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MINIREVIEWS

Management of afferent loop obstruction: Reoperation or endoscopic and percutaneous interventions?

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Abstract

Afferent loop obstruction is a purely mechanical complication that infrequently occurs following construction of a gastrojejunostomy. The operations most commonly associated with this complication are gastrectomy with Billroth Ⅱ or Roux-en-Y reconstruction, and pancreaticoduodenectomy with conventional loop or Roux-en-Y reconstruction. Etiology of afferent loop obstruction includes: (1) entrapment, compression and kinking by postoperative adhesions; (2) internal herniation, volvulus and intussusception; (3) stenosis due to ulceration at the gastrojejunostomy site and radiation enteritis of the afferent loop; (4) cancer recurrence; and (5) enteroliths, bezoars and foreign bodies. Acute afferent loop obstruction is associated with complete obstruction of the afferent loop and represents a surgical emergency, whereas chronic afferent loop obstruction is associated with partial obstruction. Abdominal multiple detector computed tomography is the diagnostic study of choice. CT appearance of the obstructed afferent loop consists of a C-shaped, fluid-filled tubular mass located in the midline between the abdominal aorta and the superior mesenteric artery with valvulae conniventes projecting into the lumen. The cornerstone of treatment is surgery. Surgery includes: (1) adhesiolysis and reconstruction for benign causes; and (2) by-pass or excision and reconstruction for malignant causes. However, endoscopic enteral stenting, transhepatic percutaneous enteral stenting and direct percutaneous tube enterostomy have the principal role in management of malignant and radiation-induced obstruction. Nevertheless, considerable limitations exist as a former Roux-en-Y reconstruction limits endoscopic access to the afferent loop and percutaneous approaches for enteral stenting and tube enterostomy have only been reported in the literature as isolated cases.

Key words: Afferent loop; Obstruction; Reoperation; Endoscopy; Enterostomy

Core tip: Management strategy of afferent loop obstruction (ALO) depends on: (1) the benign or malignant nature of the obstruction. ALO caused by a benign lesion needs definitive repair of the primary cause by surgery. ALO caused by a malignant lesion needs palliative treatment (percutaneous and endoscopic interventions, by-pass surgery) or excision; and (2) the site of obstruction. An obstruction at the inframesocolic portion of the afferent loop can be easily reconstructed, whereas an obstruction at the supramesocolic portion needs copious mobilization and may require revision of the hepaticojejunostomy or pancreaticojejunostomy and/or a modified Puestow procedure in the setting of a preceded pancreaticoduodenectomy.

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DEFINITIONS

Creation of a gastrojejunostomy leaves a segment of proximal small bowel, most commonly consisting of duodenum and proximal jejunum, lying upstream from the gastrojejunostomy. This limb of intestine conducts bile, pancreatic juices, and other proximal intestinal secretions toward the gastrojejunostomy and is termed the afferent loop[1]. Afferent loop obstruction (ALO) is a purely mechanical complication that infrequently occurs following construction of a gastrojejunostomy. The operations most commonly associated with this complication include total gastrectomy with loop esophagojejunostomy and simple or pouch Roux-en-Y reconstruction, partial gastrectomy with Billroth Ⅱ and Roux-en-Y reconstruction, and pancreaticoduodenectomy with conventional loop and Roux-en-Y reconstruction performed for treatment of benign and malignant causes[2].

ETIOLOGY

Causes of ALO include: (1) Entrapment, compression and kinking of the afferent loop by postoperative adhesions[3]; (2) Internal herniation, volvulus and intussusception of the afferent loop[4]; (3) Scarring due to marginal ulceration of the gastrojejunostomy[5]; (4) Locoregional recurrence (lymph nodes, peritoneum, gastric remnant, anastomotic sites)[6]; (5) Radiation enteritis of the afferent loop[7]; and (6) Enteroliths, bezoars and foreign bodies impacted in the afferent loop[8]. The causes of ALO can be classified according to the benign or malignant nature of the obstructing lesion to emphasize the presentantion, natural history and management of ALO (Table 1). Risk factors for ALO include: (1) Redundant (longer than 30-40 cm) and antecolic afferent loops which are more prone to kinking, volvulus, and entrapment by adhesions; and (2) Improperly closed mesocolic defects which predispose to internal herniation of the retrocolic afferent loop[9].

