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Radical resection of the pancreas should not always be necessary in the surgical management of pancreatic solid pseudopapillary tumor in children

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ABSTRACT

Background/Aims: Pancreatic solid pseudopapillary tumor (SPT) is a rare neoplasm in children. In this study, we aimed to present our surgical strategy based on minimal resection by enucleation or limited resection in localized pancreatic SPT.

Materials and Methods: We retrospectively analyzed the medical records of children who underwent surgical resection between October 2011 and September 2016.

Results: Five female patients with a median age of 15 years (range, 14-17 years) were operated. Tumors were located in the pancreatic head (n=4) or tail (n=1). The median greatest tumor diameter was 9 cm (range, 5-13 cm). All the patients were investigated with MRI before the resection to demonstrate the relationship between the tumor and the main pancreatic duct. Patients underwent enucleation (n=4) for head localization or local distal resection without splenectomy (n=1) at the pancreatic tail. At postoperative follow-up, major pancreatic leakage was observed in two patients and endoscopically treated. Surgical margins were negative in all patients. The median follow-up period was 44 months (range, 2-59 months) and no local recurrence or distant metastasis was observed in the postoperative period.

Conclusion: An optimal surgical strategy is still controversial in pancreatic SPT in children. Radical resections such as pancreaticoduodenoctomy or distal pancreatectomy with splenectomy result in loss of pancreatic tissue for endocrine and exocrine functions. Minimal resections such as enucleation or limited pancreatic resection with negative surgical margins should be performed in selected patients with no invasion to the main pancreatic duct or adjacent organs.

Keywords: Solid pseudopapillary tumor, pancreas, pancreaticoduodenoctomy, enucleation, Whipple operation

Original Article

INTRODUCTION

Pancreatic solid pseudopapillary tumor (SPT) is a rare neoplasm in children and comprises 2%-3% of primary pancreatic tumors in children (1-3). It was first described by Frantz in 1959 and named several terms such as solid and papillary tumor, papillary cystic tumor, solid cystic tumor, or Frantz's tumor (4). The World Health Organization (WHO) defined this tumor as pancreatic SPT in 1996 (5).

This clinical entity is commonly seen in young female patients in the second or third decade of life. The female to male ratio is nearly 10:1 (6,7). The most frequent symptoms at admission are abdominal pain, mass, or fullness, but it can also be asymptomatic and can be incidentally detected during examination for other diseases.

Pancreatic SPT has a favorable prognosis after total resection compared with other pancreatic malignancies in childhood, such as ductal adenocarcinoma, acinar cell carcinoma, pancreatoblastoma, or endocrine tumor. The WHO classified SPT as a low-grade malignant neoplasm in 2010 (8). Most patients have long-term survival rates higher than 95% after surgical resection (6,9). However, local recurrences or distal metastases may be observed after incomplete resections (10). Therefore, radical resections such as pancreaticoduodenoctomy or distal pancreatectomy with splenectomy are usually preferred as a treatment method. In this study, we aimed to present our surgical strategy based on minimal resection by enucleation or local resection in localized pancreatic SPT and discuss its feasibility as an alternative treatment option.

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Table 1. Patient demograhics and clinical details

	Patient 1	Patient 2	Patient 3	Patient 4	Patient 5
Age	15 years	16 years	17 years	15 years	14 years
Sex	Female	Female	Female	Female	Female
Admission Symptoms	Abdominal pain	Palpable mass	Palpable mass	Abdominal pain	Abdominal pain
Diameter	5 cm	6 cm	13 cm	9 cm	9 cm
Localization	Tail	Head	Head	Head	Head
Tumor markers (CEA, CA 19-9, CA125, AFP)	Negative	Negative	Negative	Negative	Negative
Surgical method	Distal pancreatectomy	Enucleation	Enucleation	Enucleation	Enucleation
Complication	(-)	(-)	(-)	Major pancreatic leakage	Major pancreatic leakage
Duration for drain	3 days	5 days	8 days	39 days	25 days
Follow-up period	59 months	44 months	22 months	16 months	2 months

