Translated by E.V. Trushina

Research Article

https://doi.org/10.23934/2223-9022-2024-13-3-346-352

Laparoscopic Access in Radical Surgical Treatment of Complicated Gastric Cancer: a Single-Center Experience

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ABSTRACT Over the past decades, there has been an active introduction of minimally invasive surgical technologies in the treatment of various diseases, including gastric cancer. In Asian countries and Europe, laparoscopic gastrectomy is an alternative to open gastrectomy for early gastric cancer, with a tendency to displace the latter. In the Russian Federation, laparoscopic gastrectomy is performed in a few specialized centers. From 2013 to 2022, the surgeons of our Center treated 141 patients diagnosed with gastric cancer at different stages (64 men, 39 women, mean age of 60.5±10 years). Of these, 52 patients (50.5%) underwent open surgeries (group I), 51 (49.5%) — laparoscopic surgeries (group II). The study included patients diagnosed with gastric cancer complicated by bleeding or gastric outlet/cardioesophageal junction obstruction, over 18 years of age, who signed consent for the processing of personal data and inclusion of their clinical data in the research and underwent surgical treatment. We analyzed such parameters as the duration of surgical intervention and the duration of hospital stay, the rates of hospital/relapse-free 2-year survival, and uncomplicated postoperative period. Laparoscopic-assisted surgeries lasted longer; however, due to more precise technique and better visualization of anatomical structures, there was a smaller volume of intraoperative blood loss. During laparoscopic-assisted radical gastrectomy, it is possible to perform more precise lymph node dissection, increase the number of harvested lymph nodes and, thus, increase the probability of detecting lymph nodes with metastases; which, in turn, has a direct impact on increasing the 2-year relapse-free and 2-year overall survival of patients. There was no significant difference in the incidence or severity of postoperative complications and mortality. These data are an important indicator of the effectiveness of the minimally invasive surgical method of treatment, which indicates greater safety of the laparoscopic method compared to intervention from laparotomy access.

Keywords: gastric cancer, minimally invasive technologies, surgical complications, 2-year survival

For citation Tarasov SA, Yartsev PA, Kirsanov II, Rogal MM, Aksenova SO. Laparoscopic Access in Radical Surgical Treatment of Complicated Gastric Cancer: a Single-Center Experience. *Russian Sklifosovsky Journal of Emergency Medical Care.* 2024;13(3):346–352. https://doi.org/10.23934/2223-9022-2024-13-3-346-352 (in Russ.)

Conflict of interest Authors declare lack of the conflicts of interests

Acknowledgments, sponsorship The study had no sponsorship

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INTRODUCTION

According to the WHO, the number of people diagnosed with malignant neoplasms worldwide in 2020 was 18 million, 1.1 million of whom were diagnosed with gastric cancer (GC). The annual mortality rate from GC is 770 thousand people (2nd place in the structure of mortality from all malignant neoplasms after lung cancer – 9.1% and 17%, respectively). The Russian Federation, along with the countries of Asia and Eastern Europe, is one of the territories with a high incidence of GC [1]. In 2020, 35 thousand Russians (5.8%) were diagnosed with GC, and the disease resulted in death in 29.5 thousand people. The prevalence of GC in the Russian Federation is 21.89 per 100 thousand people, the mortality rate is 20.5% of the number of cases. In Russia, 75% of cases of GC are diagnosed at stages 3–4 [2], when the clinical picture and complications of the disease are clearly expressed. This is the reason for the unsatisfactory prognosis, high mortality during the first year after diagnosis (56%) and low population survival (10%).

Surgery is currently the only potentially effective treatment option, therefore it is fundamental in the treatment of GC [3,4]. The principles of primary tumor excision are determined by the localization, spread, and histological subtype of GC [5]. Currently, in case of early gastric cancer, low probability of metastasis and possibility of tumor removal in one piece, endoscopic resection (endoscopic mucosal resection or endoscopic submucosal dissection) is performed [6–8]. The above techniques are considered as the standard of treatment for small (less than 2 cm) highly differentiated adenocarcinomas without signs of tumor disintegration. Laparoscopic gastrectomy is currently an alternative to open gastrectomy in late-stage GC due to its minimal invasiveness, lower intraoperative blood loss, better recovery, and comparable outcomes [3, 4, 6–14]. When performing gastrectomy to restore passage through the gastrointestinal tract, three reconstructive techniques are used: Bilroth-1, Bilroth-2, and Roux-en-Y reconstruction [6, 15]. The volume of lymphadenectomy in GC usually depends on the number and localization of the group of regional lymph nodes. According to modern clinical research, in late-stage GC, dissection of the lymphatic vessels accompanying the celiac trunk and its branches (D2) is most preferable; it is included in the standard of treatment in many countries [5, 6, 15].

