

Is totally laparoscopic gastrectomy without prophylactic drains feasible for patients with distal gastric cancer? The experience of China National Cancer Center

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Research

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Abstract

Background

Prophylactic drains have been used to remove intraperitoneal collections and to detect complications early in open surgery. In the last decades, Gastric cancer minimally invasive surgery has been widely carried out throughout the world. However, little has been reported on routine prophylactic abdominal drainage after totally laparoscopic distal gastrectomy. To evaluate the feasibility of without prophylactic drains in totally laparoscopic distal gastrectomy in selective patients.

Methods

Data of distal gastric cancer patients underwent totally laparoscopic distal gastrectomy with and without prophylactic drainage at China National Cancer Center/Cancer Hospital from February 2018 to August 2019 were reviewed. The outcomes of patients with and without a prophylactic drainage were compared.

Results

A total of 420 patients who underwent surgery for gastric cancer were identified; of these, 88 patients who received totally laparoscopic distal gastrectomy were included. The incidence of concurrent illness was higher in the drain group, (48.8% vs. 27.7%, $p = 0.041$). The overall postoperative complication rate was 19.5% in the drain group ($n = 47$), and 10.6% in the no-drain group ($n = 41$), there were no significant differences between two groups ($p > 0.05$). The need for percutaneous catheter drainage (PCD) was also not significantly different between groups (9.8% vs. 6.4%, $p = 0.700$). However, patients with larger BMI (≥ 29) are prone to postoperative complications ($p = 0.042$). In addition, more operating time cost in the drain group than in the no-drain group (188.10 ± 38.89 min vs. 164.30 ± 36.97 min, $p < 0.05$). The number of days after surgery until the initiation of soft diet (5.34 ± 2.27 days vs. 4.17 ± 2.13 days, $p < 0.05$) and first flatus (4.29 ± 1.45 days vs. 3.55 ± 1.83 days, $p = 0.041$) were greater in the drain group.

Conclusions

Without prophylactic drainage may reduce surgery time and result in faster recovery. Routine prophylactic drains are not necessary in selective patients. A prophylactic drain may be useful in patients at higher risk.

Background

In recent ten years, gastric cancer is still one of the most frequently occurring malignancies worldwide. In 2017, there were about 1 million new cases of gastric cancer worldwide, which was the fifth most common malignancy, and the death rate was 783,000, which was the third highest malignant tumor (1).In

China, it was estimated that there were 677,000 new gastric cancer cases in China in 2015, accounting for half of the new gastric cancer cases in the world (2).

In 1994, Kitano reported the first case of laparoscopic assisted distal gastrectomy(LADG) with D2 lymphadenectomy (3), the recent South Korea multi-center clinical study also confirmed the operation was safe and effective treatment method (4), with the development of surgical instruments and the progress of technology, early gastric cancer minimally invasive surgery has been widely carried out throughout the world. Meanwhile, the interim results of class 01 clinical trial led by China southern hospital showed that the efficacy of laparoscopic surgery for advanced distal gastric cancer was comparable to that of open surgery (5).

With the development of laparoscopic surgery for gastric cancer, many surgeons begin to use totally laparoscopic surgery for distal gastric cancer, compared with laparoscopic assisted surgery, totally laparoscopic distal gastrectomy (TLDG) for reconstruction of digestive tract anastomosis is intra cavitory anastomosis, which does not require auxiliary small incision. The reconstruction of TLDG's anastomosis can have a safer anastomosis regardless of tumor location, with lower incidence of incision problems than LADG, and can be performed better in obese patients (6, 7).

Prophylactic drains have been used to remove intraperitoneal collections and to detect complications early. However, numerous trials have failed to demonstrate a reduction of postoperative complications by routine drainage in gastrointestinal (GI) surgery (8). Several studies performed after open gastrectomy or LADG concluded that the prophylactic use of drains did not improve postoperative outcomes significantly. But there were few studies on routine prophylactic drainage after TLDG.

In the current retrospective study, we compared the outcomes of TLDG with drainage to the outcomes of TLDG without drainage to clarify the value of routine prophylactic drainage in uncomplicated TLDG procedures for distal gastric cancer.

