Endoscopy-assisted totally laparoscopic resection of a submucosal tumor of the duodenum

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Although, endoscopic polypectomy is one of the first options for diagnosis and treatment of submucosal tumors of the duodenum, it is sometimes difficult for large or sessile tumors. Therefore, local excision or more extended surgery is performed under open laparotomy. In this paper, we present a laparoscopic resection of Brunner's gland hyperplasia of the duodenum which demonstrated rapid interval size change. A 73-year-old male with a histologically unproven submucosal tumor underwent endoscopy-assisted laparoscopic resection of the tumor and intracorporeal suturing of the defect. Simultaneous duodenoscopy and laparoscopy were performed to identify the line of resection. A duodenotomy was performed and the tumor was excised after everting the tumor toward the abdominal cavity. The defect was handsewn with the greater curvature side rolled caudally with an exteriorized stay suture. Postoperative pain was minimal and the patient quickly returned to normal activity. Our new technique provides a minimal invasive treatment for tumors of the duodenum.

Key words: endoscopy, laparoscopy, Brunner's gland hyperplasia, duodenum

INTRODUCTION

Duodenal tumors account for 1% to 2% of total gastrointestinal tract tumors [1, 2]. Benign tumors of the duodenum represent 16% of all benign tumors of the small intestine; among them, the most frequent are leiomyoma, adenoma, lipoma, and schwannoma tumors [1]. These tumors may appear like a submucosal tumor, which makes differential diagnosis difficult. Although, ultrasosnographic evaluation is sometimes informative, histological confirmation depends on endoscopic biopsy. However, histological examination is occasionaly hampered by normal duodenal mucosa covering the tumor, and rigorous biopsy results in massive bleeding which can be life-threatening. Except for symptomatic or premalignant tumors, management of submucosal tumors may be conservative. Endoscopic resection [2, 3], which is one of the first options for diagnosis and treatment of tumors of the duodenum, is at times challenging in cases such as large or sessile tumors for which total layer resection with closure is required. Open surgery such as local excision, pancreas-preserving duodenectomy [4], or even pancreaticoduodenectomy is necessary for complete resection of tumors of the duodenum. Recently, laparoscopic treatments for duodenal tumors have been reported to reduce invasiveness [1, 5-18]. In this paper, we present a minimally invasive surgical option for resection of a duodenal submucosal tumor: endoscopy-assisted laparoscopic total layer resection of the tumor and intracorporeal suturing of the defect.

CASE REPORT

In 2003, a 73-year-old male was diagnosed with a submucosal tumor of the duodenal bulb close to the pyloric ring during a routine check by upper gastrointestinal endoscopy. At the time of diagnosis, the diameter of the tumor was 0.7 cm. The tumor demonstrated rapid interval size change up to 1.5 cm with more protrusion into the duodenal lumen within an year in 2007 (Fig. 1). A definite diagnosis was not made with repeated biopsy specimens. Upper gastrointestinal series disclosed a filling defect in the anterior wall of the duodenal bulb (Fig. 2). Endoscopic ultrasonography disclosed a low-echoic, solid tumor in the duodenal bulb. CT demonstrated a round tumor with contrast enhancement protruded into the bulb without an extraluminal component. Distant metastasis and regional lymph node swelling were absent. Endoscopic resection was failed because the sessile tumor was not elevated even after saline injection into the submucosal layer, suggesting that the tumor extended into the muscle layer. The patient, who hoped for minimal invasive treatment instead of conservative observation, was referred to surgery. Finally, the patient decided to undergo laparoscopic resection of the tumor.

