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Solid pseudopapillary neoplasm of the pancreas in pediatric patients: A case report and institutional case series



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ABSTRACT

Solid pseudopapillary neoplasm (SPN) of the pancreas is a rare tumor presenting in adolescent and young adult females. A previously healthy 13 year-old female presented to our institution with abdominal pain and emesis. Imaging revealed a pancreatic cystic mass. Endoscopic ultrasound (EUS) with fine needle biopsy suggested SPN. Pathologic evaluation following resection revealed immunohistochemical (IHC) staining positive for β -catenin and α -1-antitrypsin despite extensive necrosis. We discuss this patient as well as our institutional series of SPN of the pancreas, describing the evaluation, management, and histopathology of this rare tumor.

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Solid pseudopapillary neoplasm (SPN) of the pancreas is an uncommon tumor of the exocrine pancreas, occurring predominantly in young females [1,2]. Unlike other forms of pancreatic neoplasm, SPN of the pancreas demonstrates an excellent long-term prognosis with adequate resection [3,4]. With accurate pre-operative diagnosis, surgical planning and intraoperative decision making are enhanced.

We present a case of SPN of the pancreas in which the diagnosis was suggested after fine-needle aspiration cytology on endoscopic ultrasound. Definitive diagnosis was made from immunohistochemical (IHC) staining, which allowed for appropriate surgical planning and adequate resection. Without IHC staining, the extensive necrosis on endoscopic biopsy would have resulted in an otherwise indeterminate diagnosis, demonstrating the importance of this histologic evaluation. We also present a single-institutional case series of patients undergoing resection for SPN of the pancreas,

revealing additional pediatric patients for whom immunochemistry was valuable in establishing their diagnosis.

1. Case report

A 13-year old previously healthy female presented to our emergency department with a three day history of abdominal pain, emesis, and malaise. Physical exam revealed mild right-sided abdominal tenderness. A limited right lower quadrant abdominal ultrasound was unremarkable, therefore a computed tomography (CT) scan was obtained demonstrating a predominantly cystic structure arising from the duodenum and abutting the pancreatic head, without biliary or pancreatic ductal dilation (Fig. 1).

Carcinoembryonic antigen (CEA) and cancer antigen (CA) 19-9 were not elevated. Magnetic resonance imaging (MRI) further characterized the lesion as a peripherally enhancing round lesion insinuated between the pancreatic head and second portion of the duodenum, (Fig. 2) suggestive of either a duplication cyst with internal hemorrhage or a solid pancreatic head mass. She then underwent endoscopic ultrasonography (EUS) which revealed that this cystic mass was heterogeneous in nature and without evidence of internal vascular flow (Fig. 3). Fine needle aspiration revealed monomorphic necrotic cells

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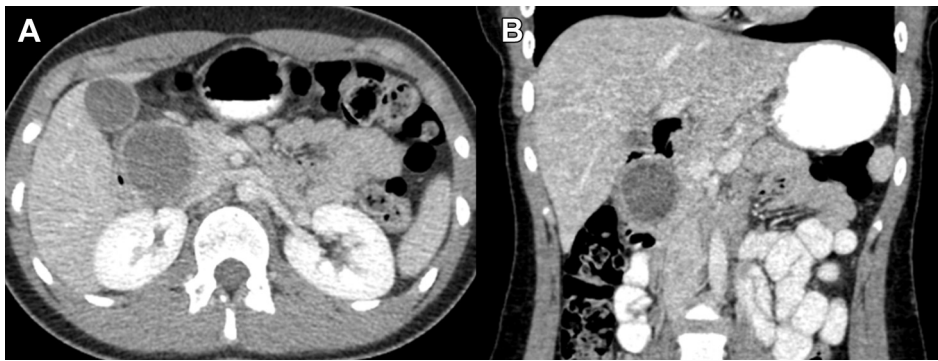


Fig. 1. Axial (A) and coronal (B) computed tomographic images of the intra-abdominal cystic mass at diagnosis.

that on immunohistochemistry were positive for vimentin and β -catenin and weakly reactive for synaptophysin and chromogranin.

