

RESEARCH ARTICLE

Three-Port Laparoscopic Exploration is not Sufficient for Patients with T4 Gastric Cancer

Hua Huang^{1,2}, Jie-Jie Jin^{1,2}, Zi-Wen Long^{1,2}, Wei Wang³, Hong Cai^{1,2}, Xiao-Wen Liu^{1,2}, Hong-Mei Yu^{1,2}, Li-Wen Zhang^{1,2}, Ya-Nong Wang^{1,2*}

Abstract

Gastric cancer continues to be a leading cause of cancer death. The majority of patients with gastric adenocarcinoma in China present with advanced disease. Ruling out unresectable cancers from an unnecessary “open” exploration is very important. The aim of this study was to assess the value of five-port anatomical laparoscopic exploration in T4 gastric cancer in comparison with three-port laparoscopic exploration and laparotomy exploration. We conducted a retrospective study on 126 patients with T4 stage scheduled for D2 curative gastrectomy based on computed tomography (CT) staging at Department of Gastric Cancer and Soft Tissue Sarcoma, Fudan University Shanghai Cancer Center, from Apr. 2011 to Apr. 2013. Laparotomy exploration (Group I), three-port laparoscopic exploration (Group II) or five-port anatomical laparoscopic exploration (Group III) were performed prior to radical gastrectomy. Accuracy rate for feasibility of D2 curative gastrectomy in laparotomy exploration and five-port anatomical laparoscopic exploration groups was higher than that in the three-port laparoscopic exploration group. Five-port anatomical laparoscopic exploration group had the highest accuracy resection rate (Group I vs Group II vs Group III, 92.6% vs 78.6% vs 97.7%; $p < 0.05$) and shorter length of hospitalization (Group I vs Group II vs Group III, 9.58 ± 4.17 vs 6.13 ± 2.85 vs 5.00 ± 1.81 ; $p < 0.001$). Three-port laparoscopic exploration has low accuracy rate for assessing feasibility of D2 curative gastrectomy and five-port anatomical laparoscopic exploration should be performed on patients with T4 gastric cancer.

Keywords: Gastric cancer - T4 - anatomical laparoscopic exploration - three port - five port

Asian Pac J Cancer Prev, 15 (19), 8221-8224

Introduction

Gastric cancer is the second leading cause of cancer-related deaths worldwide (Bertuccio et al., 2009; Strong et al., 2012; Jemal et al., 2013). Surgical resection remains the only curative treatment for patients with gastric cancer. However, surgical resection is dependent on the accuracy of the disease staging. Accurate preoperative staging can help reduce the number of unnecessary surgeries and decide other options of treatment. Computed tomography (CT) is a routine preoperative investigation. But CT scan does not totally exclude liver and peritoneal metastasis (Kapieva et al., 2010; Makino et al., 2011). Technique of laparoscopy-assisted gastric cancer resection was reported widely (Zhang et al., 2014). Laparoscopy may detect occult metastatic diseases and spare the patient an unnecessary laparotomy, result in fewer complications, and reduce the substantial morbidity and mortality associated with nontherapeutic laparotomy (Karanicolas et al., 2011). The liver, diaphragm, serosal surfaces, peritoneum, omentum, and pelvic organs can be systematically inspected. Most of the anterior wall of the stomach can be inspected

without further manipulation (Coburn et al., 2010). But the three-port laparoscopic exploration is difficult to define evaluation of posterior infiltration of the tumor. More often than not, when the tumor originates from the posterior wall or a posterior fixity is suspected, gastrocolic ligament must be scissored in order to penetrate the lesser sac. In this study, we evaluated the usefulness of five-port anatomical laparoscopic exploration to decide the resectability of gastric cancers.

