



Contents lists available at ScienceDirect

International Journal of Surgery Case Reports

journal homepage: www.casereports.com

Right gastro-omental artery reconstruction after pancreaticoduodenectomy for subtotal esophagectomy and gastric pull-up



Masayuki Okochi*, Kazuki Ueda, Takao Sakaba, Akira Kenjo, Mitsukazu Gotoh

Department of Plastic and Reconstructive Surgery, Fukushima Medical University, 1 Hikarigaoka, Fukushima 960-1295, Japan

ARTICLE INFO

Article history:

Received 15 June 2015

Received in revised form 12 August 2015

Accepted 12 August 2015

Available online 18 August 2015

Keywords:

Microsurgery

Gastro-omental artery

Middle colic artery

Pancreaticoduodenectomy

Arterial reconstruction

ABSTRACT

INTRODUCTION: There are no reports on vessel reconstruction of right gastro-omental artery deficits due to pancreatic tumor resection. Here, we describe successful arterial reconstruction using the middle colic artery in a patient who had undergone esophageal reconstruction with a gastric tube and whose right gastro-omental artery had been resected.

PRESENTATION OF CASE: A 70-year-old man underwent subtotal esophagectomy and reconstructive surgery with a retrosternal gastric tube for esophageal cancer. A follow-up computed tomography (CT) scan revealed a tumor on the pancreatic head that was adjacent to the right gastro-omental artery. Pancreaticoduodenectomy (PD) was subsequently performed. The gastro-omental artery was resected along with the tumor, creating a 7-cm deficit. The anastomosis was performed between the right branch of the middle colic artery and the distal end of the right gastro-omental artery. No complications that involved blood flow to the reconstructed esophagus were postoperatively observed. Four months after surgery, the blood flow to the gastric tube was confirmed by a contrast CT scan.

DISCUSSION: We reconstructed the right gastro-omental artery using the middle colic artery, and not a vein graft, as that would have required vessel anastomosis at two locations. The middle colic artery branches on the posterior surface of the pancreas, which is located close to the right gastro-omental artery.

CONCLUSION: The middle colic artery provides sufficient blood supply to the pulled-up gastric tube. PD can be performed even in patients who have undergone esophageal reconstruction.

© 2015 The Authors. Published by Elsevier Ltd. on behalf of Surgical Associates Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

1. Introduction

Pancreaticoduodenectomy (PD) for a pancreatic head tumor is an extremely difficult and challenging operation [1,2], and the gastric tube is frequently used for reconstruction after subtotal esophagectomy for esophageal cancers. The right gastro-omental artery, which is located close to the pancreas, is extremely important for supplying blood flow to the gastric tube. Surgeries for pancreatic head tumors become incredibly difficult in patients that have undergone esophageal reconstruction with a gastric tube.

2. Case report

The patient was a 70-year-old man who, in April 2009, underwent subtotal esophagectomy for esophageal cancer as well as reconstructive surgery with a retrosternal gastric tube. A follow-

up computed tomography (CT) scan revealed a contrast-enhanced tumor (3 cm in diameter) on the pancreatic head, adjacent to the right gastro-omental artery (Figs. 1 and 2) and PD was performed in April 2014.

Based on the intraoperative findings, the gastro-omental artery was resected along with the tumor, creating a 7-cm deficit (Fig. 3A). Direct anastomosis was not possible, so the right branch of the middle colic artery was used as the recipient vessel. The middle colic artery was separated from the intestinal membrane after confirming its path. Blood flow to the colon was confirmed and conserved using a micro-clamp. End-to-end suturing was performed with an 8-0 PRONOVA suture (Ethicon Inc., Edinburgh, UK) under an operating microscope (Fig. 3B). The patency of the right gastro-omental artery was checked using color Doppler ultrasonography. We did not use antithrombotic therapy due to risk of postoperative bleeding. Endoscopy was postoperatively performed at ten days and one month, and the findings showed good blood flow to the reconstructed esophagus, without complication (Fig. 4). Ten days after surgery, oral intake was started. Patient discharged our hospital two months after surgery. A contrast CT scan four months postoper-

* Corresponding author.

E-mail address: oktms-okt@umin.ac.jp (M. Okochi).

