

# Laparoscopic Gastrectomy for Gastric Cancer – An Overview of the Current Perspectives

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## ABSTRACT

Due to its favorable postoperative phase and outcomes, laparoscopic gastrectomy has become widely accepted as an alternative to an open surgical method for the treatment of early gastric cancer. The approach is being increasingly adopted to treat advanced gastric cancer, though concerns exist about oncological safety, technical feasibility, and long-term outcomes. This article presents a brief overview of the recent literature related to the adoption of a laparoscopic approach for the management of gastric cancer.

**Keywords:** Gastric cancer, stomach cancer, laparoscopic gastrectomy, early gastric cancer, locally advanced gastric cancer, lymphadenectomy, port-site metastasis.

## INTRODUCTION

The Billroth I gastrectomy, carried out in 1881 by Professor Christian Albert Theodor Billroth, was the first successful surgical surgery for stomach cancer. During the procedure, the pylorus was excised, and the duodenum and remaining stomach were anastomosed end to end [1]. The operation was heralded as a kind of miracle at that time and helped to establish the foundation for contemporary elective abdomen surgery [1, 2]. He modified the procedure to a Billroth II gastrectomy four years later, in 1885, closing the duodenum and reestablishing the continuity of the gastrointestinal system with anterior gastrojejunal anastomosis [3].

Since then, the procedure has undergone numerous modifications, evolving from massive resections toward highly precise operations as a result of growing knowledge of the elements pertaining to perioperative physiology and the availability of better instruments. The introduction of the laparoscopic procedure for the treatment of stomach cancer is one of these revolutionary breakthroughs. In 1992, Goh *et al.* documented the first-ever successful laparoscopic Billroth II gastrectomy [4], and shortly afterward, Kitano *et al.* reported a successful laparoscopic gastrectomy for stomach cancer in its early stages [5].

In 1994, Goh *et al.* [6] conducted an international survey and found that sixteen surgeons had performed a total of 118 laparoscopic gastrectomy operations, out of which 38% were for gastric cancer. Although there were concerns regarding the expense and lengthier operation time, the study concluded that the laparoscopic technique was superior to the standard open one

because of improved cosmesis, lower discomfort, and speedier recovery.

## METHODS

A literature review was carried out using the keywords “Gastric cancer”, “Laparoscopic gastrectomy”, “Early gastric cancer” and “Locally advanced gastric cancer” in electronic databases like PubMed, PubMed Central, ResearchGate, Google Scholar, Semantic Scholar, and Scopus. Individual keywords were used in the search together with a Boolean logic (AND) combination. Studies that were published in the English language and that were carried out recently between the years 2018 and 2023 were selected. Cross-references from earlier years found on scrutiny of references were used, if they carried some historical value.

### Laparoscopic Approach in Early Gastric Cancer

For early gastric cancer, the laparoscopic gastrectomy (LG) has been established as a viable equivalent to the traditional open procedure concerning its outcomes, with added advantages of lesser invasion, lesser blood loss, quicker recovery, and allows an early introduction of adjuvant therapy [7]. Furthermore, the laparoscopic approach provides the ability to visualize the operative field in a magnified view, thereby aiding surgeons in performing more precise dissection of lymph nodes, which is crucial for the patient’s outcome [8].

The Korean randomized study KLASS-01 by Kim *et al.* [9] compared LG and OG for early distal gastric cancer and discovered that the 5-year cancer-specific survival rates for both groups were comparable (about 97%). Hiki *et al.* and Katai *et al.*’s Japanese randomized trials [10, 11] discovered comparable long-term outcomes for 921 cases with clinical stage IA/IB gastric cancer in terms of survival and recurrence.

Using a 24-item questionnaire, Adachi *et al.* [12] evaluated the quality of life (QOL) of 41 patients who

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had undergone LG and compared it with that of 35 patients with conventional OG for the management of cancer. Patients who had undergone LG were satisfied with their surgical outcomes (88%). They consumed a normal diet (100%) with >66% of volume at each meal (90%), and did not display any features of impaired performance status (90%). The overall acceptance of LG was superior, and when compared to the OG cases, they exhibited considerably better outcomes in terms of weight loss, dysphagia, heartburn and belching, early dumping syndrome, and overall QOL. The study found that following LG, QOL was significantly better than in individuals who had undergone OG [12].

