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ROLE OF MULTIDETECTOR CT IN EVALUATION OF PANCREATIC CYSTIC LESIONS

Medical Science

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ABSTRACT

Introduction: MDCT is found to be superior among all the imaging modalities for detecting pathological lesions but the correlation studies with surgical or histopathological findings regarding its effectiveness in the characterization of pancreatic lesions are limited. **Aims and objectives:** The aim of the present prospective investigation is to determine the effectiveness of MDCT in the evaluation and characterization of cystic lesions in the pancreas in patients undergoing CT abdomen who was established to possess cystic lesions in the pancreas by comparing the MDCT results with transabdominal and FNAC. **Materials and methods:** The prospective research was carried out in the department of radiology, and the patients (n=50) who had been referred to the radiology department with abdominal pain for MDCT abdomen, aged 25 years and above, from March 2021 to July 2022 (1 year and 6-month period duration) and who were established to have pancreatic cysts under the conditions of below-stated inclusion and exclusion criteria. Transabdominal ultrasound findings, MDCT results showing the location of the cystic lesions, vascular invasions, distant metastasis, and FNAC findings, along with the surgical management procedure, were collected and entered into an excel spreadsheet and analysed using SPSS version 25. Results: The total study population's mean age was determined to be 45.1±12.0 years (ranging from 26 to 71 years) and was found to be male dominant (62%). The overall true positives, true negatives, and false positives observed with transabdominal ultrasound were estimated to be 36%, 28%, and 36% individually and in the case of MDCT, there were nil results with true negative and false negative when compared with FNAC results. MDCT revealed true positive cases were 70% and the false positive case were 30% while 36% and 64% individually. **Conclusion:** The existing study established that MDCT depicted the findings of lesions involved with pancreatic cysts were almost matched with the end outcome results of FNAC in 70% of the cases than transabdominal ultrasound which indicated the fact that MDCT is identified to be superior to transabdominal ultrasound tools in detecting the lesions of pancreatic cysts.

KEYWORDS

Cystic Lesion, Multidetector CT, Malignant Adenocarcinoma, Pancreatic Cystic Lesion, Serous Cystic Lesions.

INTRODUCTION

The inadvertent identification of cystic lesions on cross-sectional imaging in a variety of organs is becoming more widely acknowledged.[1] The cystic pathology could be pre-cancerous, malignant or benign. When the pancreatic cysts are tiny, radiologically defining the classification could be challenging.[1] However, a precise diagnosis and subsequently the best course of treatment can be determined with the precise history of patients and understanding of imaging topographies of lesions involving pancreatic cysts. Often, these lesions are detected unintentionally by imaging through cross-sectional analysis that was done for another purpose. The accurate management of any lesions involving pancreatic cysts depends on accurate characterization.[1]

Most individuals with pancreatitis (chronic), pancreatic cancer, or other pancreatic disorders have poor prognoses. Pancreatic imaging advancements may make it simpler to detect these diseases when they are still treatable at an earlier stage.[2] Imaging the pancreas is crucial for detecting lesions comprising malignancy or pre-malignancy and identifying the symptom origins. The first imaging procedure that gave precise views of the pancreatic duct was ERP but carries high risk.[3] Since then, endoscopy and radiology for the pancreas have made significant strides. Pancreatic Ductal Adenocarcinoma (PDAC), pancreatitis of chronic onset, and disorders of other pancreatic lesions are still difficult to identify.[4]

The 5-year survival rate for PDAC patients is only 8%,[5] even though clinicians have known this for decades, and the majority of patients with chronic pancreatitis do not acquire a conclusive diagnosis until several years after the onset of symptoms. Advancements in methods for pancreatic imaging may make it possible to diagnose and treat diseases early.[6] The foundations of imaging comprising the pancreas are Ultrasonography (US), and radiography with endoscopic facilities that enhance rapid advancement technologies such as high-definition (white light), which are anticipated to enhance either EUS or endoscopic radiography.[7] Molecular characteristics of lesions may be used to develop radiography techniques that may enable earlier, more accurate diagnosis.

Considering major developments in several diagnosis technologies, premalignant or malignant CLPs cannot be accurately distinguished from benign CLPs using existing imaging methods. Characterizing and diagnosis CLPs are crucial for developing the best management plan. Despite the progressive accumulation of knowledge regarding the natural history of CLPs from numerous studies,[8-10] it is still incomplete because of the small clinical situations and short follow-up periods in the majority of these studies. Making the best management strategy for CLPs is still difficult in clinical practice, and there are currently no well-established criteria for their surveillance.

