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REVIEW

Solid pseudodopillary tumor of the pancreas in children

Çocuklarda pankreasın solid psödodopiller tümörü

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Abstract

Solid pseudopapillary tumor of the pancreas (SPTP) is mostly seen in young women in the second and third decades of life; it is quite uncommon in children. In this review, to deal with the current medical experience with SPTP in pediatric age group was aimed. In childen, SPTP demonstrates different clinical features. Complete resection is curative in most patients. In children, the optimal surgical strategy for SPTP is still obscure. Instead of radical resections, limited pancreatic resections, such as enucleations, with negative surgical margins should be attempted. For unresectable or recurrent tumours, cisplatin-based chemotherapy might be considered.

Keywords:. Solid pseudopapillary tumor of the pancreas, treatment, prognosis, children

Öz

Pankreasın solid psödopapiller tümörü (SPTP) çoğunlukla yaşamın ikinci ve üçüncü dekadındaki genç kadınlarda görülür; çocuklarda oldukça nadirdir. Bu derlemede pediatrik yaş grubunda SPTP ile ilgili güncel tıbbi deneyimin ele alınması amaçlandı. Çocuklarda SPTP farklı klinik özellikler gösterir. Çoğu hastada tam rezeksiyon küratiftir. Çocuklarda SPTP için en uygun cerrahi strateji hala belirsizdir. Radikal rezeksiyon yerine, enükleasyon gibi cerrahi sınırı negatif olan sınırlı pankreas rezeksiyonu denenmelidir. Rezeke edilemeyen veya tekrarlayan tümörler için sisplatin bazlı kemoterapi düşünülebilir. SPTP'nin prognozu, lokal nüks ve metastaz olsa bile olumlu biyolojik özellikleri nedeniyle çok iyidir.

Anahtar kelimeler: Pankreasın solid psödopapiller tümörü, tedavi, prognoz, çocuklar

INTRODUCTION

Solid pseudopapillary tumor of the pancreas (SPTP) is a rare tumor mostly seen in adolescent girls. This tumor, which has a small place among primary pancreatic tumors, was first described as a new entity by V. K. Frantz in 1959[1]. Some of the names used to describe this tumor in the literature include Frantz tumor, papillary cystic tumor, solid and papillary epithelial neoplasm, solid and cystic tumor, and papillary cystic epithelial neoplasm[2]. SPTP, which generally has a good clinical course, has a low malignant potential. While the tumor may be locally infiltrative in some patients, rarely distant metastases have been reported[3]. Some studies have reported that SPTP has a lower female predominance in children than in adults[4]. Irtan et. al. stated that complete surgical removal of even recurrent tumors is the best option and reported that SPTP recurrence did not adversely affect overall survival in their pediatric series[5,6]. Some researchers suggest that a treatment approach that includes only limited tumor resection such as enucleation, with negative surgical margins will be sufficient for these tumors[7,8]. The optimal surgical strategy for SPNP in children remains controversial. In this review, it is aimed to convey epidemiological, pathological and clinical information about SPTP of the pancreas, especially based on the pediatric age group, in the light of literature.

EPIDEMIOLOGY

Since SFTP is a relatively newly identified pathology and these patients often receive other diagnoses, it is very difficult to know the true incidence of the tumor.

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It accounts for two to three percent of primary pancreatic tumors. In some studies, it is stated that SPTP is diagnosed by retrospectively examining the tissues of patients previously diagnosed with pancreatic tumor[4]. SPTP which is an extremely rare tumor, typically affects women in their second or third decade of life. However, a small number of male patients with SPTP have also been reported in the literature[5-7]. In a large series, female to male ratio was reported to be 16/3[8]. Although sex hormones are also associated with SPTP in this context, it is thought that this relationship is related to the growth of the tumor rather than playing a role in the pathogenesis[9]. Another study revealed that SPTP is more common in non-Caucasian populations[10]. The age which SPTP occurs is usually around adolescence. In the study of Mao et al., it was shown that the cases described in the literature consisted of women with an average age of 23.9 years[11]. It is stated that female dominance is less in childhood[4].

