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***Retrospective Study***

**Curative effect of jejunum-later-cut overlap method**

Huang ZN *et al*.Short-term outcomes and quality-of-life after totally laparoscopic total gastrectomy

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**Abstract**

***AIM***

to study the short-term outcomes and quality-of-life (QOL) after laparoscopic gastrectomy (LG).

***Methods***

A total of 507 patients from January 2014 to March 2016 who underwent LG (D2) were originally included in the study.The patients were grouped to: isoperistaltic jejunum-later-cut overlap method (IJOM) after totally laparoscopic total gastrectomy (TLTG) (Group T, *n =* 51) or Roux-en-Y anastomosis after laparoscopic-assisted total gastrectomy (LATG) (Group A, *n =* 456). Compared the short-term outcomes and QOL after 1:2 propensity-score matching(PSM). We used the Questionnaire to assess QOL.

***Results***

Beforematching, the age, sex, tumor size, tumor location,preoperative albumin and blood loss were significant difference between the two groups (*P* ＜ 0.05). After PSM, there were well balanced in terms of their clinicopathological characteristics but both blood loss and in-hospital postoperative days in Group T were significantly lower than Group A (*P* ＜ 0.05). After matching, Group T reported better QOL in the domains of Pain and Dysphagia. Among the items evaluating Pain and Dysphagia, Group T tended to report better QOL (“Have you felt pain” and “Have you had difficulty eating solid food”)(*P* ＜ 0.05).

***Conclusion***

The IJOM for digestive reconstruction after TLTG reduces blood loss and associated with less pain and dysphagia, thus improving QOL after LG.

**Key words:** Esophagojejunostomy; Overlap; Later-cut; Totally laparoscopic total gastrectomy; Quality-of-life

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**Core tip:** This paper used propensity score-matched analysis and Questionnaire to study the short-term outcome and quality-of-life (QOL) after laparoscopic gastrectomy (LG) by analyses the patients who underwent totally laparoscopic total gastrectomy (TLTG) using isoperistaltic jejunum-later-cut overlap method (IJOM) to carry on esophagojejunostomy and patients who underwent laparoscopic-assisted total gastrectomy using Roux-en-Y anastomosis, We found the IJOM for digestive reconstruction after TLTG reduces blood loss and associated with less pain and dysphagia, thus the QOL after LG can be improved.

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**Introduction**

Since Kitano *et al*[1] reported laparoscopic-assisted distal gastrectomy in 1991, laparoscopic techniques and instruments have improved substantially. Consequently, totally laparoscopic distal gastrectomy is increasingly employed and has a proven history of safety and feasibility[2-8]. However, although scholars have reported a variety of totally laparoscopic total gastrectomy (TLTG) methods[3,9-13], this technique has not been widely adopted because of the technological difficulty inherent in digestive reconstruction. Interest in improving the postoperative appearance and quality-of-life (QOL) of gastric cancer following treatment has been increased. This goal, combined with the reduced trauma associated with TLTG, has heightened interest in developing ways to improve TLTG. Surgeons have primarily adopted the overlap or functional end-to-end method for digestive tract reconstruction after TLTG. However, these methods have drawbacks, such as jejunal freeness, which is seen particularly frequently with large anastomoses. Therefore, we devised the isoperistaltic jejunum-later-cut overlap method (IJOM), which involves esophagojejunostomy anastomosis after TLTG. Using this technique, we believe that the jejunum can be positioned with greater ease, thereby reducing the difficulties encountered with the anastomosis. However, little is known about the short-term outcome and QOL of patients following the implementation of this IJOM of digestive reconstruction after TLTG. Thus, this research aim to study the short-term outcomes and QOL after TLTG *via* IJOM and after LATG *via* Roux-en-Y using propensity-score matching(PSM)[14,15] and a QOL assessment scale.

