Totally laparoscopic versus open gastrectomy for advanced gastric cancer: a matched retrospective cohort study

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ABSTRACT

Introduction: Laparoscopic gastrectomy revolutionised the management of gastric cancer, yet its oncologic equivalency and safety in treating advanced gastric cancer (especially that in smaller centres) has remained controversial because of the extensive lymphadenectomy and learning curve involved. This study aimed to compare outcomes following laparoscopic versus open gastrectomy for advanced gastric cancer at a regional institution in Hong Kong.

Methods: Fifty-four patients who underwent laparoscopic gastrectomy from January 2009 to March 2017 were compared with 167 patients who underwent open gastrectomy during the same period. All had clinical T2 to T4 lesions and underwent curative-intent surgery. The two groups were matched for age, sex, American Society of Anaesthesiologists class, tumour location, morphology, and clinical stage. The endpoints were perioperative and long-term outcomes including survival and recurrence.

Results: All patients had advanced gastric adenocarcinoma and received D2 lymph node dissection. No between-group differences were demonstrated in overall complications, unplanned readmission or reoperation within 30 days, 30-day mortality, margin clearance, rate of adjuvant therapy, or overall survival. The laparoscopic approach was associated with less blood loss (150 vs 275 mL, P=0.018), shorter operating time (321 vs 365 min, P=0.003), shorter postoperative length of stay (9 vs 11 days, P=0.011), fewer minor complications (13% vs 40%, P<0.001), retrieval of more lymph nodes (37 vs 26, P<0.001), and less disease recurrence (9% vs 28%, P=0.005).

Conclusion: Laparoscopic gastrectomy offers a safe and effective therapeutic option and is superior in terms of operative morbidity and potentially superior in terms of oncological outcomes compared with open surgery for advanced, surgically resectable gastric cancer, even in a small regional surgical department.

▸ A video clip illustrating totally laparoscopic subtotal gastrectomy for a patient with gastric cancer is available at <www.hkmj.org>

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New knowledge added by this study

- This is the first study showcasing the efficacy and safety profile of laparoscopic gastrectomy for advanced gastric cancer in a small regional surgical centre in Hong Kong.
- Laparoscopic gastrectomy was superior in terms of operative morbidity and potentially superior in terms of oncological outcomes.

Implications for clinical practice or policy

- Laparoscopic gastrectomy is a viable first-line treatment for surgically resectable advanced gastric cancer.
- This study could spark a paradigm shift in other local surgical departments and specialist training centres.

Introduction

With an age-standardised incidence rate of 24.2 per 100 000 population, gastric cancer is a major clinical entity in Eastern Asia.[1] Operative resection remains the only curative treatment available. Over the years, advances in minimally invasive surgery have caused a paradigm shift towards laparoscopic gastrectomy (LG), with high-quality evidence from both the East and West demonstrating a satisfactory safety profile and enhanced postoperative recovery related to reduction of surgical trauma.[2,3]

However, one major concern regarding LG is its oncologic equivalency compared with the open technique, as LG requires adequate lymphadenectomy and involves a steep learning curve. Several overseas studies have shown comparable lymph node harvest and survival data[2-4] but are limited by either short follow-up periods or

being published by major centres in Korea or Japan, where extensive experience is available. Whether or not these results are reproducible in smaller regional centres is unknown, especially in Hong Kong, where no comparative studies concerning LG for gastric cancer exist in the literature. It has been suggested that a case volume of approximately 50 to 60 LGs is required to achieve proficiency, with demonstrable decreases in blood loss, conversion rate, and hospital length of stay (LOS) with increasing experience.[5] Furthermore, most of these data were based on operations for early gastric cancer in patients selected according to strict criteria. In advanced cases requiring extensive lymphadenectomy, evidence is still emerging, and the learning curve may be steeper.

At our regional surgical centre in Hong Kong, LG is currently the first-line modality in the absence of contra-indications. We aimed to perform a matched retrospective cohort study of laparoscopic versus open gastrectomy for resectable advanced gastric adenocarcinoma of all sites, comparing intra- and peri-operative characteristics, oncological clearance, and long-term outcomes including survival and recurrence.

