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Laparoscopic gastric devascularization without splenectomy is effective for the treatment of gastric varices

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ABSTRACT

INTRODUCTION: Laparoscopic gastric devascularization of the upper stomach in patients with gastric varices has rarely been reported. Perioperative clinical data were compared with patients who underwent open surgery.
PRESENTATION OF CASES: From 2009 to 2012, we performed laparoscopic gastric devascularization without splenectomy for the treatment of gastric varices in eight patients. The patients included four males and four females. Peri-gastric vessels were divided using electrical coagulating devices or other devices according to the diameter of the vessels. Two patients underwent conversion to open surgery due to intraoperative bleeding.
DISCUSSION: Intraoperative blood loss in patients who accomplished laparoscopic devascularization was very small (mean 76 ml). However, once bleeding occurs, there is a risk of causing massive bleeding.
CONCLUSION: With further improvement of laparoscopic devices, laparoscopic gastric devascularization without splenectomy must be an effective and less-invasive surgical procedure in the treatment of gastric varices.

1. Introduction

The combination of devascularization of the lower esophagus and proximal stomach, with splenectomy and pyloroplasty (Hassab's operation) was first reported as an effective surgical treatment for esophago-gastric varices in 1964 [1]. Hassab's operation is highly invasive and is associated with severe postoperative complications including portal vein thrombosis and refractory ascites.

There are several reports of laparoscopic or hand-assisted laparoscopic surgery for esophago-gastric varices [2–7], but operative procedures without splenectomy have rarely been reported [8–10]. We previously performed devascularization of the proximal stomach in a limited area without splenectomy as an open procedure to reduce the invasiveness of the operation compared to Hassab's operation, and obtained acceptable result [12]. In order to further limit the invasiveness of the operation, we developed the laparoscopic procedure described here.

2. Presentation of cases

From 2009 to 2012, we performed laparoscopic gastric devascularization for gastric varices in eight patients, including four males and four females, ranging in age from 46 to 76 years (mean 65 years). The causes of liver cirrhosis were HCV in three patients, idiopathic portal hypertension in one, non-alcoholic steatohepatitis in two, alcohol abuse in one, and unknown in one. Five patients were Child-Pugh Class A, and three patients Class B. Three patients had hepatocellular carcinoma (Table 1). We limited the indication for surgery to patients with gastric varices that could not be treated using balloon-occluded retrograde transvenous obliteration (B-RTO) because a gastro-renal shunt has not developed, esophageal varices well controlled by endoscopic treatment, Child-Pugh classification A and B, and a platelet count of $5 \times 10^4/mm^3$ or more. All patients were treated with endoscopic variceal ligation for esophageal varices preoperatively and followed up with CT scans and endoscopy after surgery. All patients provided informed consent.

2.1. Surgical procedure

Laparoscopic gastric devascularization was performed in the supine position with pneumoperitoneum using carbon dioxide at

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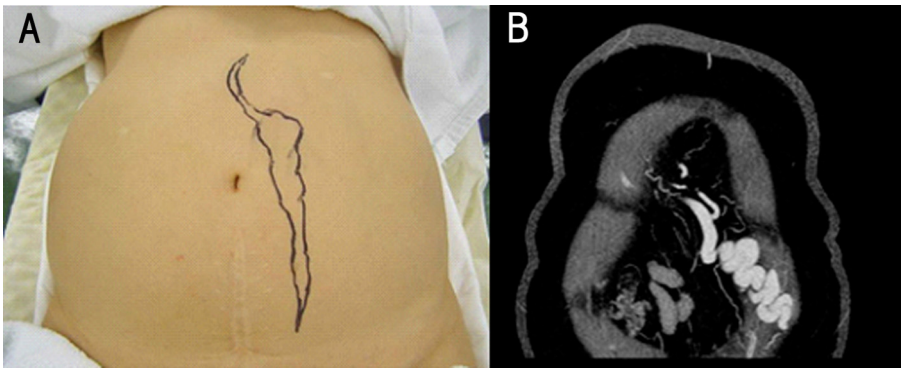

Fig. 1. (A) Dilated subcutaneous collateral veins are marked preoperatively using ultrasonography. (B) CT scan shows a dilated subcutaneous vessel connecting with the ligamentum teres hepatis.