**Materials and methods**

***Study population and inclusion/exclusion criteria***

Between January 2014 to March 2016, data were collected from 703 patients who underwent TLTG at Fujian Medical University Union Hospital. The including criteria were: (1) pathologically proved gastric cancer by endoscopic biopsy specimen analysis; (2) the aforementioned examination indicated no evidence of distant metastasis; and (3) postoperative pathological diagnosis was curative R0. The exclusion criteria were: (1) intraoperative proved distant metastasis; (2) T4b stage; (3) missing pathological data; (4) neoadjuvant therapy; and (5) comorbidities that could influence QOL (*e.g.*, previous or combined malignancies; cardiovascular disease; cerebrovascular disease; neurological conditions, such as dementia and seizure; and severe chronic obstructive pulmonary disease requiring persistent medical aid). A number of 507 patients were eligible. Group T consisted of 51 patients who underwent the IJOM after TLTG, and Group A comprised 456 patients who received a Roux-en-Y anastomosis after LATG. The 1:2 PSM was performed.Ultimately, Group T included 51 patients and 102 patients in Group A(Figure 1).

***Anastomosis step***

In Group T, the IJOM was performed after TLTG as follows: After dissecting the lymph nodes laparoscopically and mobilizing the esophagus (Figures 2.1.1 and 2.1.2) and the duodenum (Figures 2.2.1 and 2.2.2), using an endoscopic linear stapler transected they sequentially in predetermined locations. Made a small incision on the left side of the resection margin of the esophagus (Figures 2.3.1 and 2.3.2) and the antimesenteric border of the jejunum (Figures 2.4.1 and 2.4.2) approximately 20 cm away from the ligament of Treitz.

Then each incision was inserted into one limb of the stapler, and the forks of the stapler were closed and fired, achieving the side-to-side esophagojejunostomy (Figures 2.5.1 and 2.5.2). After confirmed there was no bleeding *via* common stab incision (Figures 2.6.1 and 2.6.2), we manually sutured the common stab (Figures 2.7.1 and 2.7.2).Then, the jejunum was transected after baring the mesenteric border approximately 1 cm into the jejunum wall and approximately 3 cm away from the esophagojejunostomy (Figures 2.8.1 and 2.8.2). After making a small incision on the antimesenteric border of the margin of the proximal jejunum and the distal jejunum roughly about 45 cm from esophagojejunostomy, and each incision inserted a limb of stapler, then closed the forks and fired them to achieve the side-to-side jejunojejunostomy (Figures 2.9.1 and 2.9.2).After confirmed there was no bleeding or damage to jejunal mucosa by common stab incision, the common stab incision was then sutured laparoscopically (Figures 2.10.1 and 2.10.2). Finally, we removed the specimen through the 3.5-cm incision on the lower abdomen. The differences between this method from other esophagojejunostomy anastomosis is summarize (Table 1).

For patients in Group T, the lymph nodes were dissected laparoscopically, and the esophagus and duodenum were mobilized. Then, the open traditional Roux-en-Y anastomosis was performed using a circular stapler[16].

***Definition***

All patients signed their informed consent before operation.Preoperative computed tomograph scanning,ultrasonography of the abdomen and endoscopic ultrasonography were routinely performed, when suspected of distant metastasis, the positron emission tomography were performed. Preoperative morbidities were scored according to the Charlson score system[17]. The 7th edition of the International Union against Cancer (UICC) classification[18] determined staging. Postoperative anastomosis-related complications were diagnosed by gastrografin esophagram or clinical manifestations and stratified using the Clavien–Dindo classification[19]. Perioperative death was defined as death that occurred during hospitalization. The Institutional Review Board of Fujian Medical University Union Hospital approved this study.

