

ORIGINAL ARTICLE

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## Feasibility research of treating advanced gastric carcinoma with laparoscopy

Hailin Xi<sup>1</sup>, Rui Li<sup>2</sup>, Hongqiang Yang<sup>3</sup>, Su Feng<sup>1</sup>, Ruihao Qin<sup>1</sup>

<sup>1</sup>Division of Blood, Thyroid, Hernia and Minimally Invasive Surgery of Xuzhou Central Hospital, Xuzhou, China;

<sup>2</sup>Central Laboratory of Xuzhou Central Hospital, Key Laboratory of Xuzhou City, China; <sup>3</sup> First Division of Oncological Surgery of Xuzhou Central Hospital, Xuzhou, China

### Summary

**Purpose:** To determine the feasibility and safety of treating patients with advanced gastric cancer with laparoscopy.

**Methods:** We retrospectively analyzed 180 patients with advanced gastric carcinoma and divided them into either the laparoscopy group (96 cases) or the laparotomy group (84 cases). Results: The number of lymph nodes dissected during surgery and the surgical time were similar in both groups. The incision length, total amount of bleeding during the operation, postoperative exhaust recovery time, and the length of hospital stay were significantly improved in the laparoscopy group when compared to the laparotomy group. The rate of postoperative complications was also significantly lower in the laparoscopy

group. The levels of C-reactive protein (CRP) at 1, 7, and 10 days after surgery were significantly lower in the laparoscopy group.

**Conclusion:** Overall, the laparoscopic radical operation for advanced gastric carcinoma demonstrated higher safety, shorter incision, less bleeding, faster postoperative recovery, and lower rate of postoperative complications compared to the laparotomy group. Thus, this study has shown clear advantages for shifting to laparoscopy for the treatment of advanced gastric carcinoma.

**Key words:** advanced gastric carcinoma, feasibility, laparoscopic radical operation, safety

### Introduction

As one of the most common malignant tumors, gastric carcinoma is characterized by high morbidity and mortality rates, greatly threatening also the quality of life of patients [1]. Surgery is the primary clinical method to treat gastric carcinoma. The 5-year survival rate for patients diagnosed with early gastric carcinoma using laparoscopic treatment is almost the same as in patients treated with laparotomy [2]. In China, approximately 80% of the patients are diagnosed with advanced gastric carcinoma, with a dismal 5-year survival rate of 20-30% [3]. Currently, radical surgery is the primary method to treat advanced gastric carcinoma.

The development of laparoscopic technology has resulted in widespread surgical applications due to the major advantages of this technique, such as reduction of trauma [4]. However, laparoscopic treatment for advanced gastric carcinoma is difficult in real practice, particularly concerning the dissection of lymph nodes. Therefore, the use of laparoscopic surgery in the treatment of gastric carcinoma is still controversial [5,6].

This study has retrospectively analyzed the feasibility and safety of laparoscopic and traditional radical surgery for the treatment of patients with advanced gastric carcinoma.

## Methods

### *Clinical data*

We identified 180 patients that were diagnosed with advanced gastric carcinoma through gastroscopic pathological examination and treated at our hospital from January 2009 to December 2015. Inclusion criteria were as follows: (1) Gastroscopy, ultrasound, and CT examination indicated that the cancer tissue invaded submucosa or the muscular layer of the gastric wall, as well as a diagnosis of advanced gastric carcinoma through postoperative tissue pathological examination; (2) The patient did not have obvious operation contraindication. Patients with a tumor diameter >10 cm, tumor metastasis, inability to endure an operation, with emergency operation, multiple organ dysfunction, abdominal adhesions, or incomplete clinical data were excluded.

The Ethics Committee of our hospital approved the project and we obtained informed consent from patients and their families. Patients were divided into either the laparoscopy or the laparotomy groups according to treatments they were subjected. TNM staging (UICC 2002, 6<sup>th</sup> Edn) of advanced gastric carcinoma was used.

