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Case Report

# Pancreatic schwannoma: Case report, clinico-pathologic correlation, and review of the literature☆

*Carnot Ntafam, MD[a], Adam T. Miller, MD[b], Bryce D. Beutler, MD[b,*], Judith Bamporiki, MD[c], Ara B. Sahakian, MD[d], Phillip M. Cheng, MD[b]*

[a] *Department of Radiology, Children's Hospital Los Angeles, Los Angeles, CA, USA*
[b] *Department of Radiology, University of Southern California, Keck School of Medicine, 1500 San Pablo Street, 2nd Floor, Los Angeles, CA 90033, USA*
[c] *University of Rwanda, College of Medicine and Health Sciences, Kigali, Rwanda*
[d] *Department of Gastroenterology, University of Southern California, Keck School of Medicine, Los Angeles, CA, USA*

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ABSTRACT

Schwannomas are common peripheral nerve sheath tumors that typically occur on the head, neck, trunk, or extremities. Intra-abdominal schwannomas, however, are rare. We describe a young woman who presented for imaging evaluation of suspected nephrolithiasis and was incidentally found to have a schwannoma centered within the pancreatic parenchyma. In addition, we detail the clinical, imaging, and histopathologic features of pancreatic schwannoma and summarize diagnosis and management of this rare clinical entity.



## Introduction

Schwann cells represent the supporting element of the peripheral nerve and are essential for normal neurologic function and inter-neuronal cellular communication. Each Schwann cell wraps around an axon to form a myelin sheath and guide the regeneration of nerve fibers [1]. Schwannomas arise from aberrant division and proliferation of Schwann cells. Tumors are usually encapsulated and can be found in any part of the body, most commonly the head, neck, trunk, and extremities [2,3]. Intra-abdominal schwannomas are uncommon [4]. Pancreatic schwannoma is an extremely rare clinical entity with imaging features similar to those of other benign and malignant pancreatic tumors; in the absence of characteristic radiologic findings, few patients are diagnosed pre-operatively [5]. We present a case of pancreatic schwannoma diagnosed in a patient who presented for evaluation of

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* *Corresponding author.*
E-mail address: brycebeutler@hotmail.com (B.D. Beutler).

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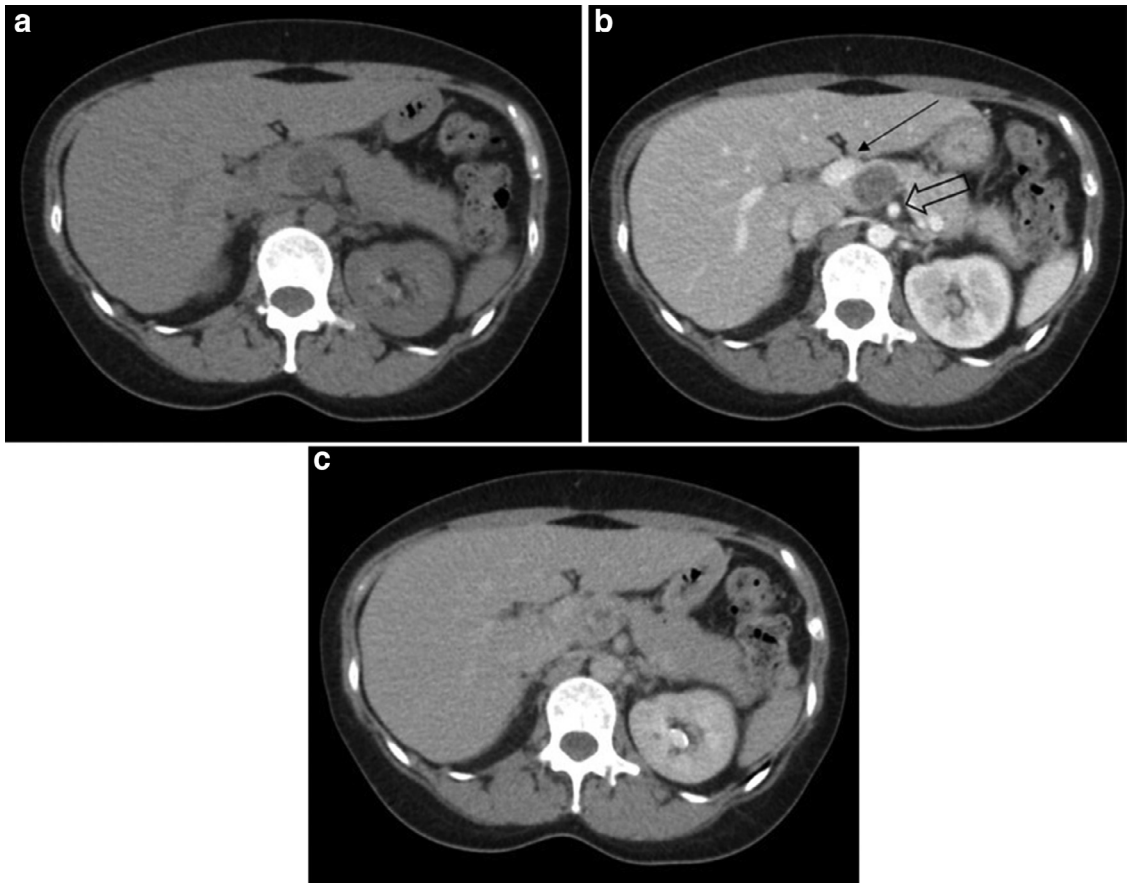