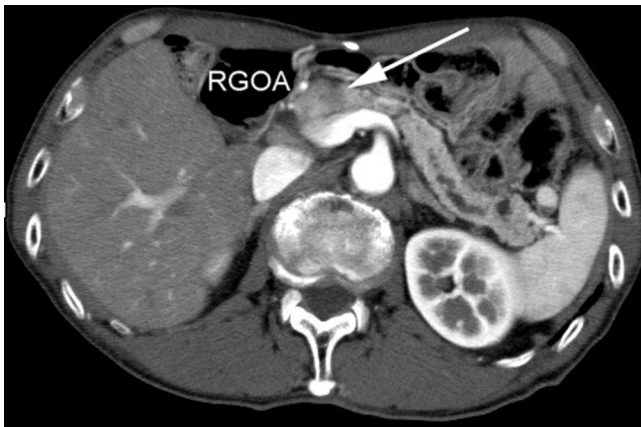


Fig. 1. Preoperative view of enhanced CT scan. The pancreatic head tumor is shown by the arrow. Tumor was adjacent to the right gastro-omental artery (RGOA).

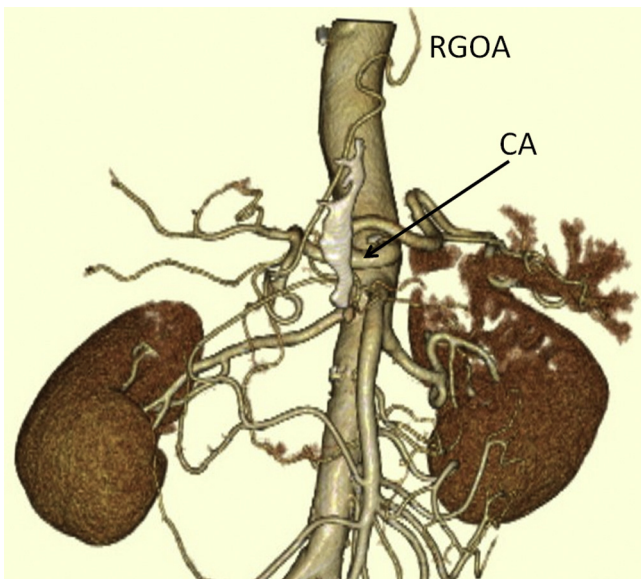


Fig. 2. 3D angiography of a CT scan. The right gastro-omental artery arose from the celiac artery. CA: celiac artery. RGOA: right gastro-omental artery.

actively confirmed blood flow to the gastric tube (Fig. 5). Histological examination revealed adenocarcinoma. At eight months, no blood flow disorders were observed in the reconstructed esophagus.

Our work has been reported in line with the CARE criteria (<http://www.care-statement.org/>).

3. Discussion

In this report, we describe successful arterial reconstruction of the right gastro-omental artery using the middle colic artery in a patient who had undergone esophageal reconstruction with a gastric tube prior to the resection of pancreatic tumor and right gastro-omental artery. When performing PD for advanced tumors, the hepatic artery [3,4], superior mesenteric artery [4,5], and celiac artery [6] can sometimes be resected. Revascularization is required when there are blood vessel deficits due to PD [7,8]. Direct anastomosis can be performed when the deficit is small. However, for larger deficits, reconstruction by vein grafting or with an artificial vessel is necessary [5]. Methods of using other vessels such as the splenic [5,9] or gastro-omental arteries [3] have also been reported.

Esophageal reconstruction using a gastric tube is carried out for esophageal cancer [10]. All arteries that supply the stomach, aside