Materials and Methods

This was a retrospective study based on 126 gastric cancer (GC) patients operated at the Department of Gastric Cancer and Soft Tissue Sarcoma, Fudan University Shanghai Cancer Center from Apr. 2011 to Apr. 2013. Data were retrieved from patient charts and a computerized database. The study was approved by the Institutional Review Board. All patients were preoperative staging T4 according to the 7th edition of the Union for International Cancer Control (UICC) by enhanced CT scan with the same setting. Patients with proven adenocarcinoma of

¹Department of Gastric Cancer and Soft Tissue Sarcoma, Fudan University Shanghai Cancer Center, ²Department of Oncology, Shanghai Medical College, Fudan University, Shanghai, ³Department of General Surgery, Affiliated Hospital of Nantong University, Nantong, Jiangsu Province, China *For correspondence: wangyanongsh@gmail.com

the stomach after diagnosis were included. Patients with obvious unresectable diseases, e.g., liver metastases, ascites, and patients with obvious resectable diseases were excluded following CT scan. A total of 126 patients were included in this study. This represented 9.38% (126/1343) of all patients operated on for gastric cancer during this period. Table 1 summarizes the patients and clinicopathological characteristics of the patients. Demographic data, pathologic data, and follow-up data were entered into a prospective gastric database at the Department of Gastric Cancer and Soft Tissue Sarcoma, Fudan University Shanghai Cancer Center. The written informed consent had been obtained from all the patients, and this study was approved by the Ethical Committee of Shanghai Cancer Center of Fudan University. A retrospective review was performed analyzing the results of exploration, curative intent, postoperative length of stay, complications, operative times, and subsequent operation. Statistical analysis of means between groups was calculated using a one-way analysis of variance. The association between different parameters was computed with the χ^2 -test and the Fisher's exact test. A *p*-value of less than 0.05 was considered to be statistically significant. SPSS 17.0 (SPSS Inc.) was used for analysis.

Operative technique

Patients underwent exploration under general anaesthesia. In the laparotomy exploration group (Group I): Upper abdominal midline incision about 15 cm was chosen (Figure.1A). The parietal and serosal surfaces of the peritoneum were inspected initially for malignant implants. The liver, diaphragm, serosal surfaces, peritoneum, omentum, and pelvic organs were systematically inspected. Then gastrocolic ligament was opened in order to penetrate the lesser sac. If the disease was identified to be resected upper abdominal midline incision was extend to 18-20cm. In three-port laparoscopic exploration (Group II): The patients are placed in supine "scissor" position, and a 12-mm trocar is inserted into the subumbilical region. A telescope angled at 30 is used to inspect the peritoneal cavity. Another trocar, 12 mm,

is inserted into the left subcostal region, and the other trocar, 5 mm is inserted into the right subcostal region (Figure 1B). (Burke et al.,1997). If the disease was identified to be curatively resectable, upper abdominal midline incision about 18-20cm was made .The parietal and serosal surfaces of the peritoneum were inspected initially for malignant implants. The liver, diaphragm, serosal surfaces, peritoneum, omentum, and pelvic organs were systematically inspected. But do not enter the lesser sac for inspection. In the five-port anatomical laparoscopic exploration group (Group III): Five trocars were under direct vision in the patient. A 30-degree telescope was used for exploration (Figure 1C). The parietal and serosal surfaces of the peritoneum were inspected initially for malignant implants. The liver, diaphragm, serosal surfaces, peritoneum, omentum, and pelvic organs were systematically inspected. We routinely scissored gastrocolic ligament in order to penetrate the lesser sac. The posterior walls of stomach and pancreas were inspected. If the disease was identified to be curatively resectable, upper abdominal midline incision about 18-20cm was made for D2 resection.

The peritoneal cavity was insufflated to 12-15 mmHg. Any suspicious lesion was biopsied. After the exploration was conducted and we deemed it resectable laparotomy was proceeded. If there are suspicious lesions, we do not proceed for resection till confirmatory results are available.

Results

One hundred twenty-six patients underwent exploration for evaluation of gastric adenocarcinoma. There are 54 patients in the laparotomy exploration group, 28 in three-port laparoscopic exploration and 44 patients in the five-port anatomical laparoscopic exploration group.

