and other desired planes. Pancreas was visualized by transverse scans in midline below the xiphoid process using the related vascular landmarks to identify it. The probe was made oblique to visualize the gland in its entirety. Using left kidney as an acoustic window, the tail of pancreas was visualized anterior to its upper pole. Wherever required, pancreatic and left upper quadrant visibility was improved by having patient drink a glass of water or making the patient stand erect. Color Doppler was done for vascularity of pancreas, pancreatic lesion and associated vascular structures. Various sonographic findings regarding size, shape, contour, echotexture of pancreas and pancreatic lesion, peripancreatic area were noted. Other associated findings like gall bladder stones, status of liver, ascites, pleural effusion, lymph nodes, calcification, vascular involvement etc were also searched. Findings were recorded as per proforma.

Following USG patient were subjected to CT examination.

Computed tomography (CT) - Patients were instructed to report after fasting for at least six hours. All patients were given oral contrast required for the opacification of duodenum and the bowel. Patients were positioned supine and scout image of abdomen taken. The region of interest was defined and extended from the domes till lower poles of kidneys. Plain sections were taken of the pancreatic area. Contrast enhanced CT scan of abdomen was then obtained after intravenous administration of 80-120ml of non-ionic contrast medium (Iohexol) containing 300 mg/ml of iodine. The amount of contrast was varied according to the patient's body weight, clinical and renal status. Lateral decubitus position was used in some cases. Scan slices were taken as 10 mm contiguous sections (Pitch - 1.5) over the entire upper abdomen and the volumetric data acquired reconstructed with 3mm thin slices. Multiplanar reconstructions were done wherever required. Axial sections were studied in detail regarding size, shape, density, enhancing pattern of pancreas and pancreatic lesion, peripancreatic infiltration/fat planes, any vascular complications etc. Other structures were also looked for any pathology particularly liver and biliary tree. Associated findings like ascites, pleural effusion, and lymphadenopathy were also noted. The findings were recorded as per proforma attached. The results of sonography and computed tomography were evaluated in each case and

findings correlated with fine needle aspiration cytology (FNAC) / histopathological findings/ laboratory tests / therapeutic follow up wherever performed.

Observations and results:

In the present series, age of the patients ranged from 11-80 years. Maximum number of patients was in the age range of 41-50 years followed by 31-40years. The mean age of occurrence of pancreatitis was around 45 years and malignant pancreatic lesions were around 62 years. Male patients outnumbered the female patients in this study. There were 18 males (60%) and 12 females (40%). Maximum no of males (6) and females (3) were in the age range of 41-50 years. Most common symptom was pain abdomen seen in 22 patients. The pain was present in the epigastric region radiating to back. Next common symptom was nausea and vomiting in 20 patients. Weight loss was seen in 16 patients and jaundice was seen in 10 patients. Many of the patients presented with more than one symptom. However lump in the abdomen was detected in 4 cases only. Serum amylase was done in 20 patients. A raised level of >140 IU/L was found in 8 patients of acute pancreatitis and a normal level between 35-140 IU/L was seen in 12 patients. Serum lipase was found to be more sensitive being positive in 10 cases (Table-1).

