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Surgical Management of Solid Pseudopapillary Tumor of the Pancreas

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ABSTRACT

Background and Objectives: Although solid pseudopapillary tumor (SPT) of the pancreas is rare, its diagnosis has increased severalfold in the past decades. We present our experience in the management of SPT, including a patient who experienced tumor rupture during laparoscopy pancreatic resection.

Methods: Data on all patients with SPT who were subjected to surgical treatment were retrospectively obtained.

Results: Of 20 patients evaluated, 17 (85%) were females. The mean age was 31 years. Tumor size varied from 2.7 × 1.5 to 13.5 × 10.0 cm, with a mean of 6.4 × 7.6 cm. The most common location was the tail and/or body of the pancreas (14 patients [70%]). Pancreatic tumor resection was performed in 19 patients (50%). The type of resection depended on tumor location and size: distal pancreatectomy (n = 13), pancreatoduodenectomy (n = 5), and central pancreatectomy (n = 1) Pancreatic resection was performed via laparoscopy in 7 patients who underwent distal pancreatectomy. Tumor resection was not performed in only 1 patient (5%), due to invasion of mesenteric vessels and presence of liver metastases. One patient had tumor rupture during laparoscopic resection, with no apparent macroscopic dissemination of the tumor. All 19 patients who underwent SPT resection had no tumor recurrence, including a patient with capsule invasion and another patient with tumor rupture during surgical dissection. The mean follow-up time was 38 months (range, 6–72 months).

Conclusion: Complete SPT resection is possible in most patients, with a low recurrence rate. Because of its large size, laparoscopic resection of SPT's should be performed only by experienced surgeons to avoid tumor rupture.

Key Words: Pancreatic tumor, Pancreatic resection, Laparoscopic resection, Tumor rupture.

INTRODUCTION

Solid pseudopapillary tumor (SPT) of the pancreas is an uncommon neoplasm with a low malignant potential that generally occurs in young women.[1,2] SPT was first described by Frantz in 1959.[3] In the following years, it was assigned different names, such as papillary epithelial tumor, solid cystic tumor, solid and papillary tumor, papillary cystic tumor, and Hamoudi tumor.[4–6] In 1996, it received the present denomination of SPT by the World Health Organization (WHO), which became the preferred terminology.[7,8]

SPT constitutes about 1% to 2% of all pancreatic neoplasms.[4,9] It has been reported more frequently in the past decades due to the widespread availability of high-quality imaging examinations, mainly ultrasonography, tomography, and magnetic resonance imaging. In a recent review of all SPT reports published in the English language up to 2012, Law et al[10] identified a total of 2744 cases for this tumor. The great majority of the tumor occurrences were reported between 2000 and 2012 (n = 2410 [87.8%]), compared with the period between 1961 and 1999 (n = 334 [12.2%]). Our objective in the present study is to describe our experience with the treatment of 20 patients with SPT, including a patient who experienced tumor rupture during laparoscopic resection. To the best of our knowledge, this is the first report of an SPT rupture during laparoscopic pancreatectomy.

METHODS

The database of the Nossa Senhora das Graças Hospital and Clinical Hospital was retrospectively reviewed for all

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patients with a pathologic diagnosis of SPT of the pancreas who underwent surgical treatment between January 1997 and December 2016.

Patients' demographic characteristics, clinical presentation, imaging findings, surgical treatment, postoperative follow-up, and pathologic findings were obtained and analyzed. Follow-up information was obtained from hospital and outpatient records. When a patient had not had an outpatient visit within the past 6 months, the patient or his or her family was contacted by telephone. Patients had follow-up every 3 months for 1 year and then every 6 months. All surgical procedures were performed by 3 academic surgeons who had more than 20 years of experience in open and laparoscopic biliopancreatic surgery.

SPT was considered malignant in the presence of metastases, pancreatic or extrapancreatic invasion, capsular invasion, or perineural or vascular invasion. The protocol of this study was approved by the ethical committee of our institution.

RESULTS

Demographic Characteristics and Clinical Presentation

A total of 20 patients had the diagnosis of SPT confirmed by histologic examination. There were 17 (85%) women and 3 (15%) men, with a mean age of 31 years (range, 20–48 years; 11 patients <30 years old).

The main presenting clinical manifestation was abdominal pain or discomfort, which was referred by 9 (45%) patients. Palpable abdominal mass was the second most common presentation (5 patients [25%]). Other clinical presentations are shown in **Table 1**. Duration of symptoms varied from 2 weeks to 10 months, with a mean of 6 weeks.

