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Role of Percutaneous Transhepatic Biliary Drainage in Patients With Complications After Gastrectomy

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The aim of this study was to elucidate the role of percutaneous transhepatic biliary drainage (PTBD) in patients with duodenal stump leakage (DSL) and afference loop syndrome (ALS) postgastrectomy for malignancy or benign ulcer perforation. Percutaneous transhepatic biliary drainage (PTBD) is an interventional radiologic procedure used to promote bile drainage. Duodenal stump leakage (DSL) and afferent loop syndrome (ALS) can be serious complications after gastrectomy. From January 2002 through December 2014, we retrospectively reviewed 19 patients who underwent PTBD secondary to DSL and ALS postgastrectomy. In this study, a PTBD tube was placed in the proximal duodenum near the stump or distal duodenum in order to decompress and drain bile and pancreatic fluids. Nine patients with DSL and 10 patients with ALS underwent PTBD. The mean hospital stay was 34.3 days (range, 12 to 71) in DSL group and 16.4 days (range, 6 to 48) in ALS group after PTBD. A liquid or soft diet was started within 2.6 days (range, 1 to 7) in the ALS group and within 3.4 days (range, 0 to 15) in the DSL group after PTBD. One patient with DSL had PTBD changed, and 2 patients with ALS underwent additional surgical interventions after PTBD. The PTBD procedure, during which the tube was inserted into the duodenum, was well-suited for decompression of the duodenum as well as for drainage of bile and pancreatic fluids. This procedure can be an alternative treatment for cases of DSL and ALS postgastrectomy.

Key words: Gastrectomy – PTBD – Duodenal stump leakage – Afferent loop syndrome

Postoperative complications after gastrectomy are difficult for both patients and surgeons. In the past, most of the major complications after gastrectomy required re-operation. The rate of re-operation for these complications ranges from 2.8% to 10%.[1–3] After gastrectomy, duodenal stump leak-

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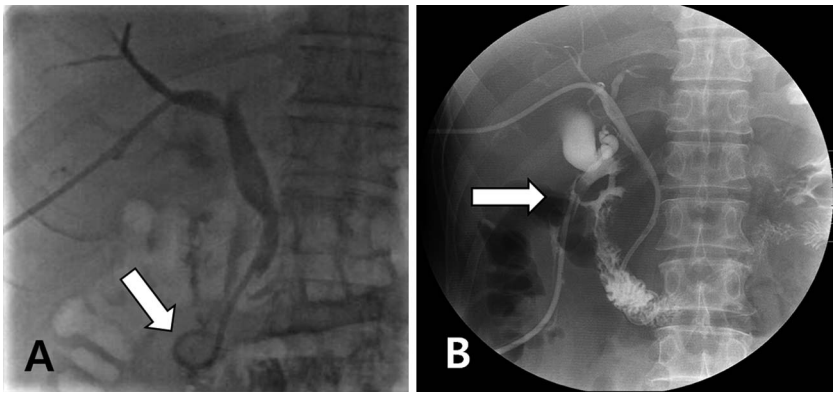

Fig. 1 PTBD inserted in duodenal stump leakage. Its tip was located in the duodenal leakage site (A, white arrow). PTBD was useful in identifying the leakage site, amount of leakage, and healing process by PTBD cholangiography (B, white arrow).

age (DSL) occurs during early postoperative periods and afferent loop syndrome (ALS) during late postoperative periods after reconstruction with Billroth-II gastrojejunostomy or Roux-en-Y esophagojejunostomy.[4–6] These complications can be serious and require re-operation, although other major complications can be more awful.

With recent improvements in surgical technique and postoperative management, the treatment of these complications has changed to nonsurgical therapies, including endoscopic or other interventional radiologic procedures.[7–12]

Percutaneous transhepatic biliary drainage (PTBD) is an interventional radiologic procedure for bile drainage secondary to biliary or intrahepatic obstruction due to calculus, malignancy, or benign tumors. Since PTBD was first described for the treatment of obstructive jaundice by Glen *et al*,[13] it has been an effective and common intervention for bile drainage. Recently, the use of PTBD has been expanded to the management of complications after gastrectomy.[7,9,10,12]

The aim of this study was to elucidate the role of PTBD in patients with DSL or ALS who underwent gastrectomy for malignancy or benign ulcer perforation.