**Fig. 1 – Axial noncontrast, portal venous, and excretory phase (left to right) CT images demonstrate a well-circumscribed, hypodense 2.5 x 2.0 cm mass in the neck of the pancreas which demonstrates progressive delayed enhancement. Note the proximity of the mass to the main portal vein (solid arrow) and superior mesenteric artery (unfilled arrow).**

suspected renal calculi. In addition, we review the literature on pancreatic schwannoma and summarize salient imaging and pathologic features of this rare benign neoplasm.

## Case report

A female patient in her late 30s with a history of nephrolithiasis, status-post right lithotripsy, presented for evaluation of suspected urolithiasis. A contrast-enhanced computed tomography (CT) urogram was performed, revealing a 3 millimeter partially obstructive renal calculus at the right ureteropelvic junction with mild upstream hydronephrosis. In addition, a well-circumscribed, hypoattenuating mass with progressive delayed enhancement measuring 2.5 × 2.0 centimeters was identified within the pancreatic neck (Fig. 1). There was no pancreatic ductal dilatation, peripancreatic inflammatory changes, or locoregional lymphadenopathy. The finding was discussed with the ordering provider, who reported that the patient endorsed intermittent, transient epigastric and left upper quadrant abdominal pain for several years. There was no known history of pancreatitis or evidence of significant pancreatic parenchymal volume.

Subsequent magnetic resonance imaging (MRI) of the abdomen obtained 2 months after the initial CT showed a well-circumscribed, T1 hypointense mass with heterogeneously increased T2 signal arising from the neck of the pancreas and abutting the main portal vein and superior mesenteric artery. Contrast-enhanced images showed heterogeneous enhancement throughout the extent of the mass (Figs. 2 and 3). Endoscopic ultrasound (EUS) performed 2 weeks later revealed a well-circumscribed, heterogeneous but predominantly hypoechoic mass in the region of the pancreatic neck (Fig. 4). Pathology from endoscopic fine needle aspiration showed fragments of spindle cell lesion with bland cytologic features, in a background of benign pancreatic tissues. Immunohistochemistry stains showed negative Alpha inhibin, IgG4, CD117, desmin, congo red and positive AE1/3 and S-100, strongly supporting a diagnosis of schwannoma.

A follow up contrast-enhanced MRI of the abdomen performed 7 months later demonstrated a stable 2.5 cm enhancing pancreatic neck mass; there was no change in size, morphology, or enhancement as compared to the prior MRI. Given the stability and reassuring pathology results, continued annual surveillance MRI to monitor for interval change in size or morphology of the pancreatic mass was recommended. The patient agreed to return for regular follow-up imaging.

