ORIGINAL RESEARCH ARTICLE

Evaluation of Variations in Pancreatic Contour and Morphology of Tail on Mulitphase Contrast Enhanced Multidetector Computed Tomography

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DOI: http://dx.doi.org/10.21276/ijcmsr.2021.6.1.5

How to cite this article: Ramakrishna Narayanan, Anu Kapoor. Evaluation of variations in pancreatic contour and morphology of tail on mulitphase contrast enhanced multidetector computed tomography. International Journal of Contemporary Medicine Surgery and Radiology. 2021;6(1):A26-A28.

ABSTRACT

Introduction: Morphology and contour variations in the pancreatic parenchyma are incidentally detected while reporting multidetector computed tomography scans of the abdomen. Awareness of these variations and their enhancement characteristics allows the radiologist to distinguish them from pathologies and abates the need for further testing. This study aimed to evaluate the variations in morphology and contour in a disease free pancreas.

Material and Methods: This is a descriptive retrospective study conducted in the Department of Radiology and Imageology at Nizam's Institute of Medical Sciences, Hyderabad, between October 2019 and December 2020. Four hundred and twenty-one (421) patients who underwent contrast-enhanced double or triple-phase contrast enhanced computed tomography were included in this study. Pancreatic variations were grouped into two types. Pseudomass type, consisting of variations in the contour, which were further sub-grouped as anterior lobulation and posterior lobulation and variations in morphology of the tail, which were sub-grouped into lobulated, globular, bifid and whale tail.

Results: 43 among 421 patients were found to have variations in the morphology or contour of the pancreas. The most commonly seen variation was anterior lobulation type of pseudomass in the tail of the pancreas. There was no statistically significant difference in the frequency of occurrence among males and females. The mean size of the lobulation was found to be 15.17 mm $\pm$ 4.806 mm in the anterior lobulation and 18mm $\pm$ 7.0mm in the posterior lobulation in the anteroposterior direction and 11mm $\pm$ 3.281 mm for anterior lobulation and 12.33 mm $\pm$ 6.658mm for posterior lobulation in the transverse direction. Among variations in the morphology of the tail, the presence of a globular tail was the most commonly seen variation.

Conclusion: Variations in the pancreatic anatomy may be related to its development and the peritoneal coverings of the pancreatic surfaces. Identifying these variations and the associated subtypes could help prevent misinterpretation of normal variants as pancreatic tumors thus reducing the need for further investigations.

Keywords: Pancreas, Contour, Morphology, Multidetector Computed Tomography

INTRODUCTION

The etymology of pancreas was derived from the Greek words pan meaning all and kreas, meaning flesh.[1] It develops from two distinct anlagen, which form at the caudal end of the foregut during the 4th week of development.[1,2] The dorsal anlage forms the entire neck, body and tail and a part of the head, while the ventral anlage forms the rest of the head.[2] Pancreas is situated in the retroperitoneum in the anterior pararenal space, surrounded by the retroperitoneal fat.[2]

The position, morphology and contour of the pancreas are very variable and depends on the embryological development, size and shape of adjacent organs and the body habitus.[2] Variations in morphology, ductal anatomy and contour in head, uncinate process, body and tail of pancreas have been described in multiple studies.[3–5] These variations can be misinterpreted as they mimic pancreatic tumors, metastatic deposits or lymphadenopathy. This study aimed to evaluate some of the common variations seen in the contour and shape of the tail of the pancreas in order create awareness among the reporting radiologists. This study aimed to evaluate the variations in morphology and contour in a disease free pancreas.

MATERIAL AND METHODS

As this was a retrospective study informed consent requirements were waived. The study was conducted between October 2019 and December 2020. Four hundred and fifty (450) patients who underwent contrast enhanced double or triple phase contrast enhanced computed tomography were

included in this study and their scan images were reviewed. Cases with poor image quality, clinical or radiological evidence of pancreatitis, lipomatous atrophy of pancreas, pancreatic trauma, splenomegaly and postoperative cases like those who underwent Whipple's procedure were excluded. These accounted for 29 of the 450 cases. CT scan images of the remaining four hundred and twenty-one (421) patients were reviewed and evaluated for variations in the pancreatic contour and tail morphology.

All scans were performed on Somatom Definition AS+™, Siemens Multidetector Computed tomography scanner with scan parameters of 120kVp, 200-400 mA, 500 ms exposure time, spiral pitch of 0.8 and 1 mm reconstruction. Plain and contrast scans were performed during inspiratory breath hold. Intravenous iohexol contrast medium containing 300 mg/ml of iodine was injected through a peripheral vein using a power injector at the rate of 3-3.5 ml/second. For dual phase scans arterial phase was acquired at 30 seconds and portovenous phase at 60 seconds. For triple phase scans arterial phase was acquired at 30 seconds, portovenous phase at 60 seconds and delayed phase at 180 seconds.

