Am J Transl Res 2023;15(3):2183-2190
www.ajtr.org /ISSN:1943-8141/AJTR0146790

Original Article

Comparison of the effects of endoscopic submucosal dissection and laparoscopic distal radical surgery on the rehabilitation and quality of life of patients with early gastric cancer

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Received September 30, 2022; Accepted November 29, 2022; Epub March 15, 2023; Published March 30, 2023

Abstract: Objective: This study was designed to compare the effects of endoscopic submucosal dissection (ESD) and laparoscopic distal radical surgery (LDRS) on patient rehabilitation and quality of life (QoL) in patients with early gastric cancer (GC). Methods: The clinical data of 52 patients with early GC admitted to Wuhan Union Hospital from January 2018 to December 2020 were retrospectively analyzed. Among them, 32 patients who underwent LDRS were assigned to the laparoscopic group, and the rest of the 20 patients who underwent ESD were assigned to the endoscopic group. The two groups were compared in clinical efficacy, intraoperative blood loss, operation time, postoperative hospitalization time, gastrointestinal ventilation time and postoperative complications, and the postoperative recurrence and postoperative QoL of the two groups were evaluated and recorded. Independent risk factors for recurrence of gastric cancer were analyzed by logistics regression. Results: The laparoscopic group showed a significantly lower complete resection rate than the endoscopic group (P=0.030). The endoscopic group experienced notably less intraoperative blood loss and operation time, significantly earlier time for the first anal exhaust and shorter hospitalization time in contrast to the laparoscopic group (all P<0.05). Six months after operation, the endoscopic group had notably higher MOS 36-Item Short-Form Health Survey (SF-36) scores than the laparoscopic group (P<0.001). In addition, the laparoscopic group had a notably higher total incidence rate of complications than the endoscopic group (P<0.05). Among the 52 patients, 8 patients had recurrence. According to Logistics regression analysis, tumor diameter and invasion depth were independent risk factors for recurrence (both P<0.05). Conclusion: With significantly better efficacy than that of LDRS, ESD is beneficial to postoperative rehabilitation and can improve the QoL of patients, and both schemes cause no significant effect on the recurrence of patients.

Keywords: Endoscopic submucosal dissection, laparoscopic distal radical surgery, gastric cancer, rehabilitation, prognosis

Introduction

Gastric cancer (GC) is a common malignant tumor of the digestive tract throughout the world [1]. According to statistics [2], over 1 million new cases of GC occur each year worldwide. The number of affected people is uneven in different regions, with more patients in East Asian countries such as China, South Korea and Japan than that in Europe and Africa, and approximate 800,000 people die of GC each year. According to cancer-associated statistics in 2015, China had 679,000 new cases of GC, of which 499,000 died of the cancer, ranking second among patients with malignant tumors and first among patients with malignant tumors of the digestive system [3]. The 5-year survival rate of GC is only 7%-14%, which is because of the lack of specific digestive tract symptoms in early GC. Early GC may manifest with symptoms such as epigastric discomfort, abdominal distension, and acid reflux. Some patients do not care about these symptoms, so it may have already developed into advanced GC when it is finally diagnosed [4-6]. Moreover, the operation of advanced GC is difficult, and the prognosis is unsatisfactory [7]. Accordingly, the key to the treatment of GC is early detection and timely treatment.

As medical levels advance, endoscopic screening technology has achieved continuous impro-

vement, and the detection rate of early GC has been improved, especially in Japan and South Korea [8, 9]. In the current medical field, clinicians generally accept that the treatment of GC is complete surgical resection of the lesion and thorough dissection of the lymph nodes [10]. Although surgical operations such as laparoscopy and laparotomy can achieve radical cure of GC, changing the original physiological and anatomical structure of the gastrointestinal tract brings various postoperative complications, slow recovery, high cost and poor quality of life (QoL) [11]. Additionally, the traditional radical gastrectomy for GC is relatively traumatic, with much intraoperative blood loss, severe postoperative inflammatory response, various complications, and easy recurrence, and its overall therapeutic effect is not satisfactory [12]. The development of endoscopic technology has given birth to a way to remove early GC under endoscope, and the emergence of endoscopic submucosal dissection (ESD) broadens the scope of endoscopic resection of early GC, contributing to a higher complete resection rate and a lower local recurrence rate, but it should also be adopted strictly according to the indications [13]. However, laparoscopic surgery largely depends on surgical equipment and instruments, and the standard instruments have higher technical requirements for the surgeon.