### *Laparoscopic radical surgery for gastric carcinoma*

Patients were subjected to endotracheal intubation and intravenous/inhalational general anesthesia. A 10mm cannula was placed as an observation spot at the lower margin of the umbilicus, the patient being in supine position. Pneumoperitoneum was formed and the intra-abdominal pressure was kept at 133mmHg. A 5mm cannula was inserted at a site that was 1cm lower from the costal margin at the left anterior axillary line as the main handle hole for the operation. A 5mm cannula was inserted parallel to the umbilicus at the left mid-clavicular line as the auxiliary hole. At the corresponding position on the right, a 5mm diameter cannula was inserted at the upper right and a 12mm-diameter cannula was inserted at the lower right. The condition inside the abdominal cavity was examined by laparoscope in order to locate the diseased region and determine whether there was intraabdominal dissemination or invasion of the surrounding organs. Then, the gastric greater omentum was turned up towards the head, and ultrasonic knife was used to dissociate the gastrocolic ligament and moved towards the right to the hepatic flexure of the colon, and then to the left of the splenic flexure of the colon in order to cut and apply ligation of the left gastric omental artery and related veins. The middle colic artery was located and its surface was followed to dissociate the transverse colon mesentery to the position of the lower margin of the pancreas. The mesenteric artery and vein were exposed and dissected, and the 14<sup>th</sup> lymph node was dissected. Then, the right artery and veins of the gastric omentum were dissociated by clinging closely to the head of the

pancreas, cut at the bottom, and ligation was performed and the 6<sup>th</sup> lymph node was dissected. Starting at the root of the right artery of the gastric omentum, the loose connective tissue among the antrum of stomach, duodenum, and pancreas was separated in order to fully expose the gastroduodenal artery. The capsule of the pancreas was dissociated from the upper margin from bottom to top and from right to left. The posterior peritoneum was cut at the upper margin of the pancreas and the coronary vein was exposed and cut with ligation close to the basilar part. The common hepatic artery was exposed and dissociated along the arterial sheath and the 8<sup>th</sup> lymph node was dissected. The gastric left artery and vein, coeliac truncus arteriosus, and the near-end of splenic artery were exposed. The gastric left artery and vein were cut from the bottom with ligation to dissect the 7<sup>th</sup>, 9<sup>th</sup>, and 11<sup>th</sup> lymph nodes. The cannulas were moved continuously upward from the gastroduodenal artery to apply ligation and cut at the bottom of the gastric right artery and dissect the 5<sup>th</sup> lymph node. Following this, the hepatoduodenal ligament was dissociated in order to expose the hepatic artery and dissect the 12<sup>th</sup> lymph node. Following this, gastric lesser omentum was dissociated along the lower margin of the liver to the right of the cardia. At the side of the lesser curvature, it was stripped to 3-4cm above the tumor and then the 1<sup>st</sup> and 3<sup>rd</sup> lymph nodes were dissected. Afterwards, the duodenal bulb was separated 2cm below the pylorus and the straight-line cutter was applied to cut the duodenum and lift the transverse colon upward. The starting area of the jejunum was searched and marked with a cotton tape. An incision was created 6-8cm at the right middle of the midsection and the greater omentum, lesser omentum and the gastric tissue was dragged out of the abdominal cavity. The tumor tissue was cut according to the predetermined plan. Finally, 28-29mm anastomosis was performed for the stomach and jejunum Billroth II type anastomosis. The wound was carefully sutured and the pneumoperitoneum was rebuilt. A drainage tube was placed through the lower right cannula and out of the abdominal cavity. Later, all cannulas were pulled out under the laparoscope in the correct order. The gas in the abdominal cavity was fully released and the cannula wound was stitched.

