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Original Research Article

A Study of Multidetector Computed Tomography in Evaluation, Characterization and Classification of Traumatic, Inflammatory and Neoplastic Pancreatic Lesions

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Abstract:

Background: Currently, pancreatic lesions are becoming more frequent and are a major source of morbidity and mortality. Therefore, it is important to assess the imaging techniques that aid in the early diagnosis, assessment, and characterisation of these lesions. Early diagnosis of tiny pancreatic lesions is attainable with triphasic contrast studies and multidetector computed tomography, which both provides the best evaluation of pancreatic lesions.

Aim and Objective: To assess the role of Multi detector Computed Tomography in evaluation, characterization and classification Of Traumatic, Inflammatory and Neoplastic Pancreatic Lesions.

Materials and methods: This was prospective observational study in which total 78 patients of all ages who had been clinically suspected of having pancreatic diseases were referred to the radiology department were included in the study after following inclusion and exclusion criteria after getting ethical approval and consent from the patients.

Results and Conclusion: Adenocarcinomas in particular have a male to female ratio of 1:4 and are more prevalent in females. Males frequently experience inflammation and trauma. In pancreatic neoplasm, the head of the pancreas is the most frequent site, solid tumours are more prevalent, and most of them are malignant. Mucinous cystadenoma was the most common benign tumor whereas Adenocarcinoma is the most common malignant tumor followed by secondary metastasis predominantly from liver. Conclusion : Neoplasms are more common in females, Inflammatory & trauma are common in males, with increase in age there is shift in frequency of cases from inflammatory to neoplasm

Keywords: Adenocarcinoma, serous cystadenoma, mucinous cystadenoma, neuroendocrine tumor, lymphoma.

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Introduction

Pancreatic lesions are now an increasingly common in occurrence and a significant cause of morbidity and mortality. They may present with an array of symptoms while some are asymptomatic for long periods and others are often encountered as incidental findings on evaluation for other pathologies.[1, 2] Due to the increasing incidence and the myriad ways, it has become necessary to evaluate imaging modalities that can help in early detection and the proper evaluation and characterization of each of these lesions. Modalities for imaging pancreas ranges from plain x-ray to Ultrasonography (USG), Endoscopic ultrasound (EUS), Endoscopic retrograde cholangio pancreatography (ERCP), Computed tomography (CT), Magnetic resonance imaging (MRI) with magnetic resonance cholangiopancreatography (MRCP), and Positron emission tomography-computed tomography (PETCT). With the introduction of Multidetector Computed Tomography (MDCT), evaluation of pancreatic lesions allows data to be acquired during optimal pancreatic enhancement. The advent of triple phase-contrast study aids in the early detection of small and early pancreatic lesions. This technology permits thinner slices to be acquired during multiphasic scanning, with improved spatial resolution. The use of multi-planar reformatted

images and 3-dimensional representations of the vascular structures as well as the ability to provide preoperative vascular mapping, helps in the accurate staging of pancreatic tumors and aids in successful surgical resection. Since MDCT technologic advances facilitate the early detection of small pancreatic lesions, they are likely to have an impact on the treatment of pancreatic diseases. Hence, this study aims to assess the role of MDCT (triple phase study) in the evaluation of pancreatic diseases.[3]

Materials and Method: This was prospective observational study, included 78 cases to evaluate the role of MDCT- triple-phase study in the pancreatic pathologies, for the duration of one year, in the department of Radiology, Chalmeda Anand Rao Institute of Medical Sciences Karimnagar, after following inclusion and exclusion criteria, consent from the patients and approved by institutional ethical committee.

Inclusion criteria:

- Patients presenting with suspicious clinical symptoms of pancreatic pathology and with associated biochemical parameters such as elevated amylase, lipase levels.
- Patients with suspicious or definite findings on ultrasound of pancreatic pathology.