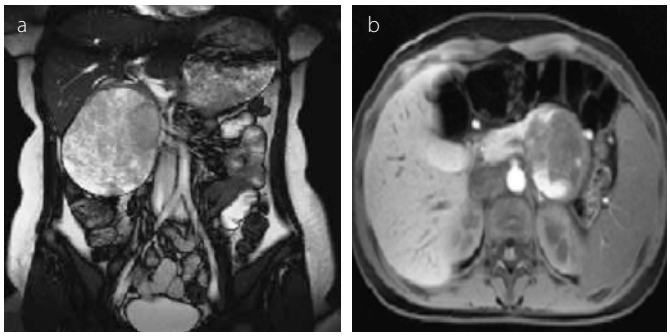

Figure 1. a, b. (a) The tumor was observed in the pancreatic head on magnetic resonance imaging (MRI). (b) The tumor was located in the pancreatic tail on MRI

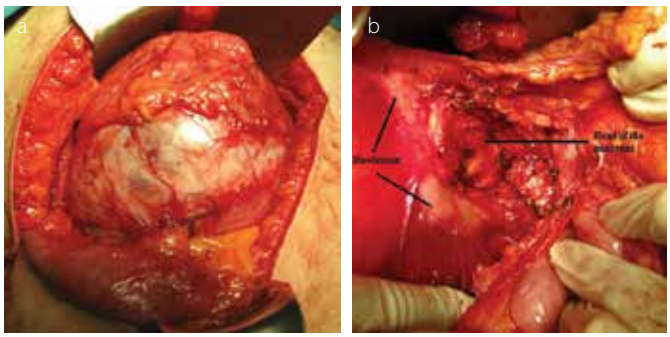

Figure 2. a, b. (a) The intraoperative appearance of the tumor in the pancreatic head. (b) The tumor was enucleated from the pancreatic head

MATERIALS AND METHODS

We retrospectively analyzed the medical records of five children who underwent surgical resection for pancreatic SPT at our clinic between October 2011 and September 2016. Demographic characteristics, admission symptoms, radiological studies, surgical treatment strategies, pathological findings, and prognoses were reviewed. All parents and adolescents gave their informed consent prior to their inclusion in the study. Ethical approval was obtained from our institution's ethical committee.

RESULTS

Five patients underwent surgery for pancreatic SPT at our clinic. Patient demograhics and clinical details are presented in Table 1.

The median age of patients at diagnosis was 15 years (range, 14-17 years). All patients were females. Symptoms at admission were palpable abdominal mass (n=2) or abdominal pain (n=3). Patients were previously examined with ultrasonography and/or computed tomography at local hospitals and were referred to us as having pancreatic tumor. Magnetic resonance imaging (MRI) was used at our clinic to identify the tumor's relationship with or invasion of the main pancreatic duct or vessels. Radiological studies demonstrated a well-circumscribed, encapsulated, heterogenous (cystic/solid) mass with no invasion of adjacent tissues, vessels, or main pancreatic duct with no distant metastasis (Figure 1). SPT was preoperatively diagnosed with radiological imaging. Tumors were located in the pancreatic head (n=4) or tail (n=1) with the median greatest tumor diameter as 9 cm (range, 5-13 cm). All preoperative tumor markers and routine laboratory tests were normal (carcinoembryonic antigen, cancer antigen 19-9, cancer antigen 125, alfa-fetoprotein, amylase/lipase).

Patients underwent surgery after preoperative work-up. The tumor was located in the pancreatic tail of patient 1 and resected via local resection of the tail with sufficient normal pancreatic tissue. Splenic vein was isolated from the tumor; therefore, splenectomy was not required. Tumors were located in the pancreatic head in the other patients and resected with enucleation (Figure 2a). Tumors were well-capsulated and meticulously dissected from adjacent pancreatic tissues. Pancreatic duct was not observed during enucleation and tumor was totally resected without major bleeding or leakage (Figure 2b). A percutaneous drain was indwelled to the abdomen in all patients. At postoperative follow-up, major leakage was observed in two patients (patients 4 and 5). Patients underwent endoscopic retrograde cholangiopancreatiography, and a pancreatic stent was placed in main pancreatic duct. Leakage was finally resolved after stent placement. The median duration for drain displacement was 8 days (3-39 days). There were no other complications in the intraoperative or postoperative period.