Given these findings, the patient underwent exploratory laparotomy via a bilateral subcostal incision. A 3 cm mass arising from the head of the pancreas and adherent to the second portion of the duodenum was identified (Fig. 4). A pancreaticoduodenectomy was performed for complete resection. The pancreatic duct was not dilated, measuring approximately 2–3 mm. Visceral reconstruction was achieved with hepaticojejunostomy, pancreaticojejunostomy, and gastrojejunostomy.

On pathological examination, the mass was an encapsulated $3 \times 3 \times 2.5$ cm lesion arising from the head of the pancreas. The cut surface showed yellow brown necrotic tissue with gritty yellow calcified material. Microscopically, the lesion had a large amount of necrosis with focal areas of neoplastic cells, characterized by small to medium sized cells mostly in sheets. Within the necrotic areas, ghosts of papilliform structures were present (Fig. 5). On IHC, the tumor was positive for β -catenin and α -1-antitrypsin. Testing for CD10 was indeterminate, and the tumor was not tested for e-cadherin.

The patient's postoperative recovery was complicated by prolonged gastroparesis. She received total parenteral nutrition for two weeks and subsequent nasojejunal feeding which was discontinued once she tolerated oral intake. This ultimately resolved and her postoperative course was otherwise uncomplicated. Final histopathology demonstrated this lesion to be a solid pseudopapillary neoplasm of the pancreas with extensive necrosis and negative margins. Follow-up imaging has demonstrated no evidence of recurrence at 1 year from resection. Given complete resection, adjuvant therapy was not indicated.

Following this case, a review of medical and pathological records at our institution, revealed eight patients between January 1995

and December 2014 who were treated for SPN of the pancreas (Table 1). Three of the patients demonstrated intralesional necrosis on histopathology. All eight patients were female and none required adjuvant therapy following resection. With a median follow up time of 5 years (range 1–5 years), there were no recurrences. There was one death that was unrelated to the diagnosis or treatment of SPN of the pancreas.

2. Discussion

SPNs of the pancreas are neoplasms of low malignant potential found predominantly in young females [1,2]. They account for 1–2% of all exocrine pancreatic tumors [5], but 52–71% of pancreatic tumors in children and adolescents [6,7]. The etiology is unknown but suspected to be genetically distinct from pancreatic ductal neoplasms [2]. Despite their preferential association with young women, there are no reports suggesting an association with endocrine disturbances [8]. These tumors do not demonstrate a preferential localization within the pancreas. These neoplasms are often found incidentally on routine physical examination or in patients who present with abdominal pain [9,10]. As in our patient and our institutional review, they are not often associated with pancreatic ductal dilation [11,12].

The differential diagnosis for SPN includes pancreatic pseudocysts, duplication cysts, and other neoplasms of the pancreas including lymphoma and cystic neoplasms [13,14]. Pathology often reveals lobulated solid areas with zones of hemorrhage and necrosis, and cystic spaces filled with necrotic debris [9,15]. IHC is useful for diagnosis of SPN of the pancreas [9]. Positive markers for α -1-antitrypsin, α -1-antichymotrypsin, phospholipase A2, CD 10, and CD 56 are suggestive of pancreatic lesions [16]. A combination