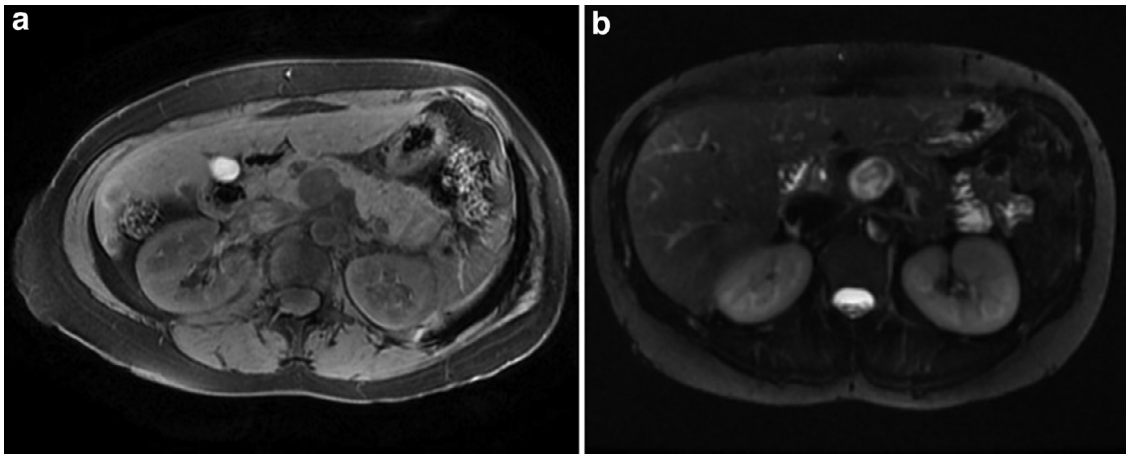


**Fig. 2 – Axial T1 (left) and T2 fat-saturated (right) MRI images demonstrate a well-circumscribed 2.5 × 2.0 cm mass in the neck of the pancreas with low T1 and heterogeneously increased T2 signal intensity.**

## Discussion

Schwannomas were first identified by the Uruguayan pathologist Dr Jose Juan Verocay in 1910, who described a mesenchymal tumor originating from peripheral nerve sheaths in an eccentric fashion. Schwannomas are now recognized as the most common peripheral nerve sheath tumor. However, intra-abdominal schwannomas are rare, and pancreatic schwannomas have been described in fewer than 100 patients worldwide.

Pancreatic schwannomas are most commonly diagnosed in late middle age, with a mean age of diagnosis of 55 years. There is a slight female predilection [3,6,7]. The pancreatic head and body are the most commonly involved sites [7]. Tumors are highly variable in size and frequently undergo degenerative change, which may be characterized by cyst formation, calcification, hemorrhage, hyalinization, and xanthomatous infiltration [8,9]. The likelihood of degeneration is directly proportional to the size of the tumor [10,11]. Differential considerations for pancreatic schwannoma are broad and include intraductal papillary mucinous neoplasm (IPMN), serous cystadenoma, and pancreatic pseudocyst [12]. Although most tumors are benign, all schwannomas—including pancreatic schwannomas—have malignant potential; larger tumors are considerably more likely to undergo malignant transformation [9,10,13–17]. Malignancy is also more common in the setting of Von Recklinghausen disease [18].

### *Clinical presentation*

There is a direct association between the tumor location and the symptoms. Tumors located in the head of the pancreas are more likely to be symptomatic as compared to tumors in the periphery of the gland [19]. In general, presenting symptoms are nonspecific and may include dyspepsia, epigastric pain, and/or nausea [19]. Generalized abdominal pain is the most commonly reported presenting symptom. In a literature review of 75 previously reported cases of pancreatic schwannoma, Zhang et al. summarized the following signs and symptoms [6]:

- Abdominal pain (44%)
- Asymptomatic (31%)
- Weight loss (17%)
- Palpable mass (12%)
- Jaundice (7%)

Laboratory studies may be useful to exclude pancreatic adenocarcinoma, as CA 19-9 and carcinoembryonic antigen (CEA) levels are typically nondetectable or within normal limits in pancreatic schwannoma. However, there have been 2 reported cases of elevated CA19-9 and CEA in patients with pancreatic schwannoma [20–22].

### *Diagnosis*

Pancreatic schwannomas are variable in appearance and may develop internal cysts, calcifications, and hemorrhage. It is often challenging to establish a diagnosis based on the imaging features alone. However, although there are no known pathognomonic features of pancreatic schwannoma, correlation of findings from multiple imaging modalities can be valuable.

The utility of transabdominal ultrasound for the evaluation of pancreatic schwannoma is limited, but may be useful in select patients. Ultrasound typically reveals a circumscribed, hypoechoic mass without significant internal vascularity. Internal cysts will manifest as small anechoic areas within the dominant hypoechoic mass. Internal shadowing echogenic foci suggestive of calcifications may also be present.

CT scan plays a central role in both the diagnosis of pancreatic schwannoma and in preoperative planning. Pancreatic schwannomas are typically circumscribed, hypoattenuating, and avidly enhancing [6]. Internal cysts, calcifications, and thin septations are often present, particularly in larger lesions [23,24]. A fibrous pseudocapsule may occasionally be visible. CT scan allows for excellent delineation of the relationship of the mass to adjacent ducts and mesenteric vessels, which is essential to determine resectability and should be detailed in the radiology report [19].