針對晚期胃癌的全腹腔鏡相對開腹胃切除術：一項匹配的回溯性隊列研究

陳彥安、邱啟榮、陳敬安

引言：腹腔鏡胃切除術徹底改變胃癌的治療方法，但由於其大規模的淋巴結切除術和學習曲線，其治療晚期胃癌的腫瘤學等效性和安全性一直存在爭議（規模較細的醫療中心尤以為甚）。本研究旨在比較本港一所地區醫院腹腔鏡與開腹胃切除術治療晚期胃癌的結果。

方法：將2009年1月至2017年3月接受腹腔鏡胃切除術的54例患者與同期接受開腹胃切除術的167例患者進行比較。所有患者均有臨床T2至T4病變並進行治癒性手術。兩組在年齡、性別、美國麻醉醫師學會等級、腫瘤位置、形態和臨床分期方面均相匹配。研究的終點是圍手術期和長期結果，包括生存和復發數據。

結果：所有患者均患有晚期胃腺癌並接受D2淋巴結切除術。總體併發症、30天內非計劃再入院或再次手術、30天死亡率、邊緣清除率、輔助治療率或總體生存率均未發現組間差異。與開腹胃切除術比較，腹腔鏡手術的失血量較少（150比275毫升，P=0.018）、手術時間較短（321比365分鐘，P=0.003）、術後住院時間較短（9比11天，P=0.011）、較少輕微併發症（13%比40%，P<0.001）、淋巴結擷取較多（37比26，P<0.001），以及疾病復發率較低（9%比28%，P=0.005）。

結論：對於治療晚期但可手術切除的胃癌，即使在規模較小的地區醫院外科部門進行腹腔鏡胃切除術也是安全有效的手術選擇；與開腹手術相比，前者的手術發病率具有優勢，也可能在腫瘤學結果方面較為優越。

Methods

Study design and participants

A prospective gastric cancer database was maintained at the Department of Surgery, Queen Elizabeth Hospital. From January 2009 to March 2017, 221 patients who underwent curative gastrectomy for advanced gastric adenocarcinoma (ie, clinical T2 to T4 lesions of all sites) were identified. Clinical T1 lesions (n=23); cases with pathologies other than adenocarcinoma, like high-grade dysplasia (n=1); squamous cell carcinoma (n=2); neuroendocrine tumours (n=4); gastrointestinal stromal tumours (n=3); and cases involving conversion of approach (n=6) were excluded. A total of 54 patients operated via a totally laparoscopic approach were identified and matched with 167 patients who underwent the same operation via an open approach during the same 8-year period. The case ratio between the laparoscopic and open groups was 1:3.09. Patients from both groups were matched in terms of age, sex, American Society of Anesthesiologists (ASA) class, tumour location, morphology, and clinical stage. Follow-up was performed on all subjects at the Upper Gastrointestinal Surgical Specialist Outpatient Clinic of our hospital at 3-month intervals up to 2 years postoperation and every 6 months thereafter.

Operative technique

All 54 LG and 167 open operations were performed by two experienced upper gastrointestinal surgeons with experience of more than 100 gastrectomy operations each. The choice of approach was decided by the attending surgeon. All subjects underwent radical gastrectomy with D2 lymph node dissection as per the guidelines of the Japanese Gastric Cancer Association[6]; that is, in addition to the perigastric nodes, a second tier of lymph nodes along the celiac axis branches were removed. Distal subtotal, proximal, or total gastrectomy was selected depending on tumour location and macroscopic characteristics. Splenectomy or distal pancreatectomy was performed if there was direct invasion with the possibility of en bloc complete resection.

Under general anaesthesia, with the patient in supine split leg position, LG was performed with the surgeon operating on either side of the patient and a camera assistant in the middle. Pneumoperitoneum was created via the open Hasson technique at a pressure of 12 mm Hg, followed by insertion of a 12-mm infra-umbilical camera port, then one 12-mm and one 5-mm working port in each upper quadrant of the abdomen for a total of five ports.