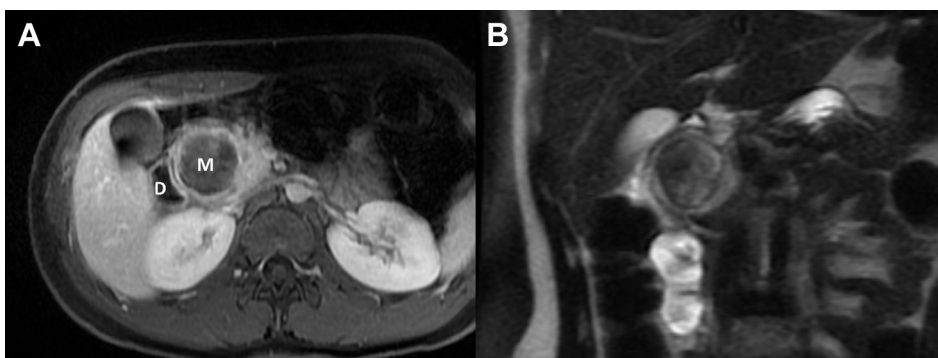


Fig. 2. A) Axial T2-weighted image of the cystic mass (M) with delineation of the plane between the mass and the duodenum (D). B) Coronal T2-weighted image of the mass, demonstrating its heterogeneity and encapsulation.

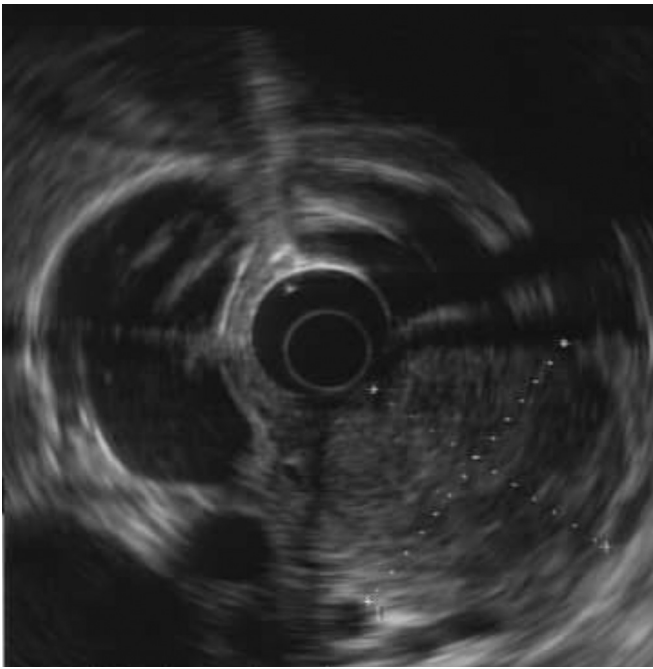


Fig. 3. Endoscopic ultrasonographic imaging of intra-abdominal mass, marked with dotted lines.