Table 2. The pathological analysis of patients with immunohistochemical staining

	Patient 1	Patient 2	Patient 3	Patient 4	Patient 5
Capsule Invasion	+	+	+	+	+
Nuclear Atypia	-	-	-	-	-
Mitosis	-	+	-	-	-
Necrosis	-	+	-	-	-
Vascular Invasion	-	-	-	-	-
Lymph Node Metastasis	-	-	-	-	-
Synaptophysin	-	-	+	-	-
Chromogranin	-	-	-	-	-
CD10	+	+	+	+	+
β-catenin	+	+	+	+	+
CD56	+	+	+	+	+
p53	-	-	-	-	-
Ki-67	-	2%	-	-	-

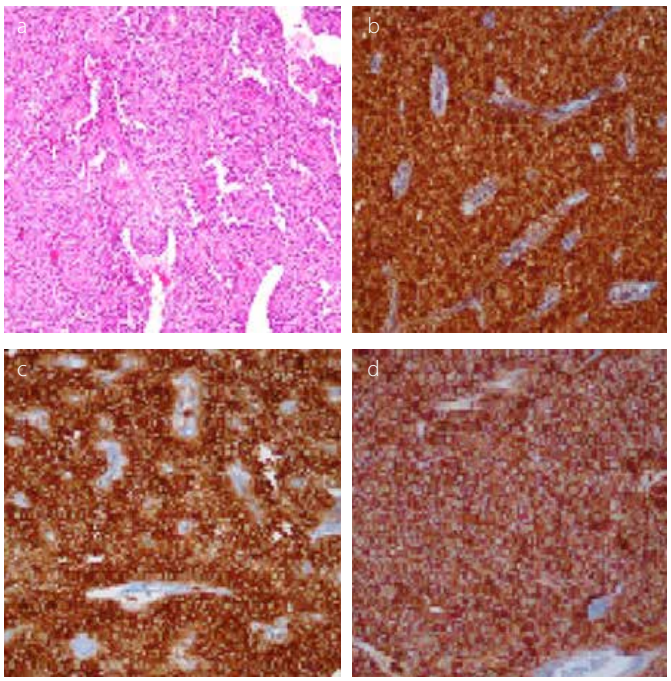

Figure 3. a-d. (a) Pseudopapillary growth pattern and polarization of cells creating a band of cytoplasm around the vessels (arrows) in solid pseudopapillary neoplasm. (b) Immunohistochemically, all neoplastic cells show both nuclear and cytoplasmic β-catenin positivity (β-catenin ×400) (c) Immunohistochemically, all neoplastic cells show cytoplasmic CD56 positivity (CD56 ×400) (d) Immunohistochemically, all neoplastic cells show membranous CD10 positivity (CD10 ×400)

Pseudopapillary growth pattern and polarization of cells creating a band of cytoplasm around the vessels were seen at pathological analysis as diagnostic criteria for solid pseudopapillary neoplasm (Figure 3). All tumor specimens have capsule invasion. There was no nuclear atypia, vascular invasion, or lymph node metastasis. The specimens were immunohistochemically stained with β-catenin, CD56, and CD10 (Figure 3). The immunohistochemical findings are listed in Table 2.

The median follow-up period was 44 months (range, 2-59 months). Distant metastasis or local recurrence was not observed in this period. All patients are alive and have no problem in the endocrine or exocrine functions of the pancreas.

