

Case Report

A Case Report of Non-typical Annular Pancreas Diagnosed during Laparoscopic Gastric Surgery

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An annular pancreas is a rare anomaly of the pancreas, defined as pancreatic tissue that totally or partly encircles the duodenum, usually the descending portion. A 76-year-old man who was diagnosed with gastric cancer cT3N0M0 Stage IIB underwent laparoscopic distal gastrectomy with D2 lymph node dissection. Intraoperatively, the dorsal half of the duodenal bulb was seen to be half surrounded by the pancreas, and a non-typical annular pancreas was diagnosed. Because of the risk to the pancreas, it was considered impossible to perform anastomosis by a linear stapler as in the usual laparoscopic procedure. Therefore, we performed laparoscopically assisted distal gastrectomy and Billroth-I reconstruction using a circular stapler, and the surgery was completed without difficulties. His postoperative course was good despite the development of a pancreatic fistula, which was an International Study Group for Pancreas Fistula biochemical leak. Some APs can be diagnosed preoperatively, but the rarer subtypes such as ours are more difficult to visualize on imaging. In gastrectomy, it is both oncologically important and technically challenging to perform lymph node dissection around the pancreas. In this case with an especially proximal pancreas, a circular stapler was considered better suited for gastroduodenal anastomosis and required a broader field than that afforded by laparoscopy. A case of non-typical annular pancreas diagnosed during laparoscopic gastric surgery is described.

Key words: annular pancreas, gastric cancer, laparoscopic distal gastrectomy

An annular pancreas (AP) is a rare congenital anomaly of the pancreas that is defined as pancreatic tissue that totally or partly encircles the duodenum, usually the descending or second portion. It can be difficult to diagnose some of the rarer subtypes of AP by preoperative imaging. Gastric cancer (GC) surgery always requires careful lymph node dissection and reconstruction to avoid harming the pancreas. This is particularly in the case of a rare annular pancreas affecting the duodenal bulb. We report our case and

summarize other reports of GC surgery in the case of AP.

Case Presentation

A 76-year-old man with a past medical history of dyslipidemia and urinary calculus underwent esophagogastroduodenoscopy (EGD) because of weight loss. EGD showed an ulcerated tumor in the anterior gastric angle, and the histological examination led to a diagnosis of poorly differentiated adenocarcinoma (Fig. 1A).

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No other findings of the stomach and duodenum were revealed (Fig. 1B). He had no medical history of upper abdominal symptoms such as hematemesis or gastric outlet obstruction. On laboratory examination, only mild anemia (Hb 12.6 g/dL; normal, 13.7-16.8 g/dL) was found, with normal routine laboratory data and normal tumor marker (CEA and CA-19) levels. Abdominal computed tomography (CT) showed thickening of the stomach wall at the gastric angle and enlarged lymph nodes at stations 3 and 7, but no findings of distant metastasis. There was no preoperative comment from the radiologist on the duodenum and pancreas. The diagnosis was gastric cancer (cT3, N0, M0, Stage IIB), and laparoscopic distal gastrectomy (LDG), D2 lymph node dissection, and Billroth-I

reconstruction were planned.

Intraoperatively, during lymphadenectomy at station 6, it was found that the dorsal half of the duodenal bulb was surrounded by pancreatic tissue, and a non-typical annular pancreas was diagnosed (Fig. 2A). We examined the course of the associated arteries including the anterior superior pancreaticoduodenal artery (Fig. 2B), which were normal. Retrospectively, it was confirmed that the abdominal CT did show pancreatic tissue close to the dorsum of the duodenal bulb, and three-dimensional reconstruction CT revealed that the pancreatic duct was included in that tissue (Fig. 3). The lymphadenectomy was completed without any difficulties. On the other hand, we confirmed jejunal adhesions, and it seemed inappropriate to transect the

