Precision anatomy for minimally invasive spleen-preserving distal pancreatectomy in children: a case of solid-pseudopapillary neoplasm in a 12-year-old girl

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Abstract

There is no standardized procedure for solid pseudopapillary neoplasm (SPN) of the pancreatic body and tail in children. Recently, an international consensus on precision anatomy for minimally invasive distal pancreatectomy in adults was established. This is the first report of a 12-year-old girl with an incidentally found SPN measuring 7.5 cm in diameter located in the pancreatic tail who successfully underwent an R0 resection by laparoscopic spleen-preserving distal pancreatectomy under the concept of precision anatomy. The implementation of this concept in the pediatric population should facilitate the safe diffusion of MIDP for SPN and other benign or low-malignant tumors in children.

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Abstract

There is no standardized procedure for solid pseudopapillary neoplasm (SPN) of the pancreatic body and tail in children. Recently, an international consensus on precision anatomy for minimally invasive distal pancreatectomy in adults was established. This is the first report of a 12-year-old girl with an incidentally found SPN measuring 7.5 cm in diameter located in the pancreatic tail who successfully underwent an R0 resection by laparoscopic spleen-preserving distal pancreatectomy under the concept of precision anatomy. The implementation of this concept in the pediatric population should facilitate the safe diffusion of MIDP for SPN and other benign or low-malignant tumors in children.

Key words

Precision anatomy, Minimally invasive distal pancreatectomy, Solid pseudopapillary neoplasm, Pediatric pancreatic tumor, Laparoscopic spleen-preserving distal pancreatectomy

Introduction

Solid pseudopapillary neoplasm (SPN) is a rare, low malignant tumor seen in young females. The treatment is complete resection and is usually associated with excellent long-term prognosis.

Recently, an international consensus on precision anatomy for minimally invasive distal pancreatectomy (MIDP) in adults was established [1]. Although the safety and feasibility of MIDP for SPN in the pediatric population has also been reported [2], no standardized procedure for children has been described to date.

We report a 12-year-old girl with an incidental SPN located in the pancreatic tail who successfully underwent an R0 resection by laparoscopic spleen-preserving distal pancreatectomy under the concept of precision anatomy.

Case report

A 12-year-old girl was referred to our hospital with an incidentally found tumor located in the pancreatic tail. Computed tomography (CT) revealed a well-circumscribed, hypovascular, 7.5 cm-solid mass in the pancreatic tail (Figure 1A). Carcinoembryonic antigen and carbohydrate antigen 19-9 levels were not elevated and SPN was suspected. No distant metastases were confirmed by positron emission tomography (PET)/CT. Dynamic CT revealed that the splenic artery (SpA) originated from the celiac artery (Type I, Adachi's classification) running along the superior edge of the pancreas (SpA type B, Inoko's classification) [3]. Laparoscopic spleen-preserving distal pancreatectomy was planned.

The patient was placed in a lithotomy position, and the scopist stood between her legs. A 12-mm camera port was placed at the umbilicus. Three 5-mm ports were placed at the right upper quadrant, left upper quadrant, and left flank. Another 12-mm port was introduced at right flank. After dividing the gastrocolic ligament, the inferior border of the pancreas was mobilized to secure adequate proximal resection margin; therefore, the root of the splenic artery, left gastric vein, and inferior mesenteric vein remained unexposed. The left gastroepiploic vessels were preserved [1]. Splenic artery was running the superior edge of pancreatic parenchyma, hence we approached it from above (anterior approach) [1,4] (Figure 1Ba). The dorsal dissection border of the pancreas was maintained along the anterior layer above the Gerota's fascia. After splenic

artery and vein were encircled individually, we carefully dissected the splenic vessels from the pancreatic parenchyma. (Figure 1Bb) [1,4]. We preserved the splenic vessels (Kimura technique) to decrease the risk of complications [1,4]. After compressing the pancreatic parenchyma with intestinal clips (Figure 1Bc), the pancreas was divided using an automatic stapling device (Figure 1Bd). The resected specimen was retrieved through a Pfannenstiel incision (operative time, 301 minutes; estimated blood loss, little). Histopathological diagnosis revealed SPN with negative surgical margins. The patient recovered uneventfully except for a biochemical leak [5] and localized discoloration in the superior pole of spleen requiring no intervention. She was discharged on day 7. She is alive and well with no signs of recurrence 1 year after the operation.