This study was designed to analyze the rehabilitation and prognosis of patients with early-stage GC who underwent either ESD or laparoscopic distal radical surgery (LDRS), with the goal of providing a reference for clinicians in therapeutic regimen selection.

Methods and data

Clinical data

A total of 52 patients with early GC admitted to Wuhan Union Hospital from January 2018 to December 2020 were retrospectively included. Among them, 32 patients who underwent LDRS were assigned to the laparoscopic group, and the other 20 patients who underwent ESD were assigned to the endoscopic group. This study was performed with permission from the Medical Ethics Committee of Wuhan Union Hospital with ethnical approval number of [2020] IEC-J (237).

Inclusion and exclusion criteria

Inclusive criteria: Patients with stage IA GC that was suggested by postoperative pathology; patients without lymph node metastasis and distant metastasis confirmed by preoperative imaging CT; patients who had received either ESD or LDRS; and patients with detailed clinical data.

Exclusion criteria: Patients who required further surgery after being evaluated as having incurable resection after ESD by eCura evaluation system; patients who had received chemotherapy and targeted therapy; patients with other malignant tumors or a history of other malignant tumors; patients comorbid with coagulation dysfunction; patients with contraindications to anesthesia or operation; pregnant women; lactating women; or patients comorbid with severe malnutrition or acute/chronic infectious diseases.

Therapeutic regimen

Therapeutic regimen for the laparoscopic (Electronic ultrasound endoscopy (Model GF-UE260-AL5) was purchased from Olympus) group: The laparoscopic group was given LDRS. Specifically, the patient was given tracheal intubation after general anesthesia, and the patient was assisted to take a lithotomy position. Then the operation field was disinfected routinely, and CO_2 pneumoperitoneum was established. An operation hole and observation hole were made in the upper abdomen to confirm the size and location of the tumor by laparoscopy. The partial splenogastric ligament and gastrocolic ligament were amputated with ultrasonic knife, and hepatogastric ligament and greater omentum were transected. In addition, the omental vessels and related veins were freed, and lymph nodes were dissected. A surgical incision (5 cm in length) was made in the upper abdomen to open the abdominal cavity, and the duodenal stump was buried. The distal stomach was resected, and the remnant stomach and proximal jejunum were reconstructed by BillrothI. After operation, the abdominal cavity was cleaned to ensure that the abdominal cavity was in a good condition, and the drainage tube was placed in the abdominal cavity. Antibiotics and gastrointestinal decompression were given after operation.

Therapeutic regimen for the endoscopic (Electronic gastroscopy (model GIF-Q260J) was purchased from Olympus) group: Specifically, the patient was given tracheal intubation after general anesthesia, and the edge of the lesion was marked by electrocoagulation. The patient was injected with methylene blue and glycerol fructose to accent the lesion. A transparent cap was set at the front end of the endoscope, and a high-frequency trap was installed in the transparent cap to attract the negative pressure of the diseased mucosa to the transparent cap. A snare device was used for pre-resection from the edge of the tumor to form a circular incision, and the submucosal connective tissue was peeled off. The diseased tissue was peeled off bluntly, and electrocoagulation was conducted to stop bleeding. The patient was prohibited from eating within 24 h after surgery, and the diet of the patient was gradually changed to a semi-liquid diet according to the recovery of gastrointestinal function until the general diet, etc.

Outcome measures

Primary outcome measures: Complete resection rate: Thorough resection of the lesion without tumor cells at the base and edge of the lesion was defined as complete resection. Logistics regression analysis was conducted for analyzing the factors influencing the recurrence of patients.

Secondary outcome measures: The operation-associated indicators of the two groups were compared, including intraoperative blood loss, operation time, first anal exhaust time and hospitalization time. The incidence of complications between the two groups was compared: The incidences of abdominal viscera adhesion, infection and bleeding in the two groups were counted. The MOS 36-Item Short-Form Health Survey (SF-36) was adopted to evaluate the QoL of the two groups before and after operation, which has a total score of 100 points, covering physical pain, physiological function, role physical, general health, vitality, role emotional, social function, mental health, etc. A higher score indicated better QoL [14]. The clinical data of the two groups were compared.