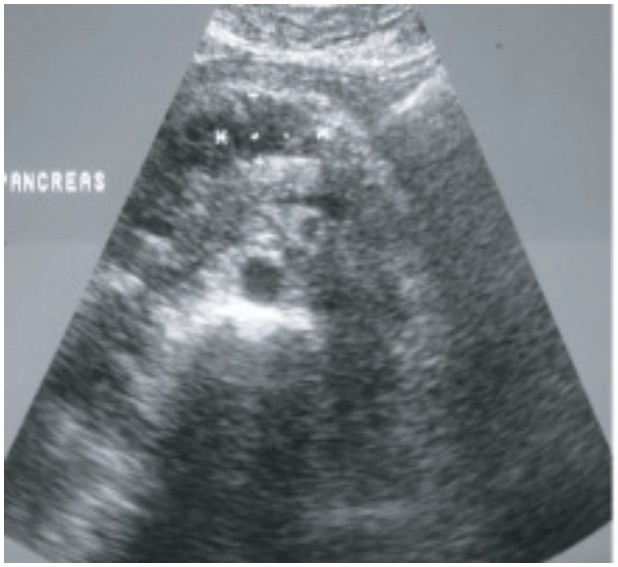

Fig.-1a: *USG -focal hypoechoic lesion is seen in body of pancreas*

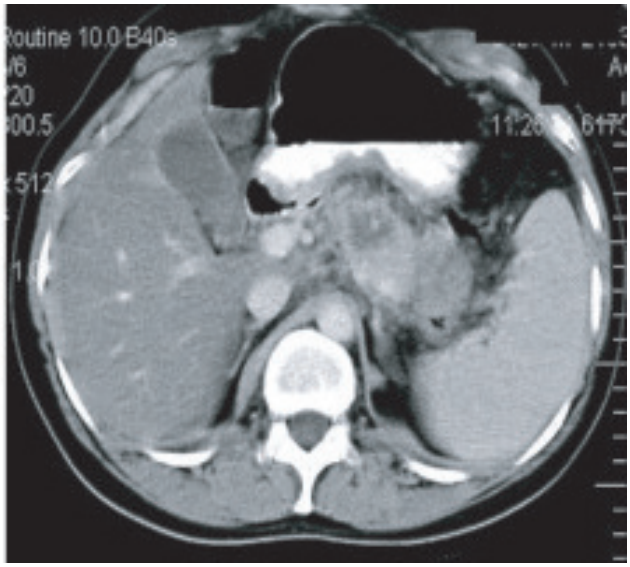

Fig.-1b: *CECT- Focal ill defined non enhancing hypodense area in body*

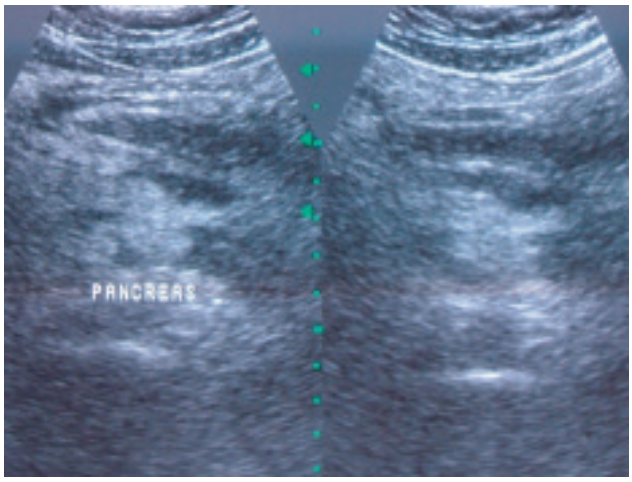

Fig.-2a: *USG shows peripancreatic collection with necros*is

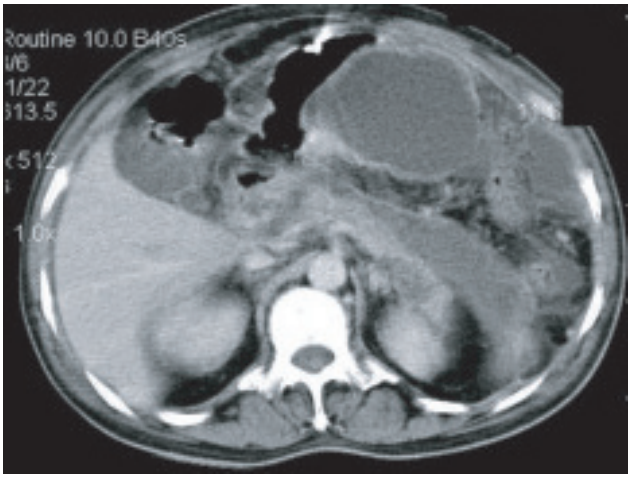

Fig.-2b: *CT showed acute necrotizing pancreatitis with peripancreatic collections*

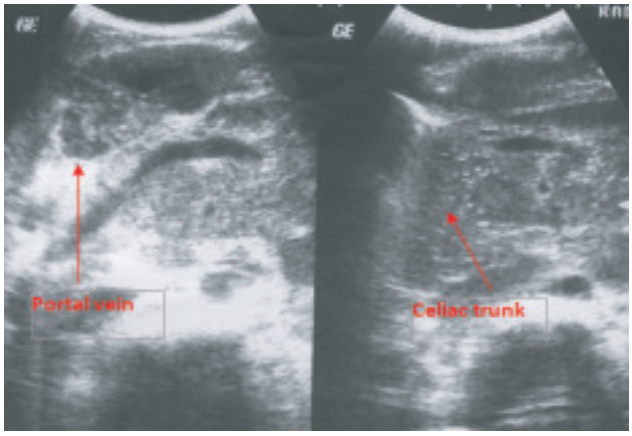

Fig.3a: *USG showed a large hypoechoic mass lesion involving pancreas with encasement of celiac trunk and portal vein.*

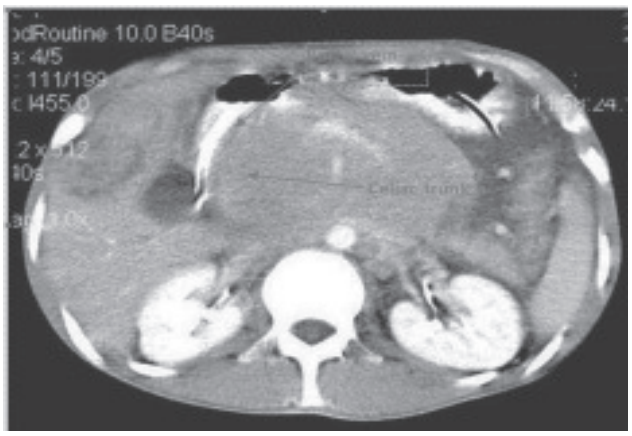

Fig.-3b: *CECT - large moderately enhancing mass lesion with diffuse involvement of pancreas with encasement of celiac trunk and portal vein with focal lesion in liver*

