ORIGINAL ARTICLE

Solid Pseudopapillary Neoplasm of the Pancreas: Unraveling Insights from a Single Institutional Study Emphasizing Preoperative Diagnosis of a Rare Tumor

Loganathan Jayapal[1], Santhosh R Kumar[2], Gilbert Samuel Jebakumar[3], Siddesh S Tasgaonkar[4], Sudeepta Kumar Swain[5], Venkatesh Munikrishnan[6], Tirupporur Govindaswamy Balachandar[7]

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Abstract

Aim: Solid pseudopapillary neoplasm (SPN), a slow-growing pancreatic tumor with a vague clinical presentation and non-specific radiological features, is rather uncommon. We share our experience emphasizing on preoperative diagnosis and the correlation with final histopathological examination.

Materials and methods: This is a retrospective analysis of the 468 patients who underwent pancreas-related surgery at our institution between January 2013 and July 2022. Demographic characteristics, symptoms at presentation, preoperative serum calcium carbohydrate antigen (CA 19-9), lesion characteristics on cross-sectional diagnostic imaging, surgical technique, complications in postoperative period, length of stay, histopathological features, and 3-year follow-up findings of the patients with SPN of pancreas were evaluated.

Results: The male-to-female ratio was 1:11 and the mean age at presentation was 33.3 ± 9.5 years. Upper abdomen discomfort was the most common presenting complaint (91%). And five patients had findings suggestive of SPN on preoperative CECT abdomen, and the remaining six individuals were diagnosed solely based on final histological examination. The tumor's median diameter was 5.6 cm (range, 4.1–7.9). The distal body and tail of pancreas was the most common location (63%), followed by the head (36%), and was managed with distal pancreatectomy with or without spleen preservation and Whipple's procedure, respectively. One patient developed grade III Clavien-Dindo complication. The average length of in-hospital stay was 8.27±2.72 days. None of the patients had recurrence on follow-up.

Conclusion: Solid pseudopapillary neoplasm of the pancreas is often misdiagnosed preoperatively. Endoscopic ultrasound-guided FNA with IHC will be beneficial to diagnose it preoperatively especially in small-sized tumors with atypical features. Complete surgical resection with adequate margins without routine lymphadenectomy is curative in resectable tumors.

Keywords: Diagnosis, Endoscopic ultrasound, Fine needle aspiration cytology (FNAC), Immunohistochemistry, Retrospective, Solid pseudopapillary neoplasm.

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Introduction

Solid pseudopapillary neoplasm (SPN) of the pancreas is an extremely uncommon and slow-growing tumor with a reported incidence of 2–3%.[1] The symptoms of this tumor are related to local manifestations of the growing tumor, with upper abdomen pain being the most prevalent. It has non-specific clinical and radiological characteristics. It is now being increasingly detected as incidental finding due to increasing frequency of different radiological investigations done for other reasons.[2] Even with the current hematological and radiological investigations, it is still exceedingly challenging to detect these tumors prior to surgery, especially the smaller sized ones. The final histological test is the only reliable source of confirmation. Surgical excision remains the cornerstone of treatment, has a 95% disease-free survival rate at long term.[3] The goal of the current study was to analyze the fundamental characteristics of this unusual pancreatic tumor, with a focus on its clinical, radiological, histopathological, and prognostic features.