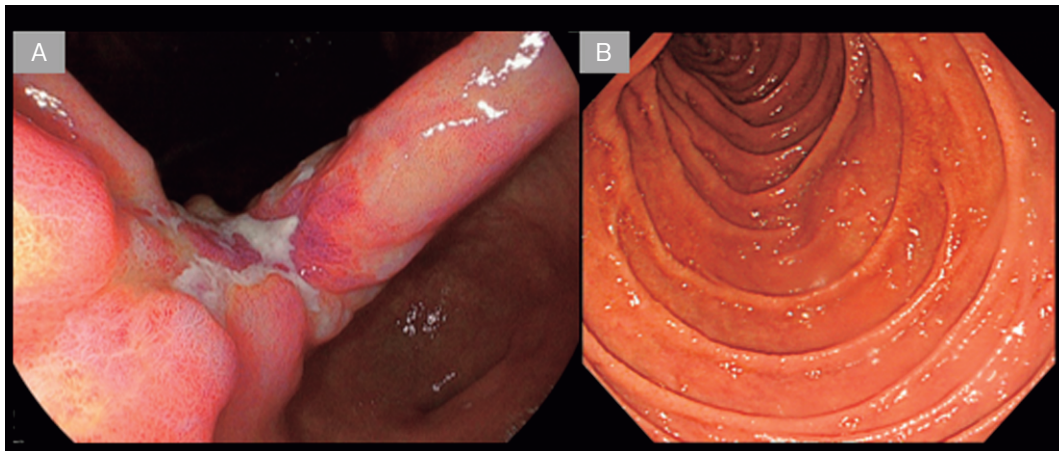


Fig. 1 EGD findings. **A**, EGD shows an ulcerated tumor at the gastric angle; **B**, There were no findings in in the 2nd portion of the duodenum.

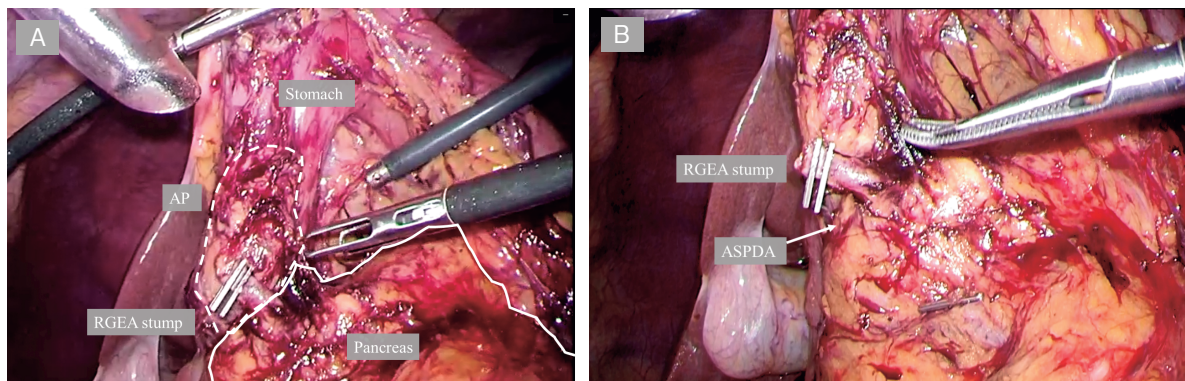


Fig. 2 Intraoperative findings. AP encircles the dorsal half of the duodenal bulb. The AP area is enclosed in the dotted line, and the normal pancreas is shown by the normal line. RGEA: Right gastroepiploic artery



Fig. 3 Preoperative abdominal CT imaging. CT (**A**, axial; **B**, coronal) shows pancreatic tissue close to the dorsal duodenal bulb. Arrow indicates AP; **C**, Three-dimensional CT reconstructed by [®]SYNAPSE VINCENT shows an AP duct that is into the Santorini duct from the ventral site.

duodenum with AP by a linear stapler because the AP was close to the required resection site of the duodenum. With this issue as well as the inadvisability of Billroth-II or Roux-en Y reconstruction due to jejunal AP adhesions, a laparoscopy-only procedure became less viable. A circular stapler was identified as the proper tool for the Billroth-I anastomosis because of the duodenum's limited length, and the total laparoscopic procedure was converted to a laparoscopically assisted procedure, in which a 5-cm laparotomy was made at the median epigastric incision.

The operating time was 268 min, and estimated blood loss was 100 ml. The histopathological examination according to the Japanese Classification of Gastric Carcinoma (The 15th Edition) [1] was 4.0×3.5 cm, subserosa (SS), poorly differentiated adenocarcinoma, type 3, pT3N0M0, stage IIA. Although his postopera-

tive course included a pancreatic fistula, which was an International Study Group for Pancreas Fistula (ISGPF) BL (biochemical leak), he recovered with conservative treatment and was discharged on postoperative day 13.

