Laparoscopic gastrectomy for remnant gastric cancer: a comprehensive review and case series

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Abstract

Background Remnant gastric cancer is increasing with the earlier detection of gastric cancer and improved medical care. Laparoscopic gastrectomy for remnant gastric cancer has been reported sporadically in association with the increased use of minimally invasive techniques. However, because of the rarity of remnant gastric cancer, the number of cases reported per study has been small. We therefore reviewed all published English-language reports, including our experience, to better characterize the technical aspects of currently used procedures.

Methods Ten patients who underwent laparoscopic gastrectomy for remnant cancer between August 2005 and March 2014 were retrospectively studied. A comprehensive literature search was performed using the PubMed database to identify English-language studies on laparoscopic gastrectomy for remnant gastric cancer that were published before May 2014.

Results There was no conversion to open surgery. The mean operating time was 325 min, and mean intraoperative blood loss was 55 g. The mean number of retrieved lymph nodes was 22, and mean postoperative hospital stay was 13 days. There was only one minor wound infection (overall morbidity rate, 10 %). From the literature review, all comparative studies revealed that laparoscopic gastrectomy for remnant gastric cancer required a longer operating time, and most studies reported less intraoperative blood loss, an equivalent number of harvested lymph

nodes, and a shorter postoperative stay as compared with open surgery.

Conclusion Proficiency in advanced laparoscopic surgical techniques, such as proper adhesiolysis and stable laparoscopic anastomosis, will allow laparoscopic gastrectomy for remnant gastric cancer to be performed with satisfactory short-term results. This minimally invasive approach can be one treatment option for remnant gastric cancer.

Keywords Laparoscopic · Gastrectomy · Remnant gastric cancer

Introduction

Gastric cancer is one of the most common malignancies in the world, especially in East Asia [1]. Earlier detection of gastric cancer and improved medical care have led to an increased prevalence of remnant gastric cancer after gastrectomy for previous gastric malignancies [2]. Remnant gastric cancer was initially defined as gastric cancer arising after gastrectomy for gastric carcinoma, and cancer in the residual stomach after gastrectomy for benign disease was sometimes referred to as “gastric stump cancer.” Recently, however, remnant gastric cancer has been widely used to refer to all cancers arising in the residual stomach after gastrectomy for either benign or malignant disease [3].

Despite recent progress in chemotherapy and radiotherapy, gastrectomy combined with adequate lymph node dissection remains the mainstay of treatment for resectable gastric cancer [4, 5] as well as resectable remnant gastric cancer. Laparoscopy-assisted surgery for remnant gastric cancer was first reported by Yamada et al. [6] in 2005. Since then, laparoscopic gastrectomy for remnant gastric

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cancer has been reported sporadically in association with the increased use of minimally invasive techniques for stomach surgery. Recently, moderate-size case series (up to 18 patients) have been published from some high-volume centers [7–10]. However, because remnant gastric cancer is rare, the number of cases reported per study has been small. We therefore reviewed all published English-language reports on laparoscopic gastrectomy for remnant gastric cancer, including our experience, to better characterize the technical aspects of currently used procedures.

Patients and methods

Between August 2005 and March 2014, a total of 702 patients underwent gastrectomy for histologically proven adenocarcinoma of the stomach in Kyoto University Hospital. Among them, 547 patients had laparoscopic gastrectomy whereas 155 patients underwent an open procedure. From this cohort, 10 patients who had a history of previous gastric surgery and underwent laparoscopic gastrectomy for remnant gastric cancer were reviewed, and perioperative short-term results were investigated.

Completely laparoscopic gastrectomy was introduced to Kyoto University Hospital in 2005 for T2N0 or earlier disease, and since then the indication of laparoscopic gastrectomy has been gradually extended. Since 2009, when we initiated a prospective study of laparoscopic gastrectomy for T3/4 or node-positive patients (UMIN000002085), patients with more advanced disease also underwent laparoscopic surgery when an informed consent was obtained. The indication of laparoscopic approach toward remnant gastric cancer was the same as that toward primary gastric cancer. Clinical stage was classified according to the TNM classification [11]. Postoperative complications occurring within 30 days after operation were classified according to the Clavien–Dindo classification system [12].