Patients and Methods

Data collections of patients and diagnosis of ALS

From January 2002 through December 2014, we prospectively collected data from our gastric surgery database and retrospectively reviewed patient medical records. From this population, we retrospectively reviewed the records of 19 patients who underwent PTBD secondary to DSL or ALS after gastrectomy. Clinicopathologic features such as age, gender, reason for gastrectomy, type of gastrectomy with anastomosis method, hospital course, and postcomplication outcomes after gastrectomy with PTBD application were analyzed.

For the diagnosis of ALS, we routinely checked abdominal computed tomography (CT) in cases suspicious for ALS or with symptoms of ALS. CT was considered to be an extremely useful tool for evaluation of ALS.[14] Radiologists reviewed CT scans and diagnosed ALS and its cause when the following finding was present: a fluid-filled, dilated, U-shaped, transversely-oriented cystic mass in the afferent loop, located in the middle of the abdomen, anterior to the spine. This mass was located behind the superior mesenteric artery and was contiguous with the biliary system.[15]

Description of PTBD technique

In our study, patient's informed consent for PTBD was obtained before performing the procedure. All procedures were carried out under local anesthesia. The patient was placed in the supine position, and monitoring of vital signs was performed. The bile ducts were punctured using a right intercostal percutaneous approach under fluoroscopic guidance. The PTBD tip was inserted into the duodenum. Percutaneous needle aspiration and drainage (PNAD) was well-suited for decompression around the DSL area as well as drainage of bile and pancreatic fluids (Fig. 1).[10] In the case of ALS, the PTBD tip was placed more distal to the duodenum and the duodenal contents decompressed (Fig. 2).

If an indwelling Jackson-Pratt (JP) tube with good function was present in patients with DSL, the JP tube was used for drainage and irrigation. In cases where the JP tube was not functioning properly, additional drainage tubes were inserted for PNAD. A PNAD tube was placed at the DSL site and was used for continuous irrigation.

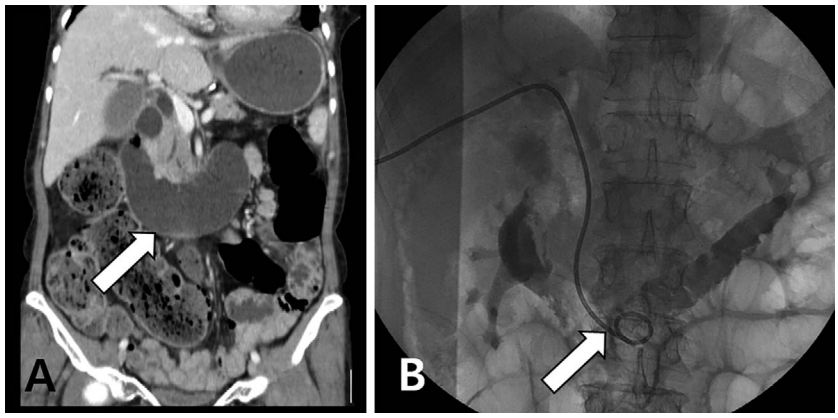

Fig. 2 PTBD inserted in afferent loop syndrome. A markedly dilated afferent loop was filled with fluid (A, white arrow). PTBD tip was located in distal duodenum, which was well decompressed (B, white arrow).

Results

Clinicopathologic features of patients

Patient characteristics are reported in Table 1. Among the 19 patients enrolled, 14 were male and 5 were female. Most of patients who had gastric cancers were treated with either radical total or subtotal gastrectomy (Billroth-II or Roux-en-Y anastomoses). One patient underwent subtotal gastrectomy (Billroth-II anastomosis) because of a benign ulcer perforation. Nine patients developed DSL postoperatively, and ALS occurred in 10 patients. Most cases of ALS were caused by postoperative adhesion; 1 patient had peritoneal carcinomatosis.

Outcomes after PTBD

The mean time to the start of a liquid or soft diet after PTBD was 3.7 days (range, 0 to 15). The liquid or soft diet was initiated within 3.4 days (range, 0 to 15) in the DSL group and within 2.6 days (range, 1 to 7) in the ALS group. The mean hospital stay was 34.3 days (range, 12 to 71) and 16.4 days (range, 6 to 48) in the DSL and ALS groups, respectively.