The hospital stay of patients who only received exploration was significantly shortened in the laparoscopy group versus those patients who had exploratory laparotomy. There was no differences between Group II and Group III (*p*=0.318). There were significant differences between Group I and Group II (*p*=0.001) and there was significant differences between Group I and Group III (*p*<0.001) (Figure 2). No perioperative complications were associated with the laparoscopic procedure. The hole implant was found in one patient

Table 1. Clinicopathologic Features of 126 Patients

Features	All Patients	Group I	Group II	Group III	<i>p</i>
No.of patients	126	54	28	44	
Age, years					0.955
mean	56.77±11.37	56.70±12.37	57.32±9.58	56.50±11.35	
range	25-80	27-80	39-75	25-78	
Gender					0.167
Male	84	32	18	34	
Female	42	22	10	10	
Tumor location					0.004
GEJ and Proximal	23	6	9	8	
Body	45	13	11	21	
Antral	58	35	8	15	
ct T stage					0.649
T4a	78	33	16	29	
T4b	48	21	12	15	
Grade					0 <0.001
Well	14	4	10	15	
Moderately	36	16	5	15	
Poorly	76	34	13	29	

*NOTE: Group I: Laparotomy exploration ;Group II: Traditional laparoscopic exploration;Group III: anatomical laparoscopic exploration.

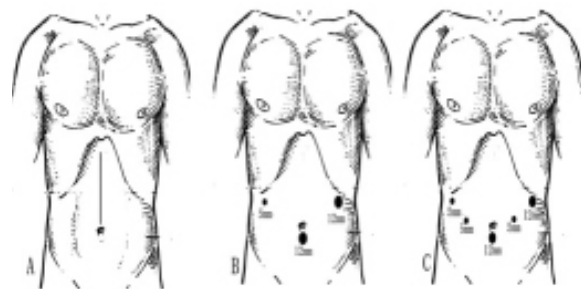


Figure 1. A) Upper Abdominal Midline Incision was Chosen in Laparotomy Exploration Group; B) Laparoscopic Port Placement in Three-Port Laparoscopic Exploration Group; C) Laparoscopic Port Placement in Anatomical Laparoscopic Exploration Group

Table 2. Comparison between Traditional Laparoscopic Exploration Group and Anatomical Laparoscopic Exploration Group.

	Age (yr)	Operative Time(min)	Bleeding Amount	Complication rate	Accuracy peritoneum implantation stage rate	Accuracy Resection Rate
Group I (n= 54)	56.70±12.37	70.57±21.61*	25.19±30.76	1.90%	100%	92.60%
Group II (n=28)	57.32±9.58	46.57±11.28	10.74±3.59*	0%	100%	78.6%*
Group III (n=44)	56.50±11.35	52.70±17.19	30.57±46.96	2.30%	97.70%	97.70%

*Note: Group I: Laparotomy exploration; Group II: Traditional laparoscopic exploration; Group III: anatomical laparoscopic exploration. *:p<0.05

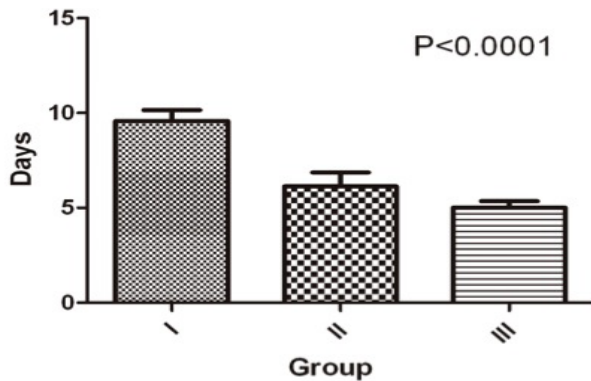


Figure 2. The hospital Stay of Patients who only Received Exploration was Significantly Shortened In the Five-Port Anatomical Laparoscopic Exploration Group (n=26, 5.00±1.81) and Three-Port Laparoscopic Exploration Group (n=15, 6.13±2.85) Versus Those Patients Who Had Exploratory Laparotomy (n=53, 9.58±4.17). There was no Differences between Group II and Group III ($p=0.318$). There were Significant Differences between Group I and Group II ($p=0.001$). There was Significant Differences between Group I and Group III ($p<0.001$)