Operative technique

The patient was placed in a modified lithotomy position in a reverse Trendelenburg fashion. The first port was inserted transumbilically by the open method. If there was not enough space for insertion of the second port, the transumbilical incision was elongated to permit specimen extraction, and adhesiolysis was performed under direct vision, as described elsewhere [13]. Once a camera port and one or two working ports were inserted, adhesiolysis could be performed laparoscopically. After a carbon dioxide pneumoperitoneum was created at 8 mmHg, four operating ports and a Nathanson liver retractor (Cook

Japan, Tokyo, Japan) were placed [13]. Lymph node dissection around the celiac axis, proximal splenic artery, and paracardial nodes was routinely performed, and the left gastric artery was ligated at its base if it had been left undivided [14, 15]. After the stomach was taken out, intracorporeal reconstruction was performed with the Roux-en-Y method, similar to laparoscopic total gastrectomy [16–18].

Literature search

A literature search was performed using the PubMed database to identify English-language reports describing clinical research on laparoscopic gastrectomy for remnant gastric cancer that were published before May 2014. The search used the following terms: gastrectomy AND laparoscopy* AND (“remnant gastric cancer” OR “gastric remnant cancer” OR “gastric stump cancer”). The references of all relevant articles were evaluated to find other related studies.

Results

The background characteristics of the ten patients who underwent laparoscopic gastrectomy are shown in Table 1. Most previous gastrectomies were distal gastrectomy with Billroth II reconstruction, and the mean interval from previous gastrectomy was 9 years. In our series, six of the ten patients had previously undergone gastrectomy for gastric cancer, and all previous gastrectomies were open procedures.

Short-term results are summarized in Table 2. There was no conversion to open surgery. The mean operating time was 325 min, and the mean intraoperative blood loss was 55 g. The mean number of retrieved lymph nodes was 22, and the mean postoperative hospital stay was 13 days. There was only one minor wound infection (Clavien–Dindo grade 1) in this cohort, which accounted for an overall morbidity rate of 10 %. There was no major morbidity or postoperative mortality.

The literature search yielded ten English-language publications on laparoscopic gastrectomy for remnant gastric cancer (Table 3) [6–10, 19–23]. A summary of open surgery for remnant gastric cancer during this study period is also presented.

One institution reported a case series of their initial two cases and later published a comparative study to open procedure. Therefore, the former study was excluded from the analysis to avoid overlapping. A total of 100 cases were reported, including our series. In the ten studies, the mean operating time was 197–488 min, mean blood loss

Table 1 Clinical demographic characteristics of ten patients who underwent laparoscopic gastrectomy for remnant gastric cancer

Case	Age	Sex	BMI	Type of previous gastrectomy	Reason for previous gastrectomy	Type of previous reconstruction	Interval (years)
1	54	M	17.2	DG + cholecystectomy	Gastric cancer (stage IB), gallstone	Billroth II (retrocolic)	6
2	58	M	18.9	DG	Perforated duodenal ulcer	Billroth II (antecolic)	40
3	68	M	20.7	Segmental gastrectomy	Gastric cancer (stage IA)	Gastro-gastrostomy	5
4	74	M	18.4	DG	Pyloric stenosis	Billroth II (retrocolic)	50
5	65	F	20.1	DG	Gastric cancer (stage unknown)	Billroth II (antecolic)	31
6	84	M	20.9	DG	Gastric ulcer	Billroth II (antecolic)	30
7	80	M	18.6	DG	Gastric cancer (stage IA)	Billroth I	9
8	74	M	16.8	DG	Gastric cancer (stage unknown)	Billroth I	31
9	66	F	17.1	Proximal gastrectomy	Gastric cancer (stage IB)	Esophago-gastrostomy	9
10	71	M	21.5	Pancreaticoduodenectomy	Intraductal papillary mucinous neoplasm (borderline atypia)	Child reconstruction	8
Mean	69.4		19.0				9

BMI body mass index, DG distal gastrectomy

Table 2 Short-term results of laparoscopic gastrectomy for remnant gastric cancer