Patients And Methods

1. Patients

We reviewed the outcomes of 420 consecutive patients with distal gastric cancer who underwent TLDG with and without prophylactic drainage at China National Cancer Center/Cancer Hospital from February 2018 to August 2019. Of these, 145 patients who underwent proximal gastrectomy or total gastrectomy, 159 patients who underwent laparoscopic assist surgery, 23 who underwent open gastrectomy (including four cases converted from laparoscopic surgery), and 5 who underwent a simultaneous surgery for other diseases such as choledocholithiasis (n = 1), ovarian tumor (n = 1),pancreatic tail (n = 3) were excluded. 88 patients were included in this study, they were assigned to drain group and no-drain group according to their operation records. Drain group comprised 41 patients who underwent TLDG with routine prophylactic drainage and no-drain group comprised 47 patients who underwent TLDG without routine prophylactic drainage. Figure 1 CONSORT diagrams. Flowchart of the patients assessed in this study

2. Totally Laparoscopic Distal Gastrectomy

The extent of gastrectomy and lymph node dissection was determined based on the Japanese gastric cancer treatment guidelines (9). The operator was on the left side of the patient to finish laparoscopic ligation and division, the first assistant was positioned on the opposite. A cameraman stood between the patients' legs. A five-port system (i.e., two 5 mm and three 12 mm ports) was used for each totally laparoscopic distal gastrectomy. 10 mm flexible laparoscopes were used with CO₂ pressure maintained at 13–15 mmHg.

The operator was on the left side of the patient to performed Billroth-I reconstruction using mortified delta-shaped anastomosis(10) or overlap anastomosis(8). Performing Billroth-II or Roux-en-Y reconstruction on the right side of the patients.

3. Postoperative Management

Patients in both groups were given prophylactic antibiotics half an hour before surgery. The decision of whether to use a prophylactic drain was made by the surgeon. Oral intake of water was initiated on the first day after the surgery. Soft diet was initiated after patient could tolerate liquid meals and postoperative UGIs confirmed the absence of anastomotic leakage.

4. Outcome Assessment

The clinical, operative, and pathological variables were compared between the two groups based on the information obtained from our prospectively collected surgical database. Early postoperative complications (occurring on postoperative days 0–30) were graded using the Clavien–Dindo classification. Early postoperative complications requiring medical, radiological, or surgical interventions (grade 2 or higher) were regarded as an event. The occurrence of postoperative complication risk was also assessed.

5. Statistical Analysis

All values were expressed as mean \pm SD. Using χ^2 test and Student's t test for comparing the clinical characteristics categorical variables and continuous variables, respectively. For categorical data, the chi-squared test or Fisher's exact test is performed. A P value of < 0.05 was considered significant. Statistical analysis was performed using the SPSS.20.

Results

1. Patient Characteristics

Table 1 shows the clinical characteristics of patients undergoing TLDG with or without prophylactic drain. Between two groups no significant differences were observed in patient sex, age, BMI, ASA-PS, pTstage, pNstage, the number of patients with a previous abdominal operation, and the number receiving neoadjuvant chemotherapy, only in preoperative concurrent illness, the drain group was significantly higher than the no-drain group (48.8% vs. 27.7%, $p < 0.05$).

Table 1
The characteristics of patients underwent TLDG with or without prophylactic drain.

Characteristics	Drain (n = 41)	Without drain (n = 47)	P
Sex (M/F)	32/9	31/16	0.21
Age	57.78 ± 9.28	54.15 ± 12.90	0.138
BMI (kg/m ²)	25.02 ± 3.55	24.88 ± 3.60	0.849
ASA(1/2/3)			0.387
1	1(2.4%)	0(0.0%)	
2	37(90.2%)	42(89.4%)	
3	3(7.3%)	5(10.6%)	
pT stage			0.889
T1	19(46.4%)	23(49%)	
T2	7(17.1%)	11(23.4%)	
T3	4(9.8%)	4(8.5%)	
T4a	11(26.8%)	9(19.1%)	
pN stage			0.800
N0	19(46.3%)	20(42.6%)	
N1	7(17.1%)	12(25.5%)	
N2	7(17.1%)	6(12.8%)	
N3	8(19.5%)	9(19.1%)	
Previous abdominal operation	6(14.6%)	13(27.7%)	0.138
Neoadjuvant chemotherapy	2(4.9%)	2(4.3%)	1.000
Concurrent illness	20(48.8%)	13(27.7%)	0.041
ASA, American Society of Anesthesiologists; BMI, body mass index			

2. Operative Findings

Operative outcomes are summarized in Table 2. More operating time cost in the drain group than in the no-drain group (188.10 ± 38.89 min vs. 164.30 ± 36.97 min, $p < 0.05$). Mean estimated blood loss and intraoperative blood transfusion were similar between the two groups. There were no significant differences between the two groups in No. of retrieved LNs and tumor size. ($p > 0.05$).