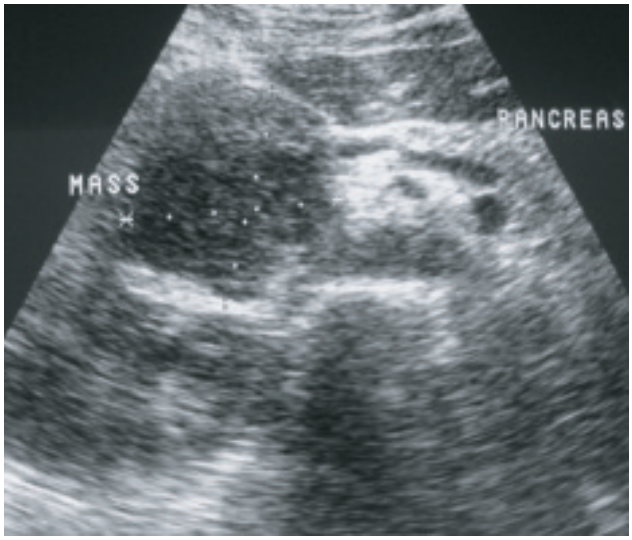

Fig.-4a: *USG – hypoechoic mass seen in head region*

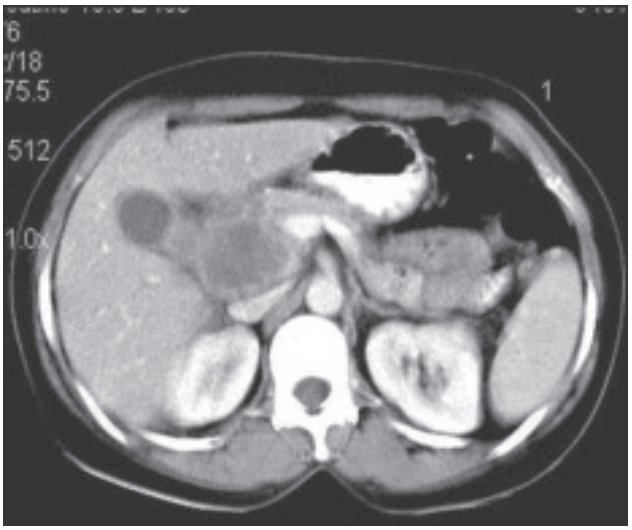

Fig.-4b: *CECT- hypodense mass with heterogenous enhancement with compression of 2nd part of duodenum.*

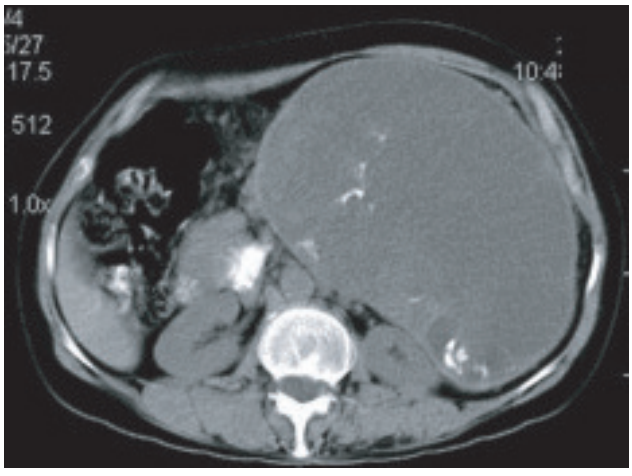

Fig.-5a: *Plain CT scan –large cystic mass with central and peripheral calcification*

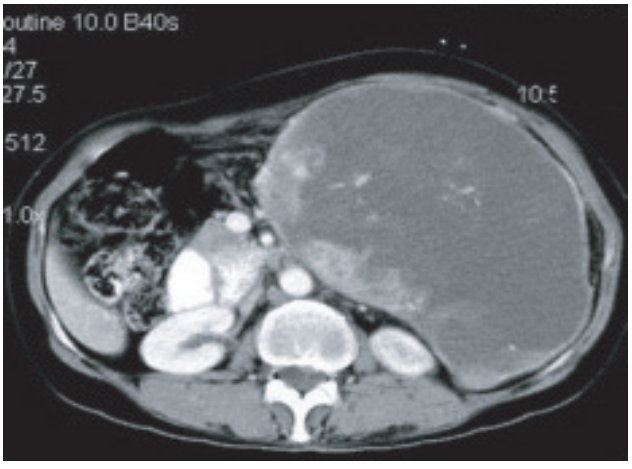

Fig.-5b: *Post contrast CT scan heterogenous enhancement seen with enhancing solid components*

Fig.-6a: *USG large hypoechoic mass head*

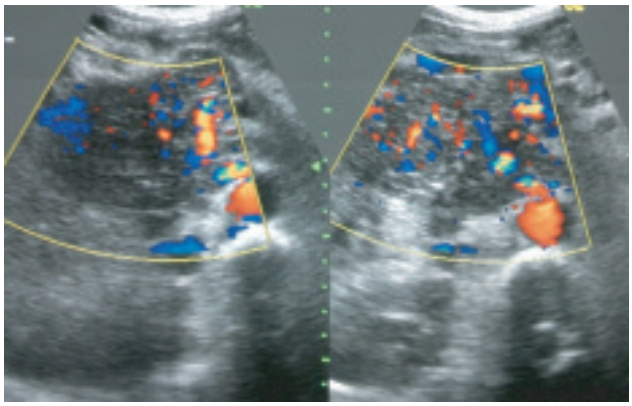

Fig.-6b: *Increased vascularity on doppler*

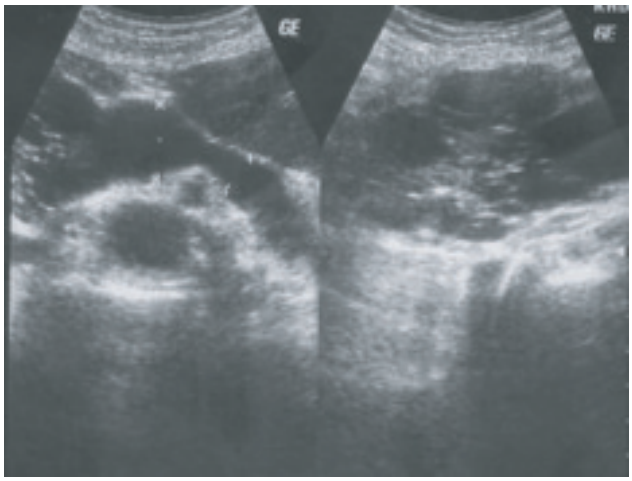

Fig.-7a: *USG – showed multicystic mass in head region communicating with PD. No calcification seen.*