Distal and total gastrectomy accounted for 98% of all LGs performed. Hence, our discussion of technique shall focus on them. For total gastrectomy, entry to the lesser sac was obtained via dissection of

the avascular plane between the greater omentum and transverse mesocolon. The gastrocolic ligament was divided proximally and then distally towards the pylorus using a laparoscopic energy device. The right gastroepiploic vessels were doubly clipped and divided at their origin. Then, dissection of the hepatoduodenal ligament was performed, with division of the right gastric artery and transection of the duodenum with a linear stapler. The dissection continued towards the gastroesophageal junction along the lesser curvature. Along with that dissection, simultaneous D1 lymphadenectomy of the perigastric nodes was performed. Then, D2 lymphadenectomy was performed, with removal of the common hepatic artery (Station 8) nodes. The root of the left gastric artery was doubly clipped and then divided, followed by dissection of celiac trunk (Station 9) and left gastric artery (Station 7) nodes. The splenic artery lymph nodes (Station 11) and hilar nodes (Station 10) were excised together with the surrounding fatty connective tissues. During distal gastrectomy, the left cardia (Station 2), greater curvature (Station 4sa), splenic hilum (Station 10), and distal splenic artery (Station 11d) nodes were left intact.

After adequate mobilisation, the stomach or distal oesophagus was divided using a linear stapler with several centimetres of margin, and the surgical specimen was placed in an endobag for later retrieval. Following total gastrectomy, oesophagojejunal anastomoses were fashioned end-to-side using a circular stapler and a transoral anvil device, whereas distal gastrectomy reconstruction was performed by either Roux-en-Y gastrojejunostomy or delta-shaped Billroth I anastomosis. Side-to-side oesophagogastrostomy was utilised in cases of proximal gastrectomy.

Open gastrectomies followed standard procedures from the surgical literature and were characterised by a wider range of reconstructive techniques in our study.

Outcome variables and bias

All clinical data originated from the patients' electronic and handwritten medical records and were recorded into the prospective gastric cancer database by one principal investigator. Recall and observer bias were addressed by this approach. Selection bias was minimised by matching and controlling for covariates in the outcome analyses. Our pathological staging followed that of the American Joint Committee on Cancer (AJCC) for gastric cancer. Complications were graded from 1 to 5 according to the Clavien-Dindo classification, with 1 to 2 being minor complications and 3 to 5 being major complications. We defined 30-day mortality as any death, inside or outside of the hospital, within 30 days of surgery. Recurrences were documented as either local or distant, depending on the first recognised disease site. We designated survival time as the time from the date of the operation until death or the last available follow-up (if the patient did not experience an event of interest).

Statistics

All statistical analyses were performed using the SPSS (Windows version 22.0; IBM Corp, Armonk [NY], United States). Frequency matching was employed to ensure that the laparoscopic and open groups had equal distributions of age, sex, ASA class, tumour location, morphology, and clinical stage. Appropriate univariate analyses like the Mann-Whitney *U* test were selected to examine continuous variables, whereas Chi squared and Fisher's exact tests were run for dichotomous and categorical variables, respectively. Operative outcomes like blood loss, operating time (OT), type of operation, complications, 30-day mortality, LOS, and oncologic outcomes such as margin clearance, pathological stage, lymph node yield, adjuvant treatment, survival time, and disease recurrence were compared. Survival probabilities were estimated using the Kaplan-Meier method and compared using stratified log-rank tests. All P values were based on two-tailed statistical analyses with $P<0.05$ as the threshold for statistical significance. All percentages were rounded off to nearest integer.

Results

Baseline demographics

A total of 221 matched patients were evaluated. The median age at the time of operation was 67 years (range, 23-80 years), with the majority of patients (145, 66%) being male. Most patients (62%) were in the ASA 2 category (ie, mild systemic disease without functional limitation).

