

Research Article

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Laparoscopic splenectomy and porto-azygos disconnection: clinical research in the treatment of portal hypertension

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Abstract: To investigate the safety and efficacy of laparoscopic splenectomy and portaazygos devascularization, we studied laparoscopic splenectomy and porto-azygos devascularization patients within the peri-operative period. Clinical data and curative effect are detailed alongside statistical analysis. The laparoscopic splenectomy and porto-azygos devascularization operation time was 2.56 ± 0.62 hours. The intraoperative bleeding and anal exhaust time was 149.5 ± 32.7 ml 3.47 ± 1.32 days, and the hospitalization time was 5.05 ± 1.22 days. When the spleen volume was greater than or equal to 1.5 liters, the rate of open abdominal surgery increased significantly. After 1, 2, 3, and 4 years of follow-up, cumulative recurrence bleeding rates were 0, 5.20%, 9.98%, and 15.83%, respectively. Laparoscopic splenectomy and pericardial devascularization is safe, effective, and feasible, and it can be confirmed by enhanced spiral computed tomography (CT). Whether spleen volume greater than 1.5L is suited to laparoscopic surgery requires further research.

Keywords: Laparoscopic operation, devascularization, open operation, portal hypertension, splenectomy

1 Introduction

China, as opposed to European and American countries, still adopts laparoscopic splenectomy/porto-azygos disconnection as the primary therapeutic measure to prevent portal hypertension and digestive tract rebleeding. In patients with cirrhosis, however, porto-azygos disconnection is a common contraindication for laparoscopic surgery due to low platelet count, poor blood coagulation function, and abundant abdominal collateral circulation [1]. Since the first clinical application of laparoscopic splenectomy in 1991 [2], as well as the development of laparoscopic instruments such as the ultrasound knife and LigaSure™, and hand assisted laparoscopic surgery [3, 4], the operation risks and difficulties caused by megalosplenism and portal hypertension have significantly decreased. The indications also have gradually extended to splenectomy and porto-azygos disconnection resulting from portal hypertension. Clinical application of the process is still relatively uncommon, however, mainly because there is no clear scientific basis for its safety or curative effect.

This research investigates the feasibility, safety, and effectiveness of laparoscopic splenectomy and porto-azygos disconnection for the treatment of cirrhosis patients with upper digestive tract bleeding, based on a comparison between perioperative clinical data and long-term curative effects of the two surgical methods.

2 Data and Methods

2.1 General Information

We selected 58 inpatient cases in General Surgery at Zhejiang Provincial Tongde Hospital and Zhejiang Provincial People's Hospital from May 2005 to October

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2014; all of the patients were confirmed to have cirrhosis and portal hypertension with upper gastrointestinal bleeding by ultrasonic B-scanning, computed tomography (CT), and gastroscopic and pathological examination. Subjects included 39 male patients (67.2% of the total) and 19 female patients (32.8%) with a median age of 47 years (range, 25–67 years). The diagnosis of liver disease in all patients complied with the standards for hepatitis and cirrhosis diagnoses formulated at the Fifth National Infectious Parasites Conference in 1995 and included 49 cases of post-hepatic cirrhosis (84.5% of the total), 4 cases of cirrhosis caused by schistosomiasis (6.9%), 3 cases of alcoholic cirrhosis (5.2%), 1 case of cryptogenic cirrhosis (1.7%), and 1 case where the cause of cirrhosis was unknown (1.7%). Child-Pugh classification of liver function at hospital admission was as follows: class A 38 cases (65.5%), class B 20 cases (34.5%). Preoperative upper gastrointestinal bleeding occurred approximately one to five times (1.50 ± 1.25).

Ethical approval: The research related to human use has been complied with all the relevant national regulations, institutional policies and in accordance the tenets of the Helsinki Declaration, and has been approved by the authors' institutional review board or equivalent committee.