INCIDENCE

The incidence of ALO after distal gastrectomy with Billroth Ⅱ or Roux-en-Y reconstruction has been reported to be 0.3%-1.0%[10]. Although there are several specific predisposing factors for ALO following laparoscopic gastrectomy such as partial omentectomy and antecolic anastomosis, the incidence of ALO after open and laparoscopic surgery is similar. Kim *et al*[11] in their retrospective cohort study, reported 4 (1.01%) patients who developed ALO among 386 gastric cancer patients submitted to laparoscopic distal gastrectomy with Billroth Ⅱ reconstruction. The interval between the initial gastrectomy and the operation for ALO ranged from 4 to 540 d (median 33 d). The causes of ALO included adhesions in 2 patients and internal herniation in 2 patients. All patients recovered following emergency operations[11]. Aoki *et al*[12] in their retrospective cohort study, reported 4 (0.2%) patients who developed ALO among 1908 gastric cancer patients submitted to distal gastrectomy with Roux-en-Y reconstruction. The causes of the ALO included internal herniation in two patients, adhesions in one patient, and peritoneal recurrence in one patient. The interval between the initial gastrectomy and emergency operations for ALO ranged from 3 wk to 2 years (median 5 mo). All patients recovered following emergency operations.

There are limited data on the incidence of ALO after pancreaticoduodenectomy, especially among long-term pancreatic cancer survivors (> 2 years). In one of the few studies in the literature, Pannala *et al*[13] evaluated the incidence of ALO in pancreatic cancer patients submitted to pancreaticoduodenectomy. Pannala *et al*[13] in their retrospective cohort study, reported 24 (13%) patients who developed ALO among 186 pancreatic cancer patients treated with pancreaticoduodenectomy. Median time to diagnosis was 1.2 years (range 0.03-12.3 years). Obstruction was primarily caused by recurrent pancreatic cancer in 8 patients (33%) and radiation enteritis of the afferent loop in 9 patients (38%)[13].

PATHOPHYSIOLOGY

Symptoms associated with ALO are attributed to the increased intraluminal pressure and distention due to accumulation of enteric, biliary and pancreatic secretions in the partially or completely obstructed afferent loop. The severity of symptoms mainly depends on the degree and duration of obstruction[14]. Acute ALO represents a closed-loop obstruction and can be complicated by: (1) Ischemia and gangrene of the completely obstructed afferent loop with subsequent perforation and peritonitis; and (2) Ascending cholangitis and pancreatitis. Chronic

Table 1 Classification of afferent loop obstruction and management strategy

Causes			Management
Benign	Intraluminal	Foreign bodies	Surgery[2]
		Bezoar	
		Enteroliths	
		Intussusception	
	Intramural	Gastrojejunostomy ulceration	
	Extrinsic	Adhesions	
		Volvulus	
		Internal hernia	
Malignant	Recurrence	Gastric remnant	Endoscopy for enteral stenting[32]
		Anastomotic sites	Transhepatic percutaneous enteral stenting or direct percutaneous tube enterostomy[29]
		Lymph nodes	By-pass surgery[2]
		Peritoneum	
		Carcinomatosis	
Radiation enteritis			Excision of the former afferent loop and reconstruction[31,33]

ALO represents an open-loop obstruction and can be complicated by: (1) Events similar to those seen in closed-loop obstruction despite the fact that the partially obstructed afferent loop can be partially decompressed; (2) Ascending cholangitis and pancreatitis; and (3) Bacterial overgrowth which can lead to steatorrhea, malnutrition, and vitamin B-12 deficiency[15].