Discussion

There are many reports of AP associated with pancreatectomy, but the reports associated with gastrectomy are very rare. The reason why it is rare is that lymph node dissection and reconstruction are not so difficult in the case of a common type of AP, which is located at the 2nd or descending portion of the duodenum. On the other hand, lymph node dissection and reconstruction for GC is affected when AP is found on the duodenal bulb, as in the present case. First, at the station 6 lymph node dissection, the pancreatic tissue

may be closer than usual to the pyloric ring. Even when the anatomy is normal, lymph node dissection of the infrapyloric area may lead to unexpected pancreatic injury. If the pancreas is especially close to the duodenal stump, the reconstruction method and approach may need to be reconsidered. In the case of a complete-type AP, Billroth-II or Roux-en-Y reconstruction can generally be recommended because of the complications of AP, such as duodenal stenosis. In the present case, because we had confirmed jejunal adhesions, we elected against Billroth-II or Roux-en-Y reconstruction and needed to change the reconstruction method using a circular stapler via a small laparotomy to avoid pancreatic and/or jejunal injury.

There are few reports about lymph node dissection for GC with AP. However, there are a few case reports of gastrectomy with anatomical anomalies of the pancreas [2, 3]. They showed that the shape of the pancreas is important, and any protrusion of the head of the pancreas is a risk factor for postoperative pancreatic fistula. Whereas laparoscopic surgery has become the standard modality, this case required an intraoperative change of the surgical strategy.

An AP is a rare congenital anomaly by which pancreatic tissue totally or partially encircles the duodenum during the first four to eight weeks of embryonic development; the pancreas normally develops following rotation and fusion of the dorsal and ventral pancreatic buds as a result of the expansion of the duodenum [4]. In previous reports, two hypotheses have been suggested to explain the cause of AP: Lecco's theory involves adhesion of the right ventral angle to the duodenal wall [5] while Baldwin's theory involves persistence of the left ventral bud [6]. Neither theory explains all AP cases, but it is clear that APs are derived from the ventral bud of the pancreas [7]. In older reports, AP was reported in 3 of 20,000 autopsies [8] and 3 of 24,519 surgical cases [9]. Although AP is rare, it is now recognized more frequently due to progress in diagnostic imaging. In patients undergoing endoscopic retrograde cholangiopancreatography (ERCP), one in 1000 examined cases was found to have an AP [10]. CT may show the pancreatic tissue encircling the duodenum completely or partially, but ERCP is specific for the diagnosis of AP because it outlines the pancreatic duct. Other devices available for the diagnosis of AP are magnetic resonance imaging (MRI), magnetic resonance cholangiopancreatography (MRCP), and endo-

scopic ultrasonography (EUS) [11, 12]. These diagnostic tools are useful for the diagnosis of AP. However, since these examinations cannot be done in all patients, it is difficult to detect and diagnose it preoperatively. The main complications of AP are generally peptic ulcers, cholecystolithiasis, and pancreatitis [6]. Treatment is not necessary for AP without symptoms, but surgical bypass of the duodenum is indicated for severe stenosis.

Yogi *et al.* [13] classified AP into 6 subtypes, with types I and II being the most common. This classification was a modification of Yumura's classification, which was reported in Japanese in 1976. Yumura *et al.* noted that there was a type of AP derived from pancreatic tissue that adheres to the outer intestinal wall, and this subtype was classified into type V and VI by Yogi. Our case was a type V, and this non-typical AP represents a very rare case.

AP has also been classified into "complete" or "incomplete" types depending on the pancreatic morphology. Complete-type AP describes cases in which the pancreatic parenchyma or annular duct has completely encircled the second part of the duodenum, whereas incomplete-type AP only partially encircles the second part of the duodenum [4]. Complete-type AP is more likely to cause symptoms or be easily detected by imaging, whereas incomplete type AP has fewer symptoms and is difficult to detect.

Lymph node dissection, especially peri-pancreatic lymph node dissection such as that at stations 6, 7, 8a, 9, 11p, and 12a, is one of the most important parts of gastrectomy. It is well known that a postoperative pancreatic fistula is one of the most severe complications after gastrectomy with lymph node dissection [14]. In the gastrectomy for GC with AP, especially in AP type V, the length of the free duodenum is too short to transect with a linear stapler. In such cases, the appropriate approach for reconstruction may need to be reconsidered. It is necessary to follow the patient carefully for postoperative complications such as pancreatic fistula or anastomotic leakage.

Conclusions

We report an adult case of non-typical annular pancreas which was diagnosed during laparoscopic gastric surgery and required conversion to laparotomy. In gastrectomy for GC with AP, the structure of the pancreas

is the key to choosing the right approach. A circular stapler was used for the gastroduodenal anastomosis, and the patient progressed without major complications.

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