### *Laparotomy radical surgery for gastric carcinoma*

Patients were subjected to endotracheal intubation and intravenous/inhalational general anesthesia. An umbilical incision of 18-22cm was performed in the midsection for regular laparotomy exploration in order to determine whether there was any metastasis inside the abdominal cavity or to the surrounding organs. Based on the conditions of the tumor, the operation method for the tumor removal was decided. Meanwhile, the lymph nodes were dissected. The digestive reconstruction and the operation dissection range was the same as in the laparoscopic radical operation.

*Clinical observation index*

Registered were the duration of surgery, total amount of bleeding during surgery, number of lymph nodes dissected, rate of complications, exhaust recovery time after surgery, length of hospital stay, and the levels of CRP 1, 7, and 10 days post-surgery.

*Statistics*

The SPSS 20.0 software was used for statistical analysis. Quantitative data were expressed as mean±standard deviation and independent samples were analyzed using t-test. Enumeration data were expressed by the number of cases or as percentages. A p value <0.05 indicated statistically significant differences.

**Results**

Our results demonstrated no significant differences in age, gender, body mass index, tissue

pathological type, tumor diameter and TNM staging of patients in the laparoscopy and laparotomy groups ( $p>0.05$ ) (Table 1).

*Analysis of indicators during surgery*

We first compared the relevant aspects of surgery, as outlined in Table 2. The duration of surgery and the number of lymph nodes dissected were comparable between the laparoscopy and laparotomy groups. However, the length of incision and the total bleeding during surgery were significantly lower in the laparoscopy group compared to the laparotomy group (Table 2). Based on these indicators, patients subjected to laparoscopic surgery benefited from a smaller incision and less bleeding.

*Analysis of indicators after surgery*

After surgery, we analyzed the relevant indi-

**Table 1.** Clinicopathological data

Basic clinicopathological data	Laparoscopy (n=96) n	Laparotomy (n=84) n	Statistical magnitude	p value
Age, years (mean±SD)	48.3 ± 4.7	45.3 ± 6.2	t=-2.75	0.45
Gender (cases)				
Male	47	58	x <sup>2</sup> =0.01	7.43
Female	49	26		
Body mass index (kg/m <sup>2</sup> ), mean±SD	21.2 ± 2.7	20.9 ± 2.3	t=-3.75	0.28
Pathological types				
Adenocarcinoma	78	73	x <sup>2</sup> =0.30	1.06
Signet-ring cell carcinoma	18	11		
Tumor diameter, cm				
<4	56	62	x <sup>2</sup> =0.03	4.75
≥4	40	22		
TNM stage				
Stage I and II	84	75	x <sup>2</sup> =0.71	0.14
Stage III				

**Table 2.** Comparison of all indicators during surgery

Group	Duration of surgery (hrs)	Number of lymph nodes dissected	Length of incision (cm)	Bleeding during surgery (ml)
Laparoscopy (mean±SD)	4.3 ± 0.8	25.0 ± 4.3	5.1 ± 0.6	157.6 ± 37.4
Laparotomy (mean±SD)	4.1 ± 0.6	25.7 ± 3.8	23.4 ± 2.6	423.9 ± 55.9
t	0.03	0.28	12.3	7.65
p	0.76	0.64	0.000	0.010

**Table 3.** Comparison of all indicators after surgery

Group	Exhaust recovery time after surgery (d) (mean±SD)	Length of stay (d) (mean±SD)	CRP levels (mg/L)		
			Day 1	Day 7	Day 10
Laparoscopy (mean±SD)	2.5 ± 0.3	8.6 ± 2.2	17.4 ± 3.3	10.6 ± 3.7	5.3 ± 2.5
Laparotomy (mean±SD)	4.7 ± 0.6	12.5 ± 3.0	29.8 ± 3.5	18.3 ± 4.8	9.9 ± 3.2
t	5.34	5.21	6.22	7.33	7.27
p	0.036	0.040	0.024	0.016	0.018

cators in order to determine the differences between the two procedures (Table 3). As a sign of post-surgical recovery, we found that the exhaust recovery time and the length of hospital stay were significantly shorter in the laparoscopy group compared to the laparotomy group. In order to assess inflammation caused by the two surgical methods, we analyzed the levels of CRP in blood and found that the CRP levels 1, 7, and 10 days post-surgery were significantly lower in the laparoscopy group compared to the laparotomy group (Table 3). Overall, the post-surgical data showed a faster recovery of the laparoscopy group.