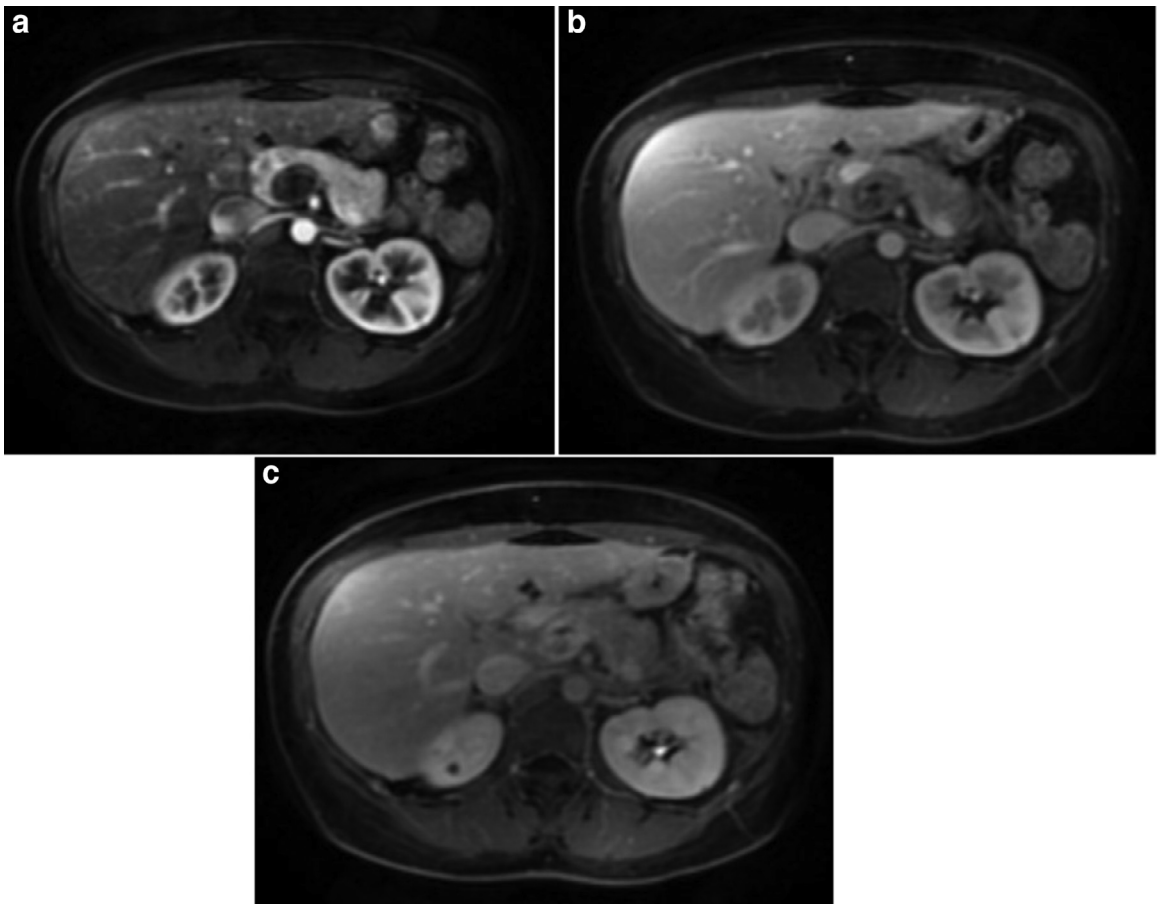


**Fig. 3 – Following administration of intravenous contrast, axial MRI images were acquired during arterial, portal venous and 5-minute delayed phases (left to right). These images demonstrate progressive, delayed heterogeneous enhancement of the pancreatic neck mass.**

Pancreatic schwannomas demonstrate relatively distinct features on MRI. Lesions are encapsulated and T1 hypointense. Signal on T2-weighted images is variable, but heterogeneously T2 hyperintense signal is common [12,20,25]. Progressive homogeneous enhancement has been described in several case reports [26]. Notably, pancreatic schwannomas share many features with pancreatic cystadenoma on MRI, and the 2 clinical entities are often indistinguishable. Nevertheless, MRI is useful to distinguish pancreatic schwannoma from other pancreatic neoplasms and to evaluate for vascular and ductal involvement [6].

Schwannomas, including pancreatic schwannomas, are often 18F-fluorodeoxyglucose (FDG) avid [27–29]. Indeed, in a recent case series detailing 5 cases of pancreatic schwannoma, Zhang et al. described significant FDG uptake in all 5 individuals with pathologically confirmed pancreatic schwannomas [6]. Notably, however, most FDG-avid schwannomas are benign and there is no known correlation between metabolic activity and malignancy. Other pancreatic neoplasms that demonstrate FDG avidity include both benign lesions, such as solid pseudopapillary tumors, and malignant pancreatic neuroendocrine tumors [6]. Pancreatic schwannomas can often be distinguished from these neoplasms based on correlation with other cross-sectional imaging, such as MRI, or endoscopic ultrasound .