Exclusion criteria:

- Patients with non-pancreatic causes of upper abdominal pain.
- Pregnant patients.
- Patient suspected of congenital anomalies of the pancreas.
- Patients with renal insufficiency or elevated urea, creatinine levels that can be exacerbated by contrast and contrast allergy used for enhanced CT.

Method

- All patients received 100-120 ml of IV noniodine contrast with a monophasic injection technique using a power injector.
- The contrast material is administrated at a rate of 4 ml/s through the antecubital vein.
- MDCT (triple phase study) will be performed on the MDCT scanner (Siemen's somatom scope 16 slice CT unit).
- The patient will be placed on a gantry table in supine position with both arms above the head.
- All scans will be acquired in a cephalocaudal direction. A digitized AP scanogram will be obtained in suspended respiration. Non-enhanced sections will be obtained throughout the abdomen.
- Before contrast injection, the patient is asked to hyperventilate so that blood oxygen level would be high and hence they would be comfortable in holding their breath.
- Continuous 1.5mm thick slices were obtained in the axial plane with a scan time of 6seconds at a 130KV tube voltage and 170 mA.
- A contrast scan is obtained in three phases after obtaining unenhanced MDCT followed by arterial phase (AP), pancreatic parenchymal phase (PPP), and portal venous phase (PVP).
- Arterial phase acquisition is initiated using "Smart Prep" bolus tracking with the ROI at descending aorta above the dome of the diaphragm, once the vessel threshold crosses 100HU the image acquisition is initiated with the delay of 810sec. The images were obtained from the dome of the diaphragm to abdominal aortic bifurcation.
- Pancreatic parenchymal phase acquisition is initiated following the arterial phase with a total delay of 18-20sec.
- Portal venous phase acquisition is initiated following the pancreatic parenchymal phase with a total delay of 40-50sec.
- The patient is instructed to hold and release the breath in between the phases

Observation and Results: In this prospective study total 78 patients were included to evaluate the role of MDCT- triple-phase study in the pancreatic pathologies, for the duration of one year, and their observation found as bellow.

Table 1: Age and pancreatic pathological distribution among study population

Parameters	Frequency	Percentage
Age		
<20 Years	6	7.7
20-39 Years	30	38.5
40-59 Years	23	29.5
>60 Years	19	24.3
Pathology Distribution		
Inflammatory	62	79.5
Tumour	14	17.9
Trauma	2	2.6
Tumour Nature Pattern		
Benign	10	71.4
Malignant	4	28.6

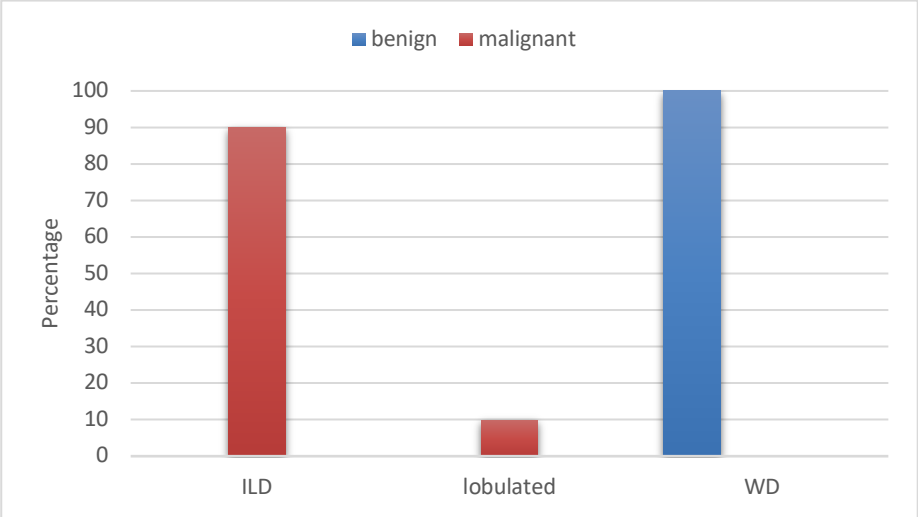

Figure 1: Distribution of tumor margin pattern

Of the 14 patients of neoplasms in the study, majority (n=10) are of malignant nature (71%) and benign cases (n=4) accounted for 29%. Chi square test p=0.0009 (highly significant) stating that majority of malignant cases (90%) have ill-defined margins, 10% cases show lobulated margins and all the benign cases (100%) have well defined margins.