ETIOLOGY

Although there are various hypotheses about the etiology of SPTP, there is no generally accepted explanation. The most emphasized one is the relationship with sex hormones since it is frequently seen in the adolescent age group. Interestingly, Kosmahl and his colleagues reported that there was sex hormone positivity in all 57 cases they studied, but there is no other study reporting a rate close to this[12]. It has been shown that SPTP grows rapidly in a pregnant woman[13]. Tamoxifen therapy has also been reported to be used successfully in a patient with estrogen receptor positivity[14]. In the study obtained by an extensive literature review and published by Mao et al. it was determined that only 9 of the patients had progesterone receptor positivity and two had estrogen receptor positivity[11]. In the light of the findings mentioned above and since SPTP is a pathology also identified in males, it is more likely that sex hormones play a role in the growth of the tumor rather than its formation.

Although it is not known from which cells SPTP originates it has been suggested that it originates from the ductal, neural crest or endocrine cells of the pancreas[15,16]. Although it comes to mind due to the positive reaction with neuron specific enolase (NSE) and somatostatin insulin glucagon staining of some tumors, hormone production in SPTP has not been shown in many studies[3]. Moreover, NSE positivity is present in many tumors that are not of neuroendocrine origin. Some authors state that this tumor originates from endocrine or pluripotent embryonic stem cells with endocrine differentiation capacity[3,16].

PATHOLOGY

SPTP takes its name from the macroscopic and microscopic appearance of the tumor. When viewed from the outside, it can be noticed that the tumor has a round or oval appearance, is surrounded by a fibrous capsule, and that the cross-sectional surface is covered with solid and cystic, hemorrhagic areas[3]. Microscopically, spindle structures formed by polygonal cells and papillary structures with fibrovascular or pseudorosettes are mentioned. It is stated that cellular atypism and mitotic figures are rarely observed[15]. The nuclei of the tumor cells are also described as round or oval. It is stated that there is some nuclear indentation, the chromatin is loosely observed and small peripherally located nucleoli can be seen attached to the nuclear membrane[15].

Immunohistochemical examinations show that the tumor is generally stained with alpha-1 antitrypsin, vimentin, alpha-1 antichymotrypsin and NSE and in some cases it is positive for epithelial markers S100, CD10, cyclin D1, and cytokeratin[18,19]. In most studies, no staining for pancreatic hormones was detected. Abnormalities such as p53 and K-ras changes, which are frequently detected in pancreatic ductal cancers could not be shown in SPTP[9].

CLINICAL FINDINGS

Since it is a slow-progressing pathology with low malignancy potential, SPTP patients may not show symptoms until the tumor reaches a fairly large diameter. For this reason, it is also reported that some patients are diagnosed with abdominal imaging performed for another reason. In the series of Sun et al. in five out of 28 cases, (17.8%) the tumor was detected by incidental abdominal imaging[20]. It has been stated that the symptoms seen in patients generally consist of gastrointestinal discomfort and pain caused by a large abdominal mass[4]. In the literature, among the reasons that lead patients to apply to the clinic, feeling of discomfort in the abdomen, abdominal pain, loss of appetite, weight loss, nausea, vomiting, noticing an abdominal mass and jaundice have also been reported[8,21]. It is stated that tumor markers and endocrinological tests were

within normal limits in almost all patients and did not contribute to the diagnosis[3,4,16].

DIFFERENTIAL DIAGNOSIS

In the pediatric age group, secondary involvement of the pancreas with lymphoma or neuroblastoma is more common than primary tumors of the pancreas. In addition to SPTP, in the differential diagnosis of masses located in this region;

1. Leukemia, lymphoma, neuroblastoma or pancreatic involvement due to lympho-proliferative diseases,
2. Post-traumatic cysts, retention cysts, inflammatory or hydatid cysts,
3. Exocrine tumors of the pancreas such as pancreatoblastoma, ductal cell carcinoma, acinar cell carcinoma,
4. Endocrine tumors of the pancreas such as islet cell hyperplasia, insulinoma, gastrinoma, vipoma,
5. Connective tissue tumors such as teratoma, hemangioendothelioma and sarcoma should also be kept in mind[3,6].