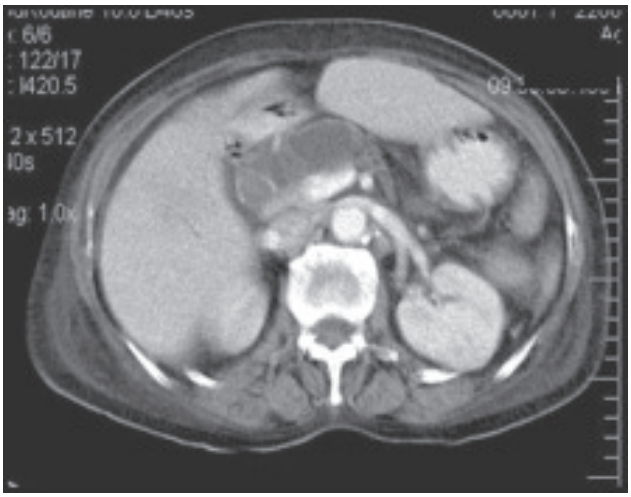

Fig.-7b: *CT- showed mass communicating with pancreatic duct*

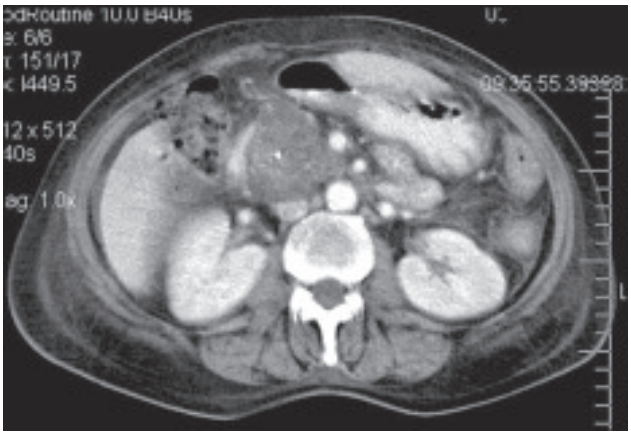

Fig.-7c: *CECT – showed multicystic mass in head region with heterogenous enhancement with speck of calcificatio*n

Table-1

Serum amylase/lipase values (n=30)

Serum Amylase	Amylase		Lipase	
/Lipase	No. of cases	%age	No. of cases	% Age
Raised	8	26.6%	12	40%
Normal	12	40%	10	33.3%
Not Done	10	33.3%	8	26.6%
Total	30	100%	30	100%

Table-II

Presence of pancreatic lesion on sonography (n=30)

Presence of lesion	No. of patients	% Age
Lesion detected	27	90%
Obscured pancreas due to bowel gases	3	10%
Total	30	100%

Sonographic observations - Ultrasound could detect pancreatic lesion in 27 out of 30 patients (90%). In 3 patients pancreas could not be visualised as it was obscured by overlying bowel gases (in 2 cases the entire pancreas was not visualised and in one case the tail region was not visualised) (Table-2). Hence in these 3 cases, pancreatic lesions could not be detected on USG; however they were seen on CT. Size of the pancreas was enlarged in 22 patients (73.3%) on sonography. The enlargement was either due to inflammatory changes /malignant pathology. Pancreas was atrophic in 5 cases of chronic pancreatitis. Pancreas was not visualised in remaining 3 cases because of overlying bowel gases. Involvement of pancreas was diffuse in 16 patients comprising 53.3 % of total cases. 11 patients showed focal involvement of pancreas involving head, body or tail. Majority of the lesions were seen in the region of head. The contour of pancreas was regular in 8cases (26.6%) whereas it was irregular in 19 cases (63.3%). Pancreas was not visualised in 3 cases because of overlying bowel gases. Majority of the lesions - 16 cases (53.3%) were heterogeneously hypoechoic in echotexture with areas of calcification/necrosis within them. The lesions were homogenously hypoechoic in 10 cases (33.3%). Echotexture of pancreas was normal in one case (Table-3). Calcification was seen in 9 pancreatic lesions on sonography comprising 30% of cases. Rest of the cases showed no evidence of any calcification. Pancreatic duct more than 3mm in calibre was considered dilated for any age. Pancreatic duct dilatation was seen in 10 patients; however in 17 patients it was normal in caliber (Table-4).

Intrapancreatic fluid collections were seen in 4 patients. Peripancreatic fluid collections were seen in 8 patients; predominantly in the region of lesser sac. Pseudocysts were seen in 3 patients of chronic pancreatitis. There was no evidence of any fluid collection in 15 patients including 3 patients in whom pancreas was not visualised (Table-5). Gall stones were seen in 8 patients of pancreatitis. CBD stone was seen in 1 case. Ascites was seen in 7 cases. Pleural

Table –III

Echotexture of pancreatic lesions (n=30)

	USG Findings			CT Scan Findings	
Echogenicity	Number of cases	% Age	Density	Number of cases	% AGE
Normal	1	3.3%	Hypodense	13	43.3%
Hypoechoic	10	33.3%	Heterogeneous	14	46.6%
Heterogeneous	16	53.3%	Cystic component	2	6.6%
Not Visualised	3	10%	Pseudocysts	3	10%
Total	30	100%	Total	30	100%

Table – IV

Pancreatic duct dilatation on sonography (n=30)

	USG			CT	
Pancreatic duct	Number of cases	%Age	Pancreatic duct	Number of cases	%Age
Dilated	10	33.3%	Dilated	10	33.3%
Not Dilated	17	56.6%	Not Dilated	20	66.6%
Not Visualised	3	10	Not Visualised	0	
Total	30	100%	Total	30	100%

Table -V

Fluid collections on sonography (n=30)

	USG			CT	
Fluid collections	Number of cases	%Age	Fluid collections	Number of cases	%Age
Intrapancreatic	4	13.3%	Intrapancreatic	5	16.6%
Peripancreatic	8	26.6%	Peripancreatic	11	36.6%
Pseudocyst	3	10%	Pseudocyst	0	
No fluid collection	15	50%	No fluid collection	14	46.6%
Total	30	100%	Total	30	100%

effusion was seen in 6 cases which was left sided in 5 cases and right sided in 1 case. Enlarged lymph nodes were seen in 6 cases. Extrahepatic and intrahepatic biliary dilatation was seen in 8 cases. Hepatic metastases were seen in 6 cases of malignant pancreatic lesions (Table-6). Ultrasound could not detect pancreas in 3 cases because of overlying bowel gases. Out of 15 cases of inflammatory pathologies, acute pancreatitis was seen in 7 cases, acute exacerbation of chronic pancreatitis was seen in 2 cases. Chronic pancreatitis was seen in 5 cases which included 3 cases of pseudocyst formation and 2 cases without pseudocyst formation. Focal acute pancreatitis in the region of pancreatic body was seen in 1 case. Provisional diagnosis of malignant lesions was made in 12 cases on sonography which included adenocarcinoma in 8 cases, lymphoma in 2 cases, macrocystic adenoma in 1 case and cystadenocarcinoma in 1 case (Table-7).