Materials and Methods

This retrospective study utilized a prospectively maintained database of patients who underwent pancreas-related surgery at Apollo Hospitals, Chennai, Tamil Nadu, India. Medical records of the patients who underwent pancreatic surgery during the time period from January 2013 to July 2022 were reviewed. Details of patients with SPN were recorded for analysis. Parameters studied included age, gender, comorbidities, symptom at presentation, serum CA 19-9, diagnostic imaging findings, type of surgery, postoperative complications categorized by the Clavien-Dindo classification, length of in-hospital stay, and final histopathological examination report. Follow-up was performed twice a year for the

[1–7]Department of Surgical Gastroenterology, Apollo Hospitals, Chennai, Tamil Nadu, India

Corresponding Author: Loganathan Jayapal, Department of Surgical Gastroenterology, Apollo Hospitals, Chennai, Tamil Nadu, India, Phone: +91 7708890209, e-mail: logusmc@gmail.com

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first 2 years, then once a year for the next 3 years, and included history taking, physical examination, routine blood tests, and ultrasound of abdomen. Contrast-enhanced computerized tomography (CECT) of abdomen was recommended for patients with significant symptoms or findings. Data analysis was done using SPSS V25. Quantitative data were expressed as mean with standard deviation, median with interquartile range (IQR), while descriptive statistics were expressed as percentages for qualitative data.

Results

During the study period, 12 patients (2.56%) had solid pseudopapillary tumor of pancreas on final histological evaluation. Table 1 represents the preoperative demographic characteristics, clinical features at presentation and tumor characteristics of the study population (Table 1). At presentation, the mean age was 33.3 ± 9.5 years. The majority of them ($n = 11$; 92%) were females, with a male-to-female ratio of 1:11. A large proportion of patients ($n = 10$; 83%), presented with upper abdominal pain. The most frequent site of the tumor was the distal body and tail of the pancreas ($n = 8$; 67%), followed by the head area ($n = 4$; 33%). On diagnosis, the median tumor size was 5.6 cm, with the largest tumor measured 10.4 cm (Fig. 1).

Table 1: Preoperative demographic characteristics, clinical features at presentation and tumor characteristics of the study population

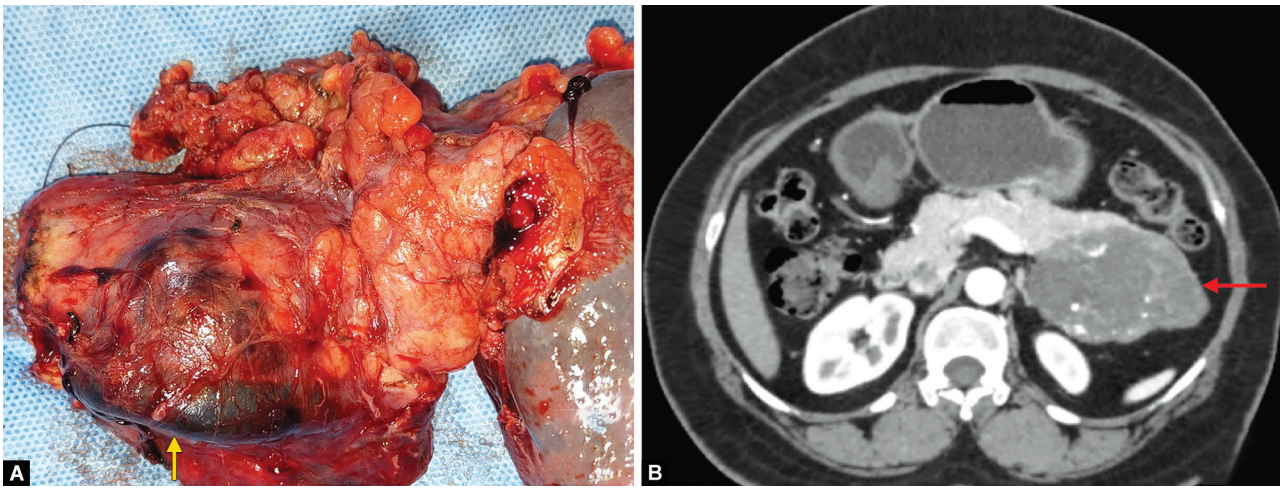
Variable	*n = 12*
Age in years (mean ± SD)	33.3 ± 9.5 years
Gender	
Female	11 (92%)
Male	1 (8%)
Presentation	
Symptomatic	11 (92%)
Incidental	1 (8%)
Complaints	
Abdomen pain	10 (83%)
Dyspepsia	4 (33%)
Lump abdomen	1 (8%)
Median size of tumor (cm)	5.6 cm (IQR 4.1–7.9)
Location of tumor	
Head	4 (33%)
Body and tail	8 (67%)
Median serum CA 19-9 (U/mL)	3.9 (IQR 2.05–5.8)