In order of descending frequency, 42% of the tumours were located in the antrum, followed by the gastric body (30%) and cardia/fundus (24%). All 221 patients had advanced gastric cancer according to the AJCC clinical staging. Clinical T3 and T2 lesions accounted for 51% and 37% of cases, respectively, and the remaining 12% were category T4. Macroscopically, 70% of the tumours were of Bormann types 3 or 4; only 30% were types 1 or 2 (ie, polypoid or ulcerative with clear margins). Of all the investigated subjects, 56% had N1 disease on imaging, while the rest (44%) were negative. No subject had clinically detectable metastases.

No statistically significant differences were demonstrated in any of the six matching parameters between the laparoscopic and open patient groups. The details of the subjects' demographic variables are charted in Table 1.

Operative outcomes

All 221 patients underwent D2 lymphadenectomy.

TABLE 1. Comparable baseline patient demographics*

Variable	All (n=221)	Laparoscopic gastrectomy (n=54)	Open gastrectomy (n=167)	P value
Age (median [range], years)	67 (23-80)	70 (30-80)	66 (23-80)	0.051
Male sex	145 (66%)	35 (65%)	110 (66%)	0.887
ASA				0.114
1	13 (6%)	0	13 (8%)	
2	136 (62%)	35 (65%)	101 (61%)	
3	71 (32%)	19 (35%)	52 (31%)	
4	1 (0.5%)	0	1 (1%)	
Tumour location				0.682
Duodenum	2 (1%)	0	2 (1%)	
Lower/antrum	93 (42%)	23 (43%)	70 (42%)	
Middle/body	67 (30%)	20 (37%)	47 (28%)	
Upper/cardia/fundus	53 (24%)	10 (19%)	43 (26%)	
OGJ	6 (3%)	1 (2%)	5 (3%)	
Bormann classification				0.424
1: Polypoid	10 (5%)	3 (6%)	7 (4%)	
2: Ulcerative	56 (25%)	13 (24%)	43 (26%)	
3: Infiltrative	125 (57%)	34 (63%)	91 (54%)	
4: Diffuse infiltrative	30 (14%)	4 (7%)	26 (16%)	
Clinical T stage				0.235
2	82 (37%)	23 (43%)	59 (35%)	
3	113 (51%)	28 (52%)	85 (51%)	
4	26 (12%)	3 (6%)	23 (14%)	
Clinical N stage				1.000
0	98 (44%)	24 (44%)	74 (44%)	
1	123 (56%)	30 (56%)	93 (56%)	
Clinical M stage				NA
0	221 (100%)	54 (100%)	167 (100%)	

Abbreviations: ASA = American Society of Anesthesiologists; M = metastasis; N = nodal; NA = not applicable; OGJ = oesophagogastric junction; T = tumour

* Because of rounding, not all percentages total 100

The frequency of operation type was comparable between distal and total gastrectomy (43% and 53%, respectively). Distal pancreatectomy was performed in six (4%) subjects in the open group only, with no statistically significant difference between groups (P=0.340). Splenectomy was performed in 10 (6%) versus 0 subjects in the open and laparoscopic groups, respectively, and this difference was not statistically significant (P=0.124). The history of laparotomy was comparable between groups (7% vs 11% for the laparoscopic and open groups, respectively, P=0.606).

The laparoscopic group had shorter median OT (321 vs 365 min, P=0.003) and less intra-operative blood loss (150 vs 275 mL, P=0.018). Operative complications were observed in 41% and 51% of laparoscopic and open cases, respectively; this trend seemed to favour the laparoscopic group but failed to reach statistical significance (P=0.210). Subgroup analyses showed that fewer minor complications were demonstrated in the laparoscopic group (13% vs 40%, P<0.001). One case of open distal gastrectomy and laparoscopic total gastrectomy each accounted for the 30-day mortality among all subjects. Both were older adults in their 70s who developed sudden cardiac arrest and cerebrovascular accident, respectively, in the days after operation. The median postoperative LOS was 9 and 11 days, significantly shorter in the laparoscopic group (P=0.011).

