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A Simple Method of Liver Retraction for Various Types of Laparoscopic Upper Gastrointestinal Surgeries: The Prolene Hanging-Up Method

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Abstract This study describes a safe and the simple method for liver retraction during various types of laparoscopic upper gastrointestinal surgeries. The technique was performed using only a 75 cm 2–0 prolene suture, which was passed through the abdominal wall with a straight needle at the two points of the epigastrium and at the pars condensa of the gastrohepatic ligament without any protective material or knotting. Seventy-six patients who underwent various types of laparoscopic upper gastrointestinal surgeries from August, 2012 to March, 2013 at Incheon St. Mary's Hospital were included in the study. The mean time for the liver retraction was 2.7 ± 0.6 min. Among the 76 cases, complication of this method was one case of the puncture site bleeding on the abdominal wall. The mean levels of alanine aminotransferase and aspartate aminotransferase on the day of the surgery were 54.9 ± 26.3 U/L and 45.2 ± 23.1 U/L, respectively, and these had decreased to 22.4 ± 13.2 U/L and 21.8 ± 14.0 U/L, respectively, on the fourth postoperative day. The prolene hanging-up method is very simple and safe, and it can be used in various types of laparoscopic upper gastrointestinal surgeries.

Introduction

Effective liver retraction is essential for sufficient exposure of the operative field and for ensuring an adequate working space in laparoscopic gastric surgery [1]. Surgeons have reported various methods of liver retraction using commercially available equipment, such as snake retractors and fan retractors. However, such equipment can cause hepatic parenchymal injury and hepatic congestion, which may result in a postoperative transient rise in aminotransferases [2]. Some liver retraction methods using accessory materials for liver parenchymal protection such as gauze, a penrose drain, and a silicon disk have been reported [1–7]. However, the use of these protective devices makes the procedure rather more complicated and extends the preparation time prior to the commencement of the main operation.

Herein, we present a safe and simple technique for liver retraction during various types of laparoscopic upper gastrointestinal surgeries.

Patients and methods

Seventy-six patients who underwent various types of laparoscopic gastric surgery, including distal gastrectomy, total gastrectomy, antireflux surgery, and bariatric surgery with using liver retraction, from August 2012 to March 2013 at Incheon St. Mary's Hospital, the Catholic University of Korea were enrolled. Patients who had a

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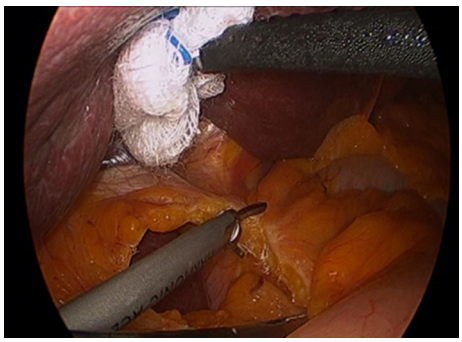

Fig. 1 Division of the pars placcida of the hepatogastric ligament

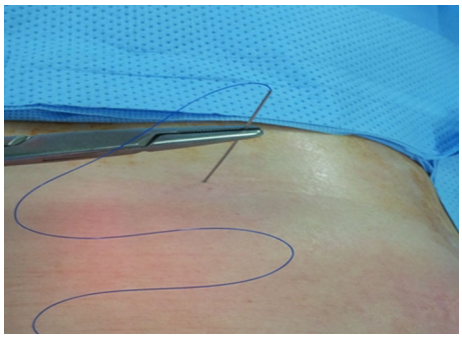

Fig. 2 Insertion of the straight needle through the abdominal wall

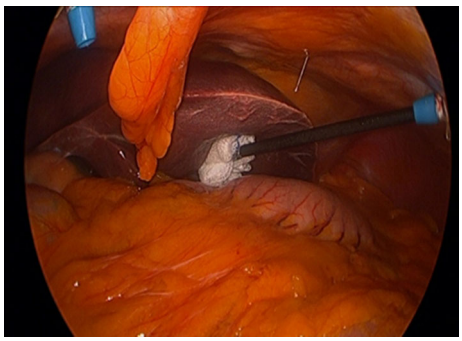

Fig. 3 Inside view of the straight needle being passed internally through the abdominal wall at an appropriate point for liver retraction

history of chronic liver disease or abnormal liver function test were excluded. Data on the patient's age, gender, and body mass index (BMI) were analyzed retrospectively. The operative time, the type of operation, and videos of the procedures were reviewed retrospectively.