IQR, interquartile range; *N*, number of patients

Computed tomography of the abdomen revealed characteristics in five patients that were suggestive of SPN and carcinoma in two instances. The differential diagnosis for the remaining five individuals was pancreatic cystic lesions. Two patients underwent immunohistochemistry (IHC)-guided fine needle aspiration (FNA) of the tumor carried out via endoscopic ultrasonography (EUS), and both had SPN as their tumor type (Fig. 2). All 12 patients demonstrated signs indicative of a resectable tumor, with the exception of one who had a pancreatic tumor in the tail area, infiltrating the spleen and left adrenal gland. The level of CA 19-9 was normal.

Table 2 represents perioperative characteristics of the study population. Depending on the tumor location, majority underwent distal pancreatectomy with or without splenectomy. One patient required surgical ligation following a failed radiological attempt to treat hypotension attributable to a bleed from the gastroduodenal artery trunk on postoperative day 12. Three patients experienced delayed gastric emptying (grade A), one experienced superficial surgical site infection. All minor complications were managed conservatively.

According to the final histopathology report, all were R0 resections. One patient had malignant tumor characteristics (local infiltration into the pancreatic parenchyma without any perineural or lymphovascular invasion and no nodal involvement), and this patient was advised continuous observation by a multidisciplinary team. The results of IHC testing for 9 specimens are given in Table 3. Table 4 summarizes the diagnostic techniques that were employed both before and after surgery to determine the initial diagnosis (Table 4). All the patients during the follow-up period did not develop any recurrence.



Figs 1A and B: (A) Specimen of distal pancreas with spleen showing a large 8 × 7.5 × 6 cm lesion (arrow); (B) CECT abdomen, axial image of portal phase showing a heterogeneously enhancing, well-defined multilobulated lesion of size 9 × 6.5 × 6.3 cm (arrow) with hypodense cystic areas and calcifications in distal body and tail of pancreas displacing nearby organs

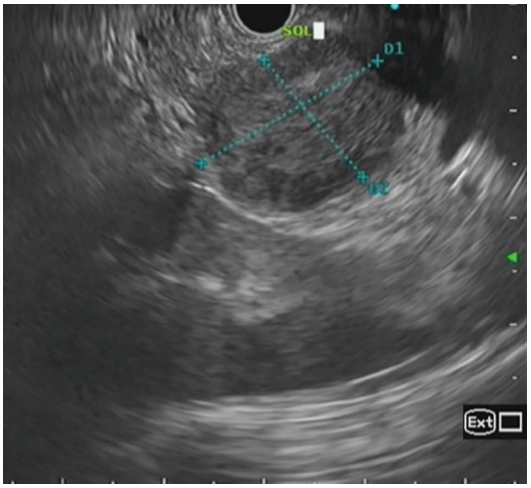


Fig. 2: EUS showing a 4 x 3 cm, well-defined lesion with mixed echoes in body of pancreas