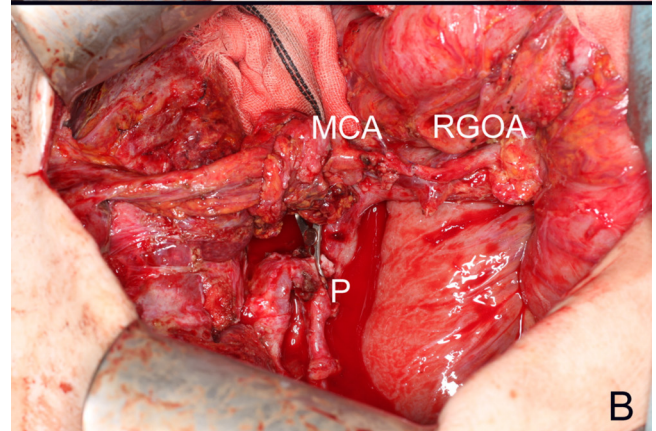
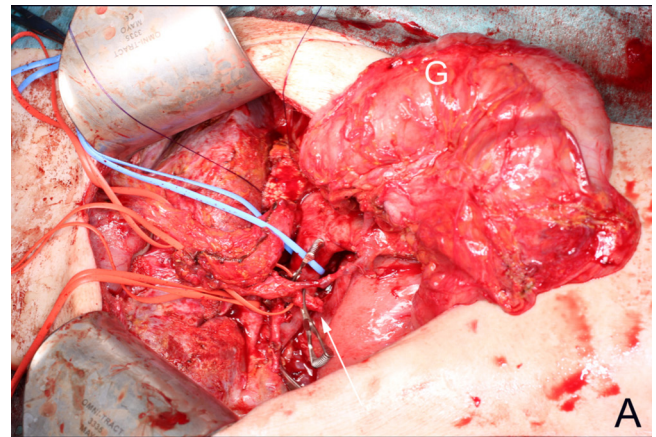


Fig. 3. (A) Pancreaticoduodenectomy was performed. Proximal stump of middle colic artery is shown by the arrow. G: gastric tube. (B) Immediately after the anastomosis. MCA: middle colic artery. RGOA: right gastro-omental artery. P: proximal stump of right gastro-omental artery.

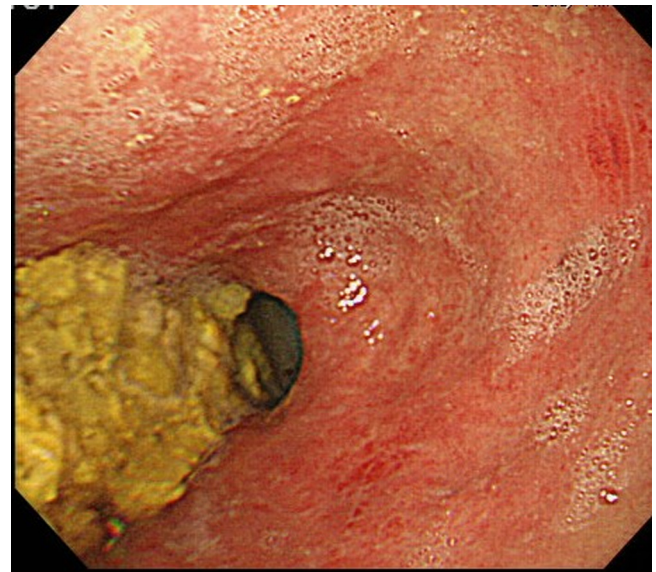


Fig. 4. One-month postoperative endoscopic view. There was no erosion.

from the right gastro-omental artery, are ligated when creating a gastric tube. Thus, the right gastro-omental artery is important for supplying blood flow to the gastric tube. Performing PD in patients who have undergone reconstructive surgery using a gastric tube for esophageal cancer is considered more difficult than in patients who have not. This is because the right gastro-omental

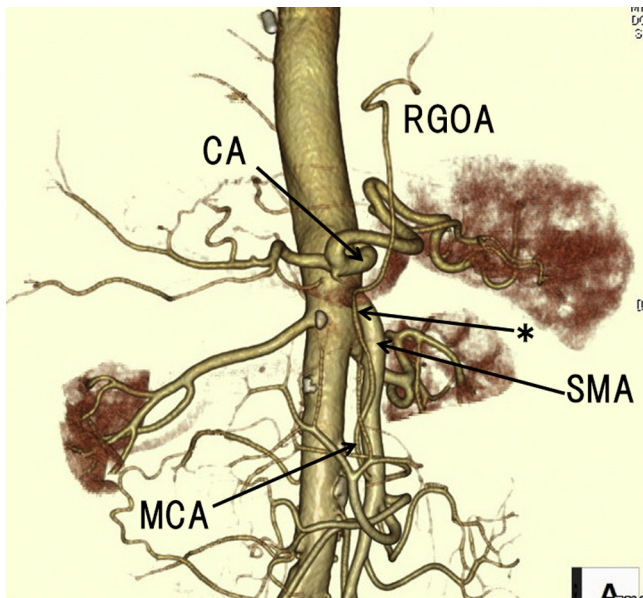


Fig. 5. Four-month postoperative view of 3D angiography of a CT scan. The right gastro-omental artery arose from the middle colic artery. RGOA: right gastro-omental artery. CA: celiac artery. SMA: superior mesenteric artery. MCA: middle colic artery. *: anastomotic site.