Statistical analyses

Counting data (%) were analyzed using the chi-square test, and measurement data (Mean ± SD) were all in a normal distribution. The inter-groups comparison was carried out via the independent-samples T test, and the intro-group comparison at different temporal points were carried out via the paired t test. Logistic regression analysis was used for analysis of the factors affecting the recurrence. $P<0.05$ suggested a significant difference. This study adopted SPSS20.0 (SPSS Co., Ltd., Chicago, USA) for statistical analyses of collected data.

Results

Clinical data

According to comparison of clinical data between the two groups, the laparoscopic group and endoscopic group were similar in age, sex, body mass index (BMI), underlying diseases, tumor diameter, histological type and invasion depth (all $P>0.05$, **Table 1**).

Comparison of complete resection rate

The laparoscopic group showed a notably lower complete resection rate than the endoscopic group ($P=0.030$, **Table 2**).

Comparison of operation-associated indexes

According to comparison of operation-associated indexes between the two groups, the endoscopic group experienced notably less intraoperative blood loss and operation time, notably earlier time for the first anal exhaust and shorter hospitalization time than the laparoscopic group (all $P<0.05$, **Figure 1**).

Comparison of QoL

According to comparison of SF-36 scores between the two groups, the laparoscopic group and endoscopic group were not greatly different in SF-36 scores before operation ($P>0.05$), while after 6 months of treatment, the SF-36 scores of the two groups increased significantly (both $P<0.001$), and the endoscopic group had significantly higher SF-36 scores than the laparoscopic group ($P<0.001$, **Figure 2**).

Statistics of the incidence of complications

According to the statistics of complications in the two groups, the laparoscopic group had a notably higher total incidence of complications than the endoscopic group ($P<0.05$, **Table 3**).

Table 1. Comparison of baseline data

Items	Laparoscopic group (n=32)	Endoscopic group (n=20)	χ^2/t value	*P* value
Age (years)			0.017	0.895
≥65	17	11		
<65	15	9		
Gender			1.004	0.316
Male	22	11		
Female	10	9		
BMI (kg/m^2)	24.85±1.63	24.72±2.11	0.656	0.514
Underlying disease				
Diabetes mellitus	12	8	0.032	0.856
Hypertension	15	10	0.048	0.826
Tumour diameter (cm)	1.96±0.96	2.14±0.99	0.794	0.430
Histological classification			1.213	0.545
Low differentiation	5	4		
Moderate differentiation	9	3		
High differentiation	18	13		
Infiltration depth			0.288	0.591
Mucous layer	26	15		
Submucosal layer	6	5		

Note: Body Mass Index (BMI).

Table 2. Comparison of complete resection rate

Group	Complete resection	Incomplete resection	χ^2 value	*P* value
Laparoscopic group (n=32)	16 (50.00%)	16 (50.00%)	4.680	0.030
Endoscopic group (n=20)	16 (80.00%)	4 (20.00%)		

Analysis of recurrence factors

According to the statistics of patients' recurrence, among the 52 patients, 8 patients had recurrence. Then univariate analysis was conducted, and the clinical data of relapsed patients with non-relapsed patients were compared. The results showed that tumor diameter and invasion depth were risk factors for recurrence (both P<0.01, **Table 4**). Then, factors with significance were included for logistic regression analysis, and the age of patients were included for analysis with reference consultation. The results showed that tumor diameter and invasion depth were independent risk factors for recurrence (both P<0.05, **Table 5**).

Discussion

With the increase of living pressure and the change of diet structure, the incidence of GC is constantly increasing, and it tends to affect the younger population. Because of the lack of specific symptoms, it is difficult to detect GC in early stages, resulting in a high mortality rate and unfavorable prognosis of patients [15]. Surgery under direct vision can ensure the integrity of lesion tissue cleaning, and contribute to a relatively high survival rate, which is a classic operation for the treatment of early-stage GC [16]. However, this operation damages the normal anatomical structure of the stomach, causing great trauma to the body, and bringing some disadvantages such as large blood loss and complications, which will compromise the QoL of patients after operation [17].

