

Hand-assisted laparoscopic versus open surgery for radical gastrectomy in the treatment of advanced distal gastric cancer: long-term overall and disease-free survival (final results of a single-center study)

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Abstract

Objective: To compare the surgical effects and long-term efficacy of hand-assisted laparoscopic surgery (HALS) and open surgery (OS) in radical gastrectomy for advanced distal gastric cancer.

Methods: One hundred twenty-four patients who were admitted to the Department of Gastrointestinal Surgery of the West War Zone General Hospital from May 2008 to April 2012 were randomly divided into a HALS group (n = 62) and an OS group (n = 62). After surgery, 113 patients were followed up for 5 and 8 years, and 11 patients were lost to follow-up. The 5- and 8-year overall survival and disease-free survival rates of the two groups were compared and analyzed.

Results: The 5- and 8-year overall survival rates were 31.90% and 18.40% in the HALS group and 32.50% and 18.60% in the OS group, respectively. The 5- and 8-year disease-free survival rates

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were 21.50% and 13.00% in the HALS group and 21.90% and 13.10% in the OS group, respectively. No significant differences were found.

Conclusion: Hand-assisted laparoscopic radical gastrectomy for advanced distal gastric cancer has the advantages of less severe trauma, less intraoperative blood loss, more rapid postoperative recovery, and equivalent long-term efficacy compared with OS.

Keywords

Hand-assisted laparoscopy surgery, open surgery, advanced gastric cancer, gastric cancer prognosis, overall survival, disease-free survival

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Background

Hand-assisted laparoscopic surgery (HALS) is a technique in which the surgeon's hand enters the abdominal cavity through a hand-assisted device to participate in the anatomical operation during laparoscopic surgery. The auxiliary hand can provide tactile feedback and participate in resisting and pulling tissues, greatly reducing the complexity of the operation.¹ The HALS technique has been previously used in the treatment of colorectal cancer and has achieved good surgical results and long-term efficacy.² In 1999, Ohki et al.³ performed the first successful radical gastrectomy for distal gastric cancer using HALS. In China, Cao et al.⁴ also gradually introduced the HALS technique for radical gastrectomy in the treatment of gastric cancer, which has obvious advantages over laparotomy. To further understand the superiority of HALS in radical gastrectomy for gastric cancer, a prospective comparative study of radical gastrectomy for advanced distal gastric cancer was conducted in 124 patients from May 2008 to April 2012 at our hospital, and the surgical results were published in March 2017.⁵ Follow-up has since continued, and the final results from our center are herein reported.

Materials and methods

General information

This study enrolled 124 patients, including 62 patients in the HALS group and 62 patients in the open surgery (OS) group. There were no statistically significant differences in sex, age, tumor size, tumor-node-metastasis (TNM) stage, or underlying diseases between the two groups (Table 1).

Ethics statement

This study was approved by the ethics committee of West War Zone General Hospital of Chinese People's Liberation Army. Written informed consent was obtained from the patients or their families.

Randomization

The patients in this study were randomized into two groups using the envelope method. The envelopes were drawn and opened by a nurse. The patients were randomized into two groups: patients in the HALS group underwent radical gastrectomy via HALS, and patients in the OS group underwent radical gastrectomy via OS.

The reporting of this study conforms to the CONSORT statement.⁶ In error, we did not prospectively register this trial; however,

Table 1. General information in the HALS and OS groups.

	HALS group (n = 62)	OS group (n = 62)	T value/ χ^2 value	P value
Sex			0.037 ^a	0.847
Male	42	43		
Female	20	19		
Age (years)	64.02 ± 15.25	63.98 ± 15.37	0.012 ^b	0.991
BMI (kg/m ²)	21.53 ± 4.26	21.52 ± 4.21	0.008 ^b	0.993
pTNM stage			0.049 ^a	0.976
IB	5	5		
II	13	14		
III	44	43		
Histological type			1.032 ^a	0.905
Adenocarcinoma	42	43		
Papillary adenocarcinoma	4	5		
Mucinous adenocarcinoma	4	4		
Tubular adenocarcinoma	5	6		
Signet ring cell carcinoma	7	4		
Tumor differentiation			0.643 ^a	0.725
High	15	18		
Intermediate	25	21		
Low	22	23		
Postoperative chemotherapy				
FOLFOX regimen	44	45		
Oral administration of S-1	11	12		
History of abdominal surgery	6	7	0.086 ^a	0.769
Combined underlying diseases	16	19	0.358 ^a	0.549

Data are presented as number of patients or mean ± standard deviation.

^aChi-square test. ^bGroup t-test.

HALS, hand-assisted laparoscopic surgery; OS, open surgery; BMI, body mass index; pTNM, pathological tumor-node-metastasis.

we retrospectively registered it at the Research Registry (<https://www.researchregistry.com/>; registration number: 1200).