Table 2
Operative findings

Variable	Drain(n = 41)	Without drain(n = 47)	P
Operation time (min)	188.10 ± 38.89	164.30 ± 36.97	0.004
Estimated blood loss(ml)	76.83 ± 58.67	71.70 ± 52.39	0.666
Intraoperative blood transfusion	1(2.4%)	2(4.3%)	1.000
Tumor size	3.36 ± 1.65	3.52 ± 1.37	0.639
No. of retrieved LNs	39.32 ± 13.06	39.26 ± 14.35	0.983

3. Recovery

Recovery outcomes are listed in Table 3. The number of days after surgery until the initiation of soft diet (5.34 ± 2.27 days vs. 4.17 ± 2.13 days, $p = 0.036$) and first flatus (4.29 ± 1.45 days vs. 3.55 ± 1.83 days, $p = 0.041$) were greater in the drain group. There no significant differences were found in first walking time, the length of postoperative hospital stay (8.15 ± 2.9 vs 6.77 ± 2.3 days, $p = 0.219$) between two group. Postoperative CRP (8.24 ± 4.47 vs. 8.67 ± 5.97 , $p > 0.05$) and Tmax ($37.6 \pm 0.6^\circ\text{C}$ vs. $37.5 \pm 0.4^\circ\text{C}$, $p > 0.05$) were similar between the two groups.

Table 3
Recovery

Variable	Drain(n = 41)	Without drain(n = 47)	P
First walking, POD	3.05 ± 1.482	3.06 ± 1.36	0.960
First flatus, POD	4.29 ± 1.45	3.55 ± 1.83	0.041
First eating soft diet, POD	5.34 ± 2.27	4.17 ± 2.13	0.014
Postoperative hospital stay	8.15 ± 5.2	6.77 ± 5.24	0.219
CRP	8.24 ± 4.47	8.67 ± 5.97	0.705
Tmax	37.6 ± 0.6	37.5 ± 0.4	0.402

4. Short-time Outcomes

Postoperative patient complications are listed in Table 4. No mortality was recorded for both groups. The overall postoperative complication rate was 19.5% in the drain group, and 10.6% in the no-drain group ($p > 0.05$). There were no anastomotic bleeding, anastomotic Leakage, lymph leakage, ileus and pancreatic fistula occur in either group. Clavien-Dindo grade 3 complication comprise duodenal stump leakage ($n = 2$), intra-abdominal abscess ($n = 2$) and intra-abdominal bleeding ($n = 1$) in the drainage group. The need for PCD was not significantly different between groups (9.8% vs. 6.4%, $p = 0.700$).

Table 4
Postoperative complications

Complications	Drain (n = 41)	Without drain (n = 47)	P
Total	8(19.5%)	5(10.6%)	0.242
Clavien–Dindo grade II			
Incision	0(0.0%)	1(2.1%)	
System complications	1(2.4%)	1(2.1%)	
Abdominal effusion	2(4.9%)	0(0.0%)	
Clavien–Dindo grade III			
Duodenal stump leakage	2(4.9%)	0(0.0%)	
Intra-abdominal bleeding	1(2.4%)	0(0.0%)	
Intra-abdominal abscess	2(4.9%)	2(4.2%)	
Pleural effusion	0(0.0%)	1(2.1%)	
Mortality	0(0.0%)	0(0.0%)	1.000
Need for PCD	4(9.8%)	3(6.4%)	0.700
PCD, percutaneous catheter drainage			

5. Risk Assessment For The Occurrence Of Postoperative Complication

Postoperative complication risk factors are listed in Table 5. Between two groups no significant differences were observed in majority of variables, only patients with larger BMI had a higher possibility of postoperative complication (27.38 ± 4.27 vs. 24.53 ± 3.27 , $p = 0.007$). In addition, we identified that patients with $BMI \geq 29$ are prone to postoperative complications ($p = 0.042$). A prophylactic drain may thus be useful in patients at higher risk and in those with larger BMI or more concurrent illness.