No patient had jaundice or pancreatitis. Six patients (30%) were asymptomatic; in these patients, the tumor was diagnosed incidentally during a routine imaging examination.

Preoperative Diagnosis and Surgical Treatment

Preoperative diagnosis was based on tomography and/or magnetic resonance imaging findings of a heterogeneous mass with cystic and solid components. The solid component enhanced on the arterial phase. Tumor markers alpha-fetoprotein (AFP), carcinoembryonic antigen (CEA), CA 125, and CA 19–9 were normal (16 patients; 80%) or slightly elevated (4 patients; 20%).

Table 1.
Demographic, Clinical, and Surgical Characteristics of Patients with Solid Pseudopapillary Tumor of the Pancreas

Characteristic	N	%
Age, mean (year)	31	
Female	17	85
Male	3	15
Clinical presentation		
Abdominal pain or discomfort	9	45
Palpable abdominal mass	5	25
Nauseas and vomiting	4	20
Weight loss	3	15
Asymptomatic	6	30
Tumor size, mean (cm)	6.4 x 7.6	
Tumor location		
Head	5	25
Uncinated process	1	5
Body	3	15
Tail	6	30
Body and tail	5	25
Surgical Treatment		
Distal pancreatectomy with splenectomy	11	55
Distal pancreatectomy with spleen preservation	2	10
Pancreatoduodenectomy	5	25
Central pancreatectomy	1	5
Laparoscopy with tumor biopsy	1	5

All patients were subjected to surgical exploration. Tumor size varied from 2.7 × 1.5 to 13.5 × 10.0 cm, with a mean of 6.4 × 7.6 cm. The most common location (11 patients [55%]) was in the tail of the pancreas alone or associated with the body. Tumor limited to the body of the pancreas was observed in only 3 (15%) patients. Tumor of the head or uncinate process occurred in 6 (30%) patients.

Pancreatic tumor resection was performed in 19 (95%) patients (Table 1). The type of resection depended on tumor location. Pancreatoduodenectomy was performed in 5 patients with tumor of the head or uncinate process of the pancreas. Distal pancreatectomy was done in 13 (65%) patients with tumor of the body and/or tail. In 2 of these 13 patients, the spleen was preserved. Central pancreatectomia was used in only 1 (5%) patient with tumor limited

to the body of the pancreas. Tumor resection was not done in 1 (5%) patient due to invasion of mesenteric vessels and liver metastases. This patient underwent only laparoscopic biopsy of the tumor and lymph node. Tumor enucleation was not performed due to either large tumor size or its proximity to the main pancreatic duct.

Pancreatic resection was performed through laparoscopy in 7 patients who underwent distal pancreatectomy, including 1 with spleen preservation. The laparoscopic procedure was performed with 4 trocars. After thorough abdominal assessment for metastatic disease, the lesser sac was entered through the gastrocolic ligament. The posterior aspect of the distal pancreas was mobilized from its inferior border. The spleen was dissected after sequential division of the splenic artery, splenic vein, and pancreas. In the case of spleen preservation, the splenic artery and vein were carefully dissected from the pancreas to divide the pancreatic parenchyma with use of a stapler. A frozen section of the pancreas was obtained to confirm a negative margin of resection.

Histopathologic examination of the 19 resected tumors showed capsular invasion in only 1 patient. None of these patients had peripancreatic lymph node metastasis. All 19 patients had R0 resection (negative microscopic margin).

Postoperative complications were observed in 6 (30%) patients. The most common complications were pancreatic fistula and surgical site infection, each occurring in 3 (15%) patients. According to the 2016 update of the International Study Group of Pancreatic Fistula, all 3 pancreatic fistulas were classified as grade B.[11] Other complications were pulmonary atelectasis (n = 2 [10%]), pleural effusion (n = 2 [10%]), pneumonia (n = 1 [5%]), delayed gastric emptying (n = 1 [5%]), lower urinary tract infection (n = 1 [5%]), leg superficial thrombophlebitis, and left fibular neuropraxia due to nerve compression on the operating table leg holder during laparoscopic pancreatectomy (n=1 patient; 5%]). Some patients had 2 or more complications. There were no perioperative deaths.

One patient experienced tumor rupture during laparoscopic dissection of the splenic vein. The inadvertent tumor rupture was due to undue pressure on the tumor by a retractor placed on the posterior surface of the tail of the pancreas. The initial surgical plan to preserve the spleen was aborted, and distal pancreatectomy with splenectomy was completed through laparoscopy. There was no apparent macroscopic spread of the tumor. The specimen was placed into a plastic bag and carefully removed though a 5- to 6-cm lower abdominal incision, without any contact between the specimen and trocar channels or wound edges.