DISCUSSION

Pancreatic neoplasms are rarely seen in childhood and SPT comprises a majority of them (71%) (11). Most SPT cases are reported in adult series (12,13). Morita et al. (14) reported five female children with SPT in a 20-year period. Tumors located in the pancreatic head were treated with pylorus-preserving pancreaticoduodenoctomy and those in the pancreatic corpus or tail with distal or central pancreatectomy with splenectomy. One patient required partial hepatectomy due to metastasis to the liver and died 60 months after surgery. Morita et al. (14) suggested radical resection with negative margins but also supposed enucleation with sufficient surgical margin in small tumors distant from the main pancreatic duct. Laje et al. (15) reported six children with SPT. They suggested an agressive resection strategy to achieve negative surgical margins in childhood: pancreaticoduodenoctomy for head localization and distal pancreatectomy with splenectomy for the pancreatic corpus or tail. Similarly, Speer et al. (16) suggested radical surgical resections in children with SPT due to the malignant potential of this tumor.

Surgery is the mainstay of the treatment of SPT and radical resections are usually preferred. These procedures are pylorus-preserving pancreaticoduodenoctomy (Whipple procedure) in the pancreatic head and distal pancreatectomy with or without splenectomy in the pancreatic tail or corpus (17,18). Radical resections result in a loss of pancreatic tissue necessary for endocrine and exocrine functions. Total resection of the tumor with enucleation or local resection can prevent this impairment in patients with no invasion of the main pancreatic duct

or adjacent organs. In recent years, enucleation or local resection with laparoscopy or conventional surgery have been proposed in the surgical treatment of SPTs (19-21).

Nakagohri et al. (22) reported 14 pediatric patients with SPT. Enucleation or local resection was performed in five of them, and 21% of the patients had positive surgical margin on pathological examination. None of them had local recurrence or distant metastasis after enucleation or local resection. They suggested limited resection in small SPTs with a well-defined capsule due to the tumor's indolent behavior and excellent prognosis. A recent report described a laparoscopic resection of pancreatic SPT in 13 patients (19). They performed enucleation for head localization and distal pancreatectomy with or without splenectomy for the pancreatic tail or corpus. No local or distant metastases were reported in after 11 months of follow-up. They suggested laparoscopic resection or enucleation of the SPT with adequate resection margins even if the tumors were located in the pancreatic head.

Papavramidis et al. (6) reported a 19% rate of metastases or local invasion during diagnosis in an adult series. However, in the pediatric literature, metastases or recurrences are extremely rare (14,23,24). Therefore, these tumors may be considered as different entities in pediatric and adult patients. Metastases are commonly seen in the liver, lymph nodes, omentum, or peritoneum. Radical resections should be preferred in patients with distant metastases or local invasions to adjacent organs. Chemotherapy and/or radiotherapy may have a role in metastatic or unresectable patients but their efficay remains unclear (25,26).

Certain prognostic factors are not yet reported in the preoperative or postoperative period. Some authors suggested the male sex as a poor prognostic factor in SPT (27,28). They reported higher metastasis and death rates in males compared with females. In addition, portal vein invasion was more ferquently observed in males. Tumor size was reported to be larger in premenopausal than in postmenopausal patients. These findings demonstrate that female hormones, such as estrogen and progesterone, may influence the proliferation of SPT (29). In our study, all our patients were females and had good prognoses. In male patients, more aggresive resections may be necessary due to increased malignant behavior.

The optimal surgical strategy is still controversial because of the rarity of this tumor. In our study, five patients underwent surgery for SPT in a 5-year period. We preferred minimal resections such as enucleation for head localization or local distal resection for the pancreatic tail. No local recurrence or distant metastasis was observed in the postoperative period; however, the short follow-up period is a limitation of this study.

Surgery is the main treatment modality of this tumor. However, there are various surgical management strategies in children. Radical resections are usually preferred as a major strategy.

All patients must be investigated with MRI before the intervention to determine the if the tumor has invaded the main pancreatic duct. Preoperative diagnosis of SPT with radiological studies is necessary to decide the surgical strategy. During the surgery, the tumor should be enucleated from the normal pancreatic tissue with negative surgical margins in selected patients with no invasion of the main pancreatic duct or adjacent organs. However, large patient series with long-term follow-up data are necessary to ascertain the appropriate surgical strategy in pancreatic SPT in children.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Ege University School of Medicine.

Informed Consent: Written informed consent was obtained from the parents of the patients who participated in this study.

Peer-review: Externally peer-reviewed.

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