Table 5
Risk assessment for the occurrence of postoperative complication

Variable	Postoperative complication (+) (n = 13)	Postoperative complication (-) (n = 75)	P
Sex (M/F)	10/3	53/22	0.751
Age	59.69 ± 10.27	55.17 ± 11.56	0.168
BMI (kg/m ²)	27.38 ± 4.27	24.53 ± 3.27	0.007
≥ 29	5(38.5%)	10(13.3)	0.042
< 29	8(61.5)	65(86.7)	
ASA(1/2/3)			0.439
1	0(0.0%)	1(1.3%)	
2	11(84.6%)	68(90.7%)	
3	2(15.4%)	6(8.0%)	
Preoperative ALB (g)	36.34 ± 9.91	37.77 ± 5.04	0.460
Preoperative HGB (g/L)	111.80 ± 19.99	120.81 ± 19.51	0.205
pT stage			0.736
T1	5(38.5%)	37(49.3%)	
T2	3(23.1%)	15(20.0%)	
T3	2(15.4%)	6(8.0%)	
T4a	3(23.1%)	17(22.7%)	
pN stage			0.728
N0	5(38.5%)	34(45.3%)	
N1	2(15.4%)	17(22.7%)	
N2	3(23.1%)	10(13.3%)	
N3	3(23.1%)	14(18.7%)	
Previous abdominal operation	1(7.7%)	18(24.0%)	0.283
Neoadjuvant chemotherapy	2(15.4%)	2(2.7%)	0.102
Concurrent illness	6(46.2%)	27(36.0%)	0.485
ASA, American Society of Anesthesiologists; BMI, body mass index; ALB, albumin; HGB, hemoglobin.			

Variable	Postoperative complication (+) (n = 13)	Postoperative complication (-) (n = 75)	P
Type of reconstruction			0.196
Billroth I	4(30.8%)	27(36.0%)	
Billroth II	8(61.5%)	48(64.0%)	
Roux-en-Y	1(7.7%)	0(0.0%)	
Operative time (min)	185.39 ± 46.89	173.65 ± 38.18	0.326
Blood loss (ml)	63.08 ± 47.50	76.00 ± 56.43	0.439
ASA, American Society of Anesthesiologists; BMI, body mass index; ALB, albumin; HGB, hemoglobin.			

Discussion

Since 2015, totally laparoscopic surgery has been widely used in clinical practice, but there are few articles on whether totally laparoscopic surgery requires prophylactic drains(10, 11). Most of studies about prophylactic drains were based on open gastrectomy, Cochrane review by Wang et al., which included four single-institution, randomized controlled trials that sought to evaluate the role of PD placement in the setting of any type of gastric resection for gastric cancer (12–14). In this study, we reviewed the clinicopathological data of gastric cancer patients in our treatment group during the past two years, and found that routine prophylactic drains were not necessary in selective patients. A prophylactic drain may be useful in patients at higher risk.

It is generally believed that prophylactic drains are used to enhance early detection of complications, prevent collection of fluid, reduce morbidity and mortality, and decreases the duration of hospital stay (15, 16), the present study results had shown that there was no significant difference between two groups in postoperative hospital stay, while there was a trend: the length of postoperative hospital stay in no drain group was shorter than in drain group ((8.15 ± 2.9 vs 6.77 ± 2.3 days, $p > 0.05$). Among the 13 patients who experienced postoperative complications, there was also no significant difference between two groups in postoperative hospital stay. This result was different with Hirahara N et al.'s (10) study. In addition, without using prophylactic drainage can significantly improve the postoperative comfort of patients, earlier flatus (4.29 ± 1.45 days vs. 3.55 ± 1.83 days, $p < 0.05$) and feeding with soft meal (5.34 ± 2.27 days vs. 4.17 ± 2.13 days, $p < 0.05$).

Moreover, the application of Prophylactic drains does not reduce the incidence of complications, and complications were even higher in the drain group, although there was no statistically significant difference (19.5% vs. 10.6%, $p > 0.05$). By risk assessment, we identified that patients with BMI ≥ 29 are prone to postoperative complications ($p = 0.042$). It is important to note that there are a variety of causes of the results, on the one hand, this is a retrospective study, differences between two groups of data in

concurrent illness maybe lead to more postoperative complications in drain group; On the other hand, the difference may not be statistically significant due to the insufficient number of cases.

For patients with mild symptoms, administration of broad-spectrum antibiotics could be a good conservative management strategy, but for patients with severe symptoms, they need PCD. In the current study, postoperative complications were recognized in about 15% of patients. 2 cases of duodenal stump leakage and 2 cases of intra-abdominal abscess occur in drain group, all these cases needed PCD. In the no-drain group, 2 case of intra-abdominal abscess and 1 case of pleural effusion needed a PCD. There was no significant difference between two groups. Prophylactic drains do not altering rates of secondary drainage procedures. In conclusion, without PD during gastric cancer surgery doesn't increase the risk of PCD postoperatively.

Conclusion

In conclusion, without using PD in selective patients during gastric cancer surgery is possible which can significantly improve the postoperative comfort of patients and doesn't increase risk of postoperative complications.