A definitive diagnosis of pancreatic schwannoma is established through histopathological assessment of a tissue sample. Various image-guided aspirations, such as endoscopic ultrasound-guided fine needle aspiration (EUS-FNA) or CT-guided FNA, can be used to obtain material for cytologic analysis of pancreatic tumors. New fine-needle biopsy (FNB) needles have recently been developed in order to increase the amount of tissue obtained while preserving tissue architecture. However, several studies showed no significant difference in diagnostic accuracy for malignancy [30,31] between FNA and FNB.

The use of EUS-guided FNA in diagnosing pancreatic schwannoma remains controversial due to its high false negative rate and a reported diagnostic rate of only 52.9%, which is considerably lower than that of other pancreatic tumors [19,23,32]. The diagnosis of pancreatic schwannoma by FNA may be complicated by inadequate specimen or by inherent specimen collecting techniques [31]. A definitive diagnosis can often only be made with histologic examination of a resected specimen and immunohistochemical staining [33,34].

Macroscopically, schwannomas have a variable appearance and can be solid, cystic, or demonstrate a mixture of solid

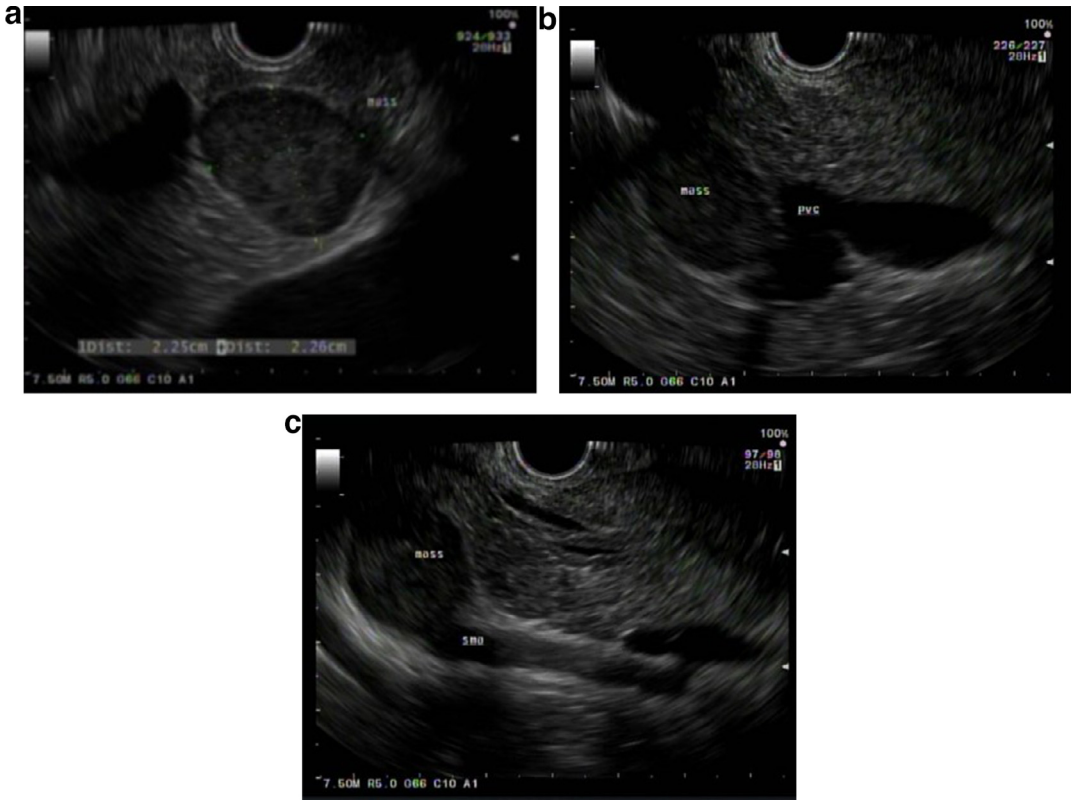


**Fig. 4 – Endoscopic ultrasound images demonstrate a predominantly hypoechoic mass in the region of the pancreatic neck. The mass is in close proximity to the portal vein confluence (PVC) and superior mesenteric artery (SMA) and measures 2.3 x 2.3 cm in largest dimension.**

and cystic components, sometimes with septations. They are usually well encapsulated and often feature degenerative changes, including hemorrhagic and/or xanthomatous infiltrations that can give the tumor a yellow-tan appearance [19].

Microscopically, schwannomas are surrounded by a thin capsule and made of hypercellular and hypocellular areas known as Antoni A and Antoni B respectively. Antoni A areas are composed of spindle cells arranged in a palisading fashion without mitotic figures, while Antoni B areas are typically hypocellular and occupied by loosely arranged tumor cells. Immunohistochemistry is important to confirm the diagnosis of schwannomas. Pancreatic schwannomas are positive for S100, Vimentin and CD 56. Conversely, spindle cells in pancreatic schwannomas stain negative for cytokeratin, CD117, desmin, CD34, AE1/AE3, alpha smooth muscle actin, and smooth muscle myosin [19,23,35].