***QOL questionnaire***

We used the validated Chinese version of the European Organization for Research and Treatment of Cancer 30-item core QOL questionnaire (EORTC-QLQ-C30)[20] assessed QOL. The questionnaire includes a global health status, 5 functional items, 3 symptom dimensions, and 6 individual symptom items (Table 2). Further we using the validated Chinese version of the 22-item EORTC-QLQ gastric cancer module (EORTC-QLQ-STO22)[21] to assessed tumor-specific QOL. This questionnaire includes a functional scale, 5 symptom dimensions and 3 individual symptom scales. QoL is represented by a score ranging from 0 to 100 for every scale. Better QOL is indicated by the higher scores in the functional scales of the EORTC-QLQ-C30 and lower scores in the symptom scores of EORTC-QLQ-C30 and STO22 (Table 2).

***Follow-up***

Team members performed the follow-up *via* mailing, telephone call, or outpatient service.We explained the content of each item on the questionnaire to the patients 6 months postoperatively, and the patients chose their own responses.Most patients underwent physical examinations, laboratory tests, chest radiography, and abdominal ultrasonography or CT and annual endoscopic examinations.

***Statistical analysis***

We using the Statistical Package for Social Science version 18.0 (SPSS, Chicago, IL, United States) to performed the statistical analyses. The *t* tests or paired *t* tests were performed to compare continuous variables. **2  tests were performed to compare categorical variables.*P* ＜0.05 were considered statistically significant.

**Results**

***Demographics and clinical characteristics***

Before matching, age, sex, tumor location, tumor size, and preoperative albumin level differed significantly between the two groups (*P* ＜ 0.05). After 1:2 matching, 51 and 102 patients were included in Groups T and A, respectively, and well balanced in their clinicopathological characteristics (Table 3).

***Perioperative results***

After matching, blood loss and postoperative days in the hospital were significantly less in Group T than Group A (*P* ＜ 0.05). The harvested lymph nodes numbers, operation time, time to first flatus, time to fluid diet, and hospitalization costs were similar in both groups (Table 4).

***Postoperative complications***

Before matching, 1 patient had an anastomotic fistula in Group T. In contrast, Group A included 22 anastomotic fistulae, 1 anastomotic hemorrhage and 4 anastomotic obstructions. The incidences of anastomosis-related complications were 2.0% and 5.9% in Groups T and A, respectively; the two rates were similar. After matching, there was 1 patient with an anastomotic fistula in Group T, whereas there were 4 patients with an anastomotic fistula, 1 with an anastomotic hemorrhage and 2 with an anastomotic obstruction in Group A. The incidence of anastomosis-related complications has no statistical difference in both groups and no perioperative deaths occurred (Table 5).

***Functional scales***

After matching, 6 patients died and 1 was lost to follow-up 6 months postoperatively in Group.Eventually, 44 patients joined the questionnaire survey. In Group A, 10 patients died, and 3 were lost to follow-up. A total of 89 patients from Group A participated in the questionnaire survey. The functional scales of EORTC-QLQ-C30 were all similar in both groups (Figure 2).

***Symptom scales***

After matching, the symptom scales of EORTC-QLQ-C30 and STO22 were compared. Based on the pain scales of EORTC-QLQ-C30 and dysphagia scales of EORTC QLQ-STO22, Group T reported better QOL (Figure 3). Subgroup analyses of 2 items in the pain scale (“Have you felt pain?” and “Has your life been affected by pain?”), Group T tended to report better QOL in “Have you felt pain?”(*P* = 0.018). In the dysphagia scale, subgroup analyses of 3 items (“Have you had difficulty eating solid food?”, “Have you had difficulty swallowing liquid or eating soft food?”, and “Have you had difficulty drinking water?”) revealed that Group T tended to report better QOL in response to the question “Have you had difficulty eating solid food?” than Group A (*P* = 0.039)(Table 6).