Pathological characteristics

Tumour location and clinical stage were comparable between groups, as they were matching variables. All patients had adenocarcinoma. Margin clearance

TABLE 2. Operative, pathologic, and oncologic outcomes

Variable	All (n=221)	Laparoscopic gastrectomy (n=54)	Open gastrectomy (n=167)	P value
Radicality (D2)	221 (100%)	54 (100%)	167 (100%)	NA
Median operating time (range, min)	350 (120-594)	321 (140-516)	365 (120-594)	0.003
Blood loss (mL)	150 (50-2600)	150 (50-500)	275 (60-2600)	0.018
Type of gastrectomy				0.659
Distal	96 (43%)	26 (48%)	70 (42%)	
Total	117 (53%)	27 (50%)	90 (54%)	
Proximal	8 (4%)	1 (2%)	7 (4%)	
Distal pancreatectomy	6 (3%)	0	6 (4%)	0.340
Splenectomy	10 (5%)	0	10 (6%)	0.124
History of laparotomy	22 (10%)	4 (7%)	18 (11%)	0.606
Overall complications	108 (49%)	22 (41%)	86 (51%)	0.210
Minor complications	73 (33%)	7 (13%)	66 (40%)	<0.001
30-Day mortality	2 (1%)	1 (2%)	1 (0.6%)	0.430
Median postoperative length of stay (range, days)	11 (1-58)	9 (4-52)	11 (1-58)	0.011
Pathology (adenocarcinoma)	221 (100%)	54 (100%)	167 (100%)	NA
Margin clearance				
Proximal	209 (95%)	52 (96%)	157 (94%)	0.735
Distal	210 (95%)	53 (98%)	157 (94%)	0.302
Radial	214 (97%)	53 (98%)	161 (96%)	0.686
Median No. of lymph node excised (range)	28 (3-95)	37 (7-77)	26 (3-95)	<0.001
Pathological stage				0.310
I	34 (15%)	7 (13%)	27 (16%)	
II	45 (20%)	12 (22%)	33 (20%)	
III	126 (57%)	34 (63%)	92 (55%)	
IV	16 (7%)	1 (2%)	15 (9%)	
Adjuvant treatment	69 (31%)	22 (41%)	47 (28%)	0.093
Recurrence	52 (24%)	5 (9%)	47 (28%)	0.005

Abbreviations: D2 = D2 lymphadenectomy; NA = not applicable

was satisfactory, ranging from 96% to 98% in the laparoscopic group and 94% to 96% in the open group, and the P value showed no significant between-group difference in this metric. Over half (57%) of the patients were in pathological stage III, with no significant difference in staging between the groups. Interestingly, the median number of lymph nodes harvested was higher in the laparoscopic group at 37 (range, 7-77) compared with 26 (range, 3-95) in the open group (P<0.001). Adjuvant treatment was prescribed in 41% (22 of 54) of laparoscopic group patients versus 28% (47 of 167) of open group patients, but this difference did not reach statistical significance (P=0.093).

Oncological outcomes

The mean postoperative follow-up duration was 33 months (laparoscopic group: 25 months, open group: 35 months). Disease recurrence was observed in 9% and 28% of laparoscopic and open group patients, respectively, with a statistically significant between-group difference (P=0.005). During the entire follow-up period, death occurred in 19 out of 54 laparoscopic group (35%) and 97 out of 167 open group (58%) patients. Median disease-free survival (DFS) was 46.9 months and 31.7 months, and median overall survival (OS) was 46.9 months and 34.9 months, for the laparoscopic and open groups, respectively. Using a 60-month cut-off, the estimated 5-year DFS and OS were both 47% for the laparoscopic group and 39% for the open group (P=0.210 and P=0.233, respectively). The details of the operative, pathological, and oncological outcomes are charted in Table 2, and the Kaplan-

Meier plots for DFS and OS are shown in Figures 1 and 2, respectively.