### *Management*

Pancreatic schwannomas are exceedingly rare and thus there are no established clinical practice guidelines for management. Correlation of patient presentation, tumor size, location, laboratory studies, and histolopathologic findings is often used to guide management. The vast majority of tumors are benign and simple enucleation is usually sufficient if pathology is confirmed prior to surgery. Imaging surveillance may also be appropriate in some patients, as 58%-69% of schwannomas treated conservatively do not grow, and those that do grow demonstrate a growth rate of only 0.9-2 mm per year [37–39]. However, margin negative resection may be indicated if a tumor is large, abuts adjacent vessels, or if histopathologic findings are inconclusive [16]. Chemotherapy with doxorubicin and radiotherapy are used to treat peripheral schwannomas, but, there is no data available on the use of chemotherapy for pancreatic schwannoma.

Given the benign features of pancreatic schwannomas, enucleation would likely be curative in the majority of patients in whom intervention is indicated. However, in a review by Zhang et al., authors found that the most common treatment for pancreatic schwannoma was a Whipple procedure (33%), followed by pancreatectomy with splenectomy (20%), unspecified surgical resection (19%) and lastly enucleation (15%) [6]. Ma et al. reported similar findings [36]. A high rate of extensive resection for a tumor that is virtually always benign reflects the challenge of obtaining an accurate preoperative diagnosis of pancreatic schwannoma and distinguishing pancreatic schwannoma from malignant neoplasms [36]. Intraoperative consultation with a pathologist may help the surgeon to select the appropriate operative method [1]. Following tumor excision, patients with pancreatic schwannoma generally have a good prognosis. Imaging follow-up is advised after the surgery, as the risk of pancreatic schwannoma recurrence remains to be established [19,23].

## Conclusion

Pancreatic schwannoma is a rare nerve sheath tumor with imaging features similar to those of other benign and malignant pancreatic lesions. Correlation of findings from multiple imaging modalities—including EUS, CT, and MRI—may help establish a diagnosis and prevent unnecessary surgical resection in select patients. However, histopathological examination of a tissue sample is required for confirmation and should be obtained if imaging findings are equivocal. There are no defined clinical practice guidelines for management or follow-up of pancreatic schwannoma. The decision to pursue active surveillance, enucleation, or surgical resection should be individualized and based on patient presentation, tumor size, location, laboratory studies, and/or histolopathologic findings.

## Patient consent

Informed patient consent was obtained for publication of the case details.

REFERENCES


[1] Feldman L, Philpotts LE, Reinhold C, Duguid WP, Rosenberg L. Pancreatic schwannoma: report of two cases and review of the literature. Pancreas 1997;15(1):99–105 PMID: 9211499.

[2] Bhattacharyya AK, Perrin R, Guha A. Peripheral nerve tumors: management strategies and molecular insights. J Neurooncol 2004;69(1-3):335–49 PMID: 15527099. doi:10.1023/b:neon.0000041891.39474.cb.

[3] Akiyoshi T, Ueda Y, Yanai K, Yamaguchi H, Kawamoto M, Toyoda K, et al. Melanotic schwannoma of the pancreas: report of a case. Surg Today 2004;34:550–3.

[4] Fu H, Lu B. Giant retroperitoneal schwannoma: a case report. Int J Clin Exp Med 2015;8(7):11598–601 PMID: 26379989; PMCID: PMC4565372.

[5] Hanaoka T, Okuwaki K, Imaizumi H, Imawari Y, Iwai T, Yamauchi H, et al. Pancreatic schwannoma diagnosed by endoscopic ultrasound-guided fine-needle aspiration. Intern Med 2021;60(9):1389–95 Epub 2020 Nov 30. PMID: 33250465; PMCID: PMC8170256. doi:10.2169/internalmedicine.6129-20.

[6] Zhang X, Siegelman ES, Lee MK 4th, Tondon R. Pancreatic schwannoma, an extremely rare and challenging entity: report of two cases and review of literature. Pancreatology 2019;19(5):729–37 Epub 2019 May 23. PMID: 31153779. doi:10.1016/j.pan.2019.05.460.

[7] von Dobschuetz E, Walch A, Werner M, Hopt UT, Adam U. Giant ancient schwannoma of pancreatic head treated by extended pancreatoduodenectomy. Pancreatology 2004;4(6):505–8 Epub 2004 Aug 16. PMID: 15316226. doi:10.1159/000080247.