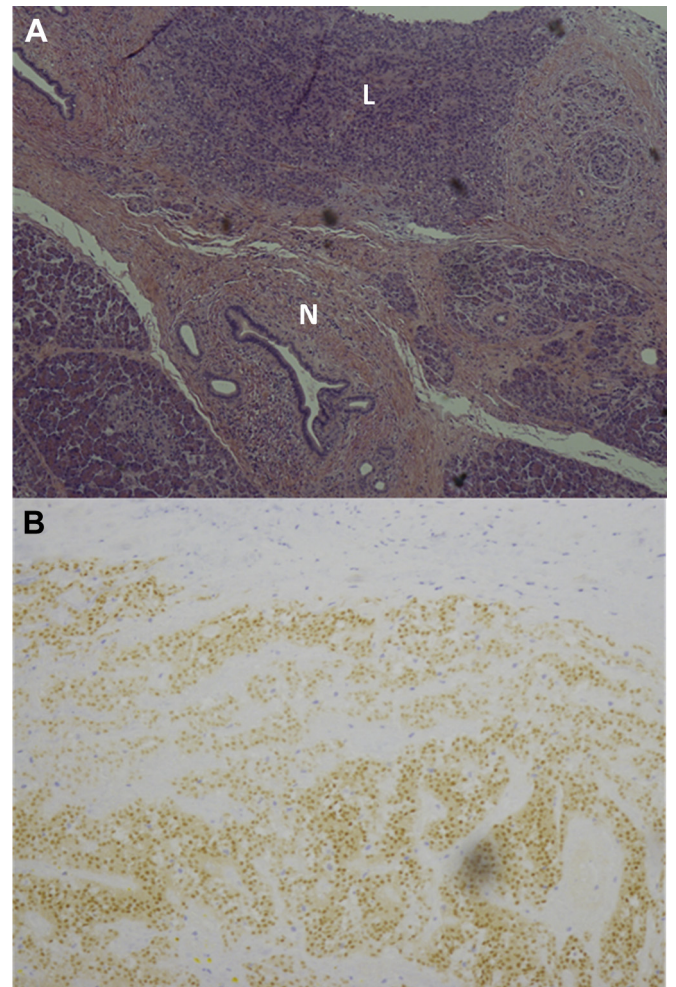


Fig. 5. A) Hematoxylin-eosin staining of the lesion at 100× magnification. Sheets of small to medium-sized, relatively uniform lesional cells growing in an infiltrative sheet are present in the upper portion with normal pancreatic islands of acini in the lower half. A group of normal ductules separate the lesion (L) from normal (N). B) Immunohistochemical staining for β -catenin at 100× magnification. Strong, diffuse nuclear staining in lesional cells within a necrotic area is noted.

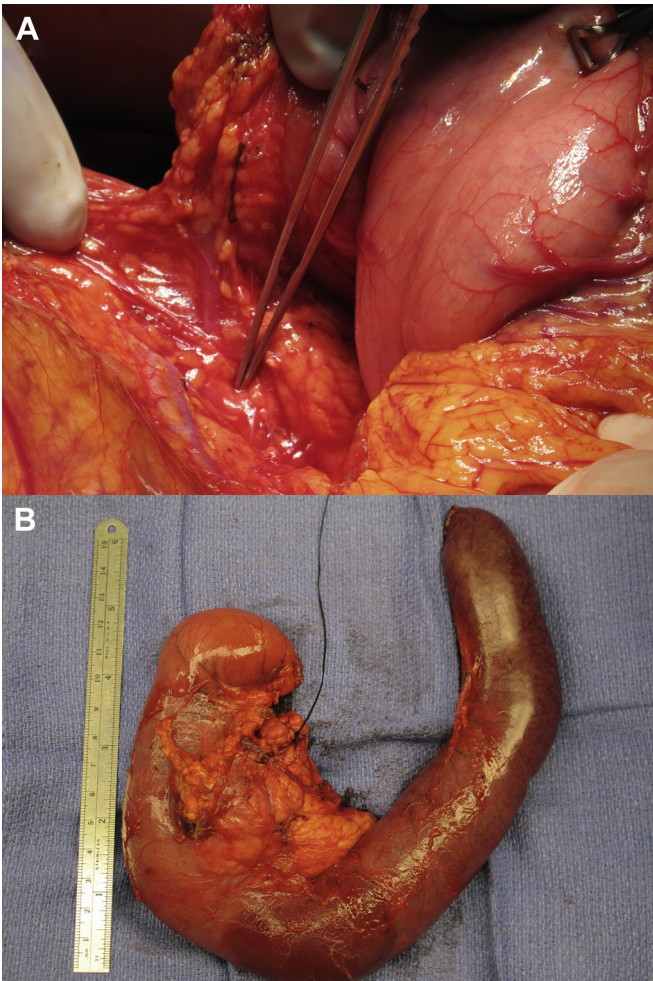


Fig. 4. Surgical resection specimen with the antrum, duodenum, and pancreatic head mass (3 × 3 × 2.5 cm).

of β -catenin and CD 10 and absence of e-cadherin is most specific for SPN when compared to other pancreatic neoplasms [2,17–19]. Unlike pancreatic adenocarcinoma and neuroendocrine carcinoma, patients do not typically demonstrate elevated CEA or CA 19-9 [20].

Due to these staining characteristics, fine-needle aspiration (FNA) cytology is frequently helpful for making a diagnosis preoperatively [21]. However, FNA is rarely used in pediatric patients [10,22,23]. EUS-FNA demonstrates improved sensitivity for diagnosing SPN of the pancreas in adults, correctly identifying over 80% of patients with SPN [11]. In the present case, FNA revealed necrotic laminar cells typical in large neoplasms (>5 cm) and nondiagnostic when found in isolation, but the diagnosis was still strongly suspected by IHC. Our institutional case series includes several patients for whom histopathology revealed central hemorrhage and necrosis (Table 1). Others have also reported SPN of the pancreas with extensive cellular degeneration [24].