Observations on computed tomography (CT scan)

Pancreatic lesions were seen in all thirty patients on CT scan. 3 cases which were not visualised on sonography were also seen on CT. Pancreas was enlarged in 24 cases (80%) out of

Table-VI

Additional sonographic and CT findings

USG			CT		
Findings	Number of cases	%Age	Findings	Number of cases	%Age
Gall Bladder Stones	8	26.6%	Gall Bladder Stones	6	20%
CBD stone	1	3.3%	CBD stone	1	3.3%
IHBR/CBD Dilatation	9	30%	IHBR/CBD Dilatation	9	30%
Ascites	7	23.3%	Ascites	7	23.3%
Lymphadenopathy	6	20%	Lymphadenopathy	9	30%
Pleural effusion	6	20%	Pleural effusion	6	20%
Liver Metastasis	6	20%	Liver Metastasis	6	20%
Invasion/involvement of adjacent structures	0		Invasion/involvement of adjacent structures	4	13.3%
Vascular involvement	0		Vascular involvement	7	23.3%

Table -VII

Provisional sonographic and CT diagnosis

Diagnosis	Number of cases	%Age	Diagnosis	Number of cases	%Age
Inflammatory	15	50%	Inflammatory	18	60%
Acute pancreatitis	7	23.3%	Acute edematous pancreatitis	4	13.3%
			Acute necrotizing pancreatitis	5	16.6%
Acute on chronic pancreatitis	2	6.6%	Acute on chronic pancreatitis	2	6.6%
Chronic pancreatitis with pseudocyst	3	10%	Chronic pancreatitis with pseudocyst	3	10%
Chronic pancreatitis without pseudocyst	2	6.6%	Chronic pancreatitis without pseudocyst	2	6.6%
Focal pancreatitis	1	3.3%	Focal Pancreatitis	2	6.6%
Pancreas not visualised	3	10%	Pancreas not visualised	0	0%
Malignant	12	40%	Malignant	12	40%
Adenocarcinoma	8	26.6%	Adenocarcinoma	8	26.6%
Lymphoma	2	6.6%	Lymphoma	2	6.6%
Macrocystic adenoma	1	3.3%	Macrocystic adenoma	1	3.3%
Cystadenocarcinoma	1	3.3%	Cystadenocarcinoma	1	3.3%
Total	30	100%			

total 30 cases. Enlargement was either due to inflammatory/ malignant pathology. These 24 cases also included three cases which were not visualised on sonography. CT scan showed focal enlargement in region of pancreatic tail in 1 case and diffuse enlargement of pancreas in another 2 cases. Pancreas was atrophic in 5 cases of chronic pancreatitis. Size of pancreas was normal in one case. Diffuse involvement of pancreas was seen in 18 cases (60%) and focal involvement in 12 cases (40%) predominantly in the region of head - 9 cases (30%), followed by body -2 cases (6.6%) and least common in the region of tail - only 1 case (3.3%). Out of 3 cases which were not seen on sonography 2 cases showed diffuse involvement and 1 case showed focal involvement in region of pancreatic tail on CT scan. The margins of pancreas showed well defined outline in 10 cases whereas the outlines were ill defined in 20 cases.

The lesions seen on CT were either homogenously or heterogeneously hypodense.[13] cases were hypodense comprising 43.3% of cases. 14 cases were heterogeneously hypodense comprising 46.6% of cases. Out of these 14 heterogeneous lesions, 2 cases showed predominantly cystic component. Pseudocysts were seen in 3 cases (Table-3). Calcification was seen in pancreatic lesions in 11 cases on CT (36.6%) and was absent in 19 cases. CT was more sensitive than USG in detecting calcification in two cases. Out of total of 30 cases pancreatic duct dilatation was seen in 10 cases (33.3%). The calibre of pancreatic duct more than 3mm was considered dilated for any age. Main pancreatic duct (MPD) was normal in 20 cases (66.6%) (Table-4).

Maximum number of patients showed heterogeneous moderate enhancement on post contrast CT scans i.e. 18cases (60%). This was followed by homogenous moderate enhancement in 7 cases (23.3%). Few of the pancreatic lesions i.e. 5 cases (16.6%) including chronic pancreatitis showed no enhancement on CECT. The necrotic or non enhancing areas were evaluated after contrast enhanced CT scan. Maximum number of patients showed no evidence of necrosis i.e. in 15 cases (50%). There was presence of necrosis in almost equal proportion in range of 30-50 % and >50% in 4 cases of acute pancreatitis. 10 cases of malignant pathologies showed e/o necrotic areas.