PRESENTANTION

The primary symptoms of patients with acute ALO are sudden, severe abdominal pain and vomiting. The pain often occurs before associated findings of localized abdominal tenderness and involuntary guarding develop. When physical findings develop, there is a high level of suspicion that the viability of the bowel is compromised. Consequently, when ALO is the most likely diagnosis, abdominal pain out of proportion to physical findings represents a surgical emergency. The vomitus is not bilious because the biliary and pancreatic secretions remain trapped in the obstructed afferent loop[16].

Chronic ALO is more difficult to diagnose than acute ALO. Chronic ALO may manifest as periumbilical discomfort developing 15-30 min after eating and often lasting 1 to 4 h. These patients develop food fear and modify their pattern of eating so that they only consume small quantity of food. Patients with chronic ALO almost always have a profound weight loss, which raises suspicion of intraabominal malignancy. The progression from open-loop obstruction which is characterized by minor symptoms to closed-loop obstruction which represent a true surgical emergency is unpredictable. Projectile bilious vomiting may occur as the distended afferent loop decompresses forcefully providing rapid relief of symptoms. Chronic ALO with stasis and bacterial overgrowth can be further complicated by steatorrhea, diarrhea, B-12 and iron deficiency anemia[17].

Physical examination can reveal one or more of the following findings: (1) Upper abdominal distention. An ill-defined mass in the upper abdomen may be palpated representing the completely obstructed afferent loop; (2) Localized upper abdominal tenderness and involuntary guarding if perforation and peritonitis have occurred; (3) Jaundice; and (4) Signs of pancreatitis.

IMAGING STUDIES

Prior to the era of CT, conventional upper gastrointestinal barium studies were used to assess ALO. Two classical findings of ALO were described: (1) Non-filling of the afferent loop; and (2) Retention of barium in the dilated afferent loop for at least 60 min. However, several limitations existed as 20% of normal afferent loops were not filled with a barium meal and the underlying cause of obstruction was poorly identified[18].

CT plays a key role in the diagnosis of ALO. Zissin *et al*[19] reported that the characteristic CT appearance of the obstructed afferent loop is a U or C-shaped, fluid-filled, 5.3 cm in average diameter, tubular mass (C-loop sign) located in the midline between the abdominal aorta and the superior mesenteric artery with valvulae conniventes projecting into the lumen (keyboard sign) which can help in the differential diagnosis of pancreatic pseudocysts. Juan *et al*[20] reviewed multiple detector computed tomography scans of 22 patients who developed ALO after partial gastrectomy and pancreaticoduodenectomy. The C-loop appearance was present in 22 patients (100%) and the keyboard sign in 21 patients (95%) (Figure 1). There was only 1 patient without the presence of the keyboard sign due to bowel perforation. The maximal diameter of the afferent loop ranged from 3.3 to 5.8 cm.

CT images should be evaluated for the presence of: (1) the C-loop sign; (2) the keyboard sign; (3) pancreaticobiliary tract dilatation; (4) bowel wall thickening at the anastomotic sites, the afferent and efferent loops; and (5) lymphadenopathy, ascites, peritoneal enhancement, and metastatic lesions. Adhesions are suspected when a point of transition from a dilated to a normal-caliber loop is observed without other apparent cause. An internal hernia is suspected when crowding, stretching, and crossover of mesenteric vessels and the whirl sign are observed. Local recurrence and radiation enteritis are suspected when focal and diffuse bowel wall

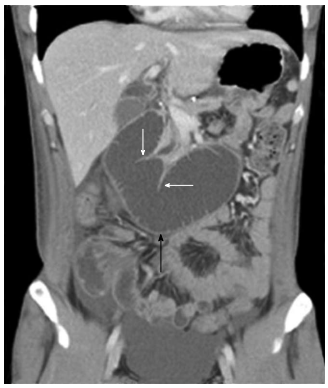

Figure 1 C-loop (black arrow) and the keyboard sign (white arrows).

thickening are observed, respectively. Carcinomatosis is suspected when ascites and peritoneal enhancement are present and bowel wall thickening around the level of obstruction is absent[21]. Kim *et al*[22] reviewed helical CT scans of 18 patients who developed ALO after partial gastrectomy. The presumed cause of obstruction on CT was compared with surgical findings and clinical courses. In all 8 patients who underwent a second operation the cause of afferent loop was correctly suggested on CT. In all 10 patients who were not re-explored, the clinical findings or biopsy indicated recurrent tumor as suggested on CT. The authors concluded that CT correctly predicted the causes of ALO[22].