Inclusion criteria

The inclusion criteria were a good general clinical condition, the ability to withstand laparoscopic surgery, a TNM stage of T2-4N0-3M0 (corresponding to stage Ib–III), a resectable gastric tumor, and the ability to undergo D2 resection.

Exclusion criteria

The exclusion criteria were peritoneal dissemination or positive peritoneal lavage

cytology found during intraoperative exploration, conversion to OS, and intraoperative resection of other organs.

Treatment

All patients underwent radical gastrectomy for gastric cancer under general anesthesia.⁷ Sixty-two patients underwent radical gastrectomy via HALS, and 62 patients underwent radical gastrectomy via OS. Fifty-five patients in the HALS group and 57 patients in the OS group underwent postoperative chemotherapy.

Re-examination

Re-examination was performed every 3 to 6 months. The re-examination included

a routine blood examination, liver function testing, renal function testing, electrolyte measurement, carcinoembryonic antigen measurement, carbohydrate antigen 19-9 measurement, contrast-enhanced chest and abdominal computed tomography, and gastroscopy.

Follow-up

The patients in the two groups were followed up, and the follow-up period ranged from 6 to 96 months (median, 41 months). The survival rates and the results of each re-examination were also recorded.

Statistical analysis

All statistical analyses were performed using SPSS for Windows, Version 11.0 (SPSS Inc., Chicago, IL, USA). The rank-sum test was used to analyze the ranked data. The measurement data were analyzed by one-way analysis of variance. The analysis of variance was performed using a randomized block design to analyze the statistical differences among different tissue types. Spearman's analysis was carried out to analyze the correlation between the HALS group and OS group. Survival curves were plotted using the Kaplan-Meier product-limit method, and differences between survival curves were tested using the log-rank test. Statistical significance was set at $P < 0.05$.

Results

Comparison of overall survival time between HALS and OS groups

The mean 5- and 8-year survival time of patients in the HALS group was 44.00 ± 4.27 and 48.95 ± 3.62 months, whereas that in the OS group was 44.00 ± 4.16 and 48.15 ± 3.55 months, respectively. The 5-year overall survival rate was 31.90% in

the HALS group and 32.50% in the OS group, and the 8-year overall survival rate was 18.40% in the HALS group and 18.60% in the OS group. No significant differences were found (Figure 1).

Comparison of disease-free survival time between HALS and OS groups

The mean 5- and 8-year disease-free survival time of patients in the HALS group was 38.00 ± 4.73 and 39.59 ± 3.48 months, whereas that in the OS group was 33.00 ± 4.10 and 38.68 ± 3.43 months, respectively; no significant difference was found. The 5-year disease-free survival rate was 21.50% in the HALS group and 21.90% in the OS group, and the 8-year disease-free survival rate was 13.00% in the HALS group and 13.10% in the OS group. No significant difference was observed between the two groups (Figure 2).

Comparison of incisional hernia rate between HALS and OS groups

No incisional hernia occurred in either the HALS or OS group.

Patient mortality during postoperative follow-up

During the postoperative follow-up, 36 patients in the HALS group and 35 patients in the OS group died within 5 years. The causes of death were local recurrence and metastasis of the tumor (29 patients in HALS group and 28 patients in OS group) and non-tumor causes, including traumatic death (7 patients in HALS group and 7 patients in OS group).

Discussion

China has a high incidence of gastric cancer, and most of these cases are advanced gastric cancer.⁸ At present,

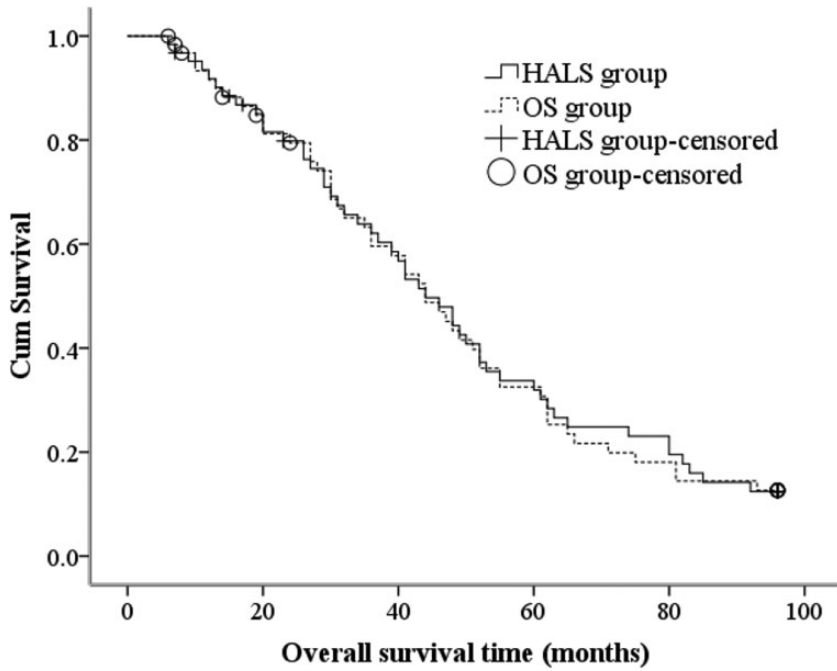


Figure 1. Kaplan–Meier postoperative survival curve of overall survival time.