Case	cStage	Histology	Operation time (min)	Blood loss (g)	Lymph node retrieval	Open conversion	Postoperative hospital stay (days)	Complications
1	IA	tub1	316	50	6	—	8	None
2	IB	tub1	307	0	22	—	13	None
3	IA	tub1	361	70	58	—	12	None
4	IA	tub2	297	215	24	—	15	None
5	IB	tub2	312	11	21	—	9	None
6	IA	por1	260	40	26	—	14	None
7	IA	tub2	286	15	1	—	12	None
8	IA	por1	354	103	20	—	13	None
9	IA	por2	344	30	12	—	11	None
10	IIA	tub2	408	20	34	—	18	Wound infection ^a
Mean			325	55	22		13	

^a Clavien–Dindo grade 1

minimal—425 g, mean number of retrieved nodes 8–24, and mean postoperative hospital stay 6–13 days. A total of 18 patients (18 %) had postoperative complications. Eight studies (67 of 100 patients) reported that no conversion to open surgery had been required, whereas one study reported a 47 % conversion rate to open surgery [10].

Five of the ten reports including the current study compared the perioperative results of laparoscopic gastrectomy for remnant gastric cancer with those of open gastrectomy. The operation time was 40–90 min longer for laparoscopic gastrectomy. However, laparoscopic gastrectomy was associated with lower intraoperative blood loss in three of four studies, an equivalent number of harvested lymph nodes, fewer postoperative complications, and a shorter postoperative hospital stay in four of five studies.

Discussion

Laparoscopic gastrectomy has become one of the standard treatments for early gastric cancer. Although the oncological feasibility remains to be fully established, laparoscopy provides a magnified view of minute structures such as tiny vessels and nerves [24], which allows lymphadenectomy to be more precisely performed, potentially leading to less intraoperative blood loss and fewer postoperative complications. As more evidence emerges, laparoscopic surgery for advanced cancer or remnant gastric cancer is expected to become more widely accepted in the next decade.

To perform laparoscopic gastrectomy for remnant gastric cancer safely, we believe there are two key precautions. First, adhesiolysis is essential to obtaining an adequate operative field, similar to other laparoscopic procedures in

Table 3 Summary of published series of laparoscopic (Lap) gastrectomy for remnant gastric cancer

Authors/year of publication	Lap/open	n	Stage (early/advanced)	Operation time (min)	Blood loss (g)	Lymph node retrieval	Open conversion	Postoperative hospital stay (days)	Complications
Yamada H. et al. (2005)	Lap	1	1/0	274	30	NA	–	NA	None
Corcione F. et al. (2008)	Lap	3	0/3	210	Minimal	18	–	11	1 postoperative bleeding (33.3 %)
Cho HJ et al. (2009)	Lap	2	0/2	488	425	14.5	–	NA	None
Qian F. et al. (2010)	Lap	15	0/15	205	110	18	–	13	None
Shinohara T. et al. (2013)	Lap	5	5/0	370	63.6	18.2	–	8.8	None
Nagai E. et al. (2014)	Lap	12	10/2	362.3	65.8	23.7	–	11.3	No intra-abdominal complication
Son SY. et al. (2014)	Open	10	5/5	270.5	746.3	15.9	NA	24.9	20.0 %
	Lap	17	11/6	234.4	227.6	18.8	8/17 (47 %)	9.3	35.2 %
	Open	17	4/13	170	184.1	22.3	NA	9.3	29.4 %
Kwon IG. et al. (2014)	Lap	18 ^a	15/3	266.2	182.2	8	1/18 (5.6 %)	6	33.3 %
Kim HS. et al. (2014)	Open	58	35/23	203.3	193.1	7	NA	9	44.8 %
	Lap	17	13/4	197.2	NA	12.9	–	11.1	23.5 %
	Open	50	NA	149.3	NA	NA	NA	13.8	30.0 %
Current series	Lap	10	7/3	325	55	22	–	13	10 %
	Open	6	1/5	289	893	7	NA	24	33 %