Discussion

Laparoscopic gastrectomy has markedly matured since its inception by Kitano et al[7] in 1994. In early gastric cancer, high-quality evidence including meta-analyses has demonstrated the equivalence of laparoscopic distal gastrectomy and open surgery. Early postoperative benefits include less blood loss, fewer complications, and shorter LOS with comparable mortality. However, lengthier operations and smaller lymph node yield remain issues in the laparoscopic approach.[8] Technical difficulties in anastomosis and laparoscopic lymph node dissection have resulted in poorer translation of these results to total gastrectomies, and such application is often practised only in expert centres with exceptional case volume.[9] Similar controversies also exist in the field of advanced gastric cancer, where adequate lymphadenectomy is of the utmost importance. Acceptable short-term outcomes have been reported only in studies that incorporated experienced surgeons, with the technique's long-term safety still unknown.[10-12]

As such, the safety and oncologic efficacy of LG are influenced to a large extent by regional incidence and the case volume of individual centres. With an age-standardised incidence rate of 9.1 per 100 000 population in Hong Kong, compared with 41.8 per 100 000 population in Korea and 24.2 per 100 000 population overall in Eastern Asia, gastric carcinoma is far from the top in terms of cancer incidence ranking.[1,13] While this low age-standardised incidence rate may be partially explained by the absence of population-wide screening, this lack of screening also implies that a higher proportion of patients will present with advanced disease. These two points, together with the absence of studies evaluating LG in the local literature, mark the importance of our study in evaluating the efficacy and safety of such procedures in treatment of advanced gastric cancer in Hong Kong.

Queen Elizabeth Hospital, the largest acute hospital in Hong Kong and a tertiary surgical referral centre, has a significant case volume and a patient pool that is representative of the local population. Through this study, we aimed to document the local Hong Kong experience, comparing and contrasting results from Hong Kong with those from overseas expert centres.

In accordance with other major studies, we demonstrated that LG was associated with less blood loss, fewer minor complications, and shorter LOS while achieving similar overall levels of complications and operative mortality to open surgery. The lesser degrees of pain, blood loss, ileus, and surgical site infections associated with laparotomy than

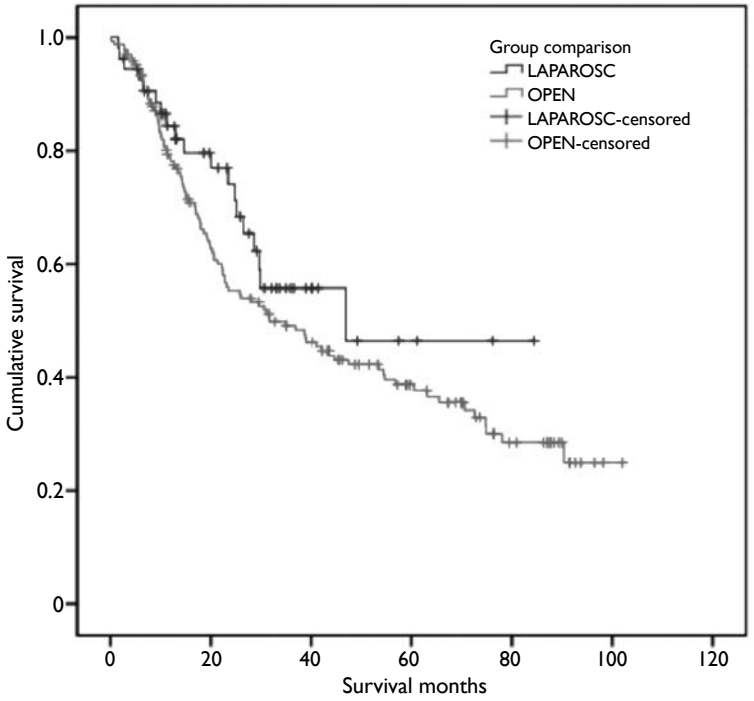

FIG 1. Disease-free survival after laparoscopic versus open gastrectomy for advanced gastric cancer (P=0.210)
Abbreviations: LAPAROSC = laparoscopic gastrectomy; OPEN = open gastrectomy