MATERIALS AND METHODS

The prospective research was carried out in the department of radiology on patients who had been referred to the radiology department with abdominal pain for MDCT abdomen with the age above 25 years, from March 2021 to July 2022 and established to have pancreatic cysts were enrolled for the study only if they met the inclusion and exclusion criteria. A total of 50 patients who have been diagnosed to have cystic lesions in the pancreas in CT abdomen during screening in the department of radiology of our Institute were selected for the present investigation after confirming the suitability for the study.

Transabdominal ultrasound findings, MDCT results showing the location of the cystic lesions, vascular invasions, distant metastasis, and FNAC findings, along with the surgical management procedure, were prospectively collected and entered into an excel spreadsheet besides the demographic details including variables such as age, and gender, along with the clinical manifestations such as abdominal pain, etc., blood investigations like serum amylase and serum lipase, serum carbohydrate antigen 19-9 (Ca 19-9), and serum bilirubin levels. The collected variables were subjected to statistical analysis employing SPSS version 25. The nature of the investigation along with the objective of the investigation was explained to the study participants. Only after receiving the informed consent from the patient and clearance from the Institutional Humans Ethics Committee (IHEC), the study was initiated accordingly.

The imaging modality used Philips Ingenuity 128 slice detector CT for MDCT. Before the procedure commenced, a short summary of the procedure was explained to patients. Imaging was done from the diaphragmatic dome level to the pubic symphysis level. If oral contrast was employed, it was administered in 30 ml of 41.7%, if intravenous contrast is utilized, administer 1 to 2 ml/kg at a rate of 4 ml/sec. Images will be taken throughout the arterial, venous, post-contrast, and delayed phases.

By using automated triggering technology and bolus tracking, the three-phase protocol is developed. 25 seconds after the contrast injection started and 45 seconds after the commencement of the contrast injection, the arterial phase, and the venous phase, whereas the delayed phase is 7 minutes after the start of the contrast administration. After obtaining the primary pictures, volumetric reconstruction was performed from the raw data using slice thicknesses of 5mm and 1mm in coronal and sagittal reformations for workstation viewing.

Finally, the clinical data of the patients were matched using SPSS software version25 to assess the possible predictors and investigate the effectiveness of MDCT when compared to the transabdominal ultrasound investigation.

RESULTS AND ANALYSIS

The total study population age means was determined to be 45.1±12.0 years and ranged from 26 to 71 years. The majority of the study population belonged to males (n=31, 62.0%) in gender than the females (n=19,38.0%). The chief complaint of the patients at the time of hospital presentation was abdominal pain (n=31, 62.0%) followed by epigastric pain (n=10, 20.0%), epigastric pain along with jaundice (n=4, 8.0%), jaundice (n=3, 6%), and epigastric pain combined with vomiting (n=2,4.0%). Among the study included patients, the circulating levels of carbohydrate antigen 19-9 were highly expressed in maximum percentages of patients (n=13,26%) when compared to the patient's percentage of abnormal expression in serum amylase/lipase (n=11,22%) and serum bilirubin (n=8,16%) levels. Transabdominal ultrasound revealed a normal study in 8% (n=4) of the patients, unable to detect or evaluate in 26% (n=13), and able to evaluate as well as characterize pancreatic focal lesions in a majority of 66% (n=33) of the population. An elevated percentage of the patients had pseudocysts (42.4%), followed by malignant cystic lesions (27.3%), IPMNs (15.2%), simple cyst (12.1%), and serous cystic lesions (3%) as analyzed in the current investigation. **(Table 1)**

A secondary assessment was performed on the study including the population with Multidetector CT to understand its potency of evaluation and characterization in pancreatic cystic lesions. The majority of the patients were identified to have pseudocysts in 48% of the study individuals followed by 18% of malignant cystic lesions but failed to characterize the lesion types, focal pancreatitis, and IPMNs in 10% each, simple cysts in 8%, malignant cystic adenocarcinoma in 4% and serous cystic lesion in 2%. The investigation concluded that it was capable of both evaluation and characterization of various types of focal lesions in the pancreas. **(Table 2)**

With respect to vascular invasion findings, multidetector CT findings confirmed the presence of vascular involvement in 20% of the cases and absence in the remaining 80% of the population had an absence of vascular involvement than transabdominal findings. Similar to the findings of vascular involvement, regional lymph nodes were also observed in 20% of the cases with the aid of transabdominal ultrasound and multidetector CT.