**Discussion**

Laparoscopy offers several advantages over traditional laparotomy, such as reduced trauma, faster recovery, fewer postoperative complications, and greater aesthetic appeal. These benefits are attributable to the minimal invasiveness of the laparoscope and the good clinical outcomes that have been reported[22-25]. Currently, the methods of digestive tract reconstruction employed after LG include LATG and TLTG. In LATG, the digestive tract reconstruction should be performed *via* a small incision after lymphadenectomy, although this decreases the advantages of laparoscopic minimally invasive surgery. Since Uyama[12] reported totally laparoscopic digestive tract reconstruction, substantial research in Japan and Korea has revealed that TLTG has desirable short-term outcomes and is also safe and effective[11,26-28].

Currently, the digestive tract reconstruction methods used after TLTG include adopt overlap[12] and functional end-to end[29] techniques. However, jejunal freeness is one of several drawbacks associated with these methods and makes the anastomosis more difficult. Therefore, we devised the isoperistaltic jejunum-later-cut overlap method, which involves esophagojejunostomy anastomosis after TLTG. We believe that, using this technique, the jejunum can be more easily positioned, thereby reducing the difficulty in creating the anastomosis. Moreover, because the proximal jejunum is divided after the anastomosis, the length of the blind loops can be easily grasped. We found that blood loss was reduced in Group T,this may be attributed to the clearer, amplified field of vision achieved during laparoscopic digestive tract reconstruction. As a result, blood vessels in the muscles and mesentery can be more readily identified and are less likely to be transected during the procedure. Consistent with our findings, previous studies have shown that reduced blood loss is associated with better postoperative recovery[30]. We found that the length of the postoperative stay of Group T was significantly shorter than that of Group A, confirming that less trauma and blood loss during TLTG can promote faster recovery.

Lee *et al*[31] showed that distal gastrectomy decreases the QOL because of problems with eating restrictions and body image. However, compared with open surgery, laparoscopic-assisted distal gastrectomy improves QOL, specifically by reducing the incidence of postoperative intestinal obstruction[32]. Fujii *et al*[33] suggested that this reduction in postoperative intestinal obstruction may be attributable to the less abdominal manipulation required for laparoscopic surgery, which may blunt the systemic cytokine and inflammatory responses[34,35]. Similarly, totally laparoscopic technology reduces the amount of intestinal manipulation required during digestive tract reconstruction and may also reduce the incidence of postoperative intestinal obstruction. However, no studies have evaluated QOL following totally laparoscopic surgery. Schneider *et al*[36] reported that the diameter of the anastomotic stoma obtained using the linear stapler was significantly larger than that achieved with the circular stapler, which benefits the passage of food. At 6 mo post-surgery, we found that symptoms of dysphagia were better in Group T, especially in terms of eating solid food. This finding indicates that using a linear stapler can expand the diameter of the anastomotic stoma and that the decreased intestinal manipulation involved in TLTG can reduce the incidence of intestinal obstruction.

Patients suffered TLTG reported significantly less pain than those in LATG. We believe that this is because the incision in the abdominal wall involved in TLTG is shorter, leading to less pain from inflammation and scar formation. In addition, less intra-abdominal manipulation likely contributes to decreasing the formation of intra-abdominal adhesions and, thus, the associated discomfort.

This is the first study investigating the differences in short-term outcomes and QOL after TLTG by the isoperistaltic jejunum-later-cut overlap method and LATG by Roux-en-Y using PSM and a QOL assessment scale. The results show that utilizing the isoperistaltic jejunum-later-cut overlap method after TLTG can reduce intra-operative blood loss and relieve symptoms of pain and dysphagia. However, this study has several limitations. First, the follow-up period was short. Second, a retrospective, single-center design was used. Therefore, a prospective, multiple-center study with a longer follow-up period is needed.

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**comments**

***Background***

Surgeons have primarily adopted several methods for digestive tract reconstruction after totally laparoscopic total gastrectomy (TLTG). However, these methods have drawbacks, such as jejunal freeness,and difficult to performed. Therefore, we devised the isoperistaltic jejunum-later-cut overlap method (IJOM),but little was known about the short-term outcome and quality-of-life (QOL) of patients following the implementation of this digestive reconstruction.

