Surgical skills for laparoscopic resection of the bursa omentalis and lymph node scavenging with radical gastrectomy

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Abstract. The aim of the present study was to inquire into the feasibility, surgical skills required and short-term effect of a laparoscopic resection of the bursa omentalis and lymph node scavenging with radical gastrectomy. In this study, the clinical data of 18 patients who received a laparoscopic resection of the bursa omentalis with radical gastrectomy in the Department of Gastrointestinal Surgery, Guangdong Province Hospital of Traditional Chinese Medicine (Guangzhou, Guangdong, China) during the period between January 2012 and January 2014. A retrospective analysis was performed and the surgical duration, bursa omentalis resection time, amount of bleeding during the surgery, post-operative complications associated with the surgery, length of hospital stay, number of lymph nodes scavenged and short-term follow-up results were assessed. The results indicated that all of these 18 patients successfully received a resection of the bursa omentalis and no one required conversion to open surgery. The mean surgical duration was 289.3±30.3 min, the bursa omentalis resection time was 46.1±18.6 min and the amount of bleeding was recorded as 35.5±6.5 ml in these patients. No patients suffered from post-operative complications, such as pancreatic fistulae, anastomotic fistulae, intestinal obstructions or succumbing to the surgery, and no patients succumbed within a 6-month follow-up period. In conclusion, for advanced gastric carcinoma, laparoscopic resection of the bursa omentalis and lymph node scavenging with radical gastrectomy is feasible. In addition to meeting the requirement that the operator should be skilled and experienced in open bursa omentalis resection, and have well-knit basic skills in using a laparoscope, attention must also be paid to the construction of the surgical team.

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Introduction

The question of whether patients with advanced gastric carcinoma should receive bursa omentalis resection treatment has long been debated (1,2). However, the Japanese Classification of Gastric Carcinoma (14th edition) (4) clearly indicates that, for cases in which the serosa of the posterior gastric wall has been invaded by the tumor, a bursa omentalis resection should be performed for the purpose of cleaning up the tiny planting nidi in the bursa omentalis (3). In traditional open surgery, the difficulty of a bursa omentalis resection is low, but in laparoscopic resection of gastric carcinoma with radical gastrectomy, it has become one of the difficult points in the surgery (5,6). Thus, there are no reports regarding bursa omentalis resection as part of a minimally invasive approach. Since the first report of laparoscopic distal gastrectomy by Kitano *et al* (7) in 1994, this technique has been widely performed for gastric cancer due to its advantages of reduced pain, earlier recovery and improved cosmetic outcome. With the use of laparoscopic technology in the clinical study of advanced gastric carcinoma, the resection paths and feasibility of the technique has increasingly become a clinical issue that requires solving urgently. The present study aimed to inquire into the skills required for a laparoscopic resection of the bursa omentalis and lymph node scavenging with radical gastrectomy, and the feasibility of the technique.

Materials and methods

General data. During the period between January 2012 and January 2012, 18 patients (10 males and 8 females) with advanced gastric carcinoma received laparoscopic resection of the bursa omentalis and lymph node scavenging with radical gastrectomy. In Table I, the general clinical characteristics of the patients, surgical duration, bursa omentalis resection time, amount of bleeding during surgery, post-operative complications associated with the surgery, length of hospital stay and number of lymph nodes scavenged are recorded.

Trocar and operator's position. The patients were placed in a horizontal supine position and the trocar was positioned adopting a five-hole method (the same as for a laparoscopic resection of gastric carcinoma with radical gastrectomy). The surgeon was positioned to the right side of the patient.

Laparoscopic resection. The main surgical steps for the laparoscopic resection of the bursa omentalis and lymph node scavenging are shown in Fig. 1.

The first step was to lift up the greater omentum on the right side of the transverse colon, create clearance between the transverse mesocolon and distal gastric membrane with an ultrasound scalpel along the pancreatic head surface, scavenge the station 6 lymph node, dissect the pancreatic head membrane, create clearance posterior to the duodenum, scavenge the station 12 and 15 lymph nodes on the right lateral border of bursa omentalis, and transect the duodenum with a linear scavenging sealer.

In the second step, the assistant lifted and tightened the distal end of the stomach to the left. The surgeon dissected the pancreatic head membrane with an ultrasound scalpel, scavenged the station 8, 9, 7 and 11 lymph nodes upwards, separated the attachment site of the bursa omentalis and liver, dissected the anterior lobe of the transverse mesocolon downwards and resected the greater omentum.