Distant metastasis abnormality was absent in 74% (n=37) of the study enrolled participants which were highly established by multidetector CT than transabdominal ultrasound imaging of the pancreas and its surrounding environment. Multidetector is superior to transabdominal ultrasound in evaluating and characterizing different focal lesions involved in the pancreas.

Multidetector CT and FNAC combined would have an impact on the plan of patient management from the initial decision. The majority of the study candidates had undergone conservative management (66%) followed by transmural drainage (16%), palliative surgery (14%), and the rest of the negligible population had a cystogastrostomy (4%). This indicates that major decisions on the treatment were directed as per the outcome of MDCT results.

The higher percentage of the populations were affected with pseudocyst (48%) followed by malignant cystic carcinoma (14%), focal pancreatitis and serous cystic lesion with an equal distribution (10%), neuroendocrine neoplasm (8%), IPMNs (6%) and benign mucinous lesion (4%). **(Table 3)** The findings of FNAC in comparison with transabdominal ultrasound and MDCT findings which illustrate the fact that pseudocyst findings of FNAC absolutely equated with MDCT findings.

The findings of pseudocyst of FNAC (48%) exactly matched with the findings of MDCT (48%) in frequency and percentage distribution whereas, transabdominal ultrasound was able to diagnose only 14 patients (28%) out of 50 patients.

Malignant cystic adenocarcinoma was identified in 7 patients (14%) by FNAC but transabdominal ultrasound diagnosed the lesion in none of the patients as malignant cystic adenocarcinoma but has diagnosed as a malignant cystic lesion in 9 patients (18%), whereas MDCT identified the lesion in 2 patients (4%) exactly to the findings of FNAC as malignant cystic adenocarcinoma. Similarly, 7 out of 9 (14%) patients diagnosed with malignant cystic lesions by transabdominal ultrasound accounted for the 7 (14%) patients of FNAC diagnosed as malignant cystic carcinoma. This indicated that in 14% of the population detected as malignant cystic lesions by transabdominal ultrasound failed to characterize the disease completely unlike MDCT. **(Table 4)**

The neuroendocrine neoplasm was diagnosed in 4 patients (8%) by FNAC, the remaining 4 patients (8%) detected as malignant cystic lesions of MDCT accounted for the neuroendocrine lesion of FNAC. Hence, this demonstrated the unsuccessfulness of MDCT in diagnosis. Absolutely, transabdominal ultrasound is not able to diagnose focal pancreatic lesions, whereas MDCT has diagnosed in 10% (n=5) in similar to the findings of FNAC. Hence, MDCT sensitivity and specificity are 100% each with regard to focal pancreatic lesions. In the diagnosis of IPMNs, FNAC has been detected in 3 patients (6%) out of the total population evaluated, out of the total population 5 patients (10%) have been detected to have IPMNs by both transabdominal ultrasound and MDCT each. In which 3 patients (6%) from both transabdominal ultrasound and MDCT each accounted to the findings exactly matched with FNAC. The remaining 2 patients (4%) were considered to be falsely positive in both MDCT and transabdominal ultrasound.

With regard to serous cystic lesions diagnosed by FNAC (5,10%), only one patient was diagnosed to have serous cystic lesion (2%) each in both transabdominal ultrasound and MDCT. The remaining population of 4 (8%) patients from FNAC was falsely positive for both transabdominal ultrasound and MDCT. The left 4 (8%) patients were falsely diagnosed as simple cyst by MDCT and transabdominal ultrasound.

The study analysis revealed that the majority of the lesions were present in head of the pancreas (45.5%) in TAUS, followed by 36.0% in MDCT and 26.4% in FNAC. The body regions were affected with a lesion in the majority with MDCT and FNAC findings which were found to be similar in the percentage of 26.0% in contrast with TAUS where the findings were estimated to be 13.6% ($p<0.05$) and were found to be statistically significant when comparing between FNAC and MDCT findings with TAUS. The lesion affecting the tail portion of the pancreas as estimated by FNAC was in the higher proportion (15.1%) of the study population than MDCT findings (10%) and much less with transabdominal ultrasound (6.8%) whereas in the case of, the involvement of both head and body of the pancreas it is revealed that transabdominal ultrasound had a percentage (11.4%) which was lower than FNAC (13.2%) and it was found to be much lower with (10.0%) than both FNAC and transabdominal ultrasound.

