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Efficacy of Prophylactic Drain Placement in Laparoscopic Total Gastrectomy: A Retrospective Study

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The aim of this study was to assess the efficacy of prophylactic drain placement in laparoscopic total gastrectomy (LTG). Ninety-four patients with gastric cancer who underwent LTG between December 2007 and December 2014 were enrolled in this study. A tube drain was placed in 29 patients after considering it necessary by operators, whereas no tube drain was placed in remaining patients. All patients were classified into either the drain or the no-drain group and were investigated for clinical characteristics and surgical outcomes. Overall, complications occurred in 15 patients and were not significantly different between the drain and no-drain groups [5 (17.2%) versus 10 (15.4%) patients]. No significant difference was observed in median duration of postoperative hospital stay between the drain and no-drain groups (12 versus 12 days). There was no significant difference in the duration of hospital stay regardless of the presence of drains in both groups of patients who developed complications (with drain: 27 days versus without drain: 21.5 days) and those who did not develop complications (with drain: 12 days versus without drain: 12 days). In conclusion, on the basis of the results of this study, routine prophylactic drain placement in LTG may not be necessary because it does not offer any additional benefits for patients.

Key words: Gastric cancer – Laparoscopic total gastrectomy – Prophylactic drain placement – Postoperative complications – Hospital stay

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Gastric cancer is common in Japan, and minimally invasive surgery, such as laparoscopic gastrectomy, has become popular in the past decade.[1] Despite improvements in surgical techniques, prophylactic drain placement after gastrointestinal surgery has been widely practiced without clear evidence of its efficacy. However, in 2005, the introduction of the concept of enhanced recovery after surgery (ERAS) made it necessary to reconsider the usefulness of drain placement.[2] Moreover, several surgeons have reported the ineffectiveness of prophylactic drains in open gastrectomy, and we have been questioned about the usefulness of drains.[3–6] Therefore, in this study, we assessed the efficacy of prophylactic drain placement in laparoscopic total gastrectomy (LTG) through a retrospective study. To the best of our knowledge, we believe that this is the first report of its kind.

Materials and Methods

Ninety-four patients (62 males and 32 females; median age: 70 years) who underwent LTG at the Department of Gastroenterological and General Surgery at Showa University Hospital in Japan between December 2007 and December 2014 were enrolled for this study. Patients whose gastric cancer had invaded other organs, those who had metastases to multiple lymph nodes, including paraaortic lymph nodes, and those who had peritoneal dissemination on preoperative diagnostic imaging were excluded from this study. Prior to the start of this study, approval was obtained from the research ethics committee of Showa University Hospital.

All surgical procedures were performed by 4 consultant surgeons in our department. Distal pancreatectomy or splenectomy was not performed unless there was a suspicion of direct cancer invasion or nearby lymph node metastasis, and we performed splenectomy in 1 case of LTG. A closed tube drain was placed in 29 patients. The drains were placed to the inferior surface of the liver, posterior part of the esophagojejunal anastomosis, or under the left diaphragm when it was considered necessary by surgeons. There was no drain placement in the remaining 65 patients.

Postoperative pain control was mainly achieved with epidural or intravenous patient-controlled analgesia (PCA) for the first 2 postoperative days. Pentazocine (15 mg) was administered after the removal of PCA if needed. The drain was removed when drainage was less than 100 mL. Patients were allowed to drink small amounts of water 1 day after surgery, and a soft diet was started on the third day after surgery.

Data were collected from medical records and pathology reports. The following variables were evaluated for clinical characteristics and surgical outcomes: sex, age, body weight, body mass index (BMI), clinical stage, lymph node dissection, number of lymph nodes retrieved, tumor size, operating time, and blood loss. The following data were evaluated for postoperative complications: intra-abdominal abscess, bleeding, anastomotic leakage, pancreatic fistula, surgical site infection (SSI), anastomotic stenosis, ileus, pneumonia, thoracic empyema, and catheter-related bloodstream infection (CRBSI). Variables were classified according to the Clavien–Dindo classification and those higher than grade II were considered as complications.