***Research frontiers***

The QOL after distal gastrectomy was reported affected by eating restrictions and body image.For TLTG, Scholars have reported a variety of digestive reconstruction which was safe and effective,but the QOL was Uncertainty.

***Innovations and breakthroughs***

The authors used propensity score-matched analysis andQuestionnaire to carry on the research. The authors found IJOM for digestive reconstruction can reduce blood loss compared with Roux-en-Y anastomosis and associated with less pain and dysphagia, thus improving QOL after laparoscopic gastrectomy.

***Applications***

Through this study,we can focus the symptoms which probably happen after surgery, accordingly improved the QOL of patients. But a prospective, multiple-center study with a longer follow-up period is needed.

***Terminology***

EORTC-QLQ-C30:Chinese version of the European Organization for Research and Treatment of Cancer 30-item core QOL questionnaire. EORTC-QLQ-STO22:the validated Chinese version of the 22-item EORTC-QLQ gastric cancer module.PSM: A statistical matching which can reduce the bias of variables.

***Peer-review***

This study is a pioneer study about esophagojejunostomy anastomosis after TLTG.

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**Table 1 characteristic, benefit and demerit of different esophagojejunostomy anastomosis**

|  |  |  |  |
| --- | --- | --- | --- |
| **Anastomosis surgeon** | **Characteristic** | **Benefit** | **Demerit** |
| Uyama *et al*[12] | The anastomosis line is vertical with esophageal long axis.  Jejunum is located in the right side of the esophagus. | Anastomotic is large enough | The number of anastomosis linear stapler is much |
| Matsui *et al*[37] | Completed the anastomosis before severed esophagus.  Close the stoma and resecting specimens at the same time.  Jejunum is located in the right side of the esophagus. | The number of anastomosis linear stapler is reduce | Probably happen dysphagia 6 months after operation |
| Lee *et al*[13] | Suture esophagus,jejunum and right angle of diaphragm after anastomosis  Jejunum is located in the right side of the esophagus. | Reduce the incidence of esophageal hiatal hernia and anastomotic fistula. | Increase the operation time. |
| Okabe *et al*[38] | Before anastomosis,the specimens was removed.  Jejunum is located in the left side of the esophagus. | The size of anastomotic stoma is bigger | The technique is difficult. |
| Inaba *et al*[29] | Overlap anastomosis  Dividing the jejunum before anastomosis | Isoperistaltic meets the physiological | The jejunum is free and difficult for anastomosis |
| Matsui *et al*[39] | Overlap anastomosis  Dividing the esophagus after anastomosis | Isoperistaltic meets the physiological | The jejunum is free and difficult for anastomosis |

**Table 2 Structure of EORTC QLC-C30 and EORTC QLQ-STO22**

|  |  |
| --- | --- |
| Scales | Number of Constituting Items |
| EORTC QLQ-C30 |  |
| Global health status/QoL scale1 | 2 |
| Functional scales1 |  |
| Physical Funcitioning | 5 |
| Role Funcitioning | 2 |
| Emotional Funcitioning | 4 |
| Cognitive Funcitioning | 2 |
| Social Funcitioning | 2 |
| Symptom Scales2 |  |
| Fatigue | 3 |
| Nausea and Vomiting | 2 |
| Pain | 2 |
| Dyspnoea | 1 |
| Insomnia | 1 |
| Appetite Loss | 1 |
| Consipation | 1 |
| Diarrhoea | 1 |
| Financial Difficulties | 1 |
| EORTC-QLQ-STO222 |  |
| Dysphagia | 3 |
| Chest and abdominal pain | 4 |
| Reflux | 3 |
| Eating restrictions | 4 |
| Anxieties | 3 |
| Dry mouth | 1 |
| Taste problem | 1 |
| Body image | 1 |
| Hair loss | 2 |

1Higher scores represent better QoL; 2Higher scores represent worse QoL. EORTC QLQ indicates European Organization for Research and Treatment of Cancer Quality-of-life Questionnaire; QoL: quality-of-life.