The study showed the findings of FNAC exactly matched with MDCT (48%), whereas in transabdominal ultrasound a percentage of only 28% from its observation matched with the FNAC findings in the case of pseudocysts. With respect to malignant cystic adenocarcinoma, transabdominal ultrasound did not document the findings whereas

MDCT showed 4% of its presence among the study included population, while with regard to neuroendocrine neoplasm, none of the investigational tools revealed its presence in similar to benign mucinous lesions. In the case of focal pancreatitis, only MDCT was able to identify the pathology corresponding to the findings of FNAC exactly, but there were nil patients interpreted with results of focal pancreatitis (0%). Both of the investigational tools revealed a similar percentage of identification with equal distribution of 6% in transabdominal ultrasound and MDCT separately whereas, in the case of the serous cystic lesion, the detection was 1% in both of the investigational tools when compared to FNAC. This indicated that serous cystic lesion over projected the estimates in both MDCT and transabdominal ultrasound. The overall true positive, true negative ad false positive observed with transabdominal ultrasound was estimated to be 36%,28%, and 36% individually and in the case of MDCT, there were nil results with true negative and false negative when compared with FNAC results. MDCT revealed true positive cases were 70% and the false positive case was 30% while 36% and 64% individually. Hence, the study concluded that MDCT is more effective than transabdominal ultrasound in the evaluation of patients with the involvement of lesions with pancreatic cysts. **(Table 5)**

Pseudocyst, focal pancreatitis, and IPMN were the predominant pancreatic cystic lesion diagnosed by the MDCT than transabdominal ultrasound. Thus, the current investigation has established that MDCT is determined to be superior to transabdominal ultrasound.

DISCUSSION

The present prospective study comprised 50 patients who were referred to the department of radiology for MDCT due to abdominal pain and suspicions of cystic lesions in the pancreas. The total study population age means was determined to be 45.1±12.0 years (ranging from 26 to 71 years) with male predominance (31,62.0%) in gender over females (n=19,38.0%) The chief complaint of the patients at the time of hospital presentation was abdominal pain (n=31, 62.0%) followed by epigastric pain (n=10, 20.0%), epigastric pain along with jaundice (n=4, 8.0%), jaundice (n=3, 6%), and epigastric pain combined with vomiting (n=2,4.0%) as conscripted. Among the study included patients, the circulating levels of carbohydrate antigen 19-9 were highly expressed in maximum percentages of patients (n=13,26%) when compared to the patient's percentage of abnormal expression in serum amylase/lipase (n=11,22%) and serum bilirubin (n=8,16%) levels. Transabdominal ultrasound was initially used in the present study population to assess the evaluation and characterization potential of various types of focal pancreatic lesions. The study results were represented in tables and exemplified in figures. Transabdominal ultrasound revealed a normal study in 8% (n=4) of the patients, unable to detect or evaluate in 26% (n=13), and able to evaluate as well as characterize pancreatic focal lesions in a majority of 66% (n=33) of the population. Pseudocyst, focal pancreatitis, and IPMN were the predominant pancreatic cystic lesion diagnosed by the MDCT than transabdominal ultrasound. The overall sensitivity and specificity for transabdominal ultrasound was determined to be 46% and 54%, whereas for MDCT was 70% and 30% with respect to the end outcome of FNAC findings. Thus, the current investigation has established that MDCT is determined to be superior to transabdominal ultrasound.

The current analysis was similarly carried out on nearly identical age groups (45.1±12.0 years), and furthermore, our sample size was twice that of the published study. Singhal et al.[11] (2017) completed a cross-sectional observational study using MDCT on 25 patients with a mean age of 54.2 years with a female population in contrast to our investigation. The majority of research involving Jemal A et al.[12], who suggested that males experience a higher age-adjusted incidence rate of pancreatic neoplasm, concur with our study's 62% male dominance. A mean age of 64.7 years was observed by Manak E et al.[13], in contrast to ours.

Twenty-four patients (57%) who were not appropriate for surgical procedure due to a non-resectable mass had their consistency of MDCT as a screening tool evaluated by Azza et al.[14] The remaining eighteen patients (43%) were considered appropriate for surgical intervention of the tumour based on MDCT criteria. The study concluded that the advancement of MDCT expertise improves the outcome of pancreatic cancer resectability whereas our study has established the benefits of MDCT in diagnosing pancreatic cystic lesions besides tumor aspects. Our study demonstrated that pseudocysts and focal pancreatitis could be 100% predicted by MDCT and it could be more reliable than other lesions concerned with pancreatic cysts.