Intrapancreatic fluid collections were seen only in 5 patients. Peripancreatic fluid collections including pseudocysts were seen in 11 patients predominantly in the region of lesser sac. Some of the patients showed both intra and peripancreatic fluid collections. There was no e/o any fluid collection in 15 patients (Table-5). Peripancreatic stranding and fascial plane thickening was seen in 12 patients (40%). It was seen predominantly in inflammatory lesions, while 2 cases of malignant lesions also showed similar findings due to local involvement. No stranding/fascial thickening was seen in 18 cases (60%). Gall stones were missed in 2 patients out of total 8 patients in whom USG was able to detect cholelithiasis.CBD stone was seen in 1 case. Enlarged regional and distant lymph nodes were seen in 9 cases while USG showed lymphadenopathy in 6 patients. Out of 12 cases of malignant lesions - 4 patients showing e/o local extension/ invasion. There was evidence of metastases to liver in 6 patients. Involvements of the peripancreatic major vessels – portal vein/IVC/SMV/SMA were seen in 7 patients including

Table – VIII
Comparative evaluation of provisional USG and CT diagnosis

Provisional diagnosis	USG		CT	
	Number of Cases	% Age	Number of Cases	% age
Inflammatory	15	50%	18	60%
Acute pancreatitis	7	23.3%	9	30%
Acute on chronic pancreatitis	2	6.6%	2	6.6%
Chronic pancreatitis with pseudocyst	3	10%	3	10%
Chronic pancreatitis without pseudocyst	2	6.6%	2	6.6%
Focal pancreatitis	1	3.3%	2	6.6%
MALIGNANT	12	40%	12	40%
Pancreas Not Visualised	3	10%	0	0%
Total	30	100%	30	100%

Table – IX

Comparative evaluation of radiological diagnosis with final diagnosis by FNAC/HPE/lab tests/follow up

Radiological diagnosis	Number of cases	% Age	Final diagnosis	Number of cases	% Age
Acute edematous pancreatitis	4	13.3%	Acute edematous pancreatitis	4	13.3%
Acute necrotising pancreatitis	5	16.6%	Acute necrotising pancreatitis	5	16.6%
Acute on chronic pancreatitis	2	6.6%	Acute on chronic pancreatitis	2	6.6%
Chronic pancreatitis with pseudocyst	3	10%	Chronic pancreatitis with pseudocyst	3	10%
Chronic pancreatitis without pseudocyst	2	6.6%	Chronic pancreatitis without pseudocyst	2	6.6%
Focal Pancreatitis1.					
1 Body	1	3.3%	1. Adenocarcinoma	1	3.3%
2 Tail	1	3.3%	2. Focal pancreatitis	1	3.3%
Adenocarcinoma	8	26.6%	Adenocarcinoma	9	30%
Lymphoma	2	6.6%	Lymphoma	1	3.3%
Macrocystic adenoma	1	3.3%	Macrocystic adenoma	1	3.3%
Cystadenocarcinoma	1	3.3%	Cystadenocarcinoma	1	3.3%
Inflammatory	18	60%	Inflammatory	16	53.3 %
Malignant	12	40%	Malignant	14	46.6 %
Total	30	100%	Total	30	100%

portal vein thrombus, encasement of PV/SMV/SMA and thrombosis of SMA /SMV and splenic vein. Features of obstructive biliopathy in form of extra/intrahepatic biliary dilatation were noted in 9 patients. Ascites and pleural effusion was seen in 7 and 6 cases respectively (Table-VI).

In accordance with the imaging findings on CT, provisional diagnosis was made in all the 30 patients. The pancreatic lesions detected on CT were characterized into inflammatory and malignant lesions. 18 patients had inflammatory pathology including acute, acute on chronic, chronic and focal pancreatitis. 12 patients had malignant pathology including adenocarcinoma, lymphoma, macrocystic adenoma and cystadenocarcinoma (Table-VII). Pancreatic lesions were seen in all thirty patients on CT scan. 3 cases which were not visualised on sonography due to overlying bowel gases were also seen on CT. These included 1 case of acute edematous pancreatitis, 1 case of acute necrotising pancreatitis and another case of focal acute pancreatitis in tail region. 12 malignant pancreatic lesions were detected by USG and CT both, though the radiological diagnosis was incorrect in 2 cases. Provisional radiological diagnosis was made in 27 out of 30 patients by USG including 3 cases in which pancreas was not visualised due to overlying bowel gases, however CT could detect pancreatic lesions in all 30 patients (Table-VIII). 1 case which was diagnosed radiologically as focal pancreatitis in body region on both CT and USG was proven to be adenocarcinoma on HPE. Another case in which radiological diagnosis proved wrong was lymphoma which was proven to be adenocarcinoma on FNAC. Thus USG was non-diagnostic in 5 cases (90% sensitive and 83.6% specific) and CT in 2 cases (100% sensitive and 93.4% specific) on correlation with final diagnosis (Table-IX).

Discussion:

The early clinical diagnosis of pancreatic lesions is fraught with difficulty. Unfortunately, the initial symptoms are often quite non-specific and subtle in onset. A number of continually evolving imaging modalities is available to diagnose the pancreatic pathologies. These include plain X-rays, transabdominal ultrasonography (TAS), computed tomography (CT), magnetic resonance imaging (MRI), endoscopic retrograde cholangiography (ERCP), endoscopic ultrasonography (EUS) and positron emission tomography (PET). This study was undertaken to assess the comparative ability of USG and CT to diagnose the pancreatic lesions. Connor OJ, McWilliams S and Maher MM[6] stated that the incidence of acute pancreatitis is approximately 5–70 cases per 100,000 per year. Acute pancreatitis has a higher incidence in men than women, (generally between 40 and 50 years old with mean age of 42 yrs) but overall gallstone acute pancreatitis was most frequent in women. The clinical signs and symptoms most commonly include epigastric pain

radiating to back.[6] Kle S, et al[7] conducted a study to assess the clinical value of USG and CT in diagnosing and staging pancreatic carcinoma. The efficiency to detect the pancreatic carcinoma by routine ultrasound was 91.3 percent, while color-Doppler and 3-D techniques increased accuracy significantly upto 93.7 percent. Helical CT was shown to be the best modality of all, with accuracy reaching 94.4 percent ($p>0.05$). The routine ultrasound procedure achieved relatively low accuracy of 82.6% and color-Doppler imaging improved the accuracy upto 92.2% in assessment of vascular neoplastic infiltration. The study proved CT to be the most precise diagnostic tool in determining lymph node metastases; its accuracy reached 91.3%, while all other modalities were below 90.0%.[7]