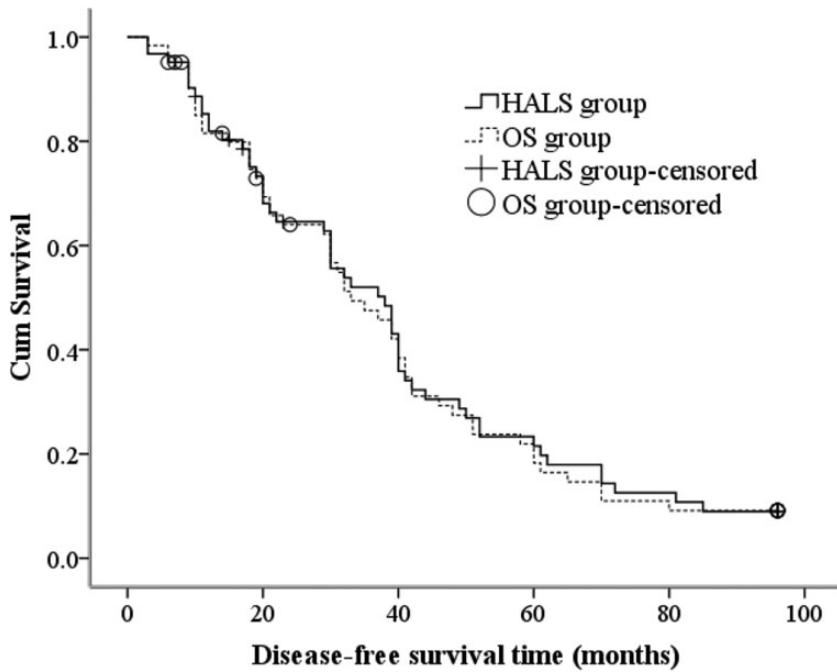


Figure 2. Kaplan–Meier postoperative survival curve of disease-free survival time.

surgery is the main treatment for gastric cancer. Most scholars in this field vigorously promote the advantages of laparoscopic surgery, which include reduced trauma and rapid postoperative recovery.⁹⁻¹¹ As an important branch of laparoscopic surgery, HALS fully combines the advantages of laparoscopic surgery and laparotomy and exploits these advantages to the full extent in the surgical treatment of gastric cancer.¹²⁻¹⁷ HALS has been used for the surgical treatment of colon cancer with good surgical results. The learning curve for HALS is short, making it suitable for senior physicians and primary hospitals without experience in laparoscopic surgery. Hand-assisted laparoscopy can be completed by only two physicians; i.e., the surgeon and the physician who holds the laparoscope. The physician who holds the laparoscope can be a resident or a regular doctor, who can perform this duty with only approximately 10 minutes of training. Only two physicians are directly involved in the operation, greatly reducing the difficulty of cooperation and shortening the training time. When performing radical gastrectomy for gastric cancer by the HALS technique, the surgeon stands on the right side of the patient to allow convenient positioning of the hand. When dissecting the 4sa and 4sb lymph nodes, splenic hilar lymph nodes, left cardia lymph nodes, and lymph nodes around the splenic artery, the surgeon's auxiliary hand can more effectively expose the blood vessels and dissect the surrounding lymph nodes. Exposure of these sites is a difficult point of laparotomic radical gastrectomy for gastric cancer and a persistent problem in lymph node dissection. In addition, in radical gastrectomy for gastric cancer performed by HALS, hand-eye coordination and tactile feedback rely on the surgeon's auxiliary hand to compress the blood vessels and perform other operations; therefore, intraoperative

massive hemorrhage can be managed in a timely manner, reducing the possibility of conversion to laparotomy.

There was no significant difference in the 5- or 8-year survival rate between the HALS group and OS group in the present study, and the statistical results were very similar; therefore, it is possible that the survival curves of the two groups of patients overlap. Our findings are similar to the 5-year survival rate reported by Lin et al.¹⁸

This study had some shortcomings. First, because it was only a single-center study, some potential bias cannot be avoided, and multicenter studies are needed to verify our results. Second, several non-medical confounding factors affected the results of the study, such as the patients' economic conditions and the degree of coordination of diagnosis and treatment. Third, the sample size was limited, which may have affected the results of the study.

In summary, radical gastrectomy for advanced gastric cancer by the HALS technique has the advantages of reduced trauma, rapid postoperative recovery, low requirements for intraoperative cooperation, and no increase in postoperative complications, which is in line with the concept of minimal invasiveness and rapid recovery. The long-term efficacy of radical gastrectomy via HALS for gastric cancer is comparable with that of traditional radical gastrectomy via OS.

Declaration of conflicting interest

The authors declare that there is no conflict of interest.

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