Informed consent: Informed consent has been obtained from all individuals included in this study

2.2 Patient Selection and Surgical Methods

2.2.1 Patient Selection

Selection criteria were as follows:

1. Cirrhotic portal hypertension accompanying hypersplenism, enlarged spleen below moderate level accompanying different levels of esophagus fundus ventricularis verification and hemorrhage history.
2. Without coagulation disorders (as they are nearly impossible to treat)
3. Tolerance to general anesthesia or lung diseases that preserve carbon dioxide pneumoperitoneum.
4. Exclusion from Child-Pugh class C. (One accepted liver-protection therapy can be selected.)
5. Without obvious inflammation around the spleen.
6. Spleen enlargement and history of epigastric operation are relative contraindications at an early stage.

Exclusion criteria: Patients with coagulation disorders that cannot be corrected or those with severe cardiopulmonary function or intolerance to general anesthesia. The test was

approved by the Medical Ethics Committee of the company. All patients signed an Information Consent Form that recognized possible complications, laparoscopic transfer laparotomy, increased operation costs, and other relevant possibilities.

2.2.2 Preoperative evaluation included

Blood biochemistry, routine blood examination, prothrombin time, feces and urine analysis, electrocardiogram, chest radiography to eliminate operations prohibited by this study, calculation and reconstruction of epigastrium enhanced spiral computed tomography (CT) and spleen volume, and upper gastrointestinal contrast or diagnosis by gastroscopy of esophageal gastric varices. Conventional liver protection measures and vitamin K1 supplementation were applied preoperatively to improve coagulation conditions and correct low protein to over 3.4 g/L. Child-Pugh class C liver function was corrected to above class B.

2.2.3 Surgical Methods

After general anesthesia was applied, the patient was maintained in a position of head raised and feet lowered, backside raised, with the right side in 30–60° oblique. Four casing tubes were then placed under the processus xiphoideus (diameter of casing tube: 0.5cm), 1/3 below the medium section of the xiphoid and umbilical cord (diameter of casing tube: 1cm), 1cm below the left collarbone midline navel (diameter of casing tube: 1cm), and below the left armpit midline costal margin, as well as the midpoint of the left iliac anterior superior spine line (diameter of casing tube: 1.2cm). The spleen perineum was raised, perisplenic ligaments were removed with an ultrasound knife or LigaSure electrotome (including cirroid vasa brevia), and the blood vessel at the splenic pedicle was processed with End-GIA. The spleen was then placed in a specimen bag, an appropriately enlarged 1.2cm incision was made after breaking the spleen, and the incision for removal of the spleen was closed.

The patient's position was then changed to head raised and feet lowered, backside raised, in supine position. A 1cm casing tube was placed under the right collarbone midline costal margin. Varicose veins were broken to the cardia and esophagus with the ultrasound knife or LigaSure electrotome at the fundus of the stomach. The omentum was separated at the lesser curvature by an ultrasound knife or LigaSure electrotome, varicose veins

were incised to reveal the left gastric artery and left gastric vein, and were cut off after installing the titanium clip. All varicose veins were cut above the left gastric artery by ultrasound knife or LigaSure electrotome, including the cardiac bronchial and high esophageal vein. Incision anulare of the cardiac serous was performed, the esophagus was reduced to 6-8cm, and esophageal varicose veins were cut off by ultrasound knife or LigaSure electrotome. After confirmation that no wound bleeding occurred, a peritoneal cavity drainage tube was placed at the splenic recess to complete the surgery. The laparotomy group adopted traditional splenectomy and porto-azygos disconnection.

2.3 Statistical Analysis

Statistics were gathered with SPSS13.0 software. Comparison between the two groups of measurement data was conducted by t test. Chi-square testing was adopted, as well; $P < 0.05$ was considered statistically significant.