True epithelial cysts of the pancreas in adults are reported to be rare pathological lesions, although now being diagnosed more frequently due to the widespread use of USG, CECT, MRI and EUS, and their etiology still remains unknown. CECT of the abdomen revealed a hypodense structure measuring 4 cm × 3.2 cm × 2.3 cm, located in the head of the pancreas, without any evidence of a solid component as reported in U Dalal case study.[8] Histopathologically, the cystic lesion was a true pancreatic cyst. they concluded that CECT, USG and FNAC are sensitive for pre operative identification of the entity and for the differential diagnosis of other cystic pancreatic lesions and helps in management.[8] Kulig J, et al [9] stated that endoscopic ultrasound was the most accurate modality for local tumor staging (93.1%), vascular infiltration (90%), and lymph node assessment (87.5%) than routine USG (82.5% for local tumor staging, 67.5% for vascular infiltration, and 72.5% for lymph node assessment). The accuracy rate for CT and Doppler US were similar (88.1% for local tumor staging, 82.5% for vascular infiltration and 80.0% for lymph node assessment). However, the advantage of endoscopic ultrasound over computed tomography and ultrasonography does not justify its routine use due to its high cost, low availability, and invasiveness.[9]

According to Lesniak RJ et al,[10] ductal adenocarcinoma does not calcify and calcification may indicate underlying chronic calcific pancreatitis. In the present series also, calcification was seen in only 3 out of 10 cases of adenocarcinoma. CT could detect calcification in 11 cases compared to 9 cases on USG including one case of pancreatitis and another one of cystadenocarcinoma. Upadhyaya V, et al[11] used atleast two imaging modalities in each patient and findings were corroborated with the operative and/or histopathological findings. The overall diagnostic accuracy for detection of level of obstruction was maximum for ERCP/PTC (95.83%), followed by MRCP (95.45%), CT (85.71%) and USG (83.50%). For assessing the cause, MRCP had the highest accuracy (87.5%), followed by CT scan (85.71%), USG (77%) and ERCP/PTC (75%). USG had traditionally been used as the initial screening procedure, however, although it was well suited to visualize the Common Hepatic Duct (CHD) and proximal CBD, one of its major limitations was in assessment of the distal CBD and pancreas, which were often obscured by overlying bowel gas in about 30-50% of the patients and obesity. In their study, USG missed many cases of CBD calculi. Other cases missed by USG were stricture, sclerosing cholangitis and cases of small mass lesions involving the head of pancreas.

Wong JC and Lu DS[12] stated the sensitivity of CT for diagnosis of pancreatic adenocarcinoma (89%-97%) and its positive predictive value for predicting unresectability (89%-100%) were high. The positive predictive value of CT for predicting resectability (45%-79%) was low because the diagnostic criteria for diagnosing vascular invasion by tumor favour specificity over sensitivity to avoid denying surgery to patients with potentially resectable tumor. Furthermore, the sensitivity of CT for small hepatic and peritoneal metastases was limited. Magnetic resonance imaging had not been shown to perform better than CT for the diagnosis and staging of pancreatic adenocarcinoma but could be helpful as an adjunct to CT, particularly for evaluation of small hepatic lesions that cannot be fully characterized by CT. Ultrasound has its limit for diagnosis and staging of patients with pancreatic adenocarcinoma. EUS was generally considered superior to CT for the diagnosis and local staging of pancreatic cancer, but was limited by availability and inability to assess for distant metastases. Takamitsu I, et al[13] has evaluated pancreatic tumors preoperatively with positron emission tomography using F-18 fluorodeoxyglucose (FDG) and compared with CT and USG. In 33 of 35 patients, foci of pancreatic carcinomas (10-100 mm in diameter) were identified as an increase in FDG uptake, whereas CT and USG depicted the foci in 31 and 28 cases respectively. Among 11 benign lesions, nine showed no increased FDG uptake (specificity=82%). False positive findings were obtained in a case of chronic active pancreatitis and in a serous cystadenoma. The authors opined that FDG PET provided biochemical information and was accurate in identifying pancreatic carcinoma and could be a method of choice in imaging equivocal masses detected with anatomic imaging studies.

Berman L, et al[14] presented a case of a patient with presumed intraductal papillary mucinous neoplasm (IPMN) who was ultimately found to have a serous cystadenoma in communication with the pancreatic duct. If EUS cannot be

performed, resection was favored to avoid under treating a premalignant lesion. The most common were serous cystadenoma (32% to 39%), intraductal papillary mucinous neoplasm (IPMN) (21% to 33%), and mucinous cystic neoplasm (MCN) (10% to 45%). Solid-pseudopapillary tumors represent less than 10%. Isolated retroperitoneal hydatid cyst is an exceptionally rare entity. Ultrasound abdomen revealed a lesion of size 7 x 5 cm in retroperitoneal region in relation to the tail of pancreas. CECT of the abdomen revealed retroperitoneal lesion of size 7 x 5 cm in relation to the tail of the pancreas with dilated small bowel loops. The rest of the organs were normal; hence, diagnosis of primary hydatid cyst of the pancreas was made radiologically. Ultrasound-guided aspiration was done again to rule out neoplastic nature of the lesion. Cytology revealed scolices compatible with hydatidosis. The histopathology of the cyst was compatible with hydatid cyst, but the attached capsule of pancreas overlying the cyst and tail was remarkably normal with no evidence of invasion. Hence, the final diagnosis of isolated primary retroperitoneal hydatid cyst of the pancreas was made, as other organs of the body did not reveal any hydatid cyst.[15]