With advantages of less trauma, short operation time, low cost and quick recovery, ESD can make the resected shape and size of the tumor better controled, and can help remove ulcerative and large lesions at one time, and completely remove the tissue, which is beneficial to postoperative pathological diagnosis [18]. In the present study, the laparoscopic group

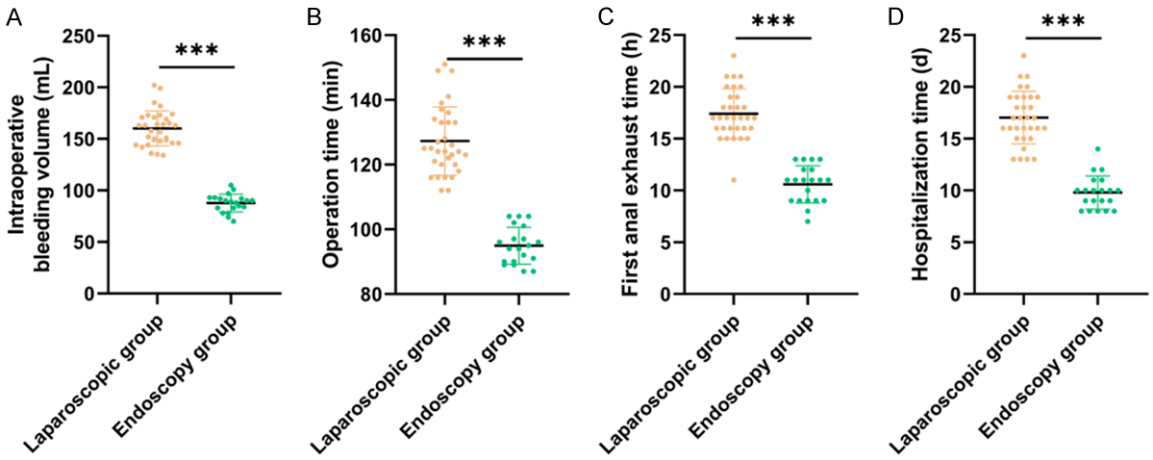

Figure 1. Comparison of operation-associated indexes between the two groups. A: Comparison of intraoperative blood loss between the laparoscopic group and endoscopic group; B: Comparison of operation time between the laparoscopic group and endoscopic group; C: Comparison of the first anal exhaust time between the laparoscopic group and endoscopic group; D: Comparison of hospitalization time between the laparoscopic group and endoscopic group. Note: ***P<0.001.

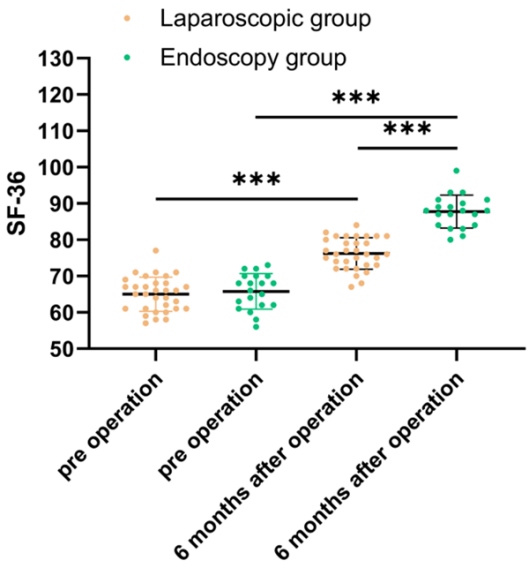

Figure 2. Comparison of SF-36 scores before and after treatment. Note: *** means P<0.001, the MOS 36-Item short-form health survey (SF-36).

showed a notably lower complete resection rate than the endoscopic group, and the endoscopic group experienced notably less intraoperative blood loss and operation time, notably earlier time for the first anal exhaust and shorter hospitalization time than the laparoscopic group. The results suggest that ESD can contribute to less trauma and faster postoperative recovery. Tian et al. [19] have found that ESD is safe in the treatment of patients with early GC, with less trauma to patients. Zhao et al. [20] revealed that ESD has the characteristics of less trauma, fast postoperative recovery, similar recurrence rate and survival rate to those after other surgery, and high safety. The results are in agreement with the research results of this study. In this study, the postoperative complications and postoperative QoL scores of patients were also evaluated. According to the results, the endoscopic group had notably higher QoL score and showed a notably lower total incidence of postoperative complications than the laparoscopic group, indicating that ESD has the ability to reduce complications and improve patients' QoL in the treatment of early-stage GC. The possible reasons are as follows: Firstly, ESD is highly targeted, and is developed according to the type, location and size of patients' lesions to ensure the complete removal of tumor tissues. Secondly, ESD can treat lesions in multiple positions at one time, and the operation can be repeated. Finally, ESD is completed under the endoscope. With the operation of high frequency electrotome, the tumor can be resected with complete compliance, and any residual tumor lesion caused by multiple cuts and damage to the normal tissues around the lesion can be avoided, which contributes to less trauma and a lower risk of complications such as abdominal organ adhesion.