3 Results

All patients were treated with splenectomy and porto-azygos disconnection without complications. Seven of them accepted open abdominal surgery. The operation time was 2.56 ± 0.62 hours, amount of intraoperative bleeding was 149.5 ± 32.7 ml, anal exhaust time was 3.47 ± 1.32 days, and hospitalization time was 5.05 ± 1.22 days. Mild pancreatic fistula occurred in two patients, both of whom recovered after abdominal cavity drainage. There were no serious complications post-surgery and no deaths during the peri-operative period.

Patients were divided into three groups through CT scanning and reconstruction of spleen volume (spleen volume < 1 litre, $1 \sim 1.5$ litres, and ≥ 1.5 litres) to observe relativity between spleen volume and open abdominal surgery rate, as shown in Table 1.

4 Discussion

As laparoscopic surgical techniques and ultrasound knife, LigaSure electrotome, and Endo-GIA technologies become more sophisticated, the type and scope of laparoscopic surgeries available have increased considerably. Ultrasound knives and LigaSure electrotome have been used successfully to separate perisplenic ligaments and peripheral cardia vessels, cutting and solidifying

Table 1: Relativity between spleen volume and open abdominal rate.

	Cases	Transited cases	?Laparoscopic transit operation rate
Total number	58	7	0.12
Spleen volume < 1000 ml	24	0	0
Spleen volume 1000 ml- 1499 ml	20	2	0.10
Spleen volume ≥ 1500	14	5	0.36

After 1, 2, 3, and 4 years of follow-up treatment, cumulative recurrence bleeding rates were 0, 5.20%, 9.98%, and 15.83%, respectively.

most blood vessels while requiring few or no titanium clips, ultimately saving operation time. In previous years, surgeons could not manage varicose veins of portal hypertension under laparoscopy, but this is now possible. Further, bleeding can be controlled properly to perform porto-azygos disconnection successfully under laparoscopy.

Complications are introduced when it is necessary to remove the larger spleen. Because splenic tissue is brittle, fragile, and prone to bleeding, grasping and traction must be avoided during the operation. Only a dial rod can be used to lift the spleen. Perisplenic ligaments are removed, including the cirroid vasa brevia. The spleen is removed by LigaSure electrotome, and then the splenic pedicle with Endo-GIA is applied. Varicose veins to the cardia and esophagus are broken with an ultrasound knife or LigaSure electrotome at the fundus of the stomach. The omentum is separated at the lesser curvature with an ultrasound knife or LigaSure electrotome, varicose veins are incised to reveal the left gastric artery and left gastric vein, which are cut off after installation of the titanium clip. All varicose veins are then cut above the left gastric artery by ultrasound knife or LigaSure electrotome, including the high esophageal vein. Incision anulare of cardiac serous is performed, the esophagus is reduced to 6-8cm, and esophageal varicose veins are removed. The method that applied a LigaSure electrotome to the left gastric artery and left gastric vein showed further shortened operation time and enhanced safety.

After 1, 2, 3, or 4 years of follow-up, the cumulative recurrence bleeding rates of patients were 0, 5.20%, 9.98%, and 15.83%, respectively. Compared to traditional laparotomy, there were no obvious differences in terms of long-term curative effect.

Spleen size is an independently influential factor in laparoscopic transfer laparotomy. When spleen volume was greater than or equal to 1.5 liters, the rate of open

abdominal surgery increased significantly. Basically, when spleen volume is greater than or equal to 1.5 liters, open operation should be considered instead of laparoscopic surgery, which is considerably more expensive [5]. Compared to traditional surgeries, laparoscopic splenectomy and porto-azygos disconnection are minimally invasive. The application range of laparoscopy, as such, has expanded in recent years. Laparoscopy is characterized by minimal injury to the patient, less hemorrhage during operation, rapid recovery, and low occurrence rate of complications. Although the surgery is risky and the level of technical difficulty is high, if operative indications are studied extensively, sufficient preoperative preparations are made, surgery procedures are detailed appropriately, and open abdominal surgery is decisively ruled out, laparoscopic splenectomy and porto-azygos disconnection are safe and feasible, with reliable curative effect.

Conflict of interest statement: Authors state no conflict of interest.

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