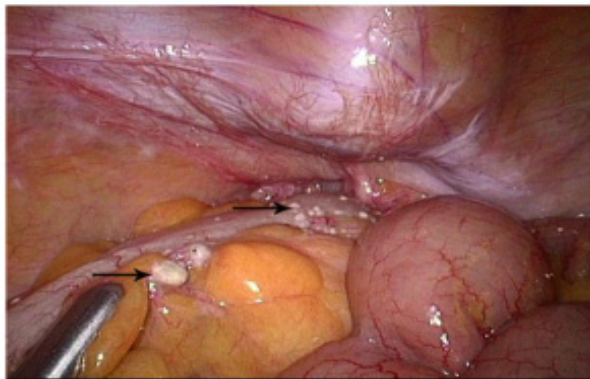


Figure 3. There was One False Positive Case in Five-Port Anatomical Laparoscopic Exploration Group. Implantation of Pelvic Organs Serosal Surfaces was Confirmed in Operation (Black Arrow), but Pathology Confirmed that they were Blood Fluke Eggs

from Group III 36 days later. The operating time was less in the laparoscopy Group II and Group III than in Group I ($p<0.001$). These numbers not statistically carry significant in Group II and Group III ($p=0.167$). As regards the accuracy of peritoneum implantation rate, there are no differences in the three group ($p=0.57$). With regards to the accuracy resection rate, there are significant differences in these three groups ($p=0.022$) with the highest in Group III (97.7%) and the lowest in Group II (78.6%) (Table 2).

There was one false positive (Figure 3) and no false negatives in the five-port anatomical laparoscopic exploration group. No pancreas invasion were missed in Group I and Group III. Six patients were not resected because of the extension of the tumor into the pancreas in Group II.

Discussion

Surgical resection remain the curative treatment for patients with gastric cancer. However, the majority of patients in China present with advanced gastric adenocarcinoma, and many are first found to be incurable or unresectable. Ruling out unresectable cancers from an unnecessary “open” exploration and ruling out resectable patients from patients suspected of having borderline resection is very important. CT and EUS are not sensitive enough to detect the small metastatic intra-abdominal deposits typical of gastric adenocarcinoma, specially to identify patient who can be resectable (Burbidge et al., 2013). It is precisely this group of patients that would benefit from five-port anatomical laparoscopic exploration. It is well-known that exploratory laparotomy to confirm of unresectability in advanced gastric cancer has its disadvantages (Yamagata et al., 2012). In our study we showed that laparoscopy was very sensitive in detecting metastasis. Prior to the introduction of laparoscopic exploration, the rate of unnecessary laparotomy in our institution was high due to improper staging. Furthermore, with the current approach of neoadjuvant treatment for advanced stage diseases, the introduction of laparoscopy would lead to a quicker referral of patients to oncology treatment (Yano et al., 2000; Shimizu et al. 2010; Cardona et al., 2013). Although laparoscopy in patients with gastric cancer has been practiced for many years, the overall number of patients in each reported series is small (Mahadevan et al., 2010). It is reported that simple laparoscopic exploration is useful for confirmation of unresectability for advanced gastric cancer (Burke et al., 1997). But in our study we found three-port simple laparoscopy had low accuracy resection rate, which was different from results of other studies, probably the reason is that three-port simple laparoscopy only three trocar. The liver, diaphragm, serosal surfaces, peritoneum, omentum, bowel, mesentery, and pelvic organs can be inspected clearly. But the lesser sac is a blind spot (Burbidge et al., 2013), because it is difficult to direct access to the lesser sac in three-port laparoscopy (D’Ugo et al., 1997), thus it can’t inspect the posterior wall and pancreas invasion (Burke et al., 1997; Mahadevan et al., 2010; Cardona et al., 2013).

Only five-port anatomical laparoscopy can scissor gastrocolic ligament to penetrate the lesser sac (Brennan et al., 2005). Then inspect the posterior wall and pancreas invasion. Five-port anatomical laparoscopic exploration has a place in the management of patients with gastric cancer by preventing unnecessary laparotomy and better selecting patients for neoadjuvant treatment. We found there were no significant differences of the complication rate and length of hospital stay in the three-port laparoscopy exploration group and five-port anatomical laparoscopy exploration group. In contrast to laparotomy exploration group, five-port anatomical laparoscopic exploration group had fewer days of hospital stay. Up to now, to predict lymph node positivity still remains a challenge during laparotomy.