In the third step, if the surgery required a distal radical gastrectomy, this requirement was met when the pancreatic capsule was dissected to the middle of the splenic artery and the anterior lobe of transverse mesocolon was dissected to the left gastroepiploic artery root (scavenging of station 3 and 1 lymph nodes). If the surgery required a radical total gastrectomy, six procedures were followed: Dissection of the pancreas to the hilus lienis; dissection of the anterior lobe of the transverse mesocolon to the left gastroepiploic artery root (scavenging of the station 4 lymph nodes); severing of the short gastric vessels on the left of the bursa omentalis; scavenging of the station 4 lymph nodes and the splenic hilar lymph nodes (station 10 lymph nodes); scavenging the station 2 lymph nodes; and removing the whole bursa omentalis.

Reconstruction of the digestive tract. Following gastric disassociation and lymph node scavenging, reconstruction of the digestive tract was completed laparoscopically. In the surgeries performed with radical total gastrectomy the reconstruction of the digestive tract was of esophagojejunal Roux-en-Y type (10 cases). For distal subtotal gastrectomy, 2 cases adopted the Billroth-I type and 6 cases adopted the Billroth-II type.

Observation indices. Observation indices used for observing the patients included: i) Surgical duration; ii) bursa omentalis resection time; iii) amount of bleeding during surgery; iv) post-operative complications associated with the surgery; v) length of hospital stay; vi) number of lymph nodes scavenged; and vii) short-term follow-up results.

Statistical analysis. Data are presented as mean ± standard deviation or median with range. All analyses were performed using SPSS software version 17.0 (SPSS, Inc., Chicago, IL, USA).

Results

All cases received D2 dissection according to the Japanese Gastric Cancer Association gastric cancer treatment guidelines (4), and the tumor location and surgical type are shown in Table II. All patients successfully received a bursa omentalis resection and lymph node scavenging, and no case underwent conversion to open surgery. The mean surgical duration was 289.3±30.3 min, the bursa omentalis resection time was 46.1±18.6 min and the amount of bleeding during surgery was 35.5±6.5 ml for these patients. No cases suffered from post-operative complications associated with the surgery, such as pancreatic fistulae, anastomotic fistulae

Table I. Clinical characteristics of the patients.

Characteristic	Value
Number of cases, n	18
Gender, n	
Male	10
Female	8
Age, years	74.6±14.5
Pre-operative T stage, n	
T2	0
T3	4
T4	14
Surgical duration, min	289.3±30.3
Bursa omentalis resection time, min	46.1±18.6
Amount of bleeding during surgery, ml	35.5±6.5
Length of hospital stay, days	9.1±2.1
Lymph nodes scavenged, n	25.3±6.2
Post-operative complications	
Wound infection	1
Bowel obstruction	1
Urinary tract infection	1

Data regarding age, surgical duration, bursa omentalis resection time, amount of bleeding, length of hospital stage and number of lymph nodes scavenged are presented as the mean ± standard deviation of all cases. T, tumor.

Table II. Tumor location and surgical type.

Parameter	No. of cases
Tumor location	
Cardia	3
Gastric body	7
Gastric mucosa	8
Surgical type	
Total gastrectomy	10
Distal gastrectomy	8
Proximal gastric resection	0
Anastomosis	
Billroth-I	2
Billroth-II	6
Roux-en-Y	10
Esophagus-stomach	0