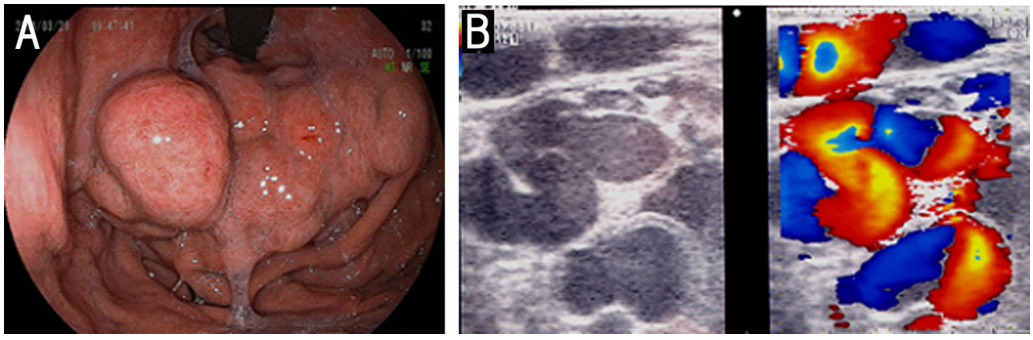

Fig. 2. (A) Endoscopic imaging of a patient who underwent intraoperative conversion to open surgery showed large gastric varices at the fornix. (B) Intraoperative color Doppler laparoscopic ultrasonography imaging outside the gastric wall. It showed high blood flow in the variceal vessels before devascularization.

a pressure of 11 mmHg. The first trocar was inserted through the umbilicus using the open technique. Five trocars were used for the procedure, which is performed using a flexible laparoscope. Patients with dilated subcutaneous veins on the abdominal wall due to liver cirrhosis, were marked preoperatively using ultrasonography and the trocar sites selected to avoid injury to the collateral veins (Fig. 1A and B). The position and blood flow of gastric varices which diagnosed preoperatively under endoscopy (Fig. 2A) were evaluated using color Doppler laparoscopic ultrasonography (Fig. 2B). Devascularization was then begun on the lesser curvature of the proximal stomach along the gastric wall, to preserve the anterior gastric branch of the vagus nerve. Small branches of the left gastric vessels were divided using the LigaSure™ vessel sealing system (COVIDIEN Japan, Tokyo, Japan) near the gastric wall to avoid a truncal vagotomy. The left gastric vein was divided using a combination of vascular clips and the LigaSure™. The omentum was divided and the omental pouch opened to approach the posterior gastric vessels. The short gastric vessels of the gastrosplenic ligament were divided using vascular clips and the LigaSure™ or the linear stapler. The posterior gastric vessels and collateral veins at the upper posterior part of the stomach were divided using the LigaSure™, vascular clips, or the linear stapler based on the caliber of the vessels (Fig. 3). After dividing the vessels, interruption of blood flow in the varices was ascertained using color Doppler laparoscopic ultrasonography. Since there is a defect in the muscular layers of the stomach at the sites where the large varices penetrate, the seromuscular layer was reinforced with sutures to prevent delayed postoperative gastric perforation (Fig. 4).

2.2. Postoperative course

For the eight patients who underwent laparoscopic gastric devascularization, the operative time ranged from 174 to 459 min (mean: 266 ± 91 min). Intraoperative blood loss ranged from 0 to 3080 ml (median: 105 ml, mean: 825 ± 1390 ml). Two patients underwent conversion to open surgery because of significant intraoperative bleeding from gastric varices (Table 1, patient nos. 5 and 6). In one of these patients, bleeding occurred when the posterior gastric vein was divided using the LigaSure™ alone. In the second patient, an enlarged meandering posterior gastric vein ruptured when connective tissue on the dorsal part of the vein was dissected (Fig. 5).