All patients were classified into either the drain group (n = 29) or the no-drain group (n = 65). They were compared in terms of clinical characteristics, surgical outcomes, postoperative complications, and postoperative hospital stay. In addition, we classified all patients into either the complication group (n = 15) or the no-complication group (n = 79) to compare clinical characteristics and surgical outcomes. Multivariate analysis was performed to detect risk factors of complications. This was done by comparing drain placement and the items whose *P* values were less than 0.05 as a result of comparison between the complication and no-complication groups. Besides, we examined the correlation between postoperative day (POD) and operating time and blood loss comparing with or without drains to assess the correlation between POD and surgical stress.

Data were expressed as median and interquartile range. All statistical analyses were performed using JMP version 11.0 (SAS Institute Inc, Cary, North Carolina). Intergroup comparisons were made using Wilcoxon rank-sum test for continuous variables and Fisher's exact test for discrete variables. Binomial logistic regression analysis was performed for multivariate analysis. For correlation, we used Pearson's correlation coefficient (r). A *P* value of less than 0.05 was considered significant.

Results

Patient clinical characteristics and surgical outcomes

Median operating time was significantly longer in the drain group than in the no-drain group [255 minutes (interquartile range, 213–288 minutes) versus 220 minutes (interquartile range, 190–248

Table 1 Clinical characteristics and surgical outcomes comparing drain group with no-drain group

Characteristics	Drain group (n = 29)	No-drain group (n = 65)	*P* value
Sex, male/female	23/6	39/26	0.0985
Median age (range), yr	72 (66–76)	70 (63.5–78)	0.4010
Median body weight (range), kg	58 (51.5–66.5)	57 (47–63)	0.1998
Median BMI (range)	21.9 (19.8–24.6)	22.0 (19.9–24.0)	0.9553
Clinical stage, n (%)			0.1135
IA	5 (17.2)	16 (24.6)	
IB	4 (13.8)	9 (13.9)	
IIA	2 (6.9)	11 (16.9)	
IIB	4 (13.8)	11 (16.9)	
IIIA	2 (6.9)	6 (9.2)	
IIIB	8 (27.6)	3 (4.6)	
IIIC	4 (13.8)	9 (13.9)	
LN dissection, n (%)			1.0000
D1	5 (17.2)	12 (18.5)	
D1+	21 (72.4)	47 (72.3)	
D2	3 (10.4)	6 (9.2)	
Median LN retrieved (range), n	31 (27–46)	41 (28–55)	0.1449
Median tumor size (range), mm	60 (40–65)	45 (25.5–60)	0.1561
Median operating time (range), min	255 (212.5–287.5)	220 (190–247.5)	0.0225
Median blood loss (range), g	150 (62.5–212.5)	55 (7.5–112.5)	0.0101

LN, lymph node; range, interquartile range.

minutes); $P = 0.0225$]. Similarly, median blood loss was significantly greater in the drain group than that in the no-drain group [150 g (interquartile range, 62.5–212.5 g) versus 55 g (interquartile range, 190–247.5 g); $P = 0.0101$]. There was no significant difference in sex, age, body weight, BMI, clinical stage, lymph node dissection, number of dissected lymph nodes, and tumor size (Table 1).

Postoperative complications

Postoperative complications occurred in 15 cases, and no significant difference was observed between the drain group and the no-drain group (5 versus 10 patients; 17.2% versus 15.4%; $P = 1.0000$; Table 2). Similarly, there was no significant difference between the 2 groups for each complication. Anastomotic leaks were observed in 6 cases: 2 cases in the drain group and 4 cases in the no-drain group. Major leaks were observed at the site of esophagojejunal anastomosis in 2 cases in the drain group and they were reoperated. In contrast, 4 cases in the no-drain group had leaks at the site of esophagojejunal anastomosis (1 major leak and 1 minor leak) or at the site of duodenal stump (2 major leaks), and 3 cases with major leaks were reoperated. The 1 case with minor leak was treated by conservative therapy. The other 9 complications were treated by antibiotic administration, direct drainage under CT guidance, or endoscopic procedures.