Table 2: Perioperative characteristics of the study population

Variable	*n = 12*
Surgery	
Whipple procedure	4 (34%)
Distal pancreato-splenectomy	6 (50%)
Spleen-preserving distal pancreatectomy	2 (16%)
Clavien-Dindo complications	
Major (grade III and above)	1 (8%)
Minor (<grade II)	4 (33%)
Final histopathology	
Malignant	1 (8%)
Non-malignant	11 (92%)
Average hospital stay (day's)	8.27 ± 2.72
Median follow-up (months)	56 (3–118)
Recurrence	Nil

n, number of patients

Discussion

Solid pseudopapillary neoplasm of pancreas also known as Frantz or Hamoudi tumor, accounts for 6–12% of all pancreatic cystic neoplasms.[4] With female-to-male ratio of 11:1, it has a female predominance. It primarily affects the young women in the age group of 30–40 years.[3] This is similar to the findings of our study. It frequently presents as a benign tumor with a low risk of malignancy of 10–15%, and may metastasize to other organs, most frequently the liver, lymph nodes, and omentum.[5,6] The most common symptom at presentation is pain in the abdomen. It has been identified as an accidental finding due to increased imaging frequency for other reasons. The tumor is typically bulky, encapsulated, and causes the displacement of nearby structures without direct invasion. The most common site of the tumor is the body and tail region (55–60%), followed by the head of pancreas (35–40%).[5] The size of the tumor and location are unlikely to predict whether it will become malignant.[6] Similar to the previous studies, blood investigation and tumor marker (CA 19-9) did not contribute to diagnosis in our study. The risk of tumor rupture is 2.7% and is most commonly due to blunt trauma of the abdomen.[7]

The CECT abdomen revealed an encapsulated tumor having solid and cystic components, occasional calcifications with gradual enhancement over arterial and venous phases. These characteristics

Table 3: Immunohistochemistry markers (*n* = 9/12)

IHC marker	*Positive*	*Negative*
Beta-catenin	9	0
Vimentin	8	1
Cytokeratin	5	4
CD10	6	3
CD56	6	3
Chromogranin	0	9
Synaptophysin	2	7
Neuron-specific enolase	4	5
Progesterone receptor	4	5
Trypsin	0	9

Table 4: Initial diagnosis on various modalities

Case No.	*CECT abdomen*	*HPE*	*IHC*
1	SPN	SPN	N/A
2	CP, multiloculated cyst with calcification*	SPN	SPN
3	Carcinoma head of pancreas*	SPN with malignancy features	SPN with malignancy
4	Locally advanced carcinoma tail of pancreas*	SPN	SPN
5	Solid variety of serous cystadenoma/malignant*	SPN	SPN
6	SPN	SPN	N/A
7	Mucinous cystadenoma*	SPN	SPN
8	SPN	SPN	SPN
9	SPN/Serous cystadenoma*	SPN	SPN
10	SPN	SPN	SPN
11	Mucinous cystadenocarcinoma or SPN*	SPN	SPN
12	SPN	SPN	SPN

*Alternative diagnosis considered; SPN, solid pseudopapillary neoplasm; CP, chronic pancreatitis; N/A, not available; CECT, contrast-enhanced computerized tomography; HPE, histopathological examination; IHC, immunohistochemistry

were not specific to SPN because pancreatoblastoma and other cystic pancreatic tumors can also exhibit them.[8] Similarly, in our series, only 7 patients exhibited CT abnormalities strongly suggestive of pancreatic SPN, whereas the other five individuals had other diagnoses such serous/mucinous cystadenoma or carcinoma.

When combined with IHC, endoscopic ultrasound-guided FNA is helpful for preoperative diagnosis of SPN in questionable tumors.[9] In a multicenter study, preoperative diagnosis is accurately made in 75% with EUS FNA.[10] Few studies have examined the possibility of tumor cells spreading down the needle tract after EUS FNA for space-occupying lesions of the pancreas. Compared with the head of the pancreas, this risk is larger for tumors in the body and tail of the organ.[11–13] During the Whipple's treatment for lesions involving the head of the pancreas, the tract and the tumor were both removed, whereas the transgastric tract was not removed during distal pancreatectomy for tumors located in body and tail region. Two of our patients underwent EUS FNA and IHC of non-diagnostic lesions, which confirmed the diagnosis of SPN preoperatively. However, one patient with distal body tumor experienced hemorrhage into the lesser sac after the procedure, obliterating the anatomical planes and making the surgical resection difficult to complete.