DIAGNOSTIC EVALUATION

SPTP of the pancreas is localized to the body and tail in approximately two-thirds and to the head of the pancreas in one-third[21]. While SPTP is observed as a heterogeneous mass with encapsulated cystic and solid components on ultrasonography, it can sometimes appear as a mass with a completely solid character or containing septate calcifications or hypoechoic fluid-filled cystic areas[16]. It is possible to both localize the mass and predict the diagnosis with computed tomography (CT) or magnetic resonance imaging (MRI). With CT examination, the image of a heterogeneous mass with peripheral contrast enhancement due to the fibrous capsule is obtained[20]. Due to the superiority in contrast resolution, it may be easier to distinguish tissue features of the lesion such as bleeding, cystic degeneration, and the presence of a capsule in MRI. With this method, a heterogeneous and well-circumscribed mass with low or high signal intensity is seen on T1-weighted images, while heterogeneous and high signal intensity ones are obtained on T2-weighted images. After gadolinium application, heterogeneous peripheral contrast enhancement can be observed in T1 slices[6]. Increased FDG uptake in the lesion can be seen on positron emission tomography (PET)[22]. Despite the advances in imaging methods, it is not possible to make a diagnosis without tissue sampling due to the similarity in cystic lesions. Although needle biopsy from the tumor or cytological examination of the material aspirated from the cyst can sometimes make the diagnosis, in most cases the diagnosis cannot be made until a detailed pathologic examination of the frozen biopsy or resection material[23]. It is observed that a very small number of patients in the reported case series can be diagnosed with SPTP by preoperative fine needle biopsy[8,20,24-26].

TREATMENT

Surgical resection of the tumor is the recommended treatment. While the recommended surgical method for tumors located in the head of the pancreas is pancreaticoduodenectomy, distal pancreatectomy is preferred for tumors located in the tail[27]. Because the tumor is surrounded by a fibrous capsule, it usually allows tissue-sparing surgery. Additionally, lesion size does not stand out as a criterion for operability since large tumors can also be resected with safe surgical margins[9,28]. In selected cases, pylor-preserving pancreaticoduodenectomy and tumor enucleation can be performed[16]. Studies conducted in recent years have reported that laparoscopic resection is a method that can be safely applied in children[29]. Most studies indicate that extensive lymphatic dissection or more aggressive local approaches are not necessary[3]. It has been reported that it is appropriate to surgically remove metastases as much as possible in order to reduce the tumor burden[20]. Chemotherapy and/or radiotherapy have not been proven effective in treating SPTP. Although there are a few cases in which radiotherapy, ifosfamide, cisplatin and etoposide chemotherapy and preoperative gemcitabine treatment were applied, the place of neoadjuvant or adjuvant treatments remains unclear since SPTP is a surgically removable tumor[3,24,30]. Soloni et al. reported that in 5 of 17 cases who had unresectable SPTP surgical resection could have been possible after neoadjuvant cisplatin-based chemotherapy[31]. Patients without any treatment and whose tumors were monitored as stable have also been reported[8].

PROGNOSIS

It is reported that the 5-year overall survival in SPTP, which exhibits features of low-grade malignancy, is over 90%. It is stated that distant metastases occur in

approximately 10% of cases and tumor-related deaths are rare[16]. Although rare, it has been reported that SPTP behaves locally aggressively, shows local recurrence, and metastasizes to the liver or peritoneum after resection[21]. In general, it has been observed that the tumor behaves more aggressively in older ages and in men[32].

CONCLUSION

Although complete resection is curative in most patients, the optimal surgical strategy for SPNP in children remains controversial. Instead of radical resections, limited pancreatic resections with negative surgical margins, such as enucleation, should be tried in selected cases. It is of great importance that radiologists, pediatric surgeons and pathologists, as well as pediatric oncologists, have knowledge about SPTP in order to diagnose this entity correctly and treat it appropriately, as it is rare in the pediatric age group and has been shown to have a very good prognosis with surgical resection.

