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REVIEW ARTICLE

Totally laparoscopic total gastrectomy for gastric cancer: Literature review and comparison of the procedure of esophagojejunostomy

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Summary There has been a recent increase in the use of totally laparoscopic total gastrectomy (TLTG) for gastric cancer. However, there is no scientific evidence to determine which esophagojejunostomy (EJS) technique is the best. In addition, both short- and long-term oncological results of TLTG are inconsistent. We reviewed 25 articles about TLTG for gastric cancer in which at least 10 cases were included. We analyzed the short-term results, relationships between EJS techniques and complications, long-term oncological results, and comparative study results of TLTG. TLTG was performed in a total of 1170 patients. The mortality rate was 0.7%, and the short-term results were satisfactory. Regarding EJS techniques and complications, circular staplers (CSs) methods were significantly associated with leakage (4.7% vs. 1.1%, $p < 0.001$) and stenosis (8.3% vs. 1.8%, $p < 0.001$) of the EJS as compared with the linear stapler method. The long-term oncological prognosis was acceptable in patients with early gastric cancers and without metastases to lymph nodes. Although TLTG tended to increase surgical time compared with open total gastrectomy and laparoscopy-assisted total gastrectomy, it reduced intraoperative blood loss and was expected to shorten postoperative hospital stay. TLTG is found to be safer and more feasible than open total gastrectomy and laparoscopy-assisted total gastrectomy. At present, there is no evidence to encourage performing TLTG for patients with advanced gastric cancer from the viewpoint of long-term oncological prognosis. Although the current major EJS techniques

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are CS and linear stapler methods, in this review, CS methods are significantly associated with leakage and stenosis of the EJS.

1. Introduction

Laparoscopy-assisted distal gastrectomy (LADG) for gastric cancer was first performed by Kitano et al[1] in 1994 and showed satisfying short-term results.[2] The long-term results of LADG for early gastric cancer were also favorable,[3] and LADG was reported to be surgically less invasive and lead to an earlier recovery than open surgery.[4,5]

The number of reports on laparoscopy-assisted total gastrectomy (LATG) for gastric cancer has increased with the advancement of techniques for lymphadenectomy and reconstructive procedures for the upper stomach.[6–10] However, esophagojejunostomy (EJS) via minilaparotomy in LATG is relatively difficult because of the limited angle of the direct view, depending on the patient's somatotype and obesity index, and totally laparoscopic total gastrectomy (TLTG) has become more commonly used for intracorporeal anastomosis performed under pneumoperitoneum. As surgical techniques progressed from LATG to TLTG, new EJS techniques have been devised for TLTG.[11–15] TLTG has been widely performed in Japan and Korea and has shown favorable short-term performance results.[16–19]

EJS in TLTG is a very important surgical procedure because it is associated with the risk of anastomotic leakage, bleeding, and stenosis.[20,21] No scientific conclusion can be drawn at present regarding which procedure reduces the postoperative complications of EJS in TLTG because no clear evidence is available based on well-designed randomized controlled trials (RCTs). We retrospectively reviewed reports on various techniques for EJS in TLTG, compared various EJS techniques and complications, and investigated short- and long-term oncological results and comparative study results of TLTG.

2. Methods

2.1. Definition and surgical techniques

This review included TLTG or totally laparoscopic degastrectomy for gastric or remnant gastric cancer, using Roux-en Y reconstruction. As with surgical procedures via minilaparotomy, the removal of resected specimens and performing jejunojejunostomy were permitted. EJS had to be performed intracorporeally under pneumoperitoneum to satisfy the determination of TLTG. Regarding EJS techniques, this review targeted the so-called single stapling technique (SST), double stapling technique (DST), and hemidouble stapling technique (HDST) using circular staplers (CSs), as well as the functional end-to-end anastomosis (FETEA) and overlap methods using linear staplers (LSs), and the hand-sewn (HS) method, and classified procedures into these six types. Reports that did not meet the above criteria or those using several or unknown EJS techniques were excluded from the analyses of EJS techniques.

We analyzed short-term results, relationships between EJS techniques and complications, as well as long-term oncological results and comparative study results of TLTG.

2.2. Search strategy

This review included only English articles identified by the term "totally laparoscopic" or a combination of "laparoscopic" and "total gastrectomy" in the PubMed online database. On July 15, 2013, a final search of PubMed was performed, and we selected and reviewed original articles describing the clinical results of TLTG performed in at least 10 cases. Reports using animal data or those including robotic surgeries were excluded.

2.3. Statistical analyses

Data were collected and analyzed using StatMate IV for Windows (ATMS Co., Ltd., Tokyo, Japan). The Student *t* test was used to compare the continuous variable, and the Chi-square test was used to compare the categorical variable. A p value < 0.05 was considered significant.

3. Results

3.1. Literature overview

In 2005, Dulucq et al[22] reported the first case series of TLTG for gastric cancer ($n = 8$), which was a prospective single-center study of TLTG and other surgical procedures. Since then, TLTG has become a more commonly used surgical procedure for gastric cancer, and many reports focusing on reconstruction techniques in EJS and short-term results have been published in recent years. Our initial literature search found 629 articles; however, only 25 of them satisfied the conditions described above.[11–19,23–38]

Table 1[11–19,23–36] summarizes the reports cited in this review. Of the 25 articles cited in this review, only two were prospective studies and the remaining 23 were retrospective studies. Three articles described comparative studies of TLTG and open total gastrectomy (OTG),[16,17,19] including one comparing TLTG versus LATG.[18] Sixteen articles focused on surgical and short-term results only, and nine articles described long-term oncological results.[13,17,23,25,27,29,35–37]