Limitations

Here is a retrospective study, selection bias is unavoidable, for example the differences between two groups of data in concurrent illness maybe lead to more postoperative complications in drain group, and the decision regarding whether to use a PD is decided by surgeon. Another limitation is that this study only enrolled the patients undergone gastrectomy in our center during the last two years, which means results are not universal. Thus, we are going to perform a randomized, controlled trial to compare the outcomes between routinely used PD group and selectively used PD based on the present study.

Declarations

Ethics approval and consent to participate

This study was approved by the Institutional Review Board at the Cancer Hospital of the Chinese Academy of Medical Sciences. Written informed consent was obtained from all patients, and the data were anonymously analyzed.

Consent for publication

Not applicable.

Availability of data and material

The datasets supporting the conclusions of this article are available from the corresponding author on demand.

Competing interests

The authors declare that they have no competing interests.

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The funding body did not contribute to the design of the study and collection, analysis, and interpretation of data, or in writing the manuscript.

Author contributions: Hao Liu and Peng Jin contributed equally to this work and they were involved in concept, data interpretation, wrote the first draft, and revised it critically in light of comments from other authors; Quan Xu and Fuhai Ma analyzed the data. Shuai Ma and Yibin Xie collected the patient's clinical data. Yantao Tian was involved in study conception and design, data interpretation, manuscript revision, and discussion; all authors approved the final version submitted.

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Figures

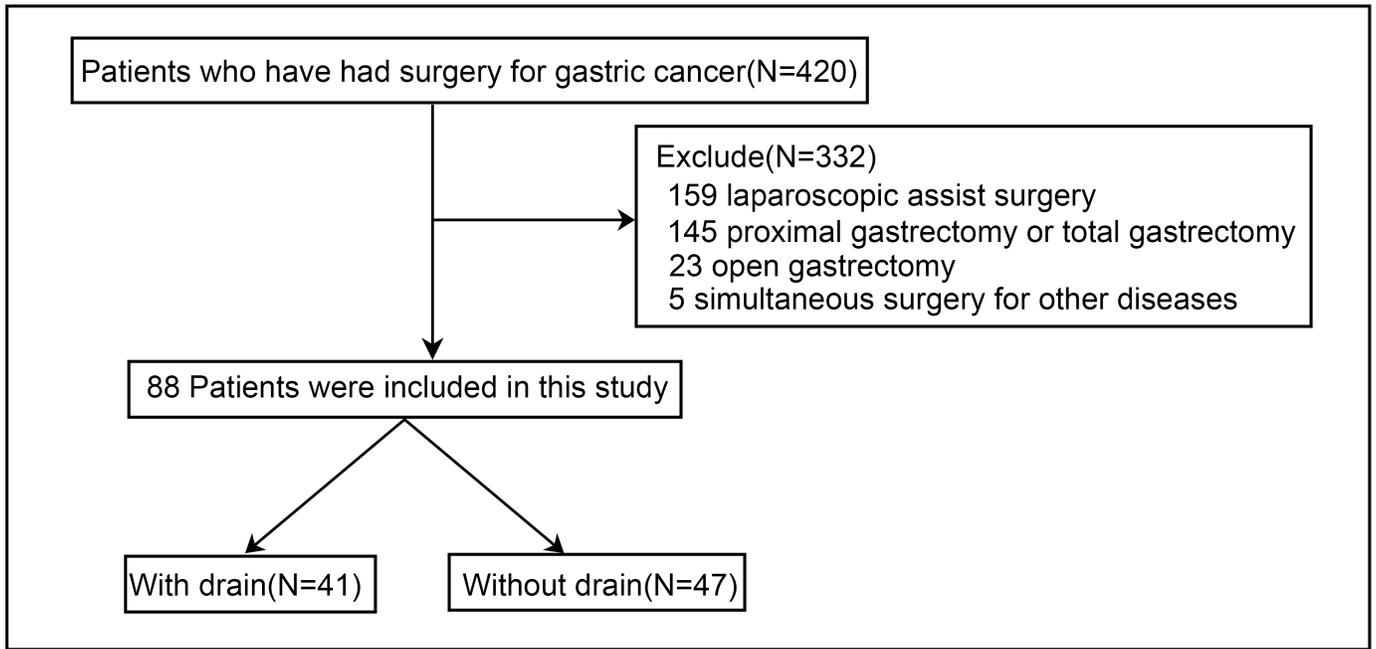


Figure 1

CONSORT diagrams. Flowchart of the patients assessed in this study