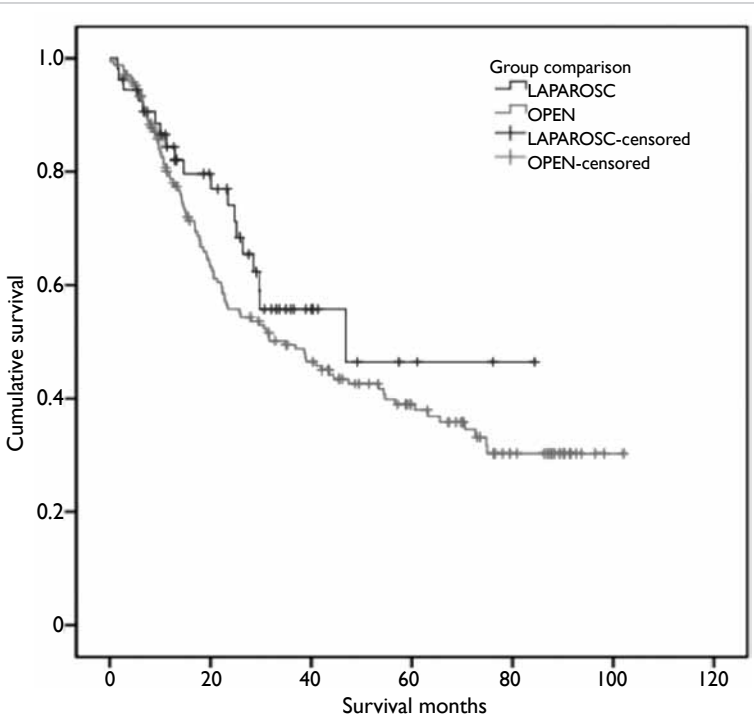

FIG 2. Overall survival after laparoscopic versus open gastrectomy for advanced gastric cancer (P=0.233)
Abbreviations: LAPAROSC = laparoscopic gastrectomy; OPEN = open gastrectomy

open surgery are well-investigated benefits of the laparoscopic approach, and this explains the scarcity of minor complications.[3,8] Median postoperative LOS was 2 days shorter after LG than open surgery, a small but statistically significant difference. No local data on average post-gastrectomy LOS exist, but our results are comparable with an LOS of 11 days (range, 8-12.5 days) observed in the United Kingdom.[14] The small difference in LOS between the laparoscopic and open groups may be partially explained by the fact that, compared with Western counterparts, local Chinese patients prefer in-patient care over community care despite being fit for out-patient treatment. Enhanced Recovery After Surgery (ERAS) protocols have been gradually adapted in local surgical units in recent years, but no data on their efficacy in gastrectomy patients have been reported.[15] With wider implementation of ERAS and better patient education, it is expected that differences in LOS between types of surgery will become even more apparent.

About half (53%) of the operations performed in this study were total gastrectomies, and all patients had advanced gastric cancer; both of these factors have been associated with longer OT in the literature.[16] The OT inherent to the laparoscopic approach has been reported as longer in many studies, but the median OT of LG was 44 minutes shorter than that of open surgery in our series. This may be partly explained by the more complex procedures expected in patients chosen for open gastrectomies. For example, en bloc splenectomy and distal pancreatectomy were only performed in the open group, despite the between-group differences in frequency not reaching statistical significance. Further, the overall histories of laparotomy, tumour location, and clinical and pathological staging were comparable between the two groups. Another explanation for the shorter OT observed in LG in our study is the maturation of our surgeons' laparoscopic technique. The higher ratio of total gastrectomies (50%-54%) compared with literature values was caused by pathological characteristics and surgeon preference. The 42% of cases with distally located tumours accounted for a compatible 43% of cases in which distal gastrectomies were performed. In contrast, for the remaining tumours in the gastric cardia or body, because 70% of tumours were Bormann types 3 and 4, total gastrectomy was the curative operation of choice.

