

Comparative study on long-term survival results between minimally invasive surgery and traditional resection for esophageal squamous cell carcinoma

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Abstract. – OBJECTIVE: To investigate the long-term survival between minimally invasive surgery and traditional resection in the treatment of stage I esophageal squamous cell carcinoma.

PATIENTS AND METHODS: 240 patients with esophageal squamous cell carcinoma were divided randomly into the study group (120 cases) treated by minimally invasive surgery and the control group (120 cases) treated by traditional resection. Patients were followed-up by phone or visiting, and were observed for survival rates, complications and quality of life.

RESULTS: The study group survival rates of one, three and five years are 92.6%, 88.5% and 67.6%, respectively. The control group survival rates of one, three and five years are 87.1%, 76.3% and 52.5%, respectively, and the difference was statistically significant ($p < 0.01$). The post-operative complication rate was 12.5% in the study group and 33.3% in the control group and the difference was statistically significant ($p < 0.05$). Furthermore, the post-operative quality of life of patients in the study group are improved. 96.7% (116/120) are above 70 in Karnofsky score, with most surviving patients living independently, and having lighter self-reported symptoms. 81.7% (98/120) of patients in the control group are above 70 in Karnofsky score, and the Karnofsky score of post-operative quality of life between the two groups is statistically significant ($p < 0.05$).

CONCLUSIONS: Compared with traditional resection, minimally invasive surgery is advantageous in improving both survival rates and quality of life, and is thereby worthy of clinical promotion and application.

Key Words:

Minimally invasive surgery, Traditional resection operation, Esophageal cancer, Squamous cell carcinoma, Survival rate.

includes forms of squamous-cell carcinoma, adenocarcinoma, and adenosquamous carcinoma, among others¹. In recent years, the incidence rate of esophageal cancer in our country has risen, and the rate of mortality from this disease is relatively high. Surgery is currently the preferred method of treating esophageal cancer. Total resection and minimally invasive surgery are the main surgical methods for treatment². Currently, there are no reports concerning the long-term quality of life and survival rates between minimally invasive surgery and total resection of esophageal squamous cancer during the clinical period. Therefore, in the present manuscript, we performed a tracking and comparative study of survival conditions among patients with esophageal squamous cancer treated by total resection and minimally invasive surgery.

Patients and Methods

Patients

240 patients with esophageal cancer who were primarily diagnosed and cured in the Surgical Oncology Department of our hospital between June 2004 and June 2009 were selected. Among which, 180 patients were male and 60 patients were female (the ratio was 3:1). 46 patients were >70 years old; 126 patients were 55-70 years old; 68 patients were <55 years old, and the average age was 61.3 years old. Among patients, 34 had tumors were in the upper thoracic segment, 122 had tumors in the middle thoracic segment, 53 had tumors in the lower thoracic segment and 31 patients had tumors in the abdominal esophagus. All patients were diagnosed with clinical stage I esophageal squamous cancer before surgery by gastroscopically mediated pathological examination

Introduction

Esophageal cancer is a form of malignant tumor that frequently appears clinically. It mainly

and postoperative pathological types were also verified. No distant metastases were observed in selected patients, and no severe functional damages in heart, lung, liver and kidney or other surgical contraindications were observed. Patients were divided into the study group and control group by surgical methods, with 120 patients in each group. Minimally invasive surgeries were performed on patients in the study group, while total resections were performed on patients in the control group. The comparisons between patients in both groups in terms of gender, age, pathological stage and tumor location were all comparable (i.e. no statistical differences).

Methods

Patients in both groups were treated by general anesthesia through orotracheal intubation. Patients in the control group were treated by total resection, and the methods adopted involved making incisions in the neck, chest, and abdomen. Surgery was performed on the right chest and upper abdomen. Left side chest aortic arch anastomosis and left side chest and left neck anastomosis was then performed. A single-use circular stapler was used to anastomose the esophagus, stomach and chest of patients, and 4/0 absorbable suture material was used to carry out double-layer manual anastomosis at the neck. Minimally invasive surgeries were adopted in the study group, where patients were placed in the left 90° decubitus position under the laparoscope to clean esophageal free lymph nodes and mediastinal area lymph nodes, then patients were made to lie in a supine position with arms and legs spread apart, under the laparoscope to clean their stomach free lymph nodes and abdominal area lymph nodes. Finally, 5 cm incision cervical esophageal breaks were carried out at the left side of the neck, lesions were removed, and gastroesophagostomy was carried out following surgery. ICU monitoring was provided to pa-

tients in both groups, gastrointestinal decompression and fasting operations were carried out, and enteral nutritional treatments were given to patients 2 days after surgery.