In most cases, the tumor's histopathology shows homogeneous, polyhedral cells with round nuclei, granular eosinophilic cytoplasm, and scattered cystic areas devoid of any cellular atypia and mitotic activity.[2] Foci of cystic change, pseudopapillary appearance and dense fibrocollagenous zone are observed at the periphery of the lesion. Extensive necrosis, a high mitotic rate, nuclear atypia, and sarcomatoid regions are characteristics of that point to the tumor's aggressive behavior.[2,14] In our study, majority of the cases did not have any of these high risk features suggestive of malignancy except one patient who had local infiltration into pancreatic parenchyma. All patients in our study had complete (R0) resection without any nodal disease.

Solid pseudopapillary neoplasm must be distinguished from other illnesses, such as pancreatic cystic neoplasms, pancreaticoblastomas, acinic cell tumors, and neuroendocrine tumors using IHC.[9] Beta-catenin was positive in 98%, followed by vimentin (88%), α1-antitrypsin (82%), and neuron-specific enolase (70%).[15] Only nine patients in our study had IHC done, and most of them were positive for beta-catenin and vimentin similar to other studies.[17]

There is excellent long-term survival even after multivisceral resection and vascular repair with this tumor.[17,18] Due to a low incidence of nodal metastases, extensive lymphadenectomy is not always performed.[19] Only one patient in our study underwent right adrenalectomy along with distal pancreatosplenectomy for preoperative CT finding of locally advanced carcinoma of tail of pancreas infiltrating into spleen and right adrenal gland but had non-malignant SPN on final histopathology. After surgical excision, the reported 5-year overall survival is between 95 and 97%, with a recurrence rate of less than 10%.[3,20] On follow-up, none of the patients in our series experienced recurrence.

Conclusion

Solid pseudopapillary neoplasms of the pancreas are difficult to diagnose preoperatively with the available hematologic and radiological investigations, especially for ambiguous, small-sized lesions. In such cases, endoscopic ultrasound-guided FNA with IHC will be beneficial. However, caution should be exercised for distal body and tail lesions due to the risk of leaving the needle tract in resectable lesions of other pathology.

When evaluating a young female patient for a pancreatic space-occupying lesion using cross-sectional imaging showing a sizable, well-circumscribed tumor, SPN must be taken into consideration as a differential diagnosis. Both histopathological and IHC examinations of the surgical specimen are necessary to confirm the diagnosis and its malignant potential for further management.