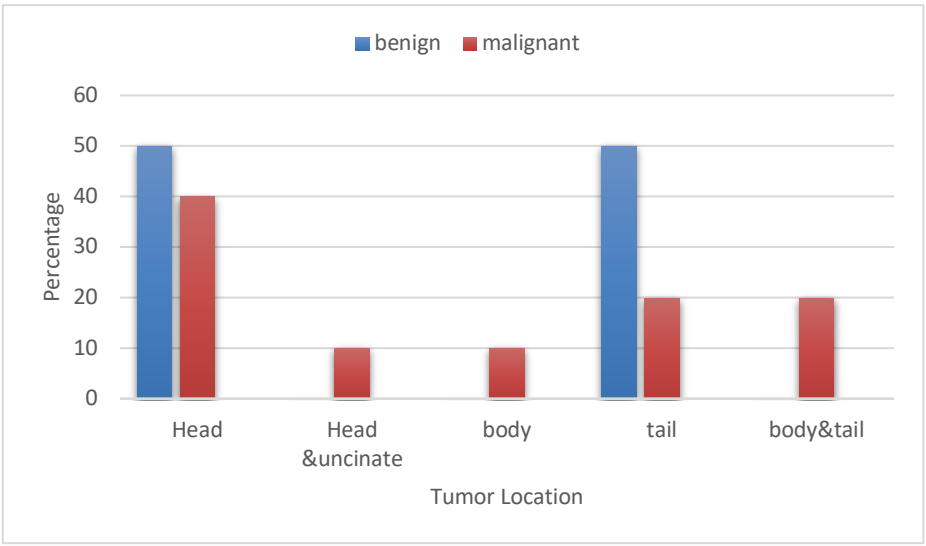

Figure 2: distribution of tumor location

Of the 14 neoplastic patients in the study, majority of cases (50%) involved head of pancreas followed by tail region (28%). Majority of malignant cases were seen involving head of pancreas (40%) whereas no specific pattern is seen in benign cases.

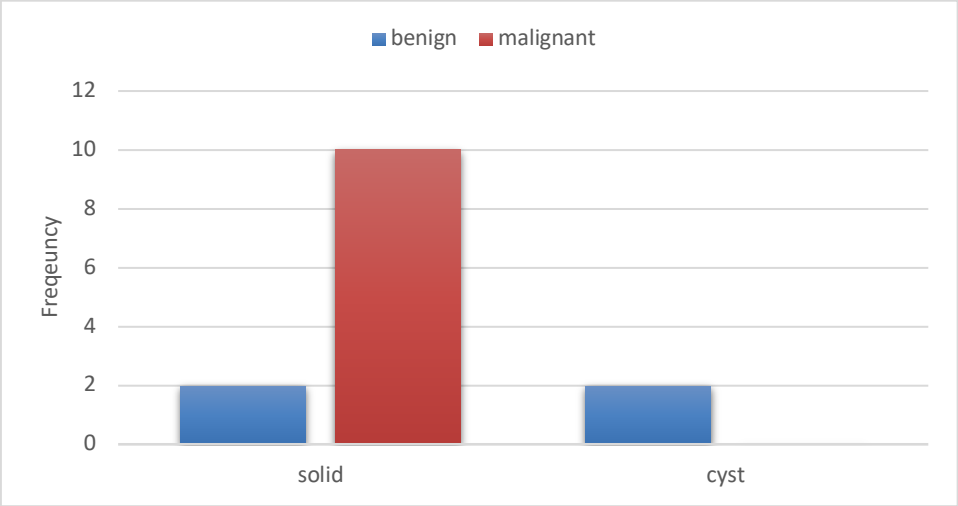

Figure 3: Tumor composition distribution

Chi square test p=0.0028 (highly significant) stating that majority of solid tumor (n=10) are malignant (83.3%) in nature compared to 16.7% benign cases (n=2). Chi square test p=0.0455 (highly significant) stating that all cystic tumor (100%) is benign in nature. All malignant tumors have solid composition in them whereas 50% of benign tumors are solid and 50% are cystic in composition.