Discussion

In adults, MIDP has become the preferred approach for the treatment of the pancreatic tumor located in the body or tail and an international consensus on precision anatomy for MIDP was recently established. Laparoscopic spleen preserving distal pancreatectomy (LSPDP) has the advantage of eliminating the risk of overwhelming post-splenectomy sepsis and has been proposed for benign or low-grade malignant tumor in adults. Theoretically speaking, LSPDP should be the treatment of choice in the pediatric population as well. However, the data on the safety and efficiency of MIDP in children remains scarce. The present case is the first report of LSPDS for a child under the concept of precision anatomy.

To the best of our knowledge, only a total of 34 pediatric patients (less than 18 years old) who have undergone MIDP for SPN of the pancreatic body or tail has been reported in English literature (Table1). Of 34 MIDPs, spleen preservation was attempted in 26 cases; however, splenectomy was required for a tumor in the close vicinity of the splenic hilum and for another tumor in which the splenic vessels were embedded. In the remaining 24 cases with spleen preservation, splenic vessels were preserved (Kimura's technique) in 20 and in the other 2 cases, spleen vessels were dissected (Warshaw' s technique). In Warshaw' s technique, the blood flow to the spleen is compensated by collateral circulation [4].

The aforementioned international consensus underscores the importance of understanding the pros and cons of Kimura's and Warshaw's techniques. Although Kimura's technique leads to fewer postoperative complications related to infection and pancreatic fistula compared to Warshaw's, it is technically more demanding. In the present case, Kimura's technique was successfully performed and resulted in an uneventful recovery. In addition, the recognition of celiac trunk variation, origin and course of the splenic and dorsal pancreatic arteries, and drainage pattern of left gastric and inferior veins is paramount to perform MIDP safely under the concept of precision anatomy. The preservation of the left gastric/gastroepiploic veins and splenic hilum veins is crucial to prevent symptomatic gastric varices [1]. In the present case, we intentionally did not expose the celiac trunk and left gastric/gastroepiploic veins because the tumor was located in the very end of the pancreatic tail, but we precisely checked the courses of these vessels preoperatively to ensure preservation. It is also important to identify the anatomical layer when dissecting the posterior aspect of the pancreas. We first identified the Gerota's fascia and kept the dissection line above so as not to injure other structures. There are two approaches to dissect the splenic artery in relation to the pancreatic parenchyma; anterior and posterior. A comparative study revealed that the anterior approach resulted in shorter operative time and lower estimated blood loss than the posterior approach.

In conclusion, the implementation of precision anatomy for MIDP in the pediatric population is urgently needed to establish LSPDP as a standardized procedure for SPN and other benign or low-grade malignant tumors in the pancreatic body or tail in children. Randomized controlled trial is unlikely to take place considering the low incidence rate of SPN and global collaborations are warranted for safe diffusion of this procedure.

References

1. Ban D, Nishino H, Ohtsuka T, et al. International Expert Consensus on Precision Anatomy for minimally invasive distal pancreatectomy: PAM-HBP Surgery Project. *J Hepatobiliary Pancreat Sci.*2022;29(1):161-173.

2. Namgoong JM, Kim DY, Kim SC, et al. Laparoscopic distal pancreatectomy to treat solid pseudopapillary tumors in children: transition from open to laparoscopic approaches in suitable cases. *Pediatr Surg Int.* 2014 Mar;30(3):259-66.
3. Nishino H, Zimmitti G, Ohtsuka T, et al. Precision vascular anatomy for minimally invasive distal pancreatectomy: A systematic review.*J Hepatobiliary Pancreat Sci.* 2022;29(1):136-150.
4. Ban D, Garbarino GM, Ishikawa Y, et al. Surgical approaches for minimally invasive distal pancreatectomy: A systematic review. *J Hepatobiliary Pancreat Sci.* 2022;29(1):151-160.
5. Bassi C, Marchegiani G, Dervenis C, et al. The 2016 update of the International Study Group (ISGPS) definition and grading of postoperative pancreatic fistula: 11 Years After. *Surgery.*2017;161(3):584-591.

Figure Legends

Figure 1.

(A) Preoperative dynamic computed tomography revealed that the splenic artery originated from the celiac artery (Type I, Adachi's classification), running along the superior edge of the pancreas (SpA type B, Inoko's classification)

(B) After switching from posterior to anterior approach, the splenic artery was encircled for traction because they were firmly embedded in the pancreatic parenchyma (a). The posterior dissection line was kept above the renal fascia (b). After compression of the pancreatic parenchyma with two intestinal clips (c), the pancreas was divided with an automatic stapling device (d).

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