All the patients underwent liver function tests to check their levels of aspartate aminotransferase (AST) and alanine aminotransferase (ALT) on the postoperative day (POD) and on PODs one, two, and four.

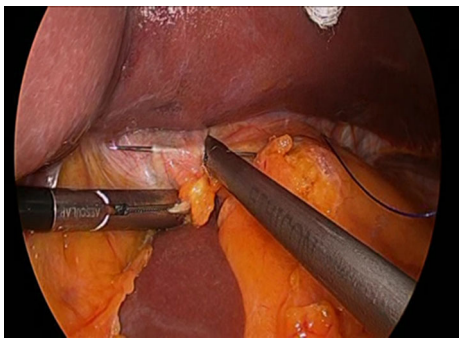

Fig. 4 Straight needle was passed directly through the pars condensa of the hepatogastric ligament

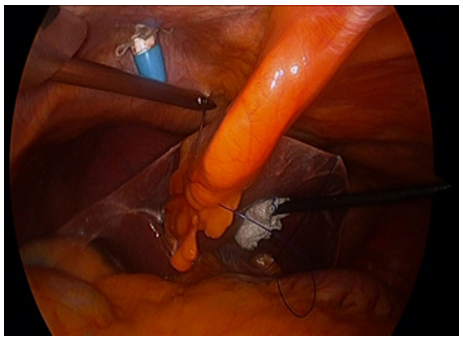

Fig. 5 Passing the prolene suture through the abdominal wall externally using the straight needle

Liver retraction technique

The liver retraction technique required only a 75-cm polypropylene monofilament with a 70 mm double straight needle (2–0 prolene W8400; Ethicon, JJ Medical GmbH, Norderstedt, Germany). The pars placcida of the hepatogastric ligament was divided, and the pars condensa of hepatogastric ligament was exposed (Fig. 1). The first needle puncture site was usually selected at left lower side of the xiphoid process with the aid of laparoscopic view (Fig. 2). One side of the needle was passed internally through the abdominal wall (Fig. 3), and then the straight needle was passed through the pars condensa of the hepatogastric ligament directly (Fig. 4). The prolene was then passed through the abdominal wall externally (Fig. 5). The prolene was tied at the outside of the abdomen, and the left lateral section of the liver was hung up on the two threads (Fig. 6). A surgical gauze was put underneath the prolene to protect the skin before knotting (Fig. 7). An adequate operative view around the gastroesophageal junction which is essential especially in bariatric and antireflux surgery

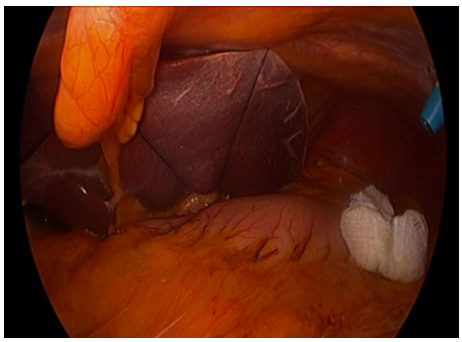

Fig. 6 Final view of the entire surgical field using the prolene hanging-up method

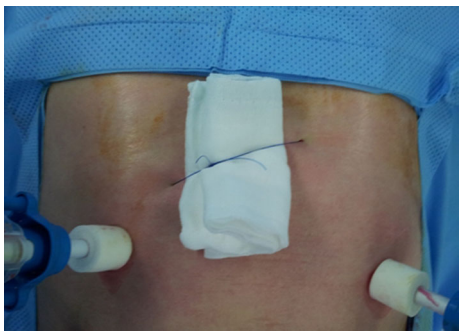

Fig. 7 Final outside view of the prolene hanging-up method