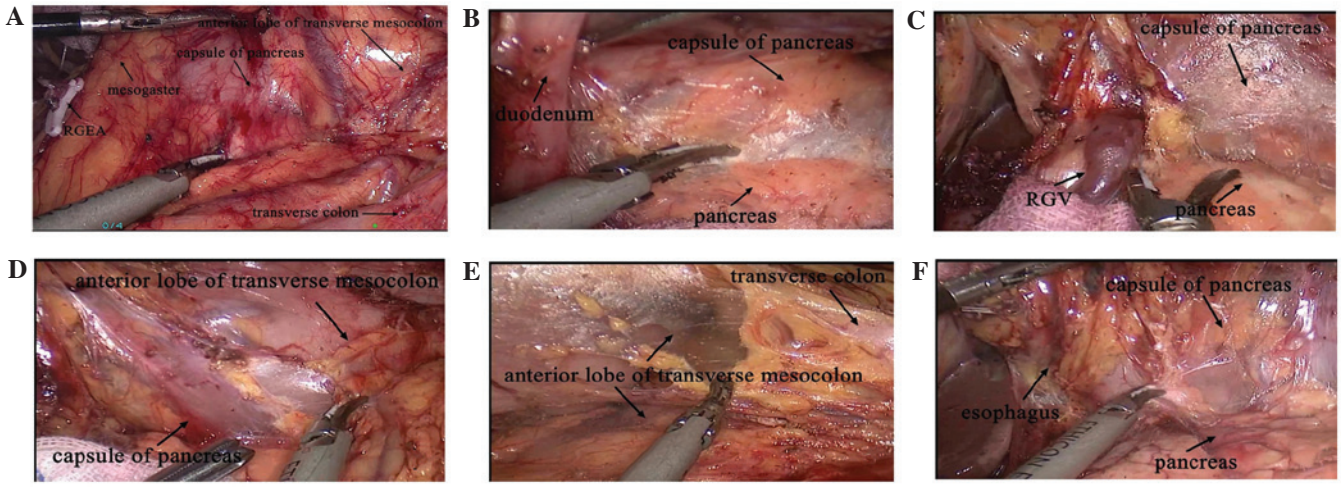

Figure 1. Main surgical steps for the laparoscopic resection of the bursa omentalis and lymph node scavenging. (A) Separation of the fusion fascia between the mesogastrium and the transverse mesocolon in the caput pancreatis; (B) separation of the capsula pancreatis from the hindside of the duodenum; (C) scavenging of station 7 lymph node and separation of the capsula pancreatis to the cauda pancreatis; (D and E) separation of the fusion fascia of the anterior lobe of the transverse mesocolon; (F) separation of the fused portion between the capsula pancreatis and the transverse mesocolon near the hilus lienis, and separation of the back of the bursa omentalis upwards along the venous ligament and the right crura of diaphragm to the cardia and the abdominal segment of the esophagus.

or intestinal obstructions. The length of hospital stay was 9.1±2.1 days and the number of lymph nodes scavenged was 25.3±6.2. There were no complications during the surgery and no patients succumbed. The short-term follow-up period was a 6 months and no patients succumbed within this time.

Discussion

For a long period of time, in East Asia and particularly in Japan, bursa omentalis resection has been used to improve the prognosis of patients with serous invasive carcinoma (8). When performing an open radical gastrectomy for the treatment of gastric carcinoma, a bursa omentalis resection and lymph node scavenging is considered to be the standard procedure, and open omental resection technology has been extensively developed (9). Although, due to the lack of concrete proof, disputes remain over whether patients can benefit from bursa omentalis resection clinically, the mid-term evaluation of a prospective, random and multi-center clinical study (3) in Japan showed that bursa omentalis resection may aid in increasing the post-operative survival rate of patients with gastric carcinoma. Therefore, unless more definite proof is obtained, the use of bursa omentalis resection will not be stopped. With the generalization and development of laparoscopic technology, the safety, possibility of a radical cure, minimally invasive nature and surgical proficiency of laparoscopic radical gastrectomy for gastric carcinoma have been confirmed (10,11). Clinical research shows that it is safe and feasible to perform a laparoscopic resection of the bursa omentalis and lymph node scavenging with radical gastrectomy (12), and studies performed in Japan also indicate that a bursa omentalis resection with laparoscopic radical gastrectomy that is performed by surgeons who have passed the learning curve period will not increase the incidence rate of surgical complications (13). As laparoscopic radical gastrectomy is at the stage of investigation and development, in addition to meeting the requirement that the operator should be skilled and experienced in open bursa omentalis resection and have well-knit basic skills in using a laparoscope, attention must also be paid to the construction of the surgical team. The assistant and camera assistant must have deep understanding and knowledge on the anatomy of the bursa omentalis. This type of surgery is demanding of the assistant's skills in separating the surgical plane at a certain angle, strength and width, and also is demanding of the camera assistant's skills in adjusting the view. The operational difficulty in the laparoscopic resection of the whole bursa omentalis is extremely high and studies associated with its clinical surgical technology are also extremely scarce.