The patient was placed in the supine position with his legs apart. The first trocar was inserted below the umbilicus using the Hasson technique for insertion of a flexible fiberscope (Fujinon). Then, two trocars were
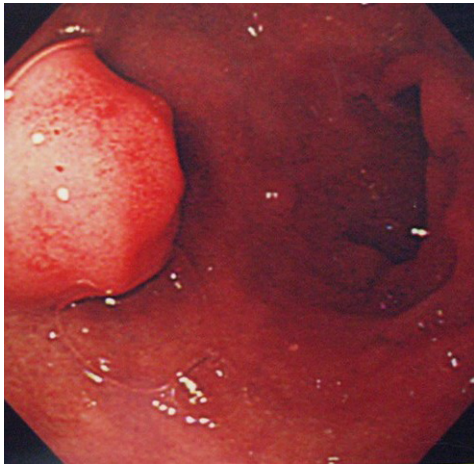
Fig. 1. Endoscopic appearance of the tumor
A sessile tumor was observed in the anterior wall of the duodenum close to the pyloric ring. The tumor rapidly grew to 1.5 cm within an year and increasingly protruded into the duodenal bulb.
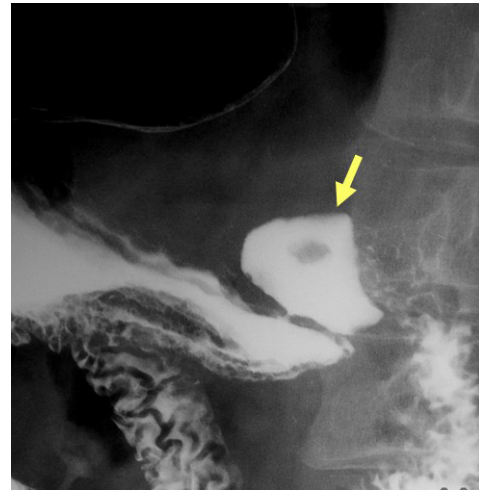

Fig. 2. Upper gastrointestinal series taken in the prone position demonstrated a filling defect (arrow) in the anterior wall of the duodenum.
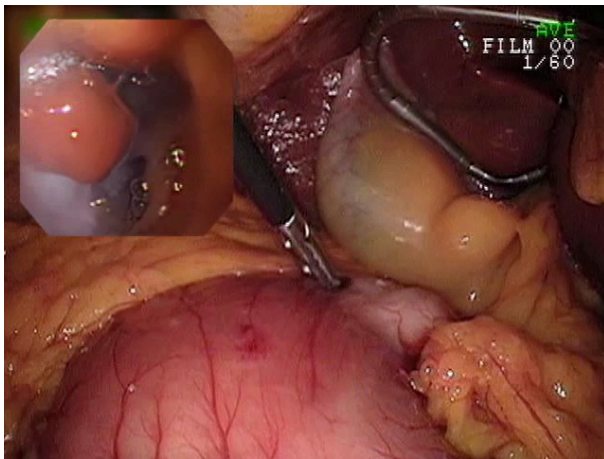

Fig. 3. Endoscopic transillumination of the duodenum in the area of the tumor and direct laparoscopic palpation of the insufflated duodenum. Inset: endoscopic view of the tumor

inserted in the upper and middle abdomen on the right midclavicular line. One trocar was inserted on the left side. For introduction of a liver retractor, one trocar was inserted under the xyphoid process on the left side of the hepatic teres. With the patient placed in the reverse Trendelenburg position, the surgeon stood on the right side of the patient with the assistant on the opposite side to introduce the liver retractor and grasper. After clamping the jejunum, intraoperative duodenoscopy was performed to identify the tumor location. With the aid of endoscopic transillumination of the duodenum in the area of the tumor and direct laparoscopic palpation of the insufflated duodenum, the surgeon made a mark precisely on the tumor-free margin using an electrocautery probe (Fig. 3). Fat tissue attached to the lesser and greater curvature sides of the duodenum was cut to obtain sufficient margins for suturing.