The article presents the experience of one Russian center in surgical treatment of complicated GC.

MATERIAL AND METHODS

From February 2013 to August 2022, 103 patients underwent radical surgical treatment for GC. Among them, there were 39 women (37.9%) and 64 men (62.1%). The age of the patients ranged from 36 to 85 years (median age was 60.5 years). Inclusion criteria: patients with GC complicated by bleeding or gastric outlet/cardioesophageal junction obstruction, over 18 years of age, who signed consent for the processing of personal data and inclusion of their clinical data in the research, and underwent surgical treatment. Exclusion criteria: patients who did not undergo invasive interventions; anesthetic risk class IV–V according to ASA classification; patient's refusal to include his/her personal data in the study.

To evaluate the effectiveness of the treatment, the patients were divided into groups by the type of surgical access: open and laparoscopic ones. 52 patients (50.5%) with complicated GC underwent open surgeries; these patients constituted group I.

The gender composition of the group was 32 men (61.5%), 19 women (38.5%). The mean age was 63.6±11 years. 51 patients (49.5%) underwent laparoscopic operations; these patients constituted group II. The gender composition was represented by 32 men (62.7%) and 19 women (37.3%). The mean age was 63.6±9.4 years. Groups I and II were comparable in age and gender composition.

The stages of GC were classified according to the TNM system (UICC, 7th revision, 2009). The Japanese Gastric Cancer Association (JGCA) classification (1998) was used to assess the extent of lymph node dissection. Standard D1 lymphadenectomy included perigastric lymph nodes (groups 1–6); extended D2 lymphadenectomy included perigastric lymph nodes along the branches of the celiac trunk and hepatoduodenal ligament (groups 1–11, 12a, 14v); and D3 lymphadenectomy included para-aortic lymph nodes. Postoperative complications were assessed according to the Clavien — Dindo Classification of Surgical Complications (2009).

Statistical processing was performed using Statistica for Windows v. 10.0, StatSoft Inc. (USA). In case of correct distribution, the mean value and standard deviation were indicated, in case of incorrect distribution, the median. When comparing groups by qualitative binary characteristics, the one-sided Fisher exact test was used. Differences were considered statistically significant at $p<0.05$.

The following distribution of patients in group I was noted based on the stage of the disease: Ib - 9 patients (17.3%), IIa - 8 patients (14.3%), IIb - 10 patients (15.9%), IIIa - 10 patients (15.9%), IIIb - 5 patients (15.4%), IV - 7 patients (13.5%) (Fig. 1, Table 1). According to the size and prevalence of primary tumors, the distribution of patients was as follows: T2 - 11 patients (21.2%), T3 - 17 patients (32.7%), T4a - 12 patients (23.1%), T4b - 1 patient (1.9%). In most cases, the tumor was located in the body of the stomach - 31 patients (59.6%), less often in the cardioesophageal junction - 2 patients (3.8%); in 1 patient (1.9%), total involvement of all parts of the stomach was noted. As for the degree of regional lymph node involvement, the following picture was noted: in 19 patients (36.5%) it was not noted (N0), in 16 patients (30.8%) - N1, in 12 patients (23.1%) - N2, in 5 patients (9.6%) - N3. In 45 patients (86.5%), there were no signs of metastasis; in 7 patients (13.5%), distant metastases were diagnosed.

The structure of disease stages in patients of group II: Ia — 2 patients (3.9%), Ib — 8 patients (15.7%), IIa — 8 patients (15.7%), IIb — 18 patients (35.3%), IIIa — 10 patients (19.6%), IIIb — 2 patients (3.9%), IV — 2 patients (3.9%). According to the size and prevalence of primary tumors, the distribution of patients was as follows: T1 - 4 patients (7.8%), T2 - 19 patients (37.3%), T3 - 22 patients (43.1%) and T4a - 5 patients (9.8%), T4b - 1 patient (2%). In most cases, the tumor was located in the body of the stomach — 26 patients (51%), less often in the cardiac section and cardioesophageal junction — 2 patients each (3.9%); in addition, there were 5 cases with damage to several or all sections of the stomach. As for the degree of involvement of regional lymph nodes, the following picture was noted: in 10 patients (19.6%) it was not noted (N0), in 22 patients (43.1%) - N1, in 14 patients (27.5%) — N2, in 5 patients (9.8%) — N3. In 49 patients (96.1%) no signs of metastasis were noted, in 2 patients (3.9%) distant metastases were diagnosed.