Diagnostic evaluation of ALO in the setting of a preceded pancreaticoduodenectomy should embrace magnetic resonance cholangiopancreatography (MRCP) or secretin-enhanced MRCP. The incidence of biliary and pancreatic stricture after pancreaticoduodenectomy is 2.6% and 2%, respectively. The patency of the primary hepaticojejunostomy and pancreaticojejunostomy should be thoroughly evaluated because the presence of a stricture can alter management strategy of ALO. Anatomic variants (pancreas divisum, dominant dorsal duct, aberrant ductal communications) and ductal pathology including filling defects, stenosis or obstruction should be recorded[23]. A hepaticojejunostomy stricture is characterized by the presence of a fixed filling defect at the anastomotic site, along with posto-bstructive extra- and intra-hepatic ductal dilation. A pancreaticojejunostomy stricture is characterized by the presence of a fixed filling defect at the anastomotic site, along with post-obstructive ductal dilation, side-branch enhancement and/or decreased functional excretion into the jejunal drainage limb[24].

MANAGEMENT

As ALO is an infrequent complication after gastrectomy and pancreaticoduodenectomy, the literature on management of this complication is limited and much of the current knowledge is derived by the accrual of single-institution series. Management strategy (Table 2) depends on the following three factors: (1) The benign or malignant nature of the obstructing lesion. ALO caused by benign lesions needs definitive treatment by surgery with the exception of anastomotic ulcerations which can be managed by endoscopic balloon dilation. Surgery includes repair of the primary cause along with a form of afferent loop reconstruction including: Addition of a Braun anastomosis in a former Billroth Ⅱ reconstruction, excision of the redundant loop and conversion of Billroth Ⅱ to Roux-en-Y gastrojejunostomy, and excision of the redundant loop and reconstruction of the former Roux-en-Y jejunojejunostomy. ALO caused by malignant lesions needs primarily palliative treatment (percutaneous and endoscopic interventions, by-pass surgery) and secondarily surgery with curative intent (excision and reconstruction); (2) The site of obstruction. An obstruction at the inframesocolic portion of the afferent loop can be easily reconstructed, whereas an obstruction at the supramesocolic portion of the afferent loop needs copious mobilization of the supramesocolic segment of the afferent loop through a field of dense adhesions; and (3) The patency of the primary hepaticojejunostomy and pancreaticojejunostomy. ALO in the setting of a preceded pancreaticoduodenectomy may require revision of the hepaticojejunostomy and pancreaticojejunostomy and/or a modified Puestow procedure during reconstruction of the obstructed afferent loop due to an anastomotic stenosis demonstrated in the preoperative secretin-enhanced MRCP[25].

As mentioned above, surgery has the principal role in the management of benign ALO. On the contrary, palliative approaches are preferred in the setting of malignant ALO as in the literature there are no data showing differences in survival between patients who submitted to palliative and curative treatment for management of malignant ALO. Endoscopic interventions at the afferent loop (balloon dilation, double-pigtail stents traversing the afferent loop strictured area, balloon dilation and double-pigtail stent placement, afferent loop metal stent placement), the bile duct (biliary balloon dilation and plastic or metal stent placement through ERCP), and the pancreatic duct (pancreatic duct balloon dilation and stent placement through ERCP or EUSguided rendezvous drainage after unsuccessful ERCP) have the principal role in the management of malignant ALO[26]. In Pannala *et al*[13] series, fifteen patients (62%) had an endoscopic intervention for management of malignant ALO after pancreaticoduodenectomy with Billroth Ⅱ reconstruction for pancreatic cancer. These patients required a median of 2 endoscopic procedures (range 1-17 endoscopic procedures); eleven patients (73%) had clinical and laboratory improvement, two patients (13%) did not improve, and two patients (13%) were lost to follow-up[13]. However, a Roux-en-Y reconstruction limits endoscopic access to the afferent loop[27]. Enteral stenting and ERCP with double-balloon enteroscope in patients with Roux-en-Y anastomosis have only been reported in small single-institute series[28]. Moreover, transhepatic enteral stent insertion and direct percutaneous tube enterostomy for management of ALO have only been reported in the literature as isolated