With the active blade of laparosonic coagulating sheers (LCS, Harmonic ACE; Ethicon EndoSurgery), the surgeon performed duodenotomy on the distal margin of the duodenal tumor (Fig. 4a). After dilating the duodenal wound, the submucosal tumor was everted toward the abdominal cavity (Fig. 4b). The tumor

was excised using the LCS with a margin toward the pyloric ring (Fig. 4c). In this way, we could minimize the defect of the duodenal wall. The resected specimen was put in a pouch made from the finger tip of a rubber glove, and was removed through the right middle port.

An anchoring suture was placed on the greater curvature side of the duodenum, which was exteriorized through the abdominal wall using an EndoClose (TycoHealthcare) to obtain a caudal rotation of the suture line which was transverse to the duodenum. Using the right lower port for the fiberscope, the surgeon introduced a needle holder from the umbilical port and the grasper from the right upper port. Beginning from the lesser curvature side of the duodenum, a continuous, full-thickness suture using 3-0 Polysorb (Syneture) was placed toward the greater curvature side (Fig. 4d). The suture was reinforced by adding four stitches of interrupted seromuscular sutures and an omental patch. A closed suction drain was placed under the hepatoduodenal ligament.

Postoperative pain was minimal with no additional analgesia other than continuous epidural anesthesia. The patient was ambulatory the next day. He started
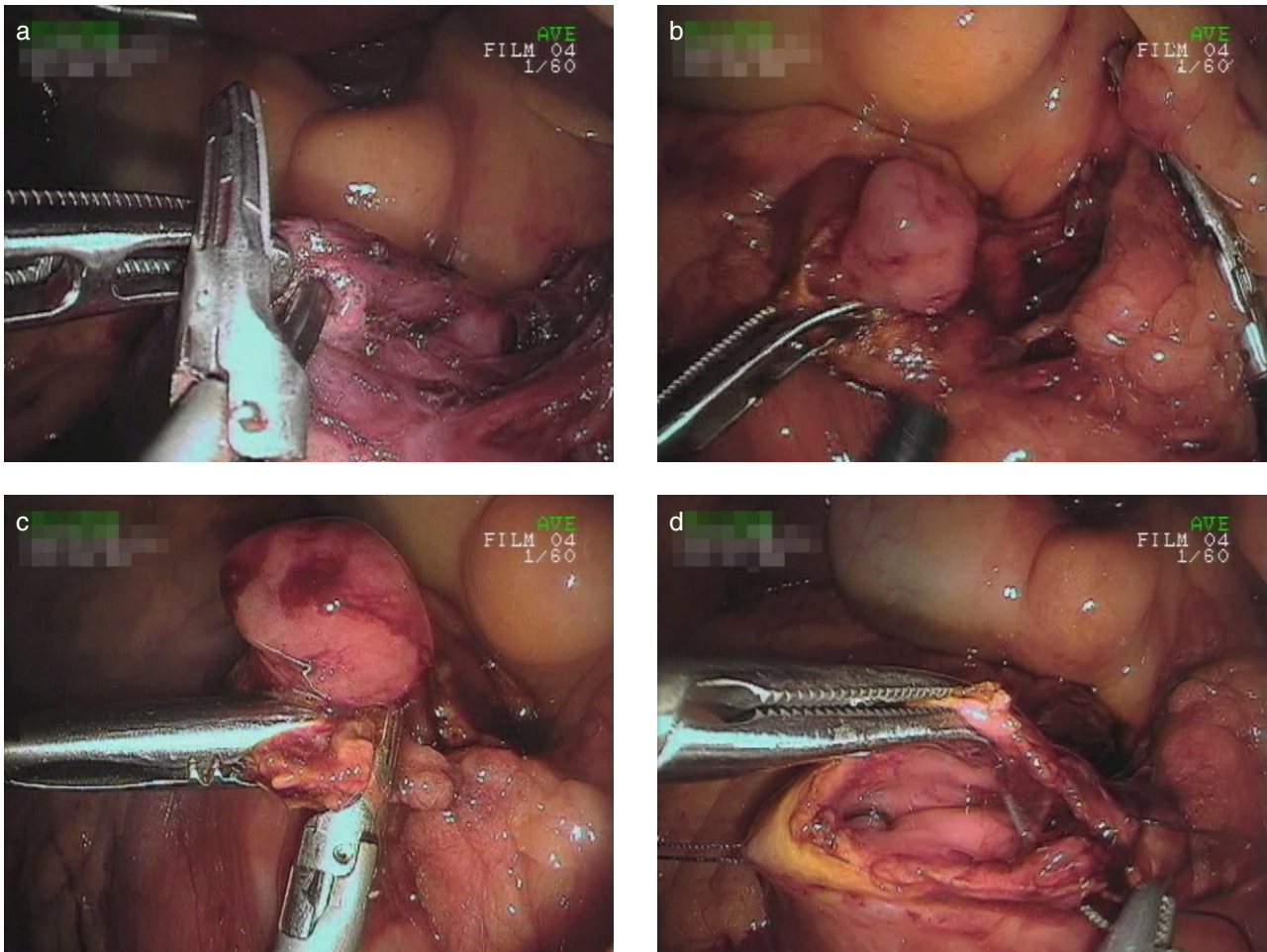
Fig. 4. Laparoscopic view of the operative procedure
(A) A duodenal wound was made in the distal margin of the duodenal tumor using the active blade of the LCS. (B) The tumor was everted to the abdominal cavity. (C) Resection proceeded toward the pyloric ring using the LCS. (D) Continuous full-thickness suture was performed with the greater curvature side rolled caudally.
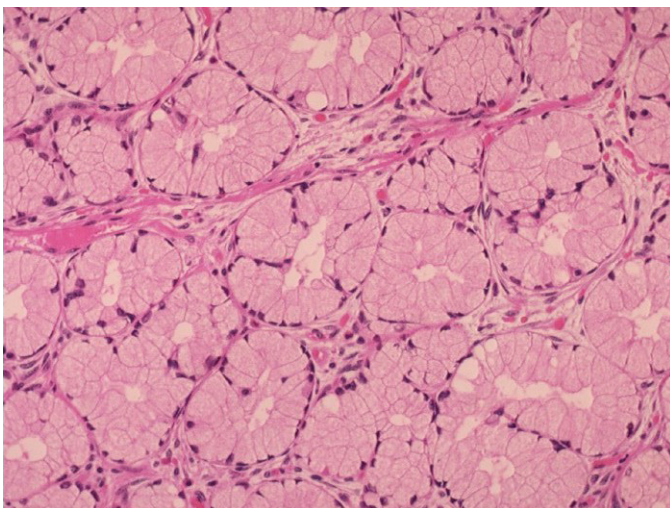