Table 2 Comparison of postoperative complications

	Drain group (n = 29)	No-drain group (n = 65)	*P* value
Total complications, n (%)	5 (17.2)	10 (15.4)	1.0000
Intra-abdominal abscess	0	2 (3.1)	1.0000
Bleeding	0	0	-
Anastomotic leakage	2 (6.9)	4 (6.2)	1.0000
Pancreatic fistula	0	0	-
Surgical site infection	1 (3.5)	2 (3.1)	1.0000
Anastomotic stenosis	0	1 (1.5)	1.0000
Ileus	0	0	-
Pneumonia	1 (3.5)	0	0.3125
Thoracic empyema	1 (3.5)	0	0.3125
CRBSI	0	1 (1.5)	1.0000

CRBSI, catheter-related bloodstream infection.

The ratio of males in the complication group (n = 15) was significantly higher than that in the no-complication group (n = 79; male/female: 14/ 1 versus 48/ 31; $P = 0.0164$). In addition, median body weight was significantly higher in the complication group than that in the no-complication group [60 kg (interquartile range, 58–64 kg) versus 55 kg (interquartile range, 47–64 kg); $P = 0.0316$; Table 3].

Moreover, multivariate analysis showed that male gender was the only 1 risk factor for postoperative complications (odds ratio = 6.5705; 95% confidence interval, 1.0508–128.91; $P = 0.0433$; Table 4).

Table 3 Clinical characteristics and surgical outcomes comparing complication group with no-complication group

Characteristics	Complication group (n = 15)	No-complication group (n = 79)	*P* value
Sex, male/female	14/1	48/31	0.0164
Median age (range), yr	71 (67–75)	70 (64–78)	0.9341
Median body weight (range), kg	60 (58–64)	55 (47–64)	0.0316
Median BMI (range)	22.4 (21.5–25.2)	21.2 (19.5–23.9)	0.0758
Clinical stage, n (%)			0.3646
IA	4 (26.7)	17 (21.5)	
IB	3 (20.0)	10 (12.7)	
IIA	3 (20.0)	10 (12.7)	
IIB	2 (13.3)	13 (16.5)	
IIIA	0	8 (10.1)	
IIIB	3 (20.0)	8 (10.1)	
IIIC	0	13 (16.5)	
LN dissection, n (%)			0.1008
D1	0	17 (21.5)	
D1+	13 (86.7)	55 (69.6)	
D2	2 (13.3)	7 (8.9)	
Median LN retrieved (range), n	34 (28–56)	38 (27–53)	0.8769
Median tumor size (range), mm	40 (25–60)	50 (30–67.5)	0.1914
Median operating time (range), min	220 (155–275)	230 (195–260)	0.5947
Median blood loss (range), g	60 (1–150)	70 (20–170)	0.4596

LN, lymph node; range, interquartile range.

Postoperative hospital stay

No significant difference was observed in median length of postoperative hospital stay between the drain group and the no-drain group [12 days (interquartile range, 11–21.5 days) versus 12 days (interquartile range, 10–15 days); $P = 0.2333$]. In addition, among patients in the complication group, there was no significant difference between the groups with drain and without drain [27 days (interquartile range, 22–43.5 days) versus 21.5 days (interquartile range, 15.5–34.8 days); $P = 0.2600$]. Similarly, in the no-complication group, no significant difference was observed in the drain group and the no-drain group [12 days (interquartile range, 11–15.8 days) versus 12 days (interquartile range, 9–14 days); $P = 0.3029$; Table 5].

No correlation was observed between POD and operating time and blood loss comparing with or without drains (Table 6).

Table 4 Multivariate analysis for the risk factors of postoperative complications

Factor	Odds ratio	95% CI	*P* value
Male	9.2997	1.1759–205.72	0.0330
Body weight	0.9960	0.8745–1.1303	0.9516
BMI	1.1384	0.8093–1.6145	0.4541
Drain (+)	0.8512	0.2304–2.8392	0.7973

Discussion

Several studies on the use of prophylactic drains after abdominal surgeries, such as colon resection, hepatic resection, and pancreatectomy, have reported that routine drain placement is not recommended, except in special circumstances, because drains can cause postoperative complications.[7–9] Similarly, we found a few studies on the efficacy of prophylactic drainage after gastric surgeries, such as open distal gastrectomy,[3–6] open total gastrectomy,[10] and laparoscopy-assisted distal gastrectomy (LADG),[11] which reported that drains did not offer any benefit. However, to the best of our efforts, we were not able to find any studies that reported on LTG.