Table 2 Management of afferent loop obstruction

Causes		Management	
		Former Billroth Ⅱ	Former Roux-en-Y
Benign	Enteroliths Bezoar Foreign bodies	Endoscopy and balloon dilation of anastomotic stenosis[34] or adhesiolysis, enterotomy, removal and repair of anastomotic stenosis (stricturoplasty, addition of Braun anastomosis, conversion to Roux-en-Y)[8,16]	Endoscopy and balloon dilation of anastomotic stenosis or adhesiolysis, enterotomy, removal and repair of anastomotic stenosis (stricturoplasty, revision of the Roux-en-Y reconstruction)
	Intussusception	Manual reduction or enterectomy and conversion to Roux-en-Y[4]	Manual reduction or enterectomy and revision of Roux-en-Y reconstruction
	Anastomotic ulceration	Balloon dilation[34], stricturoplasty or conversion to Roux-en-Y	Balloon dilation, stricturoplasty or revision of the Roux-en-Y reconstruction
	Adhesions	Adhesiolysis, Braun anastomosis or excision of redundant loop and conversion to Roux-en-Y[35]	Adhesiolysis, excision of redundant loop and revision of the jejunojejunostomy
	Volvulus	Enterectomy and conversion to Roux-en-Y[36]	Enterectomy and revision of the Roux-en-Y reconstruction
	Internal hernia	Reduction and repair of the defect or reduction, repair of the defect, enterectomy and conversion to Roux-en-Y[37]	Reduction and repair of the defect or reduction, repair of the defect, enterectomy and revision of the Roux-en-Y reconstruction
Malignant Radiation enteritis		Endoscopy for enteral stenting[32] Transhepatic percutaneous enteral stenting or direct percutaneous tube enterostomy[38] Redo-surgery when other approaches fail: By-pass[2] Adhesiolysis, mobilization and excision of the afferent loop, Roux-en-Y reconstruction In preceded pancreaticoduodenectomy assessment of HJ and PJ patency with MRCP. Revision of the strictured HJ, revision of the strictured PJ and/or modified Puestow[31] or pancreaticojejuno-jejunostomy if primary PJ has normal patency[33]	Double-balloon endoscopy for enteral stenting Transhepatic percutaneous enteral stenting or direct percutaneous tube enterostomy Redo-surgery when other approaches fail: By-pass Adhesiolysis, mobilization and excision of the afferent loop, revision of the Roux-en-Y reconstruction In preceded pancreaticoduodenectomy assessment of HJ and PJ patency with MRCP. Revision of the strictured HJ, revision of the strictured PJ and/or modified Puestow or pancreaticojejuno-jejunostomy if primary PJ has normal patency

HJ: Hepaticojejunostomy; PJ: Pancreaticojejunostomy; MRCP: Magnetic resonance cholangiopancreatography.

cases[29].

When endoscopic and percutaneous approaches are neither successful nor feasible for management of malignant ALO, redo surgery becomes inevitable. Reoperative surgery is a difficult undertaking and reoperation itself may be the cause of further morbidity and mortality. Reoperation rates vary from 4% to 11% among small-volume series[30]. When redo surgery is indicated, more conservative surgical approaches, such as by-pass surgery, should be performed in this challenging group of patients. When all the above approaches (percutaneous and endoscopic interventions, by-pass surgery) fail, excision of the obstructed afferent loop and reconstruction should be considered as a treatment option[31].