^a Ten laparoscopic, eight robotic

NA not applicable

patients with a history of laparotomy. Indeed, laparoscopic surgery had been contraindicated in patients who had previously undergone laparotomy in the early era of laparoscopic surgery [25]. However, previous upper abdominal surgery is no longer considered a contraindication for laparoscopic gastrectomy [13, 26]. Second, the identification of anatomical landmarks is very important. In most patients, the suture line of the lesser curvature of the remnant stomach densely adheres to the lateral segment of the liver, obscuring the right crus. Normally, careful sharp dissection between the liver and remnant stomach leads to the underlying intact caudate lobe of the liver, which will guide us to the right crus, a good landmark for esophageal dissection. However, in patients who have undergone Billroth I reconstruction after previous gastrectomy, adhesions around the gastroduodenal anastomoses are sometimes very thick, requiring extreme care and precision [7]. Once the right crus is identified, we proceed to mobilization of the gastric fundus by a medial approach [15]. Even after distal gastrectomy with standard D2 lymphadenectomy, the posterior regions of the cardia and fundus are normally preserved untouched. Thus, once the membranous border of perigastric fat tissue and retroperitoneal fat is identified at the right side of the esophagus, it is very easy and safe to mobilize the fundus, thereby allowing the esophagus to be safely divided.

The last component is reconstruction, that is, safe esophagojejunostomy. There are many reports describing various procedures for laparoscopic or laparoscopy-assisted esophagojejunostomy using linear staplers and circular staplers. However, the leakage rate varies among studies irrespective of the type of stapling device used, and technical proficiency may be as important as the anastomotic method itself [17]. In our hospital, functional end-to-end anastomosis performed using linear staplers [18, 27] is the method of choice, unless tumor invades the esophagus. If a long proximal margin is necessitated by esophageal invasion or proximal spread of tumor, we perform an intracorporeal isoperistaltic anastomosis using laparoscopic linear staplers with hand-sewn entry-hole closure (overlap method [28]).

Remnant gastric cancer is a relatively rare disease even in Japan, where the incidence of gastric cancer is the highest in the world [1]. Consequently, previous reports on laparoscopic treatment of such a rare disease did not include large numbers of patients. However, from a comprehensive review of the literature, we were able to compile data on as many as 100 laparoscopic gastrectomies for remnant gastric cancer. One must be aware of the inevitable selection bias in such a retrospective case series. The indications for laparoscopic gastrectomy might have differed among hospitals, and more advanced cases most

likely underwent open surgery. Nevertheless, our analysis showed that laparoscopic gastrectomy for remnant gastric cancer tended to require a longer operating time with less blood loss and a shorter hospital stay than open gastrectomy in four of five studies. These trends are similar to the trends associated with laparoscopic distal gastrectomy [29, 30] and laparoscopic total gastrectomy [31].

In terms of the postoperative complication rate, four studies of five reported a 6.5–20 % risk reduction in laparoscopic approach compared to the open approach. Only one study showed an unfavorable result of laparoscopic approach in terms of blood loss, number of lymph nodes retrieved, and postoperative mortality rate, even though it did not reach statistically significant difference. However, their open conversion rate was as high as 47 %, which might have resulted in the highest postoperative complication rate (35.2 %).

As for oncological outcomes, long-term results were reported by only two studies [8, 9]. Although the 5-year survival rates were similar in the laparoscopic group and open-surgery group, the relatively short median follow-up period (25.2–39.1 months) made it difficult to generalize the findings. The number of harvested lymph nodes is sometimes used as an indicator of quality of oncological surgery. At least similar numbers of lymph nodes, if not more, were harvested via a laparoscopic approach.

Our study had several limitations. First, because of its retrospective nature, there was potential selection bias. However, all our open gastrectomies for remnant gastric cancer in this series were performed in 2007, and all laparoscopic gastrectomies were performed after 2008. Therefore, we believe that the case selection bias is minimal. Second, the size of each study was small because of the rarity of remnant gastric cancer. However, we have attempted to minimize this drawback by comprehensively reviewing all published English-language reports on laparoscopic gastrectomy for remnant gastric cancer.

In conclusion, our results suggest that proficiency in advanced laparoscopic surgical techniques, such as proper adhesiolysis and stable laparoscopic anastomosis, will allow laparoscopic gastrectomy for remnant gastric cancer to be performed with satisfactory short-term results. This minimally invasive approach can be one treatment option for remnant gastric cancer.

Conflict of interest Shigeru Tsunoda, Hiroshi Okabe, Eiji Tanaka, Shigeo Hisamori, Motoko Harigai, Katsuhiro Murakami, and Yoshiharu Sakai have no conflicts of interest or financial ties to disclose.