References

1. Mulkeen AL, Yoo PS, Cha C. Less common neoplasms of the pancreas. World J Gastroenterol WJG 2006;12(20):3180–3185. DOI: 10.3748/wjg.v12.i20.3180.
2. Tang LH, Aydin H, Brennan MF, et al. Clinically aggressive solid pseudopapillary tumors of the pancreas: A report of two cases with components of undifferentiated carcinoma and a comparative clinicopathologic analysis of 34 conventional cases. Am J Surg Pathol 2005;29(4):512–519. DOI: 10.1097/01.pas.0000155159.28530.88.
3. Papavramidis T, Papavramidis S. Solid pseudopapillary tumors of the pancreas: Review of 718 patients reported in English literature. J Am Coll Surg 2005;200(6):965–972. DOI: 10.1016/j.jamcollsurg.2005.02.011.
4. Casadei R, Santini D, Calculli L, et al. Pancreatic solid-cystic papillary tumor: Clinical features, imaging findings and operative management. JOP J Pancreas 2006;7(1):137–144. PMID: 16407636.
5. Yao J, Song H. A review of clinicopathological characteristics and treatment of solid pseudopapillary tumor of the pancreas with 2450 cases in chinese Population. Biomed Res Int 2020;2020:2829647. DOI: 10.1155/2020/2829647.
6. Yu P, Cheng X, Du Y, et al. Solid pseudopapillary neoplasms of the pancreas: A 19-year multicenter experience in China. J Gastrointest Surg 2015;19(8):1433–1440. DOI: 10.1007/s11605-015-2862-8.
7. Takamatsu S, Nagano H, Ohtsukasa S, et al. A case of spontaneous ruptured solid pseudopapillary tumor of pancreas resected by laparoscopic surgery. Case Rep Med 2013;2013:953240. DOI: 10.1155/2013/953240.
8. Gandhi D, Sharma P, Parashar K, et al. Solid pseudopapillary tumor of the pancreas: radiological and surgical review. Clin Imaging 2020;67:101–107. DOI: 10.1016/j.clinimag.2020.06.008.
9. Hosokawa I, Shimizu H, Ohtsuka M, et al. Preoperative diagnosis and surgical management for solid pseudopapillary neoplasm of the pancreas. J Hepato-Biliary-Pancreat Sci 2014;21(8):573–578. DOI: 10.1002/jhbp.96.
10. Jani N, Dewitt J, Eloubeidi M, et al. Endoscopic ultrasound-guided fine-needle aspiration for diagnosis of solid pseudopapillary tumors of the pancreas: A multicenter experience. Endoscopy 2008;40(3):200–203. DOI: 10.1055/s-2007-995364.
11. Kita E, Yamaguchi T, Sudo K. A case of needle tract seeding after EUS-guided FNA in pancreatic cancer, detected by serial positron emission tomography/CT. Gastrointest Endosc 2016;84(5):869–870. DOI: 10.1016/j.gie.2016.01.060.
12. Paquin SC, Gariépy G, Lepanto L, et al. A first report of tumor seeding because of EUS-guided FNA of a pancreatic adenocarcinoma. Gastrointest Endosc 2005;61(4):610–611. DOI: 10.1016/s0016-5107(05)00082-9.
13. Archibugi L, Ponz de Leon Pisani R, Petrone MC, et al. Needle-tract seeding of pancreatic cancer after EUS-FNA: A systematic review of case reports and discussion of management. Cancers 2022;14(24):6130. DOI: 10.3390/cancers14246130.
14. Santini D, Poli F, Lega S. Solid-papillary tumors of the pancreas: Histopathology. JOP J Pancreas 2006;7(1):131–136. PMID: 16407635.
15. Guo T, Wang L, Xie P, et al. Diagnosis and surgical treatment and pathological findings of solid pseudopapillary tumor of the pancreas: A single-institution experience. Cancer Manag Res 2020;12:581–588. DOI: 10.2147/CMAR.S238527. eCollection 2020.

16. Serra S, Chetty R. Revision 2: An immunohistochemical approach and evaluation of solid pseudopapillary tumour of the pancreas. J Clin Pathol. 2008;61(11):1153–1159. DOI: 10.1136/jcp.2008.057828.
17. Beltrame V, Pozza G, Dalla Bona E, et al. Solid-pseudopapillary tumor of the pancreas: A single center experience. Gastroenterol Res Pract 2016;2016:4289736. DOI: 10.1155/2016/4289736.
18. Cheng K, Shen B, Peng C, et al. Synchronous portal-superior mesenteric vein or adjacent organ resection for solid pseudopapillary neoplasms of the pancreas: A single-institution experience. Am Surg 2013;79(5):534–539. PMID: 23635591.
19. Kumar NAN, Bhandare MS, Chaudhari V, et al. Analysis of 50 cases of solid pseudopapillary tumor of pancreas: Aggressive surgical resection provides excellent outcomes. Eur J Surg Oncol 2019;45(2):187–191. DOI: 10.1016/j.ejso.2018.08.027.
20. Yu PF, Hu ZH, Wang XB, et al. Solid pseudopapillary tumor of the pancreas: A review of 553 cases in Chinese literature. World J Gastroenterol WJG 2010;16(10):1209–1214.