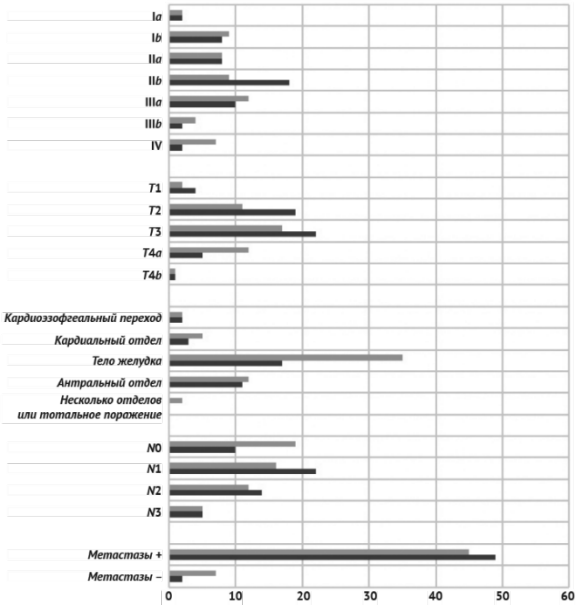

Figure. Characteristics of groups I and II based on gastric cancer parameters

Table 1

Characteristics of groups based on gastric cancer parameters

Parameters	Group II (n=52)	Group I (n=51)	*p*
I *a*	2	2	0.98
I *b*	8	9	0.82
II *a*	8	8	0.97
II *b*	18	9	0.04*
III *a*	10	12	0.67
III *b*	2	4	0.41
IV	2	7	0.09
*T*1	4	2	0.39
*T*2	19	11	0.07
*T*3	22	17	0.27
*T*4*a*	5	12	0.07
*T*4*b*	1	1	0.99
Cardioesophageal junction	2	2	0.98
Cardia	3	5	0.48
Corpus	17	35	0.001*
Antrum	11	12	0.85
Several parts or total involvement	0	2	0.16
*N*0	10	19	0.06
*N*1	22	16	0.19
*N*2	14	12	0.61
*N*3	5	5	0.97
Metastases +	49	45	0.09
Metastases –	2	7	

Notes: * — statistically significant differences. Statistically, the groups were comparable by the absolute majority of criteria

RESULTS

In group I, 32 patients (67.3%) underwent conventional gastrectomy with resection of the abdominal esophagus, 12 patients (23.1%) underwent subtotal distal gastrectomy, and 5 patients (9.6%) underwent proximal gastrectomy. 32 patients (62.7%) of group II underwent surgery in the volume of videolaparoscopic gastrectomy with resection of the abdominal esophagus, 15 (29.4%) - subtotal distal gastrectomy, 4 (7.8%) - proximal gastrectomy. In all cases of groups I and II, D2 lymphadenectomy was used as lymph node dissection. No significant differences in the number of gastrectomies and gastric resections were noted.

Despite the shorter median operation time in Group I (I - 287.5 min, II - 365 min), no significant differences in these parameters were noted in the groups (p=0.0005). The volume of blood loss in Group II was significantly lower (I - 300 ml, II - 150 ml, p<0.01).

The median length of hospitalization in Group I (26.5 bed-days) was 1.5 times longer than in Group II (18 bed-days). The postoperative day in Group I was 15.6 calendar days, while in Group II it was 10.2.

The 2-year hospital/ relapse-free survival rates were 100/41.6% and 100/75.4% in Group I and II, respectively. Thus, in Group II, as a result of the lower incidence of gastric cancer, a higher 2-year relapse-free survival was observed.

An uncomplicated postoperative period was observed in 15 patients (28.8%) of Group I and 36 patients (70.6%) of Group II (p=0.00003) (Table 2). In 37 patients (71.2%) of Group I, 17 complications were observed; in Group II - 11 complications in 15 patients (29.4%). The structure of surgical and non-surgical complications by groups is presented in Table 2.

No statistically significant differences in the incidence and severity of postoperative complications were noted between the groups. Noteworthy is the absence of grade IV–V surgical complications and the relatively low proportion of systemic complications.