The mean follow-up time was 38 months (range, 6–72 months). At the time of the last follow-up, the 19 patients who underwent tumor resection had no evidence of tumor recurrence, including the patients who had tumor rupture and capsule invasion. The last follow-up of these patients was 7 and 4 years, respectively. None of them received either adjuvant or neoadjuvant chemotherapy. The only patient who had no tumor resection died 4 years after the diagnosis. She was palliatively treated with gemcitabine-based chemotherapy.

DISCUSSION

With recent technological advances in the past decades, there has been a documented dramatic increase in the use of imaging examinations worldwide.[12] This led to the diagnosis of a larger number of pancreatic cystic tumors, including SPT. The incidence of this tumor increased 7-fold from the period 1961–1999 to the period 2000–2012.[10] In addition, the size of SPT at diagnosis decreased from 9.8 cm before 2000 to 8.1 cm between 2000 and 2012, suggesting a more precocious diagnosis.[10]

A prominent epidemiologic characteristic of SPTs is that they occur almost exclusively in young women.[4,13] The mean age at diagnosis in our institution was 31 years, similar to that reported in other series,[4,5,10] and women have accounted for 90% of the cases reported.[14] The explanation for the marked predominance in female patients is still unknown. Some authors have suggested that primordial ovarian cells migrate to the developing pancreatic tail, predisposing to SPT later in life.[6] This is the same theory proposed to explain the preponderance of mucinous cystic tumor of the pancreas in female patients.

SPT is classified by the World Health Organization as a low-grade malignant exocrine pancreatic neoplasia.[8] Because it is usually noninvasive, clinical manifestations are typically secondary to tumor compression of adjacent organs and structures. Abdominal pain or discomfort was the most common symptom. Weight loss, nausea and vomiting, and other nonspecific manifestations may also be reported.[10] Jaundice was not observed in our series, even in patients with a huge tumor in the head of the pancreas. In the largest series of SPTs from a single institution, Cai et al[5] reported only 1 in 115 (0.9%) patients who presented with jaundice. Currently, with the widespread use of imaging examinations, the proportion of asymptomatic patients at diagnosis is high, about one-third.[5,7,10,14] In this

group of patients, the tumor is usually diagnosed incidentally during a routine imaging examination.[5,10]

The preferred treatment for SPT is complete tumor resection (R0). Surgical procedure depends on tumor location and size. Because most SPTs are located in the tail and/or body of the pancreas, distal pancreatectomy is the most common procedure.[15–18] SPT of the head or uncinate process of the pancreas occurs in about one-third of patients and is treated with pancreatoduodenectomy. Small tumors distant from the main pancreatic duct may be enucleated, without decreasing long-term survival. Tumors of the neck or body of the pancreas, without vessel involvement, may be treated with central pancreatectomy.

Surgical resection is indicated even in the presence of local invasion or metastasis, because excellent long-term survival is usually the rule.[5,19,20] Some authors have reported excellent survival after pancreatectomy associated with vascular resection in patients with SPT infiltrating the portal vein and its branches.[5,20]

Although the number of laparoscopic pancreatectomies for SPT is still small, the indication has increased markedly in the past years.[10,16,21] Distal pancreatectomy is the most commonly performed laparoscopic pancreatic resection, because there is no need for manual anastomosis or complex reconstruction of the digestive tract. Several authors have demonstrated that laparoscopic distal pancreatectomy has several advantages, such as reduction of postoperative pain and analgesic requirements, wound complications, blood loss, operative time, and hospital stay compared with open distal pancreatectomy.[17,22,23] In addition, more rapid return to normal activity and better cosmetic results are observed after laparoscopic distal pancreatectomy.[22]

Several studies have demonstrated the feasibility and benefits of splenic preservation during distal pancreatectomy, including reduction in lifetime risk of postsplenectomy sepsis and malignancies.[24,25] Spleen-preserving laparoscopic distal pancreatectomy is indicated for benign or low-grade malignant tumors, such as SPT, located in the body or tail of the pancreas.[21] The most important technical aspect of this procedure is to safely separate body and tail pancreatic parenchyma from splenic vessels. This may be easier to perform through laparoscopy than open surgery.[24,25]

Laparoscopic resections are becoming the gold standard for distal pancreatectomy. An increasing number of authors perform distal pancreatectomy routinely with lower morbidity and mortality than open resection.[16,17,21] However, the advantages of the more complex pancreatoduodenectomy or central pancreatectomy through laparoscopy have not been determined. Only a very small number of surgeons perform these procedures routinely.