REFERENCES

1 **Woodfield CA**, Levine MS. The postoperative stomach. *Eur J Radiol* 2005; **53**: 341-352 [PMID: 15741008 DOI: 10.1016/j.ejrad.2004.12.009]

2 **Bolton JS**, Conway WC. Postgastrectomy syndromes. *Surg Clin North Am* 2011; **91**: 1105-1122 [PMID: 21889032 DOI: 10.1016/j.suc.2011.07.001]

3 **Uchida H**, Sakamoto S, Hamano I, Kobayashi M, Kitajima T, Shigeta T, Kanazawa H, Fukuda A, Kasahara M. Urgent living donor liver transplantation for biliary atresia complicated by a strangulated internal hernia at Roux-en Y limb: a case report. *Ann Transplant* 2014; **19**: 149-152 [PMID: 24675002 DOI: 10.12659/AOT.890213]

4 **Lee SY**, Lee JC, Yang DH. Early Postoperative Retrograde Jejunojejunal Intussusception after Total Gastrectomy with Rouxen-Y Esophagojejunostomy: A Case Report. *J Gastric Cancer* 2013; **13**: 263-265 [PMID: 24511423 DOI: 10.5230/jgc.2013.13.4.263]

5 **Ballas KD**, Rafailidis SE, Konstantinidis HD, Pavlidis TE, Marakis GN, Anagnostara E, Sakadamis AK. Acute afferent loop syndrome: a true emergency. A case report. *Acta Chir Belg* 2009; **109**: 101-103 [PMID: 19341207]

6 **Yoshida H**, Mamada Y, Taniai N, Mizuguchi Y, Kakinuma D, Ishikawa Y, Nakamura Y, Okuda T, Kiyama T, Tajiri T. Afferent loop obstruction treated by percutaneous transhepatic insertion of an expandable metallic stent. *Hepatogastroenterology* 2008; **55**: 1767-1769 [PMID: 19102388]

7 **Blouhos K**, Boulas KA, Salpigktidis Ⅱ, Konstantinidou A, Ioannidis K, Hatzigeorgiadis A. Total Reconstruction of the Afferent Loop for Treatment of Radiation-Induced Afferent Loop Obstruction with Segmental Involvement after Pancreaticoduodenectomy with Rouxen-Y Reconstruction. *Case Rep Oncol* 2013; **6**: 424-429 [PMID: 24019782 DOI: 10.1159/000354576]

8 **Sarli L**, Iusco D, Violi V, Roncoroni L. Enterolith ileus complicating afferent loop syndrome simulating acute pancreatitis. *Int Surg* 2003; **88**: 129-132 [PMID: 14584766]

9 **De Martino C**, Caiazzo P, Albano M, Pastore M, Tramutoli PR, Rocca R, Botte M, Sigillito A. Acute afferent loop obstruction treated by endoscopic decompression. Case report and review of literature. *Ann Ital Chir* 2012; **83**: 555-558 [PMID: 23110908]

10 **Grisé K**, McFadden D. Anastomotic technique influences outcomes after partial gastrectomy for adenocarcinoma. *Am Surg* 2001; **67**: 948-950 [PMID: 11603551]

11 **Kim DJ**, Lee JH, Kim W. Afferent loop obstruction following laparoscopic distal gastrectomy with Billroth-Ⅱ gastrojejunostomy. *J Korean Surg Soc* 2013; **84**: 281-286 [PMID: 23646313 DOI:

10.4174/jkss.2013.84.5.281]
12 **Aoki M**, Saka M, Morita S, Fukagawa T, Katai H. Afferent loop obstruction after distal gastrectomy with Roux-en-Y reconstruction. *World J Surg* 2010; **34**: 2389-2392 [PMID: 20458583 DOI: 10.1007/s00268-010-0602-5]
13 **Pannala R**, Brandabur JJ, Gan SI, Gluck M, Irani S, Patterson DJ, Ross AS, Dorer R, Traverso LW, Picozzi VJ, Kozarek RA. Afferent limb syndrome and delayed GI problems after pancreaticoduodenectomy for pancreatic cancer: single-center, 14-year experience. *Gastrointest Endosc* 2011; **74**: 295-302 [PMID: 21689816 DOI: 10.1016/j.gie.2011.04.029]
14 **Vettoretto N**, Pettinato G, Romessis M, Bravo AF, Barozzi G, Giovanetti M. Laparoscopy in afferent loop obstruction presenting as acute pancreatitis. *JSLS* 2006; **10**: 270-274 [PMID: 16882437]
15 **Rana SV**, Bhardwaj SB. Small intestinal bacterial overgrowth. *Scand J Gastroenterol* 2008; **43**: 1030-1037 [PMID: 18609165 DOI: 10.1080/00365520801947074]
16 **Lee MC**, Bui JT, Knuttinen MG, Gaba RC, Scott Helton W, Owens CA. Enterolith causing afferent loop obstruction: a case report and literature review. *Cardiovasc Intervent Radiol* 2009; **32**: 1091-1096 [PMID: 19365684 DOI: 10.1007/s00270-009-9561-3]
17 **Kwong WT,** Fehmi SM, Lowy AM, Savides TJ. Enteral stenting for gastric outlet obstruction and afferent limb syndrome following pancreaticoduodenectomy. *Ann Gastroenterol* 2014; **27**: 413-417 [PMID: 25332208]
18 **Sandrasegaran K**, Maglinte DD. Imaging of small bowelrelated complications following major abdominal surgery. *Eur J Radiol* 2005; **53**: 374-386 [PMID: 15741011 DOI: 10.1016/j.ejrad.2004.12.017]
19 **Zissin R**. CT findings of afferent loop syndrome after a subtotal gastrectomy with Roux-en-Y reconstruction. *Emerg Radiol* 2004; **10**: 201-203 [PMID: 15290491 DOI: 10.1007/s10140-003-0309-0]
20 **Juan YH**, Yu CY, Hsu HH, Huang GS, Chan DC, Liu CH, Tung HJ, Chang WC. Using multidetector-row CT for the diagnosis of afferent loop syndrome following gastroenterostomy reconstruction. *Yonsei Med J* 2011; **52**: 574-580 [PMID: 21623598 DOI: 10.3349/ymj.2011.52.4.574]
21 **Zissin R**, Osadchy A, Gayer G. Abdominal CT findings of delayed postoperative complications. *Can Assoc Radiol J* 2007; **58**: 200-211 [PMID: 18186431]
22 **Kim HC**, Han JK, Kim KW, Kim YH, Yang HK, Kim SH, Won HJ, Lee KH, Choi BI. Afferent loop obstruction after gastric cancer surgery: helical CT findings. *Abdom Imaging* 2003; **28**: 624-630 [PMID: 14628863 DOI: 10.1007/s00261-002-0070-y]
23 **Czakó L**, Takács T, Morvay Z, Csernay L, Lonovics J. Diagnostic role of secretin-enhanced MRCP in patients with unsuccessful ERCP. *World J Gastroenterol* 2004; **10**: 3034-3038 [PMID: 15378788]
24 **Lomanto D**, Pavone P, Laghi A, Panebianco V, Mazzocchi P, Fiocca F, Lezoche E, Passariello R, Speranza V. Magnetic resonance-cholangiopancreatography in the diagnosis of biliopancreatic diseases. *Am J Surg* 1997; **174**: 33-38 [PMID: 9240949 DOI: 10.1016/S0002-9610(97)00022-6]
25 **Demirjian AN**, Kent TS, Callery MP, Vollmer CM. The inconsistent nature of symptomatic pancreatico-jejunostomy anastomotic strictures. *HPB* (Oxford) 2010; **12**: 482-487 [PMID: 20815857 DOI: 10.1111/j.1477-2574.2010.00214.x]
26 **Kim HJ**, Park JY, Bang S, Park SW, Lee YC, Song SY. Selfexpandable metal stents for recurrent malignant obstruction after gastric surgery. *Hepatogastroenterology* 2009; **56**: 914-917 [PMID: 19621728]