[8] Paranjape C, Johnson SR, Khwaja K, Goldman H, Kruskal JB, Hanto DW. Clinical characteristics, treatment, and outcome of pancreatic schwannomas. J Gastrointest Surg 2004;8:706–12. doi:10.1016/j.gassur.2004.05.010.

[9] Di Benedetto F, Spaggiari M, De Ruvo N, Masetti M, Montalti R, Quntini C, et al. Pancreatic schwannoma of the body involving the splenic vein: case report and review of the literature. Eur J Surg Oncol 2007;33(7):926–8 Epub 2006 Oct 16. PMID: 17049200. doi:10.1016/j.ejso.2006.09.011.

[10] Móller Pedersen V, Hede A, Graem N. A solitary malignant schwannoma mimicking a pancreatic pseudocyst. A case report. Acta Chir Scand 1982;148(8):697–8 PMID: 7170905.

[11] Brown SZ, Owen DA, O'Connell JX, Scudamore CH. Schwannoma of the pancreas: a report of two cases and a review of the literature. Mod Pathol 1998;11(12):1178–82 PMID: 9872648.

[12] Moriya T, Kimura W, Hirai I, Takeshita A, Tezuka K, Watanabe T, et al. Pancreatic schwannoma: case report and an updated 30-year review of the literature yielding 47 cases. World J Gastroenterol 2012;18(13):1538–44 [PMID: 22509087]. doi:10.3748/wjg.v18.i13.1538.

[13] Coombs RJ. Case of the season. Malignant neurogenic tumor of duodenum and pancreas. Semin Roentgenol 1990;25(2):127–9 PMID: 2112269. doi:10.1016/0037-198x(90)90045-6.

[14] Eggermont A, Vuzevski V, Huisman M, De Jong K, Jeekel J. Solitary malignant schwannoma of the pancreas: report of a case and ultrastructural examination. J Surg Oncol 1987;36(1):21–5 PMID: 3626558. doi:10.1002/jso.2930360106.

[15] Walsh MM, Brandspigel K. Gastrointestinal bleeding due to pancreatic schwannoma complicating von Recklinghausen's disease. Gastroenterology 1989;97(6):1550–1 PMID: 2511055. doi:10.1016/0016-5085(89)90402-2.

[16] Stojanovic MP, Radojkovic M, Jeremic LM, Zlatic AV, Stanojevic GZ, Jovanovic MA, et al. Malignant schwannoma of the pancreas involving transversal colon treated with en-bloc resection. World J Gastroenterol 2010;16:119–22 [PMID: 20039458]. doi:10.3748/wjg.v16.i1.119.

[17] Liegl B, Bodo K, Martin D, Tsybrovskyy O, Lackner K, Beham A. Microcystic/reticular schwannoma of the pancreas: a potential diagnostic pitfall. Pathol Int 2011;61:88–92 [PMID: 21255185]. doi:10.1111/j.1440-1827.2010.02614.x.

[18] Das Gupta TK, Brasfield RD. Tumors of peripheral nerve origin: benign and malignant solitary schwannomas. CA Cancer J Clin 1970;20(4):228–33 PMID: 4316984. doi:10.3322/canjclin.20.4.228.

[19] Duma N, Ramirez DC, Young G, Nikias G, Karpeh M, Bamboat ZM. Enlarging pancreatic schwannoma: a case report and review of the literature. Clin Pract 2015;5(4):793 PMID: 26918099; PMCID: PMC4745593. doi:10.4081/cp.2015.793.

[20] Yu RS, Sun JZ. Pancreatic schwannoma: CT findings. Abdom Imaging 2006;31(1):103–5 Epub 2005 Aug 20. PMID: 16132429. doi:10.1007/s00261-005-0345-1.

[21] Kim G, Choi YS, Kim HJ, Do JH, Park ES. Pancreatic benign schwannoma: combined with hemorrhage in an internal cyst. J Dig Dis 2011;12(2):138–41 PMID: 21401900. doi:10.1111/j.1751-2980.2011.00489.x.

[22] Morita S, Okuda J, Sumiyoshi K, Taketani M, Moriguchi A, Katsu K, et al. Pancreatic schwannoma: report of a case. Surg Today 1999;29:1093–7. doi:10.1007/s005950050651.

[23] Wang S, Xing C, Wu H, Dai M, Zhao Y. Pancreatic schwannoma mimicking pancreatic cystadenoma: a case report and literature review of the imaging features. Medicine (Baltimore) 2019;98(24):e16095 PMID: 31192973; PMCID: PMC6587594. doi:10.1097/MD.0000000000016095.

[24] Xu SY, Sun K, Xie HY, Zhou L, Zheng SS, Wang WL. Schwannoma in the hepatoduodenal ligament: a case report and literature review. World J Gastroenterol 2016;22:10260–6 [PMID: 28028376]. doi:10.3748/wjg.v22.i46.10260.