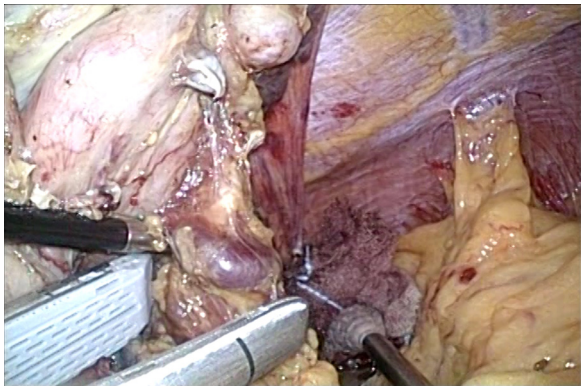

Fig. 3. The posterior gastric variceal vessels are approached from the omental pouch and divided with the linear stapler.

Reviewing the six patients who accomplished laparoscopic gastric devascularization (excluding the two patients who were converted to open surgery intraoperatively) the estimated blood loss ranged from 0 to 250 ml (mean: 76 ± 97 ml).

Postoperative complications occurred in four patients: ascites in two, pleural effusion and atelectasis in one, and gastric stasis in

Table 1
Patients underwent laparoscopic gastric devascularization.

Patient	Gender	Age	Cause of cirrhosis	Child-Pugh classification	Body mass index (kg/m^2)	Operating time (min)	Blood loss (g)	Conversion to open surgery	Gastric stasis	Postoperative hospital stay (day)	Postoperative complication
1	F	75	HCV	B	29.8	224	10	No	No	19	Ascites
2	M	61	NASH	A	29.2	307	105	No	Yes	14	Gastric stasis
3	F	70	NASH	A	29.7	235	0	No	No	9	None
4	F	54	Unknown	B	23.6	273	250	No	No	15	None
5	M	72	HCV	A	24.2	276	3080	Yes	No	10	Ascites
6	M	46	Alcohol	B	30.1	459	3070	Yes	No	12	Pleural effusion, Atelectasis
7	F	76	HCV	A	24.5	178	0	No	No	15	None
8	M	62	IPH	A	21.2	174	90	No	No	11	Gout attack

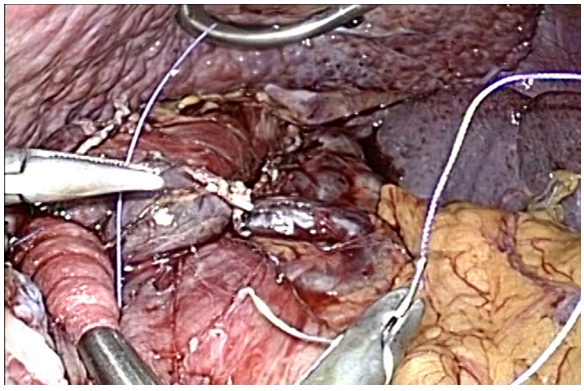

Fig. 4. The muscle layer was defected at the sites of the gastric wall where large varices penetrate. Reinforcing sutures were placed in the seromuscular layer to prevent delayed postoperative gastric perforation.

one patient. There was no operative mortality. No thromboses of the portal vein system were seen on postoperative enhanced CT scans.

Recurrent gastric varices were seen in one patient after laparoscopic devascularization at 144 days after surgery, and they were treated with cyanoacrylate injection.

3. Discussion

The necessity for splenectomy in the treatment of hypersplenism due to liver cirrhosis is controversial [11]. Thrombocytopenia due to hypersplenism is rarely seen as a clinical problem except during surgery, and the surgical treatment of hypersplenism is rarely needed. Partial splenic embolization was developed as a non-operative treatment approach for this problem to improve the rate of splenic preservation [12]. Thrombosis of the portal venous system after splenectomy has been reported as a possible cause of severe hepatic failure and death [13]. Ikeda et al. reported thromboses of the portal or splenic vein detected in 55% patients after laparoscopic splenectomy by contrast-enhanced helical CT scan [14]. In addition, subphrenic lymphatic ducts around the spleen are divided during surgery, which may lead to postoperative lymphorrhea and refractory massive ascites. For these reasons, we have attempted to avoid splenectomy whenever possible [15].

Devascularization of the lower esophagus and upper stomach with splenectomy (Hassab's operation) using laparoscopic or hand-assisted laparoscopic surgical techniques has been reported mainly from Japan and China as surgical therapy for esophagogastric varices [2–7]. However, reports of a surgical approach to this condition while preserving the spleen are rare [8–10].