### Laparoscopic Approach in Locally Advanced Gastric Cancer

For patients presenting with locally advanced gastric cancer (AGC), radical gastrectomy with D2 lymphadenectomy (RGD2) has become the standard treatment. However, over the years, concerns have been raised about the adequacy of dissection and adherence to oncological principles in the laparoscopic approach. These concerns have arisen due to technical difficulties posed by RGD2, the long learning curve associated with laparoscopic procedures per se, and the scarcity of data related to long-term oncological outcomes after LG. However, favorable data from several trials conducted recently indicates that the LG and OG do not differ in long-term oncological and survival outcomes.

Wei *et al.* [13] retrospectively analyzed data from 134 patients with similar baseline characteristics, who underwent open or laparoscopic subtotal D2 gastrectomy for locally advanced gastric cancer from 2011 to 2018, and compared clinicopathological features, preoperative events, quality of recovery after operations, and the survival. The results showed that patients who underwent LG as opposed to OG had shorter postoperative hospital stays (12.5 vs. 17.2 days;  $P < 0.05$ ), less blood loss (83.7 vs. 333 mL;  $P < 0.05$ ), earlier oral intake initiation (3.1 vs. 5.4 postoperative days;  $P < 0.05$ ), and shorter operative times (250.8 vs. 347.6 min;  $P < 0.05$ ). However, the rates of overall survival, disease-free survival, surgical morbidity, and mortality were comparable across the two groups.

Caruso *et al.* [14] conducted a retrospective audit to evaluate the safety and oncological efficacy of LG in patients with locally advanced gastric cancer. The audit compared the results of LG and OG with D2 lymphadenectomy at two Western referral hospitals. Overall complications (16.7% vs. 20.8%,  $p = 0.489$ ), the requirement of re-exploration (3.3% vs. 2.5%,  $p = 0.714$ ), anastomotic/duodenal stump leakage (5.8% vs. 3.3%,  $p = 0.072$ ), and death (4.2% vs. 3.3%,  $p = 0.987$ ) did not differ statistically significantly within 30 days. Chest infection, wound complications, and length of hospital stay were significantly lesser in the LG group though the time taken for LG was greater than OG (212 vs. 192 min,  $p < 0.05$ ). When it comes to the achievement of

clear surgical margins and the number of lymph nodes resected during D2 dissection, there was no statistically significant difference between the two approaches, thereby lending support to the feasibility and safety of the laparoscopic approach.

In China, between 2012 and 2014, a total of 1056 cases of stomach cancer with clinical stage T2, T3, or T4a but without enormous lymphadenopathy or distant metastases were randomized into LG and OG management groups at 14 tertiary care health facilities. At five years after surgical operation, there was no statistically significant difference in the outcomes in terms of survival (72.6% vs. 76.3%;  $P = .19$ ) for each cancer stage [15].

Zhu *et al.* [16] carried out a meta-analysis and systematic review of 36 randomized controlled trials (RCT) and retrospective studies published between 2010 and 2019, including 5714 cases managed by LG and 6094 cases by OG. They found that, although the conduct of LG had taken longer, there had been far less blood loss. Postoperative recovery went smoother in LG. However, there was no statistically significant difference in the rate of tumor recurrence, in-hospital mortality, or the number of removed lymph nodes during the surgery. After five years, overall survival favored LG.

Chan *et al.* [17] compared the outcomes of 54 patients who underwent LG with that of 167 patients following OG for advanced gastric cancer at a lower-volume, healthcare facility in Hong Kong. The cases were clinically comparable and had T2, T3, and T4 gastric cancer. Comparable outcomes were observed in both groups regarding total adverse effects, unplanned readmission or re-exploration or death at one-month post-surgery, margin clearance, the requirement of adjuvant therapy, and overall survival. The open approach was associated with greater blood loss (275 vs. 150 mL,  $P=0.018$ ), longer operation time (365 vs. 321 min,  $P=0.003$ ), longer postoperative hospital stays (11 vs. 9 days,  $P=0.011$ ), higher rate of minor complications (40% vs. 13%,  $P<0.001$ ), and disease recurrence (28% vs. 9%,  $P=0.005$ ). The number of harvested lymph nodes was also lesser in OG (26 vs. 37,  $P<0.001$ ). The study's findings are encouraging and kindle hope that for advanced, but surgically resectable cancers of stomach, at the level of small regional surgical departments with lesser turnover, skilled surgeons can produce results comparable with open surgery in terms of oncological outcomes.

### Impact of Neoadjuvant Therapy

Neoadjuvant therapy (NAT), in combination with proper surgical operation, has been proven by multiple studies to improve the probability of achieving R0 resection status thereby minimizing the possible micro-metastases and improving long-term outcomes [18, 19]. NAT can however induce tissue oedema, fibrosis, vascular fragility, and distortion of anatomy, thereby posing great

challenges in achieving safe en bloc surgical removal of the cancer through laparoscopic approach [20, 21].