**Table 3 Demographic and clinical characteristics of patients between two groups**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **All Patients** | | | **Propensity-matched patients** | | |
|  | **Group T**  **(*n =* 51)** | **Group A**  **(*n =* 456)** | ***P******-*value** | **Group T**  **(*n =* 51)** | **Group A**  **(*n =* 102)** | ***P-*value** |
| Age (mean±SD, yr) | 55.5±12.1 | 61.6±11.2 | ＜ 0.001 | 55.5±12.1 | 55.9±11.0 | 0.916 |
| Gender |  |  | ＜ 0.001 |  |  | 1.000 |
| Male | 34 | 345 |  | 34 | 68 |  |
| Female | 17 | 111 |  | 17 | 34 |  |
| Charlson comorbidity index |  |  | 0.281 |  |  | 0.608 |
| 0 | 48 | 418 |  | 48 | 92 |  |
| 1-2 | 3 | 38 |  | 3 | 10 |  |
| BMI (mean±SD, kg/m2) | 22.5±13.1 | 22.3±13.5 | 0.919 | 22.5±13.1 | 22.6±12.8 | 0.965 |
| Tumor size (mean±SD, cm) | 4.5±1.5 | 4.9±1.3 | 0.041 | 4.5±1.5 | 4.7±1.7 | 0.142 |
| Tumor lacation |  |  | ＜ 0.001 |  |  | 0.177 |
| Upper third | 4 | 188 |  | 4 | 12 |  |
| Middle third | 34 | 169 |  | 34 | 76 |  |
| Entird | 13 | 99 |  | 13 | 14 |  |
| Histology type |  |  | 0.453 |  |  | 0.482 |
| Differentiation | 47 | 416 |  | 47 | 97 |  |
| Undifferentiation | 4 | 40 |  | 4 | 5 |  |
| Preoperation albumin (mean±SD, g/L) | 40.8±4.3 | 39.1±5.2 | 0.025 | 40.8±4.3 | 40.6±4.6 | 0.796 |
| Depth of infiltration (T) |  |  | 0.174 |  |  | 0.643 |
| T1 | 15 | 82 |  | 15 | 23 |  |
| T2 | 8 | 83 |  | 8 | 18 |  |
| T3 | 10 | 135 |  | 10 | 16 |  |
| T4a | 18 | 166 |  | 18 | 45 |  |
| Nodal status (N) |  |  | 0.729 |  |  | 0.534 |
| N0 | 21 | 190 |  | 21 | 34 |  |
| N1 | 11 | 77 |  | 11 | 18 |  |
| N2 | 5 | 66 |  | 5 | 10 |  |
| N3 | 14 | 123 |  | 14 | 40 |  |
| UICC stage |  |  | 0.319 |  |  | 0.502 |
| I | 13 | 78 |  | 13 | 18 |  |
| II | 17 | 159 |  | 17 | 40 |  |
| III | 21 | 219 |  | 21 | 44 |  |

BMI: body mass index; UICC stage: 7th edition of the International Union against Cancer.

**Table 4 Operative variables of the patients**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **All Patients** | | | **Propensity-matched patients** | | |
|  | **Group T**  **(*n =* 51)** | **Group A**  **(*n =* 456)** | ***P-*value** | **Group T**  **(*n =* 51)** | **Group A**  **（*n =* 102）** | ***P-*value** |
| Operation time,min(mean ± SD) | 209.3±41.0 | 203.6±49.3 | 0.427 | 209.3±41.0 | 200.5±55.6 | 0.318 |
| Blood lost volume, ml(mean±SD) | 48.3±38.5 | 98.4±149.1 | 0.017 | 48.3±38.5 | 105.4±147.9 | 0.008 |
| Harvested LNs (mean ± SD) | 44.5±15.0 | 41.2±14.2 | 0.237 | 44.5±15.0 | 42.6±15.2 | 0.465 |
| Time to first flatus,day(mean±SD) | 3.8±1.2 | 3.5±1.7 | 0.220 | 3.8±1.2 | 3.6±1.2 | 0.332 |
| Time to fluid diet,day(mean±SD) | 5.6±1.4 | 5.6±1.6 | 1 | 5.6±1.4 | 5.5±1.9 | 0.739 |
| Postoperative day(mean±SD) | 12.6±4.3 | 14.7±8.9 | 0.097 | 12.6±4.3 | 15.4±8.9 | 0.035 |
| hospitalization costs,yuan | 75450±20038 | 73308±21932 | 0.505 | 75450±20038 | 70407±13254 | 0.065 |
| Chemotherapy | 33 | 310 | 0.635 | 33 | 78 | 0.123 |