Fine needle aspiration cytology together with imaging, had become a primary diagnostic modality for investigation of pancreatic mass lesions, both cystic and solid. Despite the advances in the imaging techniques, management options for patients were limited and a malignant diagnosis of solid lesions still carried a high mortality rate. This was based on the pre-operative distinction of non-mucinous and mucinous cysts in general, and benign and malignant cysts in particular. A cytological diagnosis could be obtained with minimally invasive techniques that utilize CT, US or EUS. Endoscopic Ultrasound guided FNA (EUS FNA) was evolving as the diagnostic method of choice due to its ability to more accurately stage the patient during a single procedure using EUS.[16] For detecting cystic lesions, ultrasound with fine-needle aspiration had emerged as a prime modality investigations. Pancreatic cysts include inflammatory lesions, low-grade neoplasms, and malignant neoplasms. In the older literature, pseudocysts related to acute and chronic pancreatitis accounted for the majority of pancreatic cysts, but it was difficult to differentiate pancreatic cystic neoplasms from pseudocysts even with high-resolution modalities including computed tomography (CT) and magnetic resonance imaging (MRI) scans.[17] With the development of USG and CT, the preoperative diagnosis of abdominal cystic disorder has become easy. USG can distinguish between solid and cystic masses and CT can determine extension and cystic content.[18] The clinical data of 5 patients with MSAP were retrospectively analyzed. There were 5 female and 1 male. USG and CT could detect macrocystic lesion of the pancreas; all the lesions showed a well-defined border, internal septations, enhanced cyst walls, with no intramural (mural) nodule and papillary projections; the wall was smooth and thin in 4 cases; irregular lobulation could be observed in 3 cases, 2 cases had pancreatic duct dilatation. The tumors were located in the pancreatic body and tail in 3 cases and pancreatic head in 2 cases. The size of the tumors ranged from 6.5 cm to 13.0 cm (mean, 8.8 cm).[19]

Wakabayashi T, Kawaura Y, Satomura Y, et al[20] reviewed 7 cases of chronic pancreatitis (CP) with focal narrowing of the main pancreatic duct (MPD), evidenced by ERCP, and swelling of one or two segments of the pancreas, evidenced by USG /CT. Stricture of the lower portion of the common bile duct (CBD) that caused obstructive jaundice was shown by ERCP in two cases. In all six patients, a dynamic study by CT or MRI homogeneously showed delayed enhancement of involved segments of the pancreas. The clinical, serologic, and histological findings as described above were comparable to those for 12 CP patients with diffuse narrowing of the MPD, diagnosed during the same period.[20] Vascular and perfusion images of contrast-enhanced ultrasound (CE-US) were used for the evaluation of tumor vascular-ity and parenchymal perfusion of the tumor, respectively. The hemodynamic of the tumor and the diagnostic capacity of CE-US were compared with those shown by computed tomography (CT). The endocrine tumors showed a heterogeneous hypervascular and hyperperfusion pattern. When tumors showing a hypovascular or hypoperfusion pattern on CE-US were diagnosed as carcinomas, 34 of the 39 carcinomas (87%) fit this criterion, with a 95% confidence interval (CI) of 73%-96%, whereas, on CT, 31 of the 39 were diagnosed as carcinoma; (sensitivity, 79%). The sensitivity and accuracy of CT were inferior to those of CE-US. Results of comparison between the CE-US findings and the histological diagnosis were as follows. They concluded that the differences in vascularity of pancreatic carcinomas depicted by CE-US were associated well with differences in histology.[21]

Kamisawa T, Egawa N, Nakajima H, et al[22] retrospectively examined findings of USG, CT, endoscopic retrograde cholangiopancreatography and angiography, in cases of pancreatic carcinoma, and compared histologically. USG showed an enlarged hypoechoic pancreas with sausage-like appearance and no lobulation in the contour of the pancreas. On computed tomography imaging, delayed enhancement of the swollen pancreatic parenchyma became evident. Bornman PC, Botha JF and Ramos JM et al [23] studied that CP was a disease with significant clinical and pathological

heterogeneity. The guidelines provide clear recommendations regarding the diagnostic modalities available, both imaging (which includes MRI and endoscopic ultrasound (EUS)) and pancreatic function tests. The section on medical management makes recommendations on the use of analgesics, enzyme replacement and other therapeutic options in the non-interventional management of the majority of patients with CP. The section on interventional procedures identifies the indications and options available for the interventional management of both uncomplicated and complicated CP. The role of endoscopic and surgical modalities was defined, but it was in this context especially that the best available evidence, combined with the experience of the group, influenced the recommendations put forward. Owing to the lack of evidence and the complexity of the disease, it was recommended that, where possible, CP was managed in the context of a multidisciplinary team.[23]

Our study mounted the following points -

- CT has higher overall sensitivity and specificity for detecting and differentiating inflammatory and malignant lesions of pancreas as compared to USG.
- Sonography seems to be a good screening modality for evaluating patients with pancreatic lesions, because of its low-cost, ready availability, non-invasiveness and no radiation hazards to the patients. However, few cases remain non-diagnostic due to its technical limitations because of bowel gases, obesity and operator-dependence.
- CT was far superior to USG in the evaluation of acute pancreatitis, detection peripancreatic inflammation, its extension into the retroperitoneal compartments and vascular involvement or metastasis

Conclusion:

CT and sonography are complementary imaging modalities in the evaluation of suspected pancreatic lesions. Thus in all the cases of pancreatic lesions, besides clinical examination; both these modalities (Sonography and CT scan) have their own role in detecting and differentiating lesions of pancreas and should be used in combination for accurate diagnosis and management. There is still a need to find a method which combines the accuracy of CT with similar availability and cost-effectiveness of USG.

Conflict of Interest: None

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