In our department, we started to introduce LADG in 1999 and laparoscopic distal gastrectomy (LDG) in 2005 for early gastric cancer; the latter involved reconstruction and anastomosis in the abdominal cavity. In 2007, along with improvements in surgical techniques and devices, we started to perform LTG instead of laparoscopy-assisted total gastrectomy (LATG). Initially, prophylactic drain placement after total gastrectomy was performed but we experienced that it did not help in early detection or treatment of postoperative complications. Therefore, we do not place any drain after LTG without intraoperative complications.

In this study, there was a significant difference in operating time and blood loss between the drain

Table 5 Hospital stay after surgery

	Drain group (n = 29)	No-drain group (n = 65)	*P* value
Median POD (range), days	12 (11–21.5)	12 (10–15)	0.2333
	Drain (+)	Drain (−)	
Median POD of complication group (range)	27 (22–43.5)	21.5 (15.5–34.8)	0.2699
Median POD of no-complication group (range)	12 (11–15.8)	12 (9–14)	0.3029

POD, postoperative day; range, interquartile range.

and the no-drain group; the surgeons were the ones who decided whether drain placement was needed during each procedure. When there was more bleeding than usual during surgery, we tended toward placing drains to monitor rebleeding postoperatively. Because there was no significant difference in patients' characteristics between the drain and no-drain groups, including clinical staging and lymph node (LN) dissection, it was unclear which particular procedures led to bleeding and extend surgery time in the drain group.

From the results of this study, drain placement in all cases with complications was not effective and did not help in detecting or treating postoperative complications. Once major leaks occurred, resurgeries were needed regardless whether with or without drains. Furthermore, other complications could be treated after their occurrence. This is why we do not usually place drains in LTG, which may reduce patients' postoperative pain. A prospective randomized control trial of Alvares *et al*[10] reported no significant difference in the incidence of postoperative complications between the drain group and the no-drain group of patients who underwent open total gastrectomy. Because our study was retrospective, it was unclear whether the drain placement in LTG had an effect on the incidence of postoperative complications, although there was no significant difference in the occurrence of complications between the drain and no-drain groups. However, for the treatment and detection of complications, we believe that drain placement is not helpful.

Table 6 Correlation between POD and operating time and blood loss comparing with or without drains

	Drain group (n = 29)		No-drain group (n = 65)	
Surgical outcomes	r	*P*	r	*P*
Operating time	0.1023	0.5974	−0.0624	0.6212
Blood loss	0.1919	0.3185	0.0097	0.9388

POD, postoperative day.

There were statistically significant sex- and body weight-related differences comparing the complication group with the no-complication group. However, multivariate analysis showed that the only significant risk factor for developing complications was male gender and drain placement was not significant. We were not able to find any particular reason why male patients had more postoperative complications.

There was no significant difference in the median length of postoperative hospital stay between the drain and no-drain groups; however, it tended to be longer in the drain group. Because surgeons were the ones who decided whether to place drains in this study and blood loss and surgery time were greater in the drain group than in the no-drain group, there may be more patients with more invasive surgeries in the drain group than in the no-drain group. If this is true, its surgical stress may prolong the hospital stay in the drain group and mask the efficacy of drain placement, resulting in no significant difference in the hospital stay after surgery between the 2 groups. Therefore, we examined the correlation between POD and operating time and blood loss comparing with or without drains to assess the correlation between POD and surgical stress; however, there was no correlation. From those results, drain placement may not offer additional benefits for length of postoperative hospital stay, and this is the reason that we do not prefer to place drains.

Although, to the best of our knowledge, this study is the first to assess the efficacy of drain placement in LTG, it is a retrospective study. Besides, there was 1 case of LTG with splenectomy and there were a few cases of D2 lymph node dissection. A prospective randomized control trial of LTG with D2 lymph node dissection is necessary to gather more evidence on the issue of routine prophylactic drain placement. Moreover, it could be critical if the postoperative complications were not quickly treated, and, therefore, we did not deny all cases of drain placement in LTG for which the backup system was poor.

In conclusion, on the basis of the results of this study, we believe that routine prophylactic drain placement in LTG may not be necessary because it does not offer additional benefits for patients.

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