In the DSL group, 1 patient had progressive worsening of his condition despite a well-functioning PTBD and died of sepsis and multi-organ failure. No peritonitis was present and re-operation was not needed. In the ALS group, 2 patients

Table 1 Characteristics of 19 patients with DSL and ALS

Case	Sex/age (years)	Causes of gastrectomy	Type of gastrectomy (reconstruction)	Diagnosis	Interval of diet after PTBD	Hospital stay after PTBD	Outcomes after PTBD
1	M/73	Benign	Subtotal (B-II)	DSL	2	40	Discharge
2	M/77	Malignancy	Total (RY)	DSL	15	71	Discharge
3	F/75	Malignancy	Subtotal (B-II)	DSL	1	43	Discharge
4	M/61	Malignancy	Subtotal (B-II)	DSL	0	19	Discharge
5	M/63	Malignancy	Subtotal (B-II)	DSL	2	24	Discharge
6	M/64	Malignancy	Subtotal (B-II)	DSL	0	41	Discharge
7	M/66	Malignancy	Subtotal (B-II)	DSL	9	31	Expire
8	M/67	Malignancy	Subtotal (B-II)	DSL	1	12	Discharge
9	M/63	Malignancy	Total (RY)	DSL	1	28	Discharge
10	F/54	Malignancy	Subtotal (B-II)	ALS (adhesion)	4	14	Discharge
11	M/63	Malignancy	Subtotal (B-II)	ALS (adhesion)	7	48	Operation
12	M/77	Malignancy	Subtotal (B-II)	ALS (adhesion)	5	13	Discharge
13	F/43	Malignancy	Subtotal (B-II)	ALS (adhesion)	1	7	Discharge
14	F/56	Malignancy	Subtotal (B-II)	ALS (adhesion)	2	11	Discharge
15	M/53	Malignancy	Subtotal (B-II)	ALS (adhesion)	1	6	Recurrence of ALS
16	F/76	Malignancy	Subtotal (B-II)	ALS (malignancy)	2	42	Discharge
17	M/57	Malignancy	Total (RY)	ALS (adhesion)	2	6	Discharge
18	M/62	Malignancy	Total (RY)	ALS (adhesion)	1	9	Discharge
19	M/78	Malignancy	Subtotal (B-II)	ALS (adhesion)	1	8	Discharge

ALS, afferent loop syndrome; B-II, Billroth-II; DSL, duodenal stump leakage; PTBD, percutaneous transhepatic biliary drainage; RY, Roux-en-Y.

needed additional surgery because of failure of PTBD treatment and recurrence of ALS (Table 1).

Discussion

There are many complications associated with gastrectomy, including minor and major events. In the past, most major complications after gastrectomy required re-operation, with an incidence ranging from 2.8% to 10%.[1–3] Among postgastrectomy complications, DSL is a potentially life-threatening complication with a high morbidity, a prolonged hospital stay, and an overall mortality rate of about 20% as a result of sepsis and multi-organ failure.[5]

If DSL is diagnosed after subtotal or total gastrectomy, aggressive management should be initiated immediately, including drainage, oral intake restriction, intravenous fluid administration, and antibiotic therapy.[20] Following this, treatment methods should be modified according to the patient's clinical condition. Re-operation should be considered when the following complications develop: diffuse peritonitis, intra-abdominal hemorrhage, or major wound dehiscence.[5] With DSL, nutritional support is a very important factor for the promotion of healing. In the past, many authors suggested nasogastric suction and withholding oral intake.[16] However, more recent reports have noted superior outcomes in patients in whom oral intake was maintained.[17] The role of total parenteral nutrition (TPN) in the treatment of DSL is well-established, and TPN is routinely used in all cases of high-output and many cases of low-output DSL. Enteral nutrition (EN) may provide an adequate and inexpensive alternative to TPN; however, according to the available literature, less than 50% of patients with DSL tolerate an adequate volume of EN.[18] Prolonged limitations on intake without careful nutritional support can result in severe malnutrition, sometimes leading to superior mesenteric artery syndrome with duodenal obstruction, thus, perpetuating DSL.[16]