[25] Ferrozzi F, Bova D, Garlaschi G. Pancreatic schwannoma: report of three cases. Clin Radiol 1995;50(7):492–5 PMID: 7614798. doi:10.1016/s0009-9260(05)83168-x.

[26] Novellas S, Chevallier P, Saint Paul MC, Gugenheim J, Bruneton JN. MRI features of a pancreatic schwannoma. Clin Imaging 2005;29(6):434–6 PMID: 16274899. doi:10.1016/j.clinimag.2005.04.017.

[27] De Waele M, Carp L, Lauwers P, Hendriks J, De Maeseneer M, Van Schil P, et al. Paravertebral schwannoma with high uptake of fluorodeoxyglucose on positron emission tomography. Acta Chir Belg 2005;105(5):537–8 PMID: 16315843. doi:10.1080/00015458.2005.11679777.
[28] Hamada K, Ueda T, Higuchi I, Inoue A, Tamai N, Myoi A, et al. Peripheral nerve schwannoma: two cases exhibiting increased FDG uptake in early and delayed PET imaging. Skelet Radiol 2005;34(1):52–7 Epub 2004 Oct 9. PMID: 15480645. doi:10.1007/s00256-004-0845-z.
[29] Shah N, Sibtain A, Saunders MI, Townsend E, Wong WL. High FDG uptake in a schwannoma: a PET study. J Comput Assist Tomogr 2000;24(1):55–6 PMID: 10667659. doi:10.1097/00004728-200001000-00011.
[30] Bang JY, Hebert-Magee S, Trevino J, Ramesh J, Varadarajulu S. Randomized trial comparing the 22-gauge aspiration and 22-gauge biopsy needles for EUS-guided sampling of solid pancreatic mass lesions. Gastrointest Endosc 2012;76(2):321–7 Epub 2012 May 31. PMID: 22658389; PMCID: PMC4148209. doi:10.1016/j.gie.2012.03.1392.
[31] Bui TD, Nguyen T, Huerta S, Gu M, Hsiang D. Pancreatic schwannoma. A case report and review of the literature. JOP 2004;5(6):520–6 PMID: 15536295.
[32] Bruno M, Maletta F, Gaia S, Venezia L, Cortegoso Valdivia P, Saracco GM, et al. Wait-and-see policy for a small pancreatic schwannoma diagnosed with endoscopic ultrasound with fine-needle aspiration. ACG Case Rep J 2019;6(7):e00139 PMID: 31620536; PMCID: PMC6722366. doi:10.14309/crj.0000000000000139.
[33] Yu GH, Sack MJ, Baloch Z, Gupta PK. Difficulties in the fine needle aspiration (FNA) diagnosis of schwannoma. Cytopathology 1999;10(3):186–94 PMID: 10390067. doi:10.1046/j.1365-2303.1999.00132.x.
[34] Barresi L, Tarantino I, Granata A, Traina M. Endoscopic ultrasound-guided fine-needle aspiration diagnosis of pancreatic schwannoma. Dig Liver Dis 2013;45(6):523 Epub 2013 Feb 12. PMID: 23410733. doi:10.1016/j.dld.2013.01.008.
[35] Weiss SW, Langloss JM, Enzinger FM. Value of S-100 protein in the diagnosis of soft tissue tumors with particular reference to benign and malignant Schwann cell tumors. Lab Invest 1983;49(3):299–308 PMID: 6310227.
[36] Ma Y, Shen B, Jia Y, Luo Y, Tian Y, Dong Z, et al. Pancreatic schwannoma: a case report and an updated 40-year review of the literature yielding 68 cases. BMC Cancer 2017;17(1):853 PMID: 29241452; PMCID: PMC5731208. doi:10.1186/s12885-017-3856-6.
[37] Birk H, Zygourakis CC, Kliot M. Developing an algorithm for cost-effective, clinically judicious management of peripheral nerve tumors. Surg Neurol Int 2016;7:80 PMID: 27625890; PMCID: PMC5009575. doi:10.4103/2152-7806.189299.
[38] Sughrue ME, Yang I, Aranda D, Lobo K, Pitts LH, Cheung SW, et al. The natural history of untreated sporadic vestibular schwannomas: a comprehensive review of hearing outcomes. J Neurosurg 2010;112(1):163–7 PMID: 19538047. doi:10.3171/2009.4.JNS08895.
[39] Nutik SL, Babb MJ. Determinants of tumor size and growth in vestibular schwannomas. J Neurosurg 2001;94(6):922–6 PMID: 11409521. doi:10.3171/jns.2001.94.6.0922.