Table 2: Distribution of tumor size and pattern of calcification

Parameters	Benign	Malignant	Total
Size of the tumor (cm)			
<2	0 (0%)	4 (40%)	4 (28.5%)
2-5	3 (75%)	2 (20%)	5 (36%)
5-10	1 (25%)	3 (30%)	4 (28.5%)
>10	0 (0%)	1 (10%)	1 (7%)
Calcification pattern			
Intra lesional	0(0%)	1(7.1%)	1(7.1%)
Intra parenchymal	0(0%)	1(7.1%)	1(7.1%)
Wall calcification	2(14.3%)	0(0%)	2(14.3%)
None	2(14.3%)	8(57.1%)	10(71.4%)

Of the 14 neoplastic patients in the study, maximum cases (n=9) are of less than 5cm in size accounting to 65%. Majority of benign cases (75%) were of less than 5cm in size and no specific pattern of distribution is noted in malignant cases. However, 4 out of 5 cases larger than 5cm in size are of malignant nature. About 50% cases of benign tumor showed wall calcifications whereas malignant cases showed intralesional (10%) and intra parenchymal (10%) calcifications with no calcifications in 80% cases.

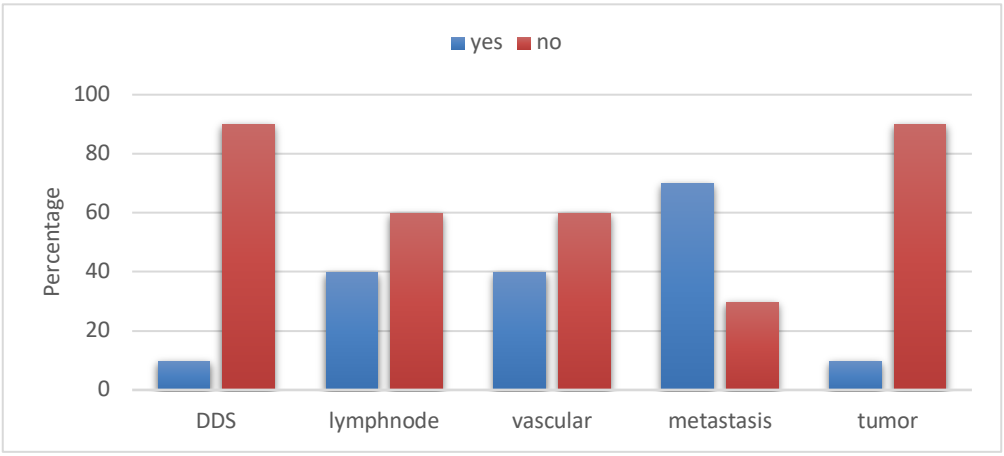

Figure 4: Distribution of other malignant signs

Of 10 malignant cases in the study, metastasis was seen in 70% cases, lymph node spread & vascular involvement in 40% each, double duct sign in 10% and non-resect ability in 90% cases.

Table 3: Distribution of probable imaging diagnosis of various neoplasms

Diagnosis	No. of patients	Percentage (%)
Benign		
Mucinous cystadenoma	2.0	14.3
Neuroendocrine tumor	1.0	7.1
Solid benign tumor	1	7.1
Malignant		
Adenocarcinoma	5	35.8
Lymphoma	1	7.1
Metastasis		
Liver	3	21.5
Gall bladder	1	7.1
Total	14	100

Of the 14 cases, adenocarcinoma is most common (35.8%) followed by liver metastasis (21.5%). In benign neoplasms mucinous cystadenoma was more common (14.3%).