Table 2

Structure of postoperative complications in groups

	Group I	Group II	*p*
Uncomplicated postoperative period	15	36	0.45
Complicated postoperative period	37	15	0.45
Local complications			
Gastrointestinal paresis	10	5	0.18
Hydrothorax (1- or 2-sided)	11	5	0.11
Pneumonia (1- or 2-sided)	7	3	0.19
Wound complications	10	4	0.09
Fluid accumulation in the abdominal cavity	6	4	0.53
Anastomotic stricture	0	3	0.08
Subdiaphragmatic hematoma with infection	0	1	0.31
Anastomotic leak requiring drainage	3	2	0.66
Anastomotic leak, peritonitis requiring relaparotomy	3	1	0.32
Anastomotic stricture	0	2	0,15
Pancreatitis/pancreatic necrosis	1	2	0.55
External pancreatic fistula	1	0	0.32
Splenic infarction	1	0	0.32
Eventration	1	0	0.32
Complications assessed using Clavien–Dindo scale			
I	39	17	0.001*
II	2	2	0.98
III*a*	5	3	0.58
III*b*	4	1	0.18
IV*a*	4	0	0.04*
IV*b*	1	1	0.99
V	9	2	0.03*
Systemic complications			
Pulmonary	1	0	0.32
Cardiac	2	0	0.16

Note: * — statistically significant differences

DISCUSSION

In both Asian and European countries, laparoscopic gastrectomy is an alternative to open gastrectomy in early-stage GC, with a tendency to displace the latter. Laparoscopic access is also actively used for locally advanced forms of GC [16]. At the same time, unlike in Asian countries, neoadjuvant therapy is currently actively used in Europe and the USA, the implementation of which is supposed to improve the prognosis of relapse-free and overall survival of patients [17, 18]. Unlike Europe, these studies are rare in Asian countries, which may be due to a more aggressive surgical approach to the volume of lymphadenectomy, and detection of the disease at early stages. In the Russian Federation, laparoscopic gastrectomy is performed in single specialized centers. The incidence of GC in this country is approximately the same as in the world, but it is detected at late stages. Our Clinic encounters patients who already have complications of GC, due to which neoadjuvant chemotherapy was considered inappropriate, and the choice of access, as a rule, did not depend on the size of the primary lesion. Over 7.5 years of laparoscopic surgeries, one conversion was performed at the beginning of the surgical intervention development, due to non-hermetic formation of anastomosis by a suturing device. Among the negative aspects, it is necessary to note the long duration of the operation, which averaged 9 hours. The most labor-intensive process was the stage of adhesiolysis, omentectomy, especially in patients with a history of surgery, lymphadenectomy, and removal of the specimen in one block. There was no significant blood loss. Currently, based on accumulated experience, the duration of surgery is on average 280 minutes, and blood loss does not exceed 150 ml. We note outcomes similar to the findings of research from around the world, they do not depend on access, but retain all the advantages of minimally invasive methods in laparoscopic gastrectomy.

CONCLUSION

Recently, there has been an increase in the number of minimally invasive technologies in the treatment of gastric cancer [19].

Laparoscopic-assisted procedures took longer, however, due to more precise technique and better visualization of anatomical structures, less intraoperative blood loss was noted.

During laparoscopic-assisted radical gastrectomy, it is possible to perform more precise lymph node dissection, increase the number of lymph nodes in the specimen and, thus, increase the probability of detecting lymph nodes with metastases. This is the most important indicator of the effectiveness of the surgical treatment method.

Thus, this difference, which has statistical significance, demonstrates that the incidence of severe systemic complications after laparoscopic surgery was lower than after open surgeries, which indicates greater safety of the laparoscopic method compared to intervention from a laparotomy approach.

The total bed-day indicator, although it is generally recognized as biased, depended on the incidence of postoperative complications, which increased the length of hospitalization. In turn, an increase in the duration of hospitalization influenced the later timing of the start of adjuvant chemotherapy, which could negatively affect its results and, in turn, increase the incidence of gastric cancer recurrence and mortality as a result of recurrence.

The use of laparoscopic technologies in our study demonstrated the safety and effectiveness of the technique for patients with complicated gastric cancer.

ВЫВОДЫ

1. The two-year relapse-free survival after laparoscopic and open interventions was 75.4% and 41.6%, respectively, p = 0.043.
2. The incidence of postoperative complications after laparoscopic surgeries was 29.4%, after interventions from laparotomic access - 71.2% (p < 0.001).
3. 3. Postoperative mortality after laparoscopic interventions was 3.9%, after "open" ones - 17.3% (p = 0.009).\

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Received on 06/09/2023
Review completed on 27/10/2023
Accepted on 05/06/2024