Measurements and data collection

Images were reviewed to confirm that the attenuation values in contour and morphologic variations in pancreatic parenchyma matched the normal parenchyma on all phases. The pancreatic gland was divided into head, isthmus, body and tail based on the segmentation proposed by Raichholz G. et al.[6] The part of the gland lateral to an imaginary line connecting gastroduodenal artery and right margin of superior mesenteric vein was considered as head, the part of gland anterior to superior mesenteric vein and artery was considered the isthmus, rest the gland was divided into equal halves as body and tail. The variations were then characterized as pseudomass type if the parenchyma of the pancreas protruded ≥ 10 mm from the surface of the head, body or tail. Pseudomasses were subclassified based on their location as anterior lobulation or posterior lobulation and based on their location on the head, body or tail of the pancreas. Variations in morphology of tail, which were subclassified as lobulated if the tail was enlarged more than 1.5 times the thickness of the body with a lobulated contour, globular if the tail was enlarged 1.5 times the thickness of the body with smooth contour, bifid if there was a cleft of more than 10 mm dividing the tail and whale tail if the tail was "Y" shaped without a deep cleft [Fig 1].

STATISTICAL ANALYSIS

The data obtained was compiled, tabulated and statistically analyzed using MS Excel version 2010 and Statistical Package for Social Sciences Software (SPSS v 21.0). Quantitative data was expressed in terms of mean and range. Comparison of two groups was done using paired students "t" test or Pearson Chi squared test.

RESULTS

In our study population of 421 patients, 43 patients (10.21%) of the patients had variations in contour or morphology of tail of the pancreas Among these 43, 27 patients had variation in contour while 16 patients had variation in the morphology of the tail. Variations were most commonly observed in patients aged between 40-50 years (30%). Variations occurred equally in both males and females with no gender predilection (21 males and 22 females).

Of the 27 patients with pseduomass anterior lobulation was seen in 24 patients and posterior lobulation was seen in 3. Of the 24 cases with anterior lobulation, 21 occurred in the tail of the pancreas (87.5%), 2 occurred in the body (8.3%) and only 1 case was seen in the head (4.1%). All the posterior lobulations were noted in the tail of the pancreas (Fig 2). The size of the pseudomass ranged between 11mm – 30 mm in the anteroposterior direction and between 11mm – 24 mm in the transverse direction. The mean diameter in the anteroposterior direction for anterior lobulations was 15.17 mm with a standard deviation of 4.806 mm while for posterior lobulations it was 18.00 with a standard deviation of 7mm. The mean diameter in the transverse plane for anterior lobulations was 11mm with a standard deviation of 3.281mm wile for posterior lobulations it was 12.33mm with a standard deviation of 6.658mm (Table 1). There was no statistically significant difference in both the anteroposterior or transverse diameters for both the anterior and posterior lobulations (*P* value – 0.365 and 0.755 respectively).

Variations in the morphology of tail were seen in 16 patients. 8 patients had globular tail, 4 patients had lobulated tail and 2 patients and bifid and whale tails each.

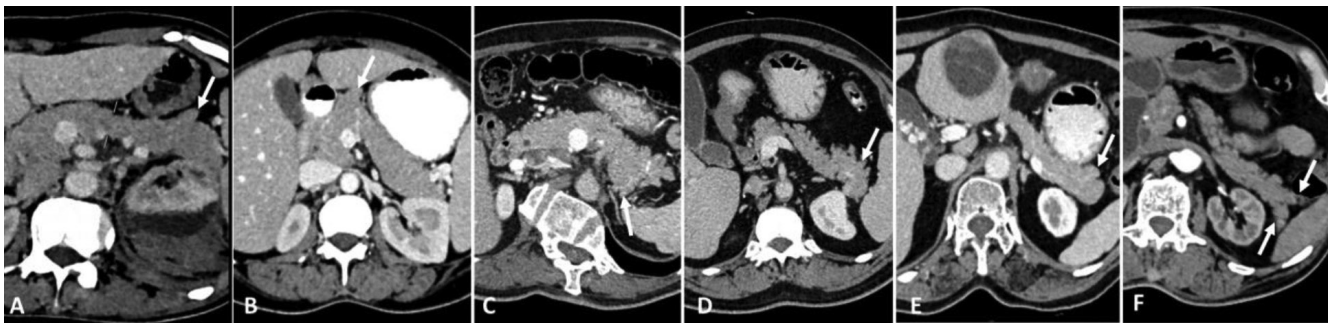

Figure-1: Contrast enhanced axial CT sections, portovenous phase showing various pancreatic contour and morphological variations. A: anterior lobulation in tail (white arrow) B: anterior lobulation in head (white arrow) C: Posterior lobulation in tail (white arrow) D: Lobulated morphology of tail (white arrow) E: Globular morphology of tail (white arrow). Note the incidentally detected Hydatid cyst in liver and cholelithiasis F: Bifid tail of pancreas (white arrows).