In conclusion, five-port anatomical laparoscopic exploration could reduce the rate of unnecessary laparotomy in advanced-stage gastric cancer patients. Five-port anatomical laparoscopic exploration was superior to three-port laparoscopic exploration and laparotomy exploration. Our results supported the use of five-port anatomical laparoscopy as the standard of care in evaluating patients with advanced gastric cancer. However important issues remain unsolved, our study was a retrospective study, and the number of patients required for statistical power was not adequately included. Thus a controlled, randomized comparison would provide valuable information to help guide clinical management of advanced gastric cancer patients.

Acknowledgements

This work was supported by a Natural Science Foundation of China grant (No.81272726), Specialized Research Fund for the Doctoral Program of Higher Education (No.20110071120097) and Shanghai Municipal Health Bureau Research Project (No.20114174).

References

- Bertuccio P, Chatenoud L, Levi F, et al (2009). Recent patterns in gastric cancer: a global overview. *Int J Cancer*, **125**, 666-73.
- Brennan MF (2005). Current status of surgery for gastric cancer: a review. *Gastric Cancer*, **8**, 64-70.
- Burbidge S, Mahady K, Naik K (2013). The role of CT and staging laparoscopy in the staging of gastric cancer. *Clin Radiol*, **68**, 251-5.
- Burke EC, Karpeh MS, Conlon KC, et al (1997). Laparoscopy in the management of gastric adenocarcinoma. *Ann Surg*, **225**, 262-7.
- Cardona K, Zhou Q, Gonen M, et al (2013). Role of repeat staging laparoscopy in locoregionally advanced gastric or gastroesophageal cancer after neoadjuvant therapy. *Ann Surg Oncol*, **20**, 548-54.
- Coburn NG, Lourenco LG, Rossi SE, et al (2010). Management of gastric cancer in Ontario. *J Surg Oncol*, **102**, 54-63.
- D'Ugo DM, Persiani R, Caracciolo F, et al (1997). Selection of locally advanced gastric carcinoma by preoperative staging laparoscopy. *Surg Endosc*, **11**, 1159-62.
- Jemal A, Siegel R, Xu J, et al (2013). Environmental and lifestyle risk factors of gastric cancer. *Arch Iran Med*, **16**, 358-65.
- Kapiev A, Rabin I, Lavy R, et al (2010). The role of diagnostic laparoscopy in the management of patients with gastric

- cancer. *Isr Med Assoc J*, **12**, 726-8.
- Karanicolas PJ, Elkin EB, Jacks LM, et al (2011). Staging laparoscopy in the management of gastric cancer: a population-based analysis. *J Am Coll Surg*, **213**, 644-51.
- Mahadevan D, Sudirman A, Kandasami P, et al (2010). Laparoscopic staging in gastric cancer: An essential step in its management. *J Minim Access Surg*, **6**, 111-3.
- Makino T, Fujiwara Y, Takiguchi S, et al (2011). Preoperative T staging of gastric cancer by multi-detector row computed tomography. *Surgery*, **149**, 672-9.
- Shimizu H, Imamura H, Ohta K, et al (2010). Usefulness of staging laparoscopy for advanced gastric cancer. *Surg Today*, **40**, 119-24.
- Strong VE (2012). Laparoscopic resection for gastric carcinoma: western experience. *Surg Oncol Clin N Am*, **21**, 141-58.
- Yamagata Y, Amikura K, Kawashima Y, et al (2012). Staging laparoscopy in advanced gastric cancer: usefulness and issues requiring improvement. *Hepatogastroenterology*, **60**, 751-5.
- Yano M, Tsujinaka T, Shiozaki H, et al (2000). Appraisal of treatment strategy by staging laparoscopy for locally advanced gastric cancer. *World J Surg*, **24**, 1130-5.
- Zhang XM, Wang Z, Liang JW, et al (2014). Analysis of laparoscopy-assisted gastric cancer operations performed by inexperienced junior surgeons. *Asian Pac J Cancer Prev*, **15**, 5077-81.