An important concern regarding laparoscopic distal pancreatectomy for SPT is oncologic safety. Initially, some authors had suggested that laparoscopic pancreatectomy might not be as effective as open pancreatic resection in tumor recurrence and in removing peripancreatic lymph nodes. However, subsequent studies have shown no difference in tumor recurrence rate and long-term survival between the 2 procedures.[16,26] Some authors have also demonstrated that the number of lymph nodes resected through laparoscopic pancreatectomy is similar to that of open pancreatic resection.[16] In addition, extensive lymphadenectomy is not recommended routinely for patients with SPT subjected to pancreatectomy because lymph node metastases occur in only about 2%.[5,10]

More recently, some studies have demonstrated the superiority of robotic-assisted over laparoscopic distal pancreatectomy in patients with benign or low-grade malignant tumors.[22,24,25] Robot-assisted distal pancreatectomy reduced the risk of conversion to open resection and improved spleen preservation rate.[27] Superior oncologic results were also recorded for the robotic-assisted group, with higher rates of margin negative resection and improved lymph node yield.[25]

Tumor rupture during pancreatic laparoscopic resection is a matter of great concern due to the possibility of neoplasia dissemination.[28–31] Although SPT recurrence was not observed in our patient with tumor rupture, its occurrence during laparoscopic pancreatectomy emphasizes that the surgeons should be very careful in performing this procedure in large tumors. SPTs are usually large. In a review of 2750 SPTs, the mean tumor size was 8.6 cm.[10] This size is greater than that of most pancreatic tumors, such as ductal adenocarcinoma and neuroendocrine tumors.[26] Large tumors make pancreatic dissection difficult and subject to tumor rupture and cell dissemination. Because SPTs are usually large, laparoscopic pancreatic resections of these tumors should be performed only t specialized hospitals by surgeons with extensive experience in advanced laparoscopic pancreatic surgery.

Contrary to several other minimally invasive procedures, laparoscopic pancreatectomy has been adopted slowly. Its results are highly dependent on surgeon experience. Laparoscopic pancreatectomies are very demanding and may be performed with excellent results only by an experienced surgeon.[29,30] The learning curve for such oper-

ations is longer than for most of the other laparoscopic procedures. Several authors have determined that the learning curve for distal laparoscopic pancreatectomy varies between 17 and 30 procedures for an experienced surgeon in other advanced laparoscopic operations at high-volume centers.[29,30]

Rupture of pancreatic SPTs is rare; very few cases have been reported either spontaneously or after abdominal trauma.[31–35] Pancreatic SPT rupture was also described after an endoscopic ultrasound-guided fine needle aspiration.[36] Most patients with ruptured SPTs were subsequently subjected to surgical excision of the tumor.[33–35] Local tumor recurrence was uncommon, but the patient follow-up was not long in most reports.[32–35]

Recent reports from Japan have shown tumor recurrence with several intra-abdominal implants in 2 patients who underwent pancreatic resection to treat ruptured SPT of the pancreas 6.5 and 7 years earlier.[28,31] These reports indicate that SPT may recur many years after tumor rupture. A prolonged postoperative follow-up is mandatory in all patients with ruptured SPT.

The role of chemotherapy and radiotherapy for patients with SPT is still unknown.[4,5] Most authors use chemotherapy or radiotherapy only in patients with tumor recurrence.

In our experience, complete tumor resection (R0) was possible in 95% of the patients. We had no recurrence after R0 resection. However, our follow-up was only 38 months. Longer follow-up is necessary, because recurrence has been described as long as 7 years after resection of ruptured tumors.[28,31] In a large literature review, the mean time to recurrence of 86 SPTs was 50.5 months.[10]

There are important limitations in our study. One of the major aspects is the small sample size. Nevertheless, our report represents one of the largest series from a South American country. Most other studies are also limited to a small number of SPTs due to the scarcity of this tumor. More recently, a larger number of SPTs have been reported at a few Chinese institutions. Our mean follow-up was not long enough to exclude all tumor recurrences. Due to its indolent nature, SPT recurrence may occur more than 5 years after adequate treatment. A prolonged postoperative follow-up is mandatory, mainly in patients with ruptured tumor.

CONCLUSIONS

Diagnosis of SPT is increasing rapidly in the past decades, possibly due to the widespread use of imaging examinations. A prominent epidemiologic characteristic of SPTs is that they occur almost exclusively in young women. Complete tumor resection is possible in most patients, with a low recurrence rate. Because SPTs are usually large, laparoscopic pancreatectomy for treatment of these tumors should be performed only by surgeons with extensive experience.

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