Based on the aforementioned background information, the present study performed an initial study on the safety of a laparoscopic resection of the bursa omentalis and lymph node scavenging with radical gastrectomy in treating advanced gastric carcinoma. Lymph node scavenging technology has become increasingly well developed, but the laparoscopic resection of the bursa omentalis remains difficult to a certain extent. Firstly, the anatomical structure of the bursa omentalis is rather complicated, consisting of the fascia, vessel and lymphatic duct between the stomach and other organs, such as the pancreas and transverse mesocolon. Furthermore, the passage of the vessels is complicated and the trauma caused by dissection of the bursa omentalis is large. Resection of the bursa omentalis and lymph node scavenging should be performed simultaneously and cannot be separated. The completion of a complete bursa omentalis resection also means the completion of lymph node scavenging around the stomach. This requires that the surgeon and the assistant should each have good knowledge of the surgery and cooperate well with each other. Meanwhile, they should also be capable of controlling the injury caused by the surgery. Secondly, the surgical view is not good: In a traditional open resection of the bursa omentalis, using multi-point exposing methods (e.g., 'four-point' page turning), the surgeons and their assistants can easily spread apart dense fascial spaces such as the middle portion of the anterior lobe of the transverse mesocolon and the capsula

pancreatis, but the laparoscopic surgical team consists of only 2-3 members (partially due to the use of a mechanical arm to hold the camera). Through the tacit 'three-point type' exposure by the surgeon and the assistant, the surgical view can be completely exposed, with the surgeon using only one operational hand to perform the separation and resection procedures. Therefore, the surgeon must have solid knowledge of anatomy and a well-developed surgical technique with the laparoscope. Currently, the method of splenic artery approach lymph scavenging causes damage to the integrity of the bursa omentalis, and stripping the outside of the bursa omentalis has become a necessary way to solve the problem. At the same time, efforts should be made to seek a method of exposure with the best surgical view and practical path. In practical surgeries, we have found that the fascial space on the right side of the anterior lobe of transverse mesocolon is loose. It is easy for the surgeon to stand on the right side of the patient to separate the space and scavenge the hepatoduodenal ligament lymph on the right side of the bursa omentalis along the mesogastrium, mesocolon and pancreatic head. Therefore, with the duodenum transected, the assistant can retract the stomach cephalad, and the right side of bursa omentalis may easily be exposed (14). Meanwhile, the surgeon performs 'apple-dissecting' surgery to complete stripping and lymph scavenging from the right side to the left side. The difficult points in the surgical process are mainly embodied by the three sections as follows: i) The middle portion of the anterior lobe of the transverse mesocolon, where the fascial spaces are dense and the spaces on the left side are loose: Fusion with the posterior lobe serosa of the greater omentum extends to the back side of the pancreas tail and spleen. When using the 'three-point' type exposure, the anterior lobe of the transverse mesentery and the transverse colon are spread to form a 45˚ angle. The surgeon should perform the procedure with patience and the camera assistant should keep a suitable distance. ii) The upper side wall: The left hepatic lobe and the caudate lobe are pulled open with a hanging maneuver method under the laparoscope, carefully dissecting away two layers of serosa in the upper wall of the bursa omentalis along the left side of the hepatoduodenal ligament and the bursa omentalis Winslow hole, transiting the back layer and the caudate lobe of the liver to the left until the crura of the diaphragm on the right side, dissecting upwards along the upper part of the vena cava ligament to the cardia and the back of the abdominal segment of the esophagus, and downwards to the cauda pancreatis capsule (the back wall of bursa omentalis is the cauda pancreatis capsule and is easily dissected away) and dissecting the posterior lobe serosa of the bursa omentalis. iii) The left side wall: Dissection is continued to the left towards the peritoneum of the left adrenal gland, left kidney, gastrolienal ligament, spleen, splenorenal ligament, stomach esophagus and hepatic ligaments along the capsula pancreatis, and the fusion fascia, formed by the capsula pancreatis, the serosa under the spleen and the mesocolon, are totally resected.

Therefore, in clinical practice, the compartments and anatomical plane should be observed carefully, in order to avoid the bleeding risks caused by mesenteric vessels, injury of the pancreas and the surgical wound. In the present study, none of the patients experienced surgery-associated complications (e.g., pancreatic fistulae, anastomotic fistulae or intestinal obstruction) following the procedure, which shows that the surgical technology is safe and feasible. However, as the number of cases is not large enough, the significance and long-term effects of laparoscopic resection of the bursa omentalis and lymph node scavenging with radical gastrectomy call for further study.

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