LN: lymph node.

**Table 5 Morbidity and Mortality associate with anastomosis**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **All patients** | | |  | **Propensity-matched patients** | | |
|  | **Group T,%** | **Group A,%** | ***P-*value** |  | **Group T,%** | **Group A,%** | ***P-*value** |
|  | **(*n =* 456)** | **(*n =* 51)** |  | **(*n =* 102)** | **(*n =* 51)** |
| Morbidity | 1 (2.0) | 27 (5.9) | 0.893 |  | 1 (1.9) | 6(11.8) | 0.552 |
| Anastomotic fistula | 1 | 22 |  |  | 1 | 4 |  |
| Anastomotic hemorrhage | 0 | 1 |  |  | 0 | 0 |  |
| Anastomotic obstruction | 0 | 4 |  |  | 0 | 2 |  |
| Mortality | 0 | 0 | / |  | 0 | 0 | / |

**Table 6 Constituent items of Pain of EORTC-QLQ-C30 and Dysphagia of EORTC-QLQ-STO22 as compared between Group T and Group A**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Propensity-matched patients** | | |
|  | **Group T**  **(*n =* 44)** | **Group A**  **（*n =* 89）** | ***P-*value** |
| Constituent items of Pain of EORTC-QLQ-C30 |  |  |  |
| Have you felt pain? |  |  | 0.018 |
| Not at all | 28 | 66 |  |
| A little | 12 | 7 |  |
| Quite a lot | 3 | 14 |  |
| Very much | 1 | 2 |  |
| Have your life affected by pain? |  |  | 0.271 |
| Not at all | 39 | 73 |  |
| A little | 4 | 7 |  |
| Quite a lot | 1 | 9 |  |
| Very much | 0 | 0 |  |
| Constituent items of Dysphagia of EORTC-QLQ-STO22 |  |  |  |
| Have you felt difficult to eat solid food? |  |  | 0.039 |
| Not at all | 26 | 31 |  |
| A little | 11 | 32 |  |
| Quite a lot | 7 | 21 |  |
| Very much | 0 | 5 |  |
| Have you felt difficult to eat liquid of soft food? |  |  | 0.275 |
| Not at all | 38 | 67 |  |
| A little | 5 | 15 |  |
| Quite a lot | 1 | 7 |  |
| Very much | 0 | 0 |  |
| Have you felt difficult to drink water? |  |  | 0.194 |
| Not at all | 39 | 80 |  |
| A little | 5 | 5 |  |
| Quite a lot | 0 | 4 |  |
| Very much | 0 | 0 |  |

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**Figure 1 The flow chart of patient selection.** LTG: Laparoscopic total gastrectomy; TLTG: Totally laparoscopic total gastrectomy; LATG: Laparoscopic assisted total gastrectomy.

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**Figure 2 The schematic diagram of anastomosis.**

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A

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a

B

**Figure 3 The Funcitional Scales.** A: EORTC-QLQ-C30; B: EORTC-QLQ-C30 and EORTC-QLQ-STO22. a*P* ＜ 0.05, EORTC-QLQ-C30 *vs* EORTC-QLQ-STO22.