artery must be conserved when resecting the tumor. The operation is more difficult if the tumor is adjacent to the right gastro-omental artery. In our case, there was a 7-cm deficit in the right gastro-omental artery, making direct anastomosis impossible. However, good results with the supercharge technique using microsurgery have been reported in esophageal reconstruction with gastric tubes [11–13]. To our knowledge, no report exists on vessel reconstruction of right gastro-omental artery deficits due to pancreatic tumor resection. Positive results have been achieved with arterial reconstruction in the abdominal cavity after hepatic tumor resection and living donor liver transplant. The right gastro-omental, gastroduodenal, splenic [14], and left gastric arteries [15] are often used as the source vessels. However, in our case, the right gastro-omental artery was the subject of reconstruction, and because the gastroduodenal and left gastric arteries were resected when creating the gastric tube, they could not be used. The pancreaticoduodenal, superior mesenteric, and splenic arteries were ligated to remove the pancreatic head, so they could not be used either. Thus, the normally-used source vessels were unavailable. Ohtsuka et al. reported a similar case to ours, which involved a reconstructed right gastro-omental artery after PD [16]. In their case, the right gastro-omental artery was used in coronary artery bypass grafting, so the right gastro-omental artery was reconstructed using a vein graft. As for us, we reconstructed the right gastro-omental artery using the middle colic artery, not a vein graft, as that would have required vessel anastomosis at two locations. The middle colic artery branches on the posterior surface of the pancreas, making it close to the right gastro-omental artery. Additionally, the middle colic artery had been exposed in order to dissect the surrounding lymph nodes during PD. For these reasons, we used the middle colic artery as the recipient vessel. Its use of the middle colic artery for reconstruction in PD was previously reported in a case of celiac artery deficit [17]. In this report, the middle colic artery was sutured to the right gastro-omental artery to supply blood flow to the stomach, liver, duodenum and pancreas. There was no impact on liver function postoperatively, which indicates that the middle colic artery had sufficient blood flow.

4. Conclusion

The middle colic artery is a useful alternative of blood supply to the pulled up gastric tube. PD can be carried out even in patients that have undergone esophageal reconstruction.

Conflict of interest

No conflicts of interest.

Funding

None.

Ethical approval

Because of case report and retrospective study, ethical approval was not required in our institute.

Consent

Studies on patients require fully informed written consent which should be documented in the paper.

Author contributions

Masayuki Okochi and Kazuki Ueda: Written.
Akira Kenjo and Mitsukazu Gotoh: Collecting date.

Guarantor

Masayuki Okochi.