ISSN (Online): 2565-4810; (Print): 2565-4802 | ICV 2019: 98.48 |

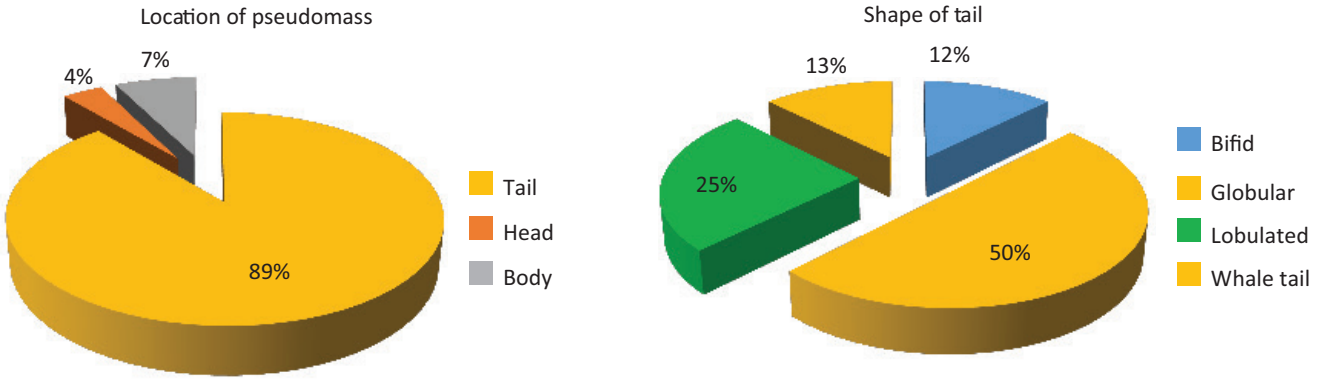

Figure-2: Pie diagram representation of location of pseudomass and shape of tail

Type		N	Mean	SD
AP dimension	Anterior	24	15.17	4.806
	Posterior	3	18.00	7.00
Transverse dimension	Anterior	24	11.00	3.281
	Posterior	3	12.33	6.658

Table-1: Group statistics

DISCUSSION

Variations in contour and morphology of pancreas can be occasionally encountered during routine reporting of abdominal CT scans. These variations can be misinterpreted as primary or secondary neoplastic lesion in the pancreas which can prompt for further investigations for the patient. In our study we tried to evaluate these variations in a disease free pancreas to bring awareness to the reporting radiologist. 10.21% of our cases showed morphology variations. Among the two subtypes of variations studied, pseudomasses were found to be more common than tail variations (62.7% vs 37.3%). Pseudomass like lobulations were more common along the anterior aspect (88.9%) of the gland than on posterior (11.1%). Pseudomasses occurred most frequently in the region of tail(88.9%). This is believed to be due to the lobulation protruding between the multiple peritoneal reflections at the tail of pancreas.[7] Posterior pseudomass like lobulations were uncommon (11.1%), with only 3 cases noted all arising from the tail of the pancreas. This is thought to be due to the close proximity of the posterior margin of pancreatic parenchyma to the splenic vein and absence of peritoneal reflections.[7] The findings we observed were similar to those obtained in other studies done by Omeri et al.[7]

Globular and lobulated appearance in the tail of pancreas were among the common morphological variations with 8 and 4 cases respectively. These variations can mimic a neoplasm, especially on unenhanced CT, like non-functioning neuroendocrine tumor.[4,7] However, contrast enhanced CT can differentiate between the two.

CONCLUSION

Morphology and contour variations in the pancreatic parenchyma are uncommon and maybe incidentally detected during routine reporting of MDCT scans of the abdomen. These variations can pose a diagnostic challenge when encountered as they may simulate the appearance of primary or secondary neoplasms of the pancreas. Awareness of these variations and remembering the key imaging pearl that these variations retain the attenuation similar to the normal pancreatic parenchyma in both unenhanced and enhanced CT allows one to differentiate them from genuine pathologies.

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Source of Support: Nil; **Conflict of Interest:** None

Submitted: 17-11-2020; **Accepted:** 14-12-2020; **Published online**: 11-01-2021