27 **Hintze RE**, Adler A, Veltzke W, Abou-Rebyeh H. Endoscopic access to the papilla of Vater for endoscopic retrograde cholangiopancreatography in patients with billroth II or Roux-en-Y gastrojejunostomy. *Endoscopy* 1997; **29**: 69-73 [PMID: 9101141 DOI: 10.1055/s-2007-1004077]
28 **Sasaki T**, Isayama H, Kogure H, Yamada A, Aoki T, Kokudo N, Koike K. Double-balloon enteroscope-assisted enteral stent placement for malignant afferent-loop obstruction after Roux-en-Y reconstruction. *Endoscopy* 2014; **46** Suppl 1 UCTN: E541-E542 [PMID: 25409061 DOI: 10.1055/s-0034-1377633]
29 **Laasch HU**. Obstructive jaundice after bilioenteric anastomosis: transhepatic and direct percutaneous enteral stent insertion for afferent loop occlusion. *Gut Liver* 2010; **4** Suppl 1: S89-S95 [PMID: 21103301 DOI: 10.5009/gnl.2010.4.S1.S89]
30 **Reddy JR**, Saxena R, Singh RK, Pottakkat B, Prakash A, Behari A, Gupta AK, Kapoor VK. Reoperation following Pancreaticoduodenectomy. *Int J Surg Oncol* 2012; **2012**: 218248 [PMID: 23008765 DOI: 10.1155/2012/218248]
31 **Morgan KA**, Fontenot BB, Harvey NR, Adams DB. Revision of anastomotic stenosis after pancreatic head resection for chronic pancreatitis: is it futile? *HPB* (Oxford) 2010; **12**: 211-216 [PMID: 20590889 DOI: 10.1111/j.1477-2574.2009.00154.x]
32 **Burdick JS**, Garza AA, Magee DJ, Dykes C, Jeyarajah R. Endoscopic management of afferent loop syndrome of malignant etiology. *Gastrointest Endosc* 2002; **55**: 602-605 [PMID: 11923786 DOI: 10.1067/mge.2002.122584]
33 **Blouhos K**, Boulas KA, Tsiomita E, Papageorgiou I, Ioannidis K, Hatzigeorgiadis A. Pancreaticojejuno-jejunostomy during reconstruction of the afferent loop in surgery of radiation-induced afferent loop obstruction following pancreaticoduodenectomy with Roux-en-Y reconstruction. *Updates Surg* 2014; **66**: 51-57 [PMID: 24254381 DOI: 10.1007/s13304-013-0238-8]
34 **Yasuda A**, Imamoto H, Furukawa H, Imano M, Yasuda T, Okuno K. [Two cases of afferent loop syndrome caused by obstruction at the jejuno-jejunostomy site in the Roux-en-Y loop that were successfully treated by endoscopic balloon dilatation]. *Gan To Kagaku Ryoho* 2014; **41**: 2322-2325 [PMID: 25731510]
35 **Spiliotis J**, Karnabatidis D, Vaxevanidou A, Datsis AC, Rogdakis A, Zacharis G, Siamblis D. Acute cholangitis due to afferent loop syndrome after a Whipple procedure: a case report. *Cases J* 2009; **2**: 6339 [PMID: 19918578 DOI: 10.4076/1757-1626-2-6339]
36 **Fleser PS**, Villalba M. Afferent limb volvulus and perforation of the bypassed stomach as a complication of Roux-en-Y gastric bypass. *Obes Surg* 2003; **13**: 453-456 [PMID: 12841911 DOI: 10.1381/096089203765887831]
37 **Kaya E**, Senyürek G, Dervisoglu A, Danaci M, Kesim M. Acute pancreatitis caused by afferent loop herniation after Billroth II gastrectomy: report of a case and review of the literature. *Hepatogastroenterology* 2004; **51**: 606-608 [PMID: 15086215]
38 **Chevallier P**, Novellas S, Motamedi JP, Gugenheim J, Brunner P, Bruneton JN. Percutaneous jejunostomy and stent placement for treatment of malignant Roux-en-Y obstruction: a case report. *Clin Imaging* 2006; **30**: 283-286 [PMID: 16814147 DOI: 10.1016/j.clinimag.2006.02.008]

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