References

- [1] J.L. Cameron, T.S. Riall, J. Coleman, K.A. Belcher, One thousand consecutive pancreaticoduodenectomies, *Ann. Surg.* 244 (2006) 10–15.
- [2] J.H. Peters, L.C. Carey, Historical review of pancreaticoduodenectomy, *Am. J. Surg.* 161 (1991) 219–225.
- [3] C.P. Fischer, W. Rosenberg, F. Bridget, B. Bass, Gastroduodenal artery used for arterial reconstruction during the Whipple operation, *Hepatogastroenterology* 54 (2007) 2228–2229.
- [4] H. Amano, F. Miura, N. Toyota, K. Wada, K. Katoh, K. Hayano, S. Kadowaki, M. Shibuya, S. Maeno, T. Eguchi, T. Takada, T. Asano, Is pancreaticectomy with arterial reconstruction a safe and useful procedure for locally advanced pancreatic cancer? *J. Hepatobiliary Pancreat. Surg.* 16 (2009) 850–857.
- [5] H. Nakano, P. Bachelier, J.C. Weber, E. Oussoultzoglou, M. Dieng, H. Shimura, K. Boudjema, P. Wolf, D. Jaeck, Arterial and vena caval resections combined with pancreaticoduodenectomy in highly selected patients with periampullary malignancies, *Hepatogastroenterology* 49 (2002) 258–262.
- [6] J.M. Baumgartner, A. Krasinskas, M. Daoouadi, A. Zureikat, W. Marsh, K. Lee, D. Bartlett, A.J. Moser, H.J. Zeh 3rd, Distal pancreaticectomy with en bloc celiac axis resection for locally advanced pancreatic adenocarcinoma following neoadjuvant therapy, *J. Gastrointest. Surg.* 16 (2012) 1152–1159.
- [7] S. Gaujoux, A. Sauvanet, M.P. Vullierme, A. Cortes, S. Dokmak, A. Sibert, V. Vilgrain, J. Belghiti, Ischemic complications after pancreaticoduodenectomy: incidence, prevention, and management, *Ann. Surg.* 249 (2009) 111–117.
- [8] M. Ouaiissi, C. Hubert, R. Verhelst, P. Astarci, C. Sempoux, A. Joutet-Mourin, A. Loundou, J.F. Gigot, Multidisciplinary HPB Group of Center of Cancer, Vascular reconstruction during pancreaticoduodenectomy for ductal adenocarcinoma of the pancreas improves resectability but does not achieve cure, *World J. Surg.* 34 (2010) 2648–2661.
- [9] V. Brasoveanu, T. Dumitrascu, N. Bacalbasa, R. Zamfir, Splenic artery used for replaced common hepatic artery reconstruction during pancreaticoduodenectomy—a case report, *Chirurgia* 104 (2009) 499–504.
- [10] H. Akiyama, H. Miyazono, M. Tsurumaru, C. Hashimoto, T. Kawamura, Use of the stomach as an esophageal substitute, *Ann. Surg.* 188 (1978) 606–610.
- [11] J.S. Chana, H.C. Chen, R. Sharma, T.M. Gedebo, G.M. Feng, Microsurgical reconstruction of the esophagus using supercharged pedicled jejunum flaps: special indications and pitfalls, *Plast. Reconstr. Surg.* 110 (2002) 742–748.
- [12] K.I. Kawai, M. Kakibuchi, M. Sakagami, J. Fujimoto, A. Toyosaka, K. Nakai, Supercharged gastric tube pull-up procedure for total esophageal reconstruction, *Ann. Plast. Surg.* 47 (2001) 390–393.
- [13] A.R. Dodd, J.E. Goodnight, L.L. Pu, Successful management of cervicoesophageal anastomosis leak after microsurgical esophageal

- reconstruction: a case report and review of the literature, *Ann. Plast. Surg.* 65 (2010) 110–114.
- [14] Y. Yamamoto, T. Sugihara, S. Sasaki, H. Furukawa, H. Furukawa, S. Okushiba, K. Nohira, Microsurgical reconstruction of the hepatic and superior mesenteric arteries using a back wall technique, *J. Reconstr. Microsurg.* 15 (1999) 321–325.
- [15] T. Iida, M. Mihara, M. Narushima, H. Yoshimatsu, H. Hara, I. Koshima, Preexcisional artery reconstruction: a new strategy in multiple hepatic artery reconstruction for reducing ischemic injury of the liver, *Microsurgery* 32 (2012) 493–496.
- [16] T. Ohtsuka, Y. Suematsu, H. Kubota, S. Takamoto, M. Makuuchi, Salvage of right gastroepiploic artery graft before pancreatoduodenectomy, *J. Thorac. Cardiovasc. Surg.* 121 (2001) 1013–1014.
- [17] S. Kondo, Y. Ambo, H. Katoh, S. Hirano, E. Tanaka, S. Okushiba, T. Morikawa, H. Igawa, Y. Yamamoto, T. Sugihara, Middle colic artery–gastroepiploic artery bypass for compromised collateral flow in distal pancreatectomy with celiac artery resection, *Hepatogastroenterology* 50 (2003) 305–307.

Open Access

This article is published Open Access at scimedirect.com. It is distributed under the [IJSCR Supplemental terms and conditions](#), which permits unrestricted non commercial use, distribution, and reproduction in any medium, provided the original authors and source are credited.