In a group of adult out-patients who were being examined for conditions unrelated to pancreatic illness, Laffan et al.[15] quantified the proportion of observations of unanticipated pancreatic cysts on 16-MDCT, unlike our investigation. The reported study has stressed the importance of MDCT in the identification of pancreatic cysts lesions in agreement with our investigation.

Due to its great spatial and temporal resolution, speed of acquisition, widespread availability, and simplicity of interpretation, MDCT is the preferred imaging technique for cystic pancreatic lesions, including IPMNs. [16,17] The outstanding depiction of the intricate regional pancreatic anatomy and the accurate delineation of the morphologic properties of cysts have been made possible by the greater quality of 2D and 3D image displays produced from isotropic MDCT data.[18] A crucial aspect in the detection of side-branch IPMNs is the ability to determine communication between the cystic lesion and the main pancreatic duct using image post-processing in the required plane. However, the visibility of ductal communications may be hampered by the existence of a tiny duct or a duct that has collapsed[19.] Comparable to MRI, MDCT has a reported accuracy of 56–85% for the characterization of cystic pancreatic lesions[20] in agreement with our study, where it was determined to be 82%.

In 58 cystic pancreatic masses with histological confirmation, Visser et al [18] reported that MDCT had an accuracy of 76-82% confirming the diagnosis of cancer as reported by our investigation. Similar accuracy (63.9–73.5%) of MDCT was reported by Lee et al.[20] like our study for separating benign from malignant cystic pancreatic tumors. However, because of overlapping imaging characteristics, it is frequently challenging to sub-classify cystic lesions into histopathologic groups.

CONCLUSION

The existing study established that MDCT depicted the findings of lesions involved with pancreatic cysts were almost matched with the end outcome results of FNAC in 70% of the cases compared to transabdominal ultrasound, which indicated the fact that MDCT is identified to be superior to transabdominal ultrasound in detecting the pancreatic cystic lesions. Thus, our study confirmed the effectiveness of MDCT and thereby, suggests that numerous investigations need to be performed on larger cohorts to confirm the validation of results so that MDCT could be routinely used in the clinical setting for the detection of lesions involving pancreatic cysts.

List of Tables and Figures

Table 1: Transabdominal ultrasound evaluation and characterization of pancreatic cystic lesions

Detection findings	Location	Frequency (n)	Percentage (%)
Pseudocyst	Head-3, Body-6, H&B-5	14	42.4
Malignant cystic lesion	Head-5, Head and uncinate process-4	9	27.3
IPMN	Uncinate process-5	5	15.2
Simple cyst	Head-2, tail-2	4	12.1
Serous cystic lesion	Tail-1	1	3
Total sample size	Total	33	100

Table 2: MDCT impression details

Detection findings	Location	Freq (n)	%
Pseudocyst	Head-6,Body-11, H&B-5,Tail-2	24	48
Malignant cystic lesion	Head-5, Head and uncinate process-4	9	18
Focal pancreatitis	Head-5	5	10
IPMN	Uncinate process-5	5	10
Simple cyst	Head-2,tail-2	4	8
Malignant cystic adenocarcinoma	Body-2	2	4
Serous cystic lesion	Tail-1	1	2
Total sample size	Total	50	100

Table 3: FNAC impression details

Detection findings	Location	Frequency (n)	%
Pseudocyst	Head-3, Body-14, H&B-2, Tail-5	24	48
Malignant cystic adenocarcinoma	Head-4, junction between the head and body-3	7	14
Neuroendocrine neoplasm	Uncinate process-4	4	8
Benign mucinous lesion	Uncinate process-2	2	4
Focal pancreatitis	Head-5	5	10
IPMN	Uncinate process-3	3	6
Serous cystic lesion	Head-2,tail-3	5	10