The median number of lymph nodes harvested was significantly higher in the LG group (37 compared with 26 in the open group). Both groups had more lymph nodes harvested than the 15 required for proper staging. Laparoscopic D2 lymphadenectomy is a technically challenging procedure, especially at Stations 4, 6, 9, and 11 and in spleen-preserving lymphadenectomy at the splenic hilum. However, advances in optics have offered unparalleled amplified clarity for identification of anatomical structures. The latest laparoscopic energy devices have also enabled pinpoint precision while performing dissection and sealing in extensive lymphadenectomies.[17] With time and experience, there are indications that our centre's surgeons have overcome the learning curve involved.

The importance of adjuvant chemotherapy in curing advanced gastric cancer cannot be undermined, as many cases have occult micrometastases. Yet, it has been reported that only 48% to 67% of patients indicated for adjuvant chemotherapy had it successfully administered, with postoperative morbidity being a significant factor behind this deficiency.[3] The advantages of fewer minor complications, shorter LOS, and overall better general condition of patients may potentially benefit those who undergo LG and are eligible for adjuvant therapy. Such eligibility was shown in 41% of patients who underwent LG versus 28% in the open group, but the difference barely fell short of reaching statistical significance (P=0.093). Higher rates of receiving adjuvant treatment may translate into the significantly lower disease recurrence of 9% in the LG group compared with 28% in the open group (P=0.005). No differences in 5-year DFS nor OS were demonstrated between the groups. Further large-scale, multicentre randomised controlled trials like the Korean Laparo-endoscopic Gastrointestinal Surgery Study (KLASS-02; registered at www.clinicaltrials.gov as NCT01456598), the Japanese Laparoscopic Gastric Surgery Study Group (JLSSG 0901; registered at www.umin.ac.jp/ctr/ as UMIN000003420), and the Chinese Laparoscopic Gastrointestinal Surgery Study (CLASS-01; registered at www.clinicaltrials.gov as NCT01609309) are needed to elucidate the short- and long-term results of LG for advanced gastric cancer.

The limitations of our study include its retrospective and single-centre nature and its limited number of participants and follow-up period. Anticipated en bloc distal pancreatectomy and splenectomy were handled exclusively via the open approach in this series. With increasing experience, it may be possible to perform these adjunct procedures laparoscopically, yielding more homogenous groups for comparison. Efforts have been made to minimise recall and observer bias and to reduce selection bias through matching.

In summary, LG was associated with shorter OT, less blood loss, fewer minor complications, shorter LOS, higher lymph node yield, and, importantly, lower rates of disease recurrence. Overall complications, 30-day mortality, margin clearance, pathological stage, percentage receiving adjuvant therapy, and survival time were comparable

between groups. Despite this study's retrospective cohort nature, which limits its generalisability, because of the characteristics of our patient base and the level of our hospital, we believe that our results are representative of the latest Hong Kong experience.

Conclusion

Laparoscopic gastrectomy is effective and safe as a curative treatment for patients with advanced gastric adenocarcinoma in Hong Kong. Apart from its overall equivalent operative and oncological outcomes, it benefited patients by being associated with less morbidity, shorter LOS, and higher lymph node clearance than open surgery. This represents the first local study of its type and illustrates the maturity of LG as a first-line treatment in our surgical department.

Author contributions

All authors had full access to the data, contributed to the study, approved the final version for publication, and take responsibility for its accuracy and integrity.

Concept and design of study: All authors.
Acquisition of data: BYO Chan, CKO Chan.
Analysis and interpretation of data: All authors.
Drafting of manuscript: BYO Chan.
Critical revision for important intellectual content: All authors.

Conflicts of interest

The authors have no conflicts of interest to disclose.

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Ethics approval

This study was approved by the Hospital Authority Kowloon Central Cluster/Kowloon East Cluster Research Ethics Committee (Ref No. KC/KE-18-0100/ER-1).

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