Fig. 5. Histological appearance of the tumor. The tumor consisted of a dilated Brunner's gland and no dysplasia was observed. Pathological diagnosis was Brunner's gland hyperplasia. (Original magnification ×100)

on a liquid diet which proceeded to a soft diet. The resected tumor demonstrated a 1.5 cm × 0.8 cm solid structure. Microscopic examination revealed a cystic dilatation of the Brunner's gland, and no abnormal structure or dysplasia was observed, hence the tumor was diagnosed as Brunner's gland hyperplasia (Fig. 5). Postoperative endoscopic examination performed one month after the surgery demonstrated a healing linear ulcer on the anterior side of the duodenal bulb, and no stricture was observed. He could eat as well as he did before the operation without any postprandial symptoms.

DISCUSSION

Open surgery has been applied for tumors of the duodenum in such cases that endoscopic treatment is not indicated. To reduce operative invasiveness, we introduced a technique of endoscopy-assisted laparoscopic minimal resection and intracorporeal suturing of the defect. In this procedure, simultaneous duodenoscopy and laparoscopy [14] were useful in identifying tumor-free margin from the laparoendoscopic view. Since the tumor was located close to the pyloric ring, we first made a duodenotomy at the distal margin of the tumor. The duodenotomy wound was dilated and the tumor was delivered toward the abdominal cavity to facilitate minimal resection. During resection of the tumor, the LCS was useful in coagulating and cutting the duodenal wall. To prevent thermal injury of the duodenal tissue, it is important to use the device for a few seconds in maximum mode, since the temperature of the active blade reaches approximately 200 °C when the tissue is coagulated and cut (Matsui, H., personal communication). In an experimental study using vessel tissue, the collateral tissue injury induced by the LCS was less than 1 mm [19]. To prevent leakage, we should give more consideration to thermal injury of the duodenal tissue caused by the LCS.

The defect of the duodenal wall was sutured intracorporeally. We placed an anchoring suture on the greater curvature side of the duodenum which was rolled caudally to facilitate suturing. The patient was obese and the duodenum ran in the ventrodorsal direction (Fig. 4). Under these circumstances, it was difficult to close the defect in the direction perpendicular to the longitudinal axis of the duodenal bulb without this maneuver. The Kocher maneuver was an another option to mobilize and expose the duodenum prior to local excision and closure of the defect [14, 15, 18].

In 1997, Van de Walle *et al.* [1] first reported laparoscopic resection of a large (5-cm diameter) duodenal tumor (they called it a benign stromal tumor). In their procedure, the tumor was dissected using an electrocautery probe, then the tumor was separated from the duodenum using a total of three endolinear staplers. Since then, several procedures using an endolinear stapler have been reported by other investigators [5–9]. Toyonaga *et al.* [7] used an endolinear stapler for wedge resection of a relatively small carcinoid tumor. Inappropriate resection (i.e., resection with an inappropriate margin or unnecessary resection of the duodenal wall) is a problem when using an endolinear stapler. Moreover, it is impossible to apply this technique to tumors on the posterior duodenum. On the other hand, transgastric endoluminal laparoscopic resection was reported for a large Brunner's gland adenoma [6]. Sato *et al.* [17] reported combined endoscopic and laparoscopic resection of a duodenal carcinoid tumor. In their procedure, an endoscopist performed endoscopic total layer resection, then a laparoscopic surgeon sutured the defect after peripheral lymph node dissection. Recently, other investigators reported laparoscopic local excision of a tumor followed by closure of the defect using a handsewn technique similar to our procedure [13–15, 18]. We believe that our procedure is effective in minimizing defects and can be applied

to any portion of the duodenum and also to tumors on the posterior duodenum.

Pathological diagnosis revealed that the tumor was Brunner's gland hyperplasia. Brunner's gland hyperplasia of the duodenum is a rare clinical condition that accounts for only about 10% of benign tumors of the duodenum [2]. Although they are usually asymptomatic, tumors greater than 2 cm occasionally cause symptoms such as obstruction and hemorrhage [20]. If a definite diagnosis had been made preoperatively, we could have observed the tumor progression, since the tumor was relatively small and asymptomatic. Endoscopic resection of the tumor was failed because the tumor was not elevated even after saline injection into the submucosal layer. Therefore, we think that endoscopic snare polypectomy [3] or even endoscopic submucosal dissection [2] was not indicated in the present case. Furthermore, it is well-known that certain duodenal carcinomas are derived from Brunner's gland [5]. Recently, Kimura *et al.* [21]reported a duodenal carcinoma with Brunner's gland adenoma and hyperplasia. They speculated a hyperplasia-adenoma-carcinoma sequence in the development of duodenal carcinoma derived from Brunner's gland. In our case, the patient strongly hoped for minimal invasive treatment instead of endoscopic observation. Moreover, rapid interval size change of the tumor suggested malignant potential of the tumor. We concluded that, even if the tumor does not exceed 2.0 cm, minimal resection should be performed to avoid invasive surgery in a future. Our new technique, endoscopy-assisted laparoscopic resection and suturing of the defect, provided a minimal invasive treatment for submucosal tumors of the duodenum.

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