#### Rate of complications

Complications are shown in Table 4. Six cases of infection at the incision site of the laparoscopy group and 13 in the laparotomy group were found. Also 2 cases of intraperitoneal hemorrhage in the laparoscopy group and 8 in the laparotomy group were noticed. Four cases of anastomotic fistula were found in the laparoscopy group compared to 5 in the laparotomy group and 3 cases of ileus in the laparoscopy group and 4 in the laparotomy group. Finally, there were 2 cases of pulmonary infection in each group. Although some complications were similar between the two groups, the overall rate of complications of the laparoscopy group was significantly lower compared to the laparotomy group, which supports the use of laparoscopy as the preferred treatment method.

## Discussion

Laparoscopic radical surgery has gradually gained wider acceptance and is currently applied as a regular treatment method for advanced gastric carcinoma. The surgical procedures, as well as the tumor-free and radical resection principles, for tumors were strictly followed during the laparoscopic radical surgery for gastric carcinoma in order to ensure complete removal of the tumor tissue at the primary site [7]. Similarly, the lymph nodes were dissected according to strict procedures outlined in the literature [8]. Since the dissection is performed with laparoscopic in-

struments, the pressure and friction on the tumor are minimized to reduce the dissemination of tumor tissue or cells [9]. This study showed that the number of lymph nodes dissected was similar in both groups. However, the amount of bleeding during surgery, the incision length, inflammation, postoperative exhaust recovery time, length of hospital stay, and postoperative complications were significantly better in the the laparoscopy group, which supports the feasibility and safety of laparoscopic radical surgery for the treatment of advanced gastric carcinoma.

During the laparoscopic surgery, an ultrasound knife was used to reduce bleeding, especially when dissecting the lymph nodes. The ultrasound knife guarantees the efficacy and safety of the surgery, and reduces the possibility of tumor dissemination through blood or lymphatics by improper handling [10]. Compared to traditional surgery, the view of the surgical field is improved with laparoscopy, which can contribute to lower injury in the surrounding tissues and organs, thus lowering the rate of postoperative complications [11]. Our data supports this idea as shown by reduced inflammation and lower complication rates. Studies also confirm that for the treatment of early gastric carcinoma, laparoscopic surgery preserves the immune function and lowers the serum IL-6 and CRP levels [12,13].

Currently, there have been few cases of advanced gastric carcinoma patients treated with laparoscopic surgery due to its technical complications, the presence of serious abdominal adhesions, difficult dissection, and the possibility of various intraoperative and postoperative complications. With continuous advances in minimally invasive technology, laparoscopic surgery starts to demonstrate significant clinical advantages.

The limitation of this study consists in the lack of analysis about survival parameters. Studies suggest that laparoscopic surgery does not prolong the survival of advanced gastric carcinoma patients or improve the overall survival rate [16,17]. This may be due to the fact that the prognosis of advanced gastric carcinoma is very poor. However, the laparoscopic approach can sig-

**Table 4.** Complications

Group	Cases	Infection of incision	Intraperitoneal hemorrhage	Anastomotic fistula	Ileus	Pulmonary infection	Total rate n (%)
Laparoscopy	96	6	2	4	3	2	17 (17.7)
Laparotomy	84	13	8	5	4	2	32 (39.3)
$\chi^2$							9.398
p							0.002

nificantly improve the perioperative treatment, which is of some value in ameliorating the patient quality of life.

## Conflict of interests

The authors declare no conflict of interests.

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