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REFERENCES

1. Ye J, Ma M, Cheng D, Yuan F, Deng X, Zhan Q et al. Solid-pseudopapillary tumor of the pancreas: clinical features, pathological characteristics, and origin. J Surg Oncol. 2012;106:728-35.
2. Thambugala GM, Pereira J, Sugo E, Henry G, Cohn RJ. Solid and cystic papillary epithelial neoplasm of the pancreas in an 11-year-old girl: imaging features with pathological correlation. Australas Radiol. 2006;50:373-6.
3. Rebhandl W, Felberbauer FX, Puig S, Paya K, Hochschorner S, Barlan M et al. Solid-pseudopapillary tumor of the pancreas (Frantz tumor) in children: report of four cases and review of the literature. J Surg Oncol. 2001;76:289-96.
4. Jung SE, Kim DY, Park KW, Lee SC, Jang JJ, Kim WK. Solid and papillary epithelial neoplasm of the pancreas in children. World J Surg. 1999;23:233-6.
5. Irtan S, Galmiche-Rolland L, Elie C, Orbach D, Sauvanet A, Elias D et al. Recurrence of solid pseudopapillary neoplasms of the pancreas: results of a nationwide study of risk factors and treatment modalities. Pediatr Blood Cancer. 2016;63:1515-21.
6. Zhang H, Liang TB, Wang WL, Shen Y, Ren GP, Zheng SS. Diagnosis and treatment of solid-pseudopapillary tumor of the pancreas. Hepatobiliary Pancreat Dis Int. 2006;5:454-8.
7. Singh P, Patel K, Ramakrishna B. Solid pseudopapillary tumor of the pancreas: A retrospective analysis of 36 cases from a single institution in India. Indian J Cancer. 2015;52:439-42.
8. Yalçın B, Yağcı-Küpeli B, Ekinci S, Orhan D, Oğuz B, Varan A et al. Solid pseudopapillary neoplasm of the pancreas in children: Hacettepe experience. ANZ J Surg. 2019;89:E236-E240.
9. Casanova M, Collini P, Ferrari A, Cecchetto G, Dall'Igna P, Mazzaferro V. Solid-pseudopapillary tumor of the pancreas (Frantz tumor) in children. Med Pediatr Oncol. 2003;41:74-6.
10. Madan AK, Weldon CB, Long WP, Johnson D, Raafat A. Solid and papillary epithelial neoplasm of the pancreas. J Surg Oncol. 2004;85:193-8.
11. Mao C, Guvendi M, Domenico DR, Kim K, Thomford NR, Howard JM. Papillary cystic and solid tumors of the pancreas: a pancreatic embryonic tumor? Studies of three cases and cumulative review of the world's literature. Surgery. 1995;118:821-8.
12. Kosmahl M, Seada LS, Jänig U, Harms D, Klöppel G. Solid-pseudopapillary tumor of the pancreas: its origin revisited. Virchows Arch. 2000;436:473-80.
13. Morales A, Ruíz Molina JM, Estéves HO, Robles-Díaz G, Díaz-Sánchez V. Papillary-cystic neoplasm of the pancreas. A sex-steroid dependent tumor. Int J Pancreatol. 1998;24:219-25.
14. Sclafani LM, Reuter VE, Coit DG, Brennan MF. The malignant nature of papillary and cystic neoplasm of the pancreas. Cancer. 1991;68:153-8.
15. Kallichanda N, Tsai S, Stabile BE, Buslon V, Delgado DL, French SW. Histogenesis of solid pseudopapillary tumor of the pancreas: the case for the centroacinar cell of origin. Exp Mol Pathol. 2006;81:101-7.
16. Divarcı E, Dökümcü Z, Çetingül N, Nart D, Barbet FY, Ergün O et al. Radical resection of the pancreas should not always be necessary in the surgical management of pancreatic solid pseudopapillary tumor in children. Turk J Gastroenterol. 2017;28:214-18.
17. Vinores SA, Bonnin JM, Rubinstein LJ, Marangos PJ. Immunohistochemical demonstration of neuron-specific enolase in neoplasms of the CNS and other tissues. Arch Pathol Lab Med. 1984;108:536-40.
18. Pettinato G, Manivel JC, Ravetto C, Terracciano LM, Gould EW, di Tuoro A et al. Papillary cystic tumor of the pancreas. A clinicopathologic study of 20 cases with cytologic, immunohistochemical, ultrastructural, and flow cytometric observations, and a review of the literature. Am J Clin Pathol. 1992;98:478-88.
19. Stömmer P, Kraus J, Stolte M, Giedl J. Solid and cystic pancreatic tumors. Clinical, histochemical, and electron microscopic features in ten cases. Cancer. 1991;67:1635-41.