The historical transition of the treatment strategy for esophagogastric varices in our institution is as follows: (1) plan elective surgery, avoiding emergency operation, (2) use endoscopic therapy (endoscopic variceal ligation and endoscopic injection sclerotherapy) for esophageal varices and limit the range of devascularization around the proximal stomach [15], (3) avoid splenectomy, (4) use intraoperative color Doppler laparoscopic ultrasonography to minimize the area of devascularization [16], (5) use the LigaSure™ to close lymphatic ducts securely [17] (6) minimize the invasiveness of the procedure using laparoscopic techniques.

In the two patients who underwent conversion to open surgery due to massive intraoperative bleeding, the venous blood pressure in the varices was extremely high, and bleeding could not be controlled by compression with laparoscopic forceps or electrical coagulating devices. Based on our experience to date, we recommend the following points to refine the operative technique: (1) peel connective tissue around the varices to expose them, but

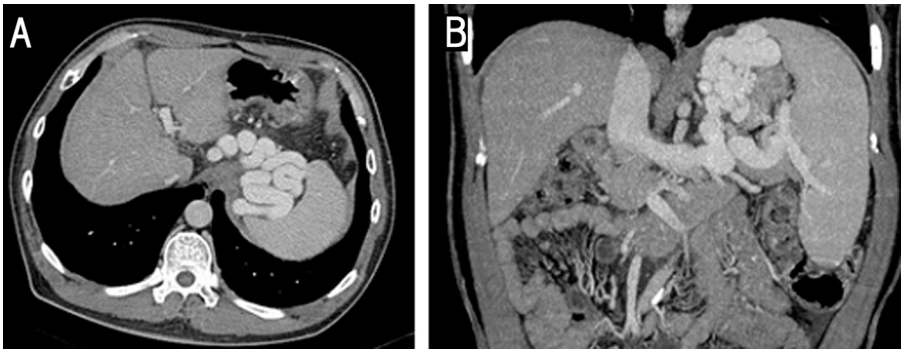

Fig. 5. (A) CT scan of a patient who underwent intraoperative conversion to open surgery showed an enlarged meandering collateral vessel at the posterior part of the stomach and gastrosplenic ligament. (B) The coronal plane of the CT scan in the same patient.

not completely, leaving a small amount of connective tissue, (2) approach the posterior gastric vessels from multiple directions, from the lesser curvature, the greater curvature, and the left side of the fornix, (3) select the hemostatic device according to the diameter of the vessels and consider the timing of dissection, (4) add reinforcement sutures to the seromuscular layer of the gastric wall where large varices penetrate, to prevent delayed gastric perforation. Similar to that reported by Zheng et al. [3], we had a patient with delayed postoperative gastric perforation after Hassab's operation.

The most important factors that influence the difficulty of laparoscopic gastric devascularization are form, meandering and diameter of the varices. With further analysis, we plan to develop preoperative criteria to predict the difficulty and determine the optimal surgical procedure by comparing diagnostic imaging and surgical findings.

Further improvement of laparoscopic devices such as peeling forceps, energy devices, and vascular staplers will also enhance the safety and use of this promising procedure. Additionally, it must be provided intraoperative bleeding in difficult cases, such as a preliminary small incision like hand-assisted laparoscopic surgery.

4. Conclusion

Laparoscopic gastric devascularization without splenectomy must be an effective and less-invasive surgical procedure in the treatment of gastric varices when this surgical procedure is performed without conversion to open surgery.

Author disclosures

Drs. Toru Zuiki, Yoshinori Hosoya, Yasunaru Sakuma, Masanobu Hyodo, Alan T. Lefor, Naohiro Sata, Nobuhiko Nagamine, Norio Isoda, Kentaro Sugano, and Yoshikazu Yasuda have no conflicts of interest or financial ties to disclose.

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Ethical approval

The operative procedure in this paper was required ethical approval by ethics committee in Jichi Medical University.

Consent

All patients in this paper provided informed consent.

Author contribution

Professor A. Lefor checked English grammar and sentences as native speaker.

Dr. Y. Hosoya and other co-authors advised this laparoscopic technique and endoscopic treatment for gastric varices.

Guarantor

The manuscript has been read and approved by all of the authors and is not under consideration for publication elsewhere.

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