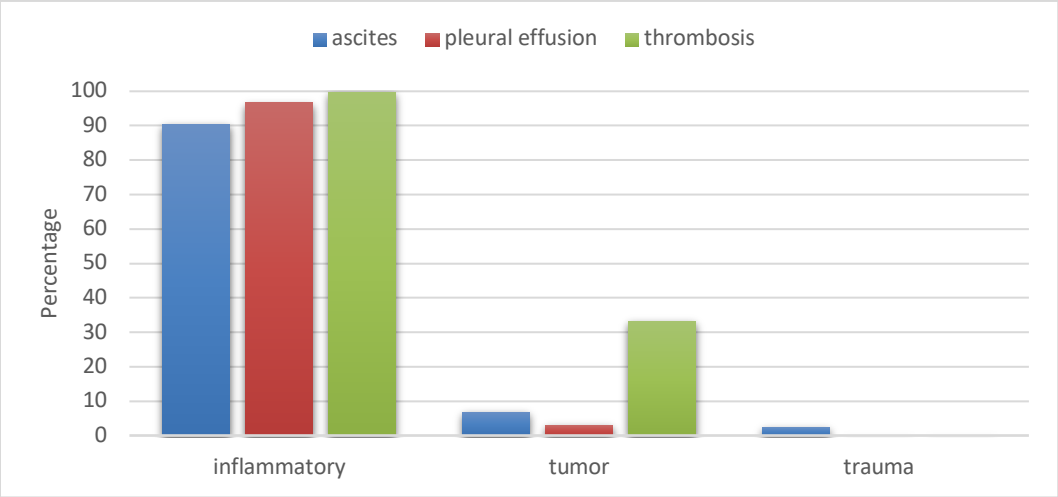

Figure 5: Distribution pattern of complications in all pathologies

Of the 78 patients in the study, ascites was seen in 42 cases (54%), pleural effusion in 32 cases (41%) and thrombosis in 9 cases (11.5%). Among all, the cases of inflammatory showed maximum cases with ascites (90.4%), pleural effusion (96.7%) and thrombosis (66.7%).

Discussion

A total of 78 patients referred for pancreatic pathology were studied using the MDCT-triple-phase which included inflammatory, neoplasm, and trauma cases. The study was done using Multidetector CT, which allowed the acquisition of images within a single breath-hold, without any motion artifacts caused by respiratory movement. This was comparable to Fletcher Joel G et all (2003))[4] in which respiratory motion artefact was absent due to faster scanning in Multidetector row CT.

Demographics:

Majority of study population (68%) are in the age group of 20 – 59 years. Mean age of patients in this study was ~45years (15-92years). These findings are comparable to study by Shalab Jain et al[5] & slightly higher in study by Avanesov M et al[6]

Study Series	Age in Years	Mean Age
Present study	15-92	45
Shalab Jain et al [5]	18-80	43.6
Avanesov M et al [6]	18-64	55

Pancreatic Neoplasm: In our study 17.9% of the cases (n=14) are of pancreatic neoplasm; of these 7% are in 20-39years, 36% in 40-59years and 57% above 60years of age. Majority are females (n=8) accounting to 57% and rest are males (n=6) accounting to 43%. Therefore in our study pancreatic neoplasms are more common in females than males. These findings are comparable to study by Ichikawa T et al [7] As opposed to studies by Dawoud MA et al [8] & Hossain MS et al [9].

Study Series	Male	Female	Total
Present study	6	8	14
Ichikawa T et al	13	18	31
Dawoud MA et al	16	4	20
Hossain MS et al	37	10	47

Out of 14 neoplasms in our study, 4 cases were found to be benign (28.5%) and 10 cases malignant (71.5%) based on imaging findings.