There are many possible late complications following a gastrectomy, including dumping syndrome, metabolic disturbance, ALS, efferent loop syndrome, alkaline reflux gastritis, retained antrum syndrome, and postvagotomy syndrome. Among these, ALS is an infrequent mechanical complication, which occurs after reconstruction of Billroth-II gastrojejunostomy or Roux-en-Y esophagojejunosotmy.[6] ALS is defined by dilatation of the afferent loop with accumulation of bile acid and pancreatic fluid on an abdominal CT scan.[19] Common causes of ALS are adhesions, recurrent cancer, inflammatory thickening of the anastomosis, kinking at the anastomosis, internal hernia, stoma stenosis, and inflammation surrounding the anastomosis.[20,21] Some cases of ALS progress rapidly and complications such as peritonitis may develop, which can be fatal. Mortality from these complications has been reported to be 30% to 60%.[22,23] Therefore, early diagnosis is important, and proper surgical treatment is strongly recommended in order to prevent worsening of the patient's condition.[24,25] Traditionally, surgery has been the treatment of choice for ALS. Surgical management options for ALS after Billroth-II gastrojejunostomy depend on the etiology and acuteness of the ALS as well as patient clinical status. Conversion to a Billroth-I anastomosis, Roux-en-Y reconstruction, and construction of a Braun-type enteroenterostomy between the afferent and efferent limbs are commonly used surgical techniques. Other treatment options include resection of the stenotic or ischemic segment with reconstruction of the afferent loop, revision of the gastric stoma, and interposition of a jejunal segment between the gastric pouch and duodenum.[26,27]

PTBD is an interventional radiologic procedure for bile drainage resulting from biliary or intrahepatic obstruction due to calculus, malignancy, or benign tumor. Recently, the use of PTBD was expanded to the management of complications after gastrectomy.[7,9,10,12]

We have already reported the use of a modified technique of PTBD after gastrectomy, where we located the PTBD tip down in the duodenum.[10] Our method was well-suited for decompression around the DSL area as well as for drainage of bile and pancreatic fluids for several reasons. First, in the case of DSL, a high intraluminal duodenal pressure has been postulated as one of the possible causes of a duodenal stump fistula and a reason for failure to heal. Therefore, PTBD can successfully reduce duodenal pressure and fistula output.[7,28] Cozzaglio *et al*[9] described a PTBD and occlusion balloon technique. However, we think that this method is not sufficient for the prevention of bile, pancreatic, and other fluids from flowing backward from the site of anastomosis. Second, in our experience, PTBD is an extremely useful treatment for decompressing an acutely dilated afferent loop. Although there are other treatments, including surgical interventions and endoscopic ballooning or stent placement, these approaches might be insufficient if patients have severe or incorporable underlying conditions. Thus, PTBD can be easily performed to reduce both the

pressure and amount of fluid collected in the dilated afferent loop. After PTBD, sufficient aspiration of accumulated fluid in a dilated afferent loop was helpful for symptom relief of patients with ALS. Moreover, because some cases progress rapidly and potentially fatal complications, such as peritonitis, can develop, use of PTBD might help to avoid emergency surgery and rupture of the loop.

One advantage of early PTBD procedure is an early start of oral intake if the patient's clinical and bowel motility status allow. As mentioned previously, early EN can be beneficial in improving the condition of patients with DSL. In our study, a liquid or soft diet was started within an average of 3.4 days after PTBD in the DSL group and within an average of 2.6 days in the ALS group.

Although this study was retrospective with regards to the use of PTBD in selected cases with DSL and ALS postgastrectomy, PTBD placement can be an effective alternative to surgery. Moreover, PTBD reduces the number of re-operations and the need for percutaneous abscess drainage, and could change the prognosis of severe DSL and ALS. Currently, our institution has made use of the early application of PTBD for the treatment of DSL and ALS cases postgastrectomy if those patients have no signs of peritonitis or unstable abdominal conditions.

In conclusion, PTBD is an interventional radiologic procedure for bile drainage in patients with bile drainage problems. However, use of PTBD is a feasible and safe procedure for post-gastrectomy complications and seems especially effective in DSL and ALS. PTBD procedures could advance the indication for early management closer to the onset of DSL and ALS postgastrectomy in order to prevent the development of intra-abdominal sepsis or other abdominal problems.

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