References

1. Ferlay J, Shin HR, Bray F, Forman D, Mathers C, Parkin DM. Estimates of worldwide burden of cancer in 2008: Globocan 2008. *Int J Cancer*. 2010;127:2893–917.
2. Ohashi M, Katai H, Fukagawa T, Gotoda T, Sano T, Sasako M. Cancer of the gastric stump following distal gastrectomy for cancer. *Br J Surg*. 2007;94:92–5.
3. Kodera Y, Yamamura Y, Torii A, Uesaka K, Hirai T, Yasui K, Morimoto T, Kato T, Kito T. Gastric remnant carcinoma after partial gastrectomy for benign and malignant gastric lesions. *J Am Coll Surg*. 1996;182:1–6.
4. Van Cutsem E, Van de Velde C, Roth A, Lordick F, Cascinu S, Aapori M, European Organisation for Research and Treatment of Cancer (EORTC)–Gastrointestinal Cancer Group. Expert opinion on management of gastric and gastro-oesophageal junction adenocarcinoma on behalf of the European Organisation for Research and Treatment of Cancer (EORTC)–Gastrointestinal Cancer Group. *Eur J Cancer*. 2008;44:182–94.
5. Japanese Gastric Cancer Association. Japanese gastric cancer treatment guidelines 2010 (ver. 3). *Gastric Cancer*. 2011;14:113–23.
6. Yamada H, Kojima K, Yamashita T, Kawano T, Sugihara K, Nihei Z. Laparoscopy-assisted resection of gastric remnant cancer. *Surg Laparosc Endosc Percutaneous Tech*. 2005;15:226–9.
7. Kim HS, Kim BS, Lee IS, Lee S, Yook JH. Laparoscopic gastrectomy in patients with previous gastrectomy for gastric cancer: a report of 17 cases. *Surg Laparosc Endosc Percutaneous Tech*. 2014;24:177–82.
8. Kwon IG, Cho I, Guner A, Choi YY, Shin HB, Kim HI, An JY, Cheong JH, Noh SH, Hyung WJ. Minimally invasive surgery for remnant gastric cancer: a comparison with open surgery. *Surg Endosc*. 2014;28(8):2452–8.
9. Nagai E, Nakata K, Ohuchida K, Miyasaka Y, Shimizu S, Tanaka M. Laparoscopic total gastrectomy for remnant gastric cancer: feasibility study. *Surg Endosc*. 2014;28:289–96.
10. Son SY, Lee CM, Jung DH, Lee JH, Ahn SH, Park do J, Kim HH. Laparoscopic completion total gastrectomy for remnant gastric cancer: a single-institution experience. *Gastric Cancer*. 2015;18(1):177–82.
11. UICC International Union Against Cancer. TNM classification of malignant tumours, 7th edn. New York: Wiley; 2009.
12. Dindo D, Demartines N, Clavien PA. Classification of surgical complications: a new proposal with evaluation in a cohort of 6336 patients and results of a survey. *Ann Surg*. 2004;240:205–13.
13. Tsunoda S, Okabe H, Obama K, Tanaka E, Akagami M, Kinjo Y, Sakai Y. Laparoscopic gastrectomy for patients with a history of upper abdominal surgery: results of a matched-pair analysis. *Surg Today*. 2014;44:271–6.
14. Obama K, Okabe H, Hosogi H, Tanaka E, Itami A, Sakai Y. Feasibility of laparoscopic gastrectomy with radical lymph node dissection for gastric cancer: from a viewpoint of pancreas-related complications. *Surgery*. 2011;149:15–21.
15. Okabe H, Obama K, Kan T, Tanaka E, Itami A, Sakai Y. Medial approach for laparoscopic total gastrectomy with splenic lymph node dissection. *J Am Coll Surg*. 2010;211:e1–6.
16. Tsunoda S, Okabe H, Obama K, Tanaka E, Hisamori S, Kinjo Y, Sakai Y. Short-term outcomes of totally laparoscopic total gastrectomy: experience with the first consecutive 112 cases. *World J Surg*. 2014;38(10):2662–7.
17. Okabe H, Tsunoda S, Tanaka E, Hisamori S, Kawada H, Sakai Y. Is laparoscopic total gastrectomy a safe operation? A review of various anastomotic techniques and their outcomes. *Surg Today*. 2014. doi:10.1007/s00595-014-0901-9.
18. Okabe H, Obama K, Tanaka E, Nomura A, Kawamura J, Nagayama S, Itami A, Watanabe G, Kanaya S, Sakai Y. Intracorporeal esophagojejunal anastomosis after laparoscopic total gastrectomy for patients with gastric cancer. *Surg Endosc*. 2009;23:2167–71.
19. Corcione F, Pirozzi F, Marzano E, Cuccurullo D, Settembre A, Miranda L. Laparoscopic approach to gastric remnant-stump: our