20. Sun CD, Lee WJ, Choi JS, Oh JT, Choi SH. Solid-pseudopapillary tumours of the pancreas: 14 years experience. ANZ J Surg. 2005;75:684-9.
21. Salvia R, Bassi C, Festa L, Falconi M, Crippa S, Butturini G et al. Clinical and biological behavior of pancreatic solid pseudopapillary tumors: report on 31 consecutive patients. J Surg Oncol. 2007;95:304-10.
22. Lee JK, Tyan YS. Detection of a solid pseudopapillary tumor of the pancreas with F-18 FDG positron emission tomography. Clin Nucl Med. 2005;30:187-8.
23. Ward HC, Leake J, Spitz L. Papillary cystic cancer of the pancreas: diagnostic difficulties. J Pediatr Surg. 1993;28:89-91.
24. Ky A, Shilyansky J, Gerstle J, Taylor G, Filler RM, Grace N et al. Experience with papillary and solid epithelial neoplasms of the pancreas in children. J Pediatr Surg. 1998;33:42-4.
25. Tipton SG, Smyrk TC, Sarr MG, Thompson GB. Malignant potential of solid pseudopapillary neoplasm of the pancreas. Br J Surg. 2006;93:733-7.
26. Nadler EP, Novikov A, Landzberg BR, Pochapin MB, Centeno B, Fahey TJ et al. The use of endoscopic ultrasound in the diagnosis of solid pseudopapillary tumors of the pancreas in children. J Pediatr Surg. 2002;37:1370-3.
27. Peng CH, Chen DF, Zhou GW, Yang WP, Tao ZY, Lei RQ et al. The solid-pseudopapillary tumor of pancreas: the clinical characteristics and surgical treatment. J Surg Res. 2006;131:276-82.
28. Bochis OV, Bota M, Mihut E, Buiga R, Hazbei DS, Irimie A. Solid pseudopapillary tumor of the pancreas: clinical-pathological features and management of 13 cases. Clujul Med. 2017;90:171-8.
29. Petrosyan M, Franklin AL, Jackson HT, McGue S, Reyes CA, Kane TD. Solid pancreatic pseudopapillary tumor managed laparoscopically in adolescents: a case series and review of the literature. J Laparoendosc Adv Surg Tech A. 2014;24:440-4.
30. Fried P, Cooper J, Balthazar E, Fazzini E, Newall J. A role for radiotherapy in the treatment of solid and papillary neoplasms of the pancreas. Cancer. 1985;56:2783-5.
31. Soloni P, Cecchetto G, Dall'igna P, Carli M, Toffolutti T, Bisogno G. Management of unresectable solid papillary cystic tumor of the pancreas. A case report and literature review. J Pediatr Surg. 2010;45:e1-6.
32. Horisawa M, Niinomi N, Sato T, Yokoi S, Oda K, Ichikawa M et al.. Frantz's tumor (solid and cystic tumor of the pancreas) with liver metastasis: successful treatment and long-term follow-up. J Pediatr Surg. 1995;30:724-6.