With the accumulation of clinical experience of ESD, the indications are gradually increased. ESD has the advantages of minimal invasion and quick recovery after operation. To some

Table 3. Incidence of complications

Group	Abdominal adhesion	Infection	Incidence of bleeding	Total incidence rate
Laparoscopic group (n=32)	3	3	3	9
Endoscopic group (n=20)	1	0	0	1
χ^2 value				4.237
P value				0.039

Table 4. Multivariate analysis

Items	Recurrence group (n=8)	Non-recurrence group (n=44)	χ^2/t value	*P* value
Age (years)			1.702	0.192
≥65 (n=28)	6	22		
<65 (n=24)	2	22		
Gender			0.738	0.390
Male (n=33)	4	29		
Female (n=19)	4	15		
BMI (kg/m^2)	24.40±1.36	24.87±1.88	0.672	0.504
Underlying disease				
Diabetes mellitus (n=20)	4	16	0.531	0.465
Hypertension (n=25)	4	21	0.014	0.905
Tumor diameter (cm)	2.99±0.91	1.86±0.88	3.317	0.002
Histological classification			4.980	0.082
Low differentiation (n=9)	3	6		
Medium differentiation (n=12)	3	9		
High differentiation (n=31)	2	29		
Infiltration depth			9.690	0.002
Mucosal layer (n=41)	3	38		
Submucosal layer (n=11)	5	6		
Therapeutic regimen			0.723	0.394
Laparoscopic distal radical surgery	6	26		
Endoscopic submucosal dissection	2	18		
Intraoperative blood loss (mL)	132.62±28.29	132.18±40.13	0.029	0.976
Operation time (min)	119.25±17.57	114.04±18.42	0.463	0.739
The first anal exhaust time (h)	15.25±3.77	14.70±4.06	0.352	0.725
Hospitalization time (d)	14.87±3.94	14.13±4.26	0.455	0.650

Table 5. Analysis of risk factors for recurrence

Factors	β	Standard error	χ^2 value	*P* value	OR value	95% CI	
						Lower limit	Upper limit
Age	0.141	1.053	0.018	0.893	1.151	0.146	9.064
Tumor diameter	1.550	0.646	5.753	0.016	4.710	1.328	16.709
Infiltration depth	2.644	1.073	6.069	0.014	14.073	1.717	115.35

extent, it makes up for the disadvantages of endoscopic submucosal excision, and its therapeutic effect is well recognized, but it cannot completely prevent postoperative recurrence [21, 22]. In the present study, the recurrence was counted, and tumor diameter and invasion depth were found to be independent risk factors for recurrence. This is because of the fact that the infiltration of the lesion tissue is deeper in larger diameter tumors, and the cancer

cells can penetrate the serous layer into the abdominal cavity, which is prone to distant implantation and metastasis. Additionally, the excessive diameter of the tumor increases the difficulty of intraoperative resection and causes the inability to completely peel off the lesion, and the lesion is likely to have residue, bringing a higher risk of postoperative recurrence [23]. Moreover, as the depth of tumor invasion deepens, the difficulty of intraoperative endometrial dissection increases. When the invasion of the lesion reaches the submucosa, surgeons worry about gastric perforation due to deep dissection during the operation. While avoiding gastric perforation, surgery may cause lesion residue, and result in incomplete striping of deep lesion tissue, which greatly increases the risk of postoperative recurrence [24, 25].

This study also has some limitations. This is a single-center, retrospective cohort study, without randomized controlled trials, and with a small sample size, especially in the endoscopic group. Secondly, the follow-up data obtained in this study were all obtained through electronic files and outpatient review records, which may result in bias in the analysis of the results. Finally, we hope to carry out randomized controlled experiments in the future to refine the research conclusions.

To sum up, with significantly better efficacy than that of LDRS, ESD is beneficial to postoperative rehabilitation and can improve the QoL of patients, and both schemes cause no effect on the recurrence of patients.

Disclosure of conflict of interest

None.

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