- initial successful experience on 3 cases. *Surg Laparosc Endosc Percutaneous Tech.* 2008;18:502–5.
20. Cho HJ, Kim W, Hur H, Jeon HM. Laparoscopy-assisted completion total gastrectomy for gastric cancer in remnant stomach: report of 2 cases. *Surg Laparosc Endosc Percutaneous Tech.* 2009;19:e57–60.
 21. Song J, Kim JY, Kim S, Choi WH, Cheong JH, Hyung WJ, Choi SH, Noh SH. Laparoscopic completion total gastrectomy in remnant gastric cancer: technical detail and experience of two cases. *Hepatogastroenterology.* 2009;56:1249–52.
 22. Qian F, Yu PW, Hao YX, Sun GH, Tang B, Shi Y, Lan YL, Luo HX, Mo A. Laparoscopy-assisted resection for gastric stump cancer and gastric stump recurrent cancer: a report of 15 cases. *Surg Endosc.* 2010;24:3205–9.
 23. Shinohara T, Hanyu N, Tanaka Y, Murakami K, Watanabe A, Yanaga K. Totally laparoscopic complete resection of the remnant stomach for gastric cancer. *Langenbecks Arch Surg.* 2013;398:341–5.
 24. Kanaya S, Haruta S, Kawamura Y, Yoshimura F, Inaba K, Hiramatsu Y, Ishida Y, Taniguchi K, Isogaki J, Uyama I. Video: Laparoscopy distinctive technique for suprapancreatic lymph node dissection: medial approach for laparoscopic gastric cancer surgery. *Surg Endosc.* 2011;25:3928–9.
 25. Curet MJ. Special problems in laparoscopic surgery. Previous abdominal surgery, obesity, and pregnancy. *Surg Clin N Am.* 2000;80:1093–110.
 26. Tokunaga M, Hiki N, Fukunaga T, Nunobe S, Ohyama S, Yamaguchi T. Laparoscopy-assisted gastrectomy for patients with earlier upper abdominal open surgery. *Surg Laparosc Endosc Percutaneous Tech.* 2010;20:16–9.
 27. Okabe H, Obama K, Tsunoda S, Tanaka E, Sakai Y. Advantage of completely laparoscopic gastrectomy with linear stapled reconstruction: a long-term follow-up study. *Ann Surg.* 2014;259:109–16.
 28. Inaba K, Satoh S, Ishida Y, Taniguchi K, Isogaki J, Kanaya S, Uyama I. Overlap method: novel intracorporeal esophagojejunostomy after laparoscopic total gastrectomy. *J Am Coll Surg.* 2010;211:e25–9.
 29. Viñuela EF, Gonen M, Brennan MF, Coit DG, Strong VE. Laparoscopic versus open distal gastrectomy for gastric cancer: a meta-analysis of randomized controlled trials and high-quality nonrandomized studies. *Ann Surg.* 2012;255:446–56.
 30. Cheng Q, Pang TC, Hollands MJ, Richardson AJ, Pleass H, Johnston ES, Lam VW. Systematic review and meta-analysis of laparoscopic versus open distal gastrectomy. *J Gastrointest Surg.* 2014;18:1087–99.
 31. Xiong JJ, Nunes QM, Huang W, Tan CL, Ke NW, Xie SM, Ran X, Zhang H, Chen YH, Liu XB. Laparoscopic vs. open total gastrectomy for gastric cancer: a meta-analysis. *World J Gastroenterol.* 2013;19:8114–32.