Table 11: Comparison of FNAC findings with that transabdominal and MDCT outcomes

FNAC findings (n,%)	TAS findings (n,%)	MDCT findings (n,%)
Pseudocyst (n=24,48%)	Pseudocyst (n=14,42.4%)	Pseudocyst (n=24,48%)
Malignant cystic adenocarcinoma (n=7,14%)	Nil	Malignant cystic adenocarcinoma (n=2,4%)
Neuroendocrine neoplasm (n=4,8%)	Malignant cystic lesion (n=9,27.3%)	Malignant cystic lesion (n=9,18%)
Benign mucinous lesion (n=2,4%)	Simple cyst* (n=4,12.1%)	Simple cyst* (n=4,8%)
Focal pancreatitis (n=5,10%)	Nil	Focal pancreatitis (n=5,10%)
IPMN (n=3,6%)	IPMN (n=5,15.2%)	IPMN (n=5,10%)
Serous cystic lesion (n=5,10%)	Serous cystic lesion (n=1,3%)	Serous cystic lesion (n=1,2%)
Total sample size (n=50,100%)	n=33, 66%	n=50,100%

Table 13: True positive, true negative, false positive, and false negative results of transabdominal ultrasound and MDCT with respect to FNAC findings

FNAC findings	TAUS-TP	TAUS-TN	TAUS-FP	MDCT-TP	MDCT-FP
Pathological lesions					
Pseudocyst	28	8	12	48	0
Malignant cystic adenocarcinoma	0	6	8	4	10
Neuroendocrine neoplasm	0	4	4	0	8
Benign mucinous lesion	0	2	0	0	4
Focal pancreatitis	0	2	6	10	0
IPMN	6	2	2	6	0
Serous cystic lesion	2	4	4	2	8
Total (%)	36	28	36	70	30

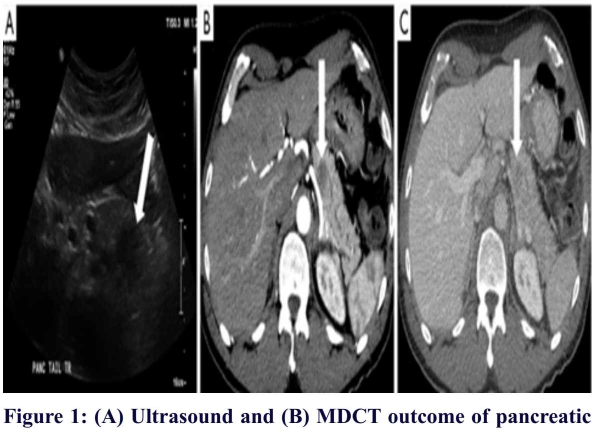

Figure 1: (A) Ultrasound and (B) MDCT outcome of pancreatic body and duct.

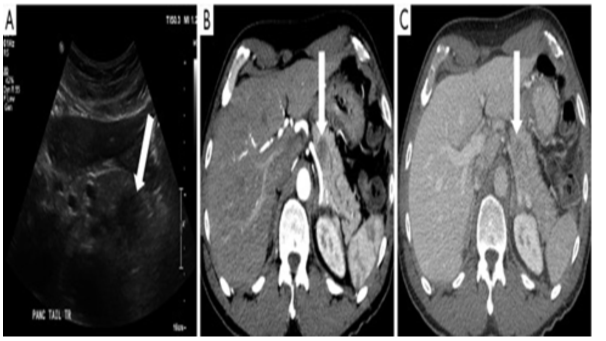

Figure 2: A potential pancreatic head mass was detected in a 61-year-old man who had nausea and abdominal tenderness (A) Head heaviness of pancreas is evident on venous phase imaging; however, a mass cannot be seen. (B) Acquired as part of the assessment of a potential pancreatic mass more obviously.

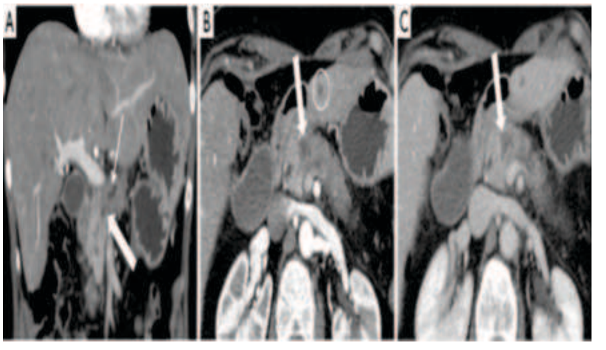

Figure 3: A 64-year-old man with an upstream main duct dilatation, minor duct pancreatic cancer. (A) A dilated duct shown leading into a 1.0 cm ductal adenocarcinoma (C), (B), and from a vascular perspective, it seems resectable. The lateral part of the left lobe of the liver does, however, have a tiny, visible metastasis (circle on B).

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