Complete surgical resection is the treatment of choice when feasible. In this case, a pancreaticoduodenectomy was performed given the location of the lesion at the head of the pancreas. Other options for treatment include enucleation or subtotal pancreatectomy, depending on location of the tumor. Making a correct intraoperative diagnosis is important because of the comparatively improved prognosis of SPN as compared to other pancreatic

Table 1
Institutional review of patients with SPN of the pancreas.

Age	Surgery	Pathology	Immunohistochemistry	Patient status
16	Spleen-preserving distal pancreatectomy	4 × 6 cm solid mass of the pancreas, hemorrhagic center, negative margins. No pancreatic ductal dilation.	No immunohistochemistry performed.	NED
11	Pancreatoduodenectomy	14 × 11 × 9 cm mass at head of pancreas, hemorrhagic center, negative margins.	No immunohistochemistry performed.	NED
14	Pancreatoduodenectomy	4.2 cm mass in the head of the pancreas, necrotic and hemorrhagic, negative margins. No pancreatic ductal dilation.	Positive: vimentin & NSE. Negative: synaptophysin, keratins and chromogranin.	NED
15	Spleen-preserving distal pancreatectomy	7.8 × 4.6 × 3.2 cm encapsulated mass with negative clear margins.	Positive: NSE. Negative: synaptophysin, keratins and chromogranin.	NED
14	Pancreatoduodenectomy	2.5 × 1.5 × 1.2 cm mass with pseudopapillary architecture and areas of hemorrhage and necrosis.	No immunohistochemistry performed.	NED
13	Pancreatoduodenectomy	3 cm encapsulated mass with pseudopapillary architecture, extensive necrosis, and negative margins. No pancreatic ductal dilation.	Positive: vimentin, β-catenin, and α-1-antitrypsin. Negative: synaptophysin and chromogranin.	NED
15	Distal spleen-preserving pancreatectomy	7 × 6 × 6 cm encapsulated mass, with central necrosis and positive margins. No pancreatic ductal dilation.	Positive: NSE and α-1-antitrypsin.	Death 3 months after surgery from respiratory complications of primary illness.
15	Pancreatoduodenectomy, pylorus preserving	5 × 4 × 2.8 cm cystic structure, encapsulated, negative margins. No pancreatic ductal dilation.	Positive: NSE, β-catenin, and α-1-antitrypsin. Negative: chromogranin.	NED

NSE: Neuron-specific enolase. NED: No evidence of disease.

Median follow-up was 5 years (range 1 year–5 years). All patients were female.

neoplasms [20,25]. In our series, several patients were able to undergo pylorus-preserving pancreatoduodenectomy or spleen-preserving distal pancreatectomy. None of the patients in our case series required adjuvant treatment.

Prognosis of SPN of the pancreas following complete resection with negative margins is excellent. Reports suggest that these neoplasms grow slowly, and recurrence is uncommon following complete resection. Although methods of treatment involving chemoradiation, radiofrequency ablation and HIPEC have been described, repeat surgical resection is warranted should they recur [3,26–28]. These various adjuvant techniques have all been applied to adult patients who presented with overwhelming metastasis. Pediatric patients reported in the current literature have typically presented with resectable disease, with an overall five-year survival of 95% [3,4].

3. Conclusion

Although SPN of the pancreas is a rare form of pancreatic neoplasm, pediatric patients with pancreatic neoplasms are more likely to have SPN than other diagnoses. The diagnosis may be difficult to make preoperatively, but EUS-FNA and IHC are frequently helpful. With complete surgical resection, patients can expect an excellent prognosis.

Conflicts of interest

The authors have no financial conflicts of interest to disclose.

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