Pang *et al.* [22] have addressed this issue and recently in May 2023, published an updated pooled analysis of eighteen studies from China, Europe, Japan, and North Africa, wherein they evaluated the perioperative and long-term survival outcomes of LG versus OG for advanced cancer of stomach after NAT. 2096 cases were included in the analysis; 933 of them had LG, while 1163 had undergone OG. It was found that LG took longer to operate but was associated with lesser blood loss, earlier passage of flatus, earlier liquid intake, and shorter hospitalization stays. No statistically significant differences between the two groups were found in terms of margin clearance, R1/R2 resection rate, and number of harvested lymph nodes, requirement of nasogastric tube or drainage tube, and adverse outcomes.

Overall survival, disease-free survival and recurrence-free survival were comparable in the two surgical approaches. The metanalysis concluded that after NAT, advanced gastric cancer patients can safely undergo LG; nonetheless, the authors emphasized that additional well-designed studies are required to confirm their findings. Shan *et al.* [23] in a clinical study comprising patients who underwent NAT, observed that a laparoscopic approach provided superior postoperative safety and adjuvant chemotherapy tolerance, though Rosa & Alfieri [24] have suggested that firm conclusions on this aspect are yet to be reached.

### Port Site Metastases

Port site metastases (PSM) are a known phenomenon after laparoscopic resection of cancers of intra-abdominal organs [25, 26]. Various studies have reported varying incidence rates, ranging from 0.71% to 10%, while the overall incidence is unclear [27, 28].

Studies conducted on animals and in humans to elucidate the mechanisms behind PSM suggest that its aetiology is probably multifactorial [28, 29]. The factors that have been suggested include direct implantation of viable cancer cells, contamination of instruments, surgical technique, and chimney effect wherein cancer cells escape in the aerosol state to settle in the gaps around the cannula aided by the pressure due to pneumoperitoneum [28], excessive manipulation of tumor, and hematogenous spread [25].

Patients of PSM present after variable periods post-gastrectomy with discomfort, indurated mass, erythema or ulcer at the port site. Surgeons must be cognizant of this condition since such scenarios are being increasingly documented post-LG for gastric cancer [29, 30]. Since PSM after LG is a rarity, there is a lack of definitive research on management; therefore, more research and evaluations of a greater number of patients are required to establish a strategy for treatment. In solitary PSM,

surgical excision has been reported to prolong survival. Namikawa *et al.* [31] treated a solitary PSM 42 months after LG for advanced gastric cancer, by excision and chemotherapy. Fukui *et al.* [32] reported that a 75-year-old man who underwent curative resection for gastric cancer had multiple recurrences at the port site, which were removed, starting two years following the primary LG. The patient had survived for 78 months.

### LIMITATIONS

One of the main obstacles to the widespread use of the laparoscopic method is the need for surgeons with specialized training and appropriate surgical equipment. These considerations can deny this new scientific achievement to cancer patients in need who live in economically developing and underdeveloped countries around the world. However, promising data [17] from a hospital with a lower patient volume by Chan *et al.* gives hope. More patients in need may likely benefit from the evolving techniques in oncological surgery if similar results are repeated in more studies of a similar kind, especially in less affluent settings.

### CONCLUSION

Laparoscopic gastrectomy is well-established in the management of early gastric carcinoma. In the treatment of locally advanced gastric cancer, laparoscopic gastrectomy with D2 nodal dissection is becoming more widely accepted as a practical, safe, and effective alternative to the conventional open surgical method. A growing number of surgeons are becoming proficient in handling advanced gastric cancers through laparoscopic total gastrectomy (LTG) and adequate D2 lymphadenectomy, owing to the significant advancements in laparoscopic technology.

In future, as more pieces of evidence about comparable oncological equivalency get accumulated and technical aspects get further refined, laparoscopic gastrectomy is expected to emerge as a standard approach for resectable gastric cancer.

### LIST OF ABBREVIATIONS

LG	: Laparoscopy Gastrectomy
OG	: Open Gastrectomy
QOL	: Quality of Life
PSM	: Port-site Metastasis
CLASS	: Chinese Laparoscopic Gastrointestinal Surgical Study
RCT	: Randomized Controlled Trials
RGD2	: Radical Gastrectomy with D2 Lymphadenectomy

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### CONFLICT OF INTEREST

The authors declare no conflict of interest.

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