Observation Indexes

Telephone contacts or home visits were carried out every three months after surgery, and follow-up visits were given to patients in both groups. Post-operative complications, survival rates and quality of life after one year, three years and five years were observed.

Statistical Analysis

Survival rate was calculated by the Kaplan-Meier method, Log-Rank examination was adopted to compare differences in survival, a χ^2 test was adopted for assessment of complications, and a *t*-test was adopted for the quality of life assessments. Finally, the Karnofsky score was used to conduct statistical analyses. $p < 0.05$ was considered statistically significant.

Results

The Comparison of Survival Rates Between the Two Groups

The survival rates of patients in the study group after one, three and five years are 92.6%, 88.5% and 67.6% respectively, while the survival rates of patients in the control group after one, three and five years are 87.1%, 76.3% and 52.5% respectively. The differences in survival rates between patients in the two groups are statistically significant ($p < 0.01$) (Table I and Figure 1).

Comparison of Complications Between the Two Groups

The occurrence rate of post-operative complications of patients in the study group was 12.5% and 33.3% in the control group. The difference was statistically significant ($p < 0.05$) (Table II).

Table I. The comparison of survival rates between the two groups.

Groups	n	Accumulated survival rate (%)			<i>p</i>
		One year	Three years	Five years	
Study group	120	92.6	88.5	67.6	$p < 0.01$, $X^2 = 10.16$
Control group	120	87.1	76.3	52.5	

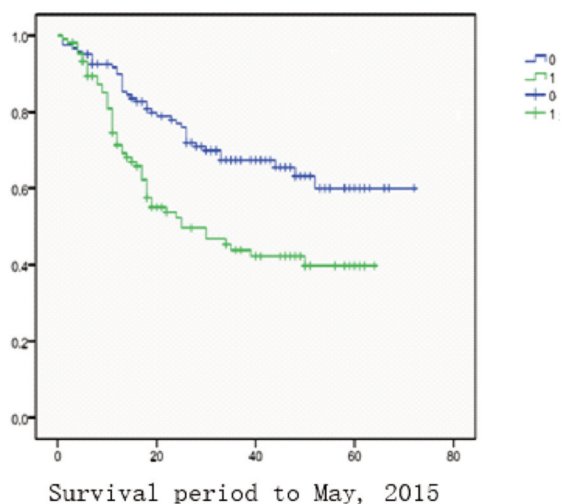


Figure 1. Survival function: 0: study group, 1: Control group, Lifetime to May, 2015.

The Comparison of Post-operative Quality of Life of Patients between the Two Groups

The post-operative quality of life of patients in the study group is overwhelmingly positive. Among them, 96.7% (116/120) of patients are above 70 in Karnofsky score. Most surviving patients can live independently, and self-reported symptoms were relatively lighter. 81.7% (98/120) of patients in the control group are above 70 in Karnofsky score in terms of post-operative quality of life, and the difference in Karnofsky score between the two groups is statistically significant ($p < 0.05$) (Table III).

Discussion

The main treatment of gastrointestinal tumors such as esophageal cancer, depends on surgical intervention. However, open surgeries cause trauma to patients, more complications after surgery and slow recovery of physical strength³. The present research shows that it is possible to treat esophageal squamous cancer by minimally invasive surgery and total resection. Compared with open total resection, minimally invasive surgery has the following advantages^{4,5}: 1) Both external lesions, and anatomical structures are clearly visible. With the aid of an endoscope, local views of lesions are amplified, and the organizational structure of the esophagus, stomach and nearby tissues can be clearly observed, without disturb-

ing the arcus venae azygos and left gastric artery. 2) The trauma caused by minimally invasive surgery is relatively minor, which can lower the operation time (includes opening and closing of the chest and abdomen) and patients can recover rapidly following the operation. The use of ultrasound knives during surgery could also lower the

Table II. The comparison of post-operative complications between the two groups.