Size:

Of the 4 benign cases majority (n=3) were in range of 2-5cm in size accounting to 75% and 1 case was in 5-10cm range (9cm). Mean size was about 5.4cm.

Of the 10 malignant cases 40% were of <2cm, 20% in 2-5cm, 30% in 5-10cm and 10% are >10cm in size. All the malignant lesions <2cm size are metastatic lesions. A size >10cm suggests high possibility of malignancy as per the study. These findings are comparable to study by Dawoud MA et al [8].

Margins:

All the benign cases (n=4) showed well defined margins in the study whereas majority (n=9) of malignant cases showed ill-defined margins accounting to 90% with 1 case showing lobulated margins (10%) with a Chi square test p=0.0009 (highly significant) stating that ill-defined/ lobulated margins are specific for malignant nature of neoplasms.

Location

Of the 14 cases of neoplasms in the study, majority of cases (n=7) accounting to 50% are seen involving head of pancreas followed by tail (28%). Among benign cases 50% involved head and 50% the tail. In malignant cases 40% were seen involving head, 10% head & uncinated process, 10% body, 20% tail, 20% body & tail with a Chi square test p=0.6327(not significant) stating that no specific pattern of distribution is seen among benign & malignant neoplasms. This correlated with the studies by Dawoud MA et al[8] & Hossain MS et al[9].

Composition

Of the 14 neoplasm cases majority of the cases (n=12) were of solid composition accounting to 85.7%, of which 2 cases (16.7%) are benign and 10 cases (83.3%) are malignant with Chi square test p=0.0028 (highly significant) stating that solid composition of masses indicates more of malignant nature.

About 2 cases (14.3%) showed cystic composition and are seen only in benign cases with Chi square test p=0.045 (highly significant) stating that cystic composition of masses indicates more of benign nature.

Calcification

Of the 14 cases of neoplasm in the study, calcifications are seen only in 4 cases (28.5%). Of this 1 case showed intra lesional calcification, 1 showed intra parenchymal calcification both are of malignant neoplasms. 2 cases of benign neoplasms showed wall calcifications in the lesions. Chi square test p=0.104 stating that there is no specific pattern of calcification in neoplasms. These findings are comparable to study by Gallotti A et al[10].

Other Malignant Signs:

Of the 10 malignant cases in the study, double duct sign (dilated main pancreatic duct and common bile duct) was seen in 1 case (10%), regional lymph node spread was seen in 4 cases (40%), metastasis was seen in 7 cases (70%), vascular involvement was seen in 4 cases (40%) and in 9 cases (90%) tumor was deemed un resectable due to the tumor infiltration and spread to vessels or distant metastasis. These findings were similar to study by Mahmoud A D et al [8].

Trauma

Of the 78 patients in the study, 2 cases are of trauma (4%). 1 case is under <20 years age group and 1 in 40-59 years. Both the cases are of males. These findings were similar to studies of Gordon RW et al [11] & Shadab Maqsood et al [12].

Conclusion

From above observation and discussion with other studies we can conclude that, neoplasms are more common in females with an M:F ratio of 1:4 in adenocarcinomas particularly. Inflammatory & trauma are common in males. In pancreatic neoplasm, head of pancreas is most common location, solid tumors were more common and

majority of them are malignant. All the tumors were of low attenuation except Lymphoma and Neuroendocrine tumor (NET) which were iso attenuating mass lesions. Almost all malignant neoplasms are unresectable owing to infiltration of adjacent organs, lymph nodal involvement, distant metastasis and vascular involvement (>180º arch of contact of lesion with vessel).

Limitation

- Measurement of attenuation HU with the lesion was varying; this was taken care of by placing the ROI in the area of maximum density of the lesion.
- Pathological correlation of all the solid pancreatic neoplasm would give more weightage to imaging diagnosis.
- Follow-up scans, for all the lesions, would have added post-treatment changes / resolution of the lesion / residual changes / changing pattern of the disease entity and is beyond the period of study.

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