Groups	n	Pulmonary infection	Pulmonary atelectasis	Pulmonary Chylothorax	Respiratory failure	Recurrent laryngeal nerve Injury	Anastomotic stenosis	Delayed gastric emptying	Arrhythmia	Occurrence rate (%)
Study group	120	1	1	2	3	3	3	2	0	12.5
Control group	120	4	5	7	8	5	2	4	5	33.3
χ^2										8.796
p										0.05

Table III. The comparison of post-operative quality of life between the two groups.

Groups	n	Karnofsky average score	Karnofsky score >70 [n(%)]
Study group	120	77.23±18.57	116 (96.7%)
Control group	120	73.81±23.42	98 (81.7%)
t/X^2		3.015	9.426
p		<0.05	<0.05

volume of blood lost, consistent with foreign reports^{6,7}. 3) The occurrence of distraction between ribs and the abdominal wall can be avoided, post-operative aches can be reduced, and the formation of abdominal incisional hernias can also be prevented.

Although the advantages of minimally invasive surgery are known, the present research shows that there are occurrences of complications such as pulmonary infection, pulmonary atelectasis, respiratory failure, recurrent laryngeal nerve injury, anastomotic stenosis, delayed gastric emptying and arrhythmia in patients of the study group after having undergone minimally invasive surgery (the occurrence rate of complications in the study group was 12.5%). However, it remains lower than the occurrence rate of complications in the patients of the control group, where they were treated by total resection (the occurrence rate of complications in this group was 33.3%). This data is consistent with domestic reports⁸. This is likely because, with the aid of an endoscope, minimally invasive surgery can prevent the incision of the diaphragm, preserving the integrity of the thoracic and abdominal walls. Therefore, the use of an endoscope can reduce the pain related to the operative incisions, allow for the promotion of patient expectoration, and minimize the effects on pulmonary function, thereby reducing the occurrence of multiple complications such as pulmonary infection.

In the long-term, minimally invasive surgery should be heavily promoted and applied. Currently, there are few studies comparing the long-term effects of esophageal squamous cancer treated by minimally invasive surgery and open total resection treatment. Our study shows that the survival rates of patients in the study group after one, three and five years are 92.6%, 88.5% and 67.6% respectively, while the survival rates of patients in the control group are 87.1%, 76.3% and 52.5% respectively. The difference in the two groups is statistically significant ($p<0.01$). However, other reports, such as that by Decker et al⁹

showed that the survival rate of patients with esophageal cancer treated by minimally invasive surgery after five years is merely 40%, which is comparable to the rates following open surgeries. This is likely related to the specific cases treated, operational skills of medical staff, physical condition of patients, clinical pathologic stage and the extent of lymph node dissection.

With the continuous perfection and refinement of surgeries to treat esophageal cancer in clinical practice, workers in the medical field began to pay attention to the post-operative quality of life of patients, in order to find a more optimal surgical method¹⁰⁻¹⁵. It is important to note that there are multiple reasons affecting the post-operative quality of life of patients with esophageal cancer, and there is no unified standard for evaluating the post-operative quality of life of patients¹¹⁻¹⁸. Our study used the Karnofsky score to observe the quality of life of patients. We show that the post-operative quality of life of patients in the study group is improved, among which 96.7% (116/120) are above 70 in Karnofsky score, with most surviving patients living independently, and self-reported symptoms were relatively lighter. 81.7% (98/120) of patients in the control group are above 70 in Karnofsky score, in terms of post-operative quality of life, and the difference in Karnofsky score between the two groups is statistically significant ($p<0.05$). However, whether this evaluation criterion can comprehensively reflect the quality of life of patients remains to be further explored by follow-up studies. Additionally, the pathological basis of the quality of life of patients after surgery needs to be determined. Only in the event that this pathological basis is fully understood, can a unified quality of life evaluation criterion be determined¹⁹⁻²¹.

Conclusions

Reducing post-operative complications and mortality, greatly improving long-term survival rates of patients and promoting post-operative

quality of life of patients are prominent topics of research in the treatment of esophageal squamous cell carcinoma. Compared with total resection, minimally invasive surgery can clearly promote the post-operative survival rates of patients with esophageal squamous cancer, reduce the occurrence of post-operative complications, improve the quality of life, and is worthy of further clinical promotion and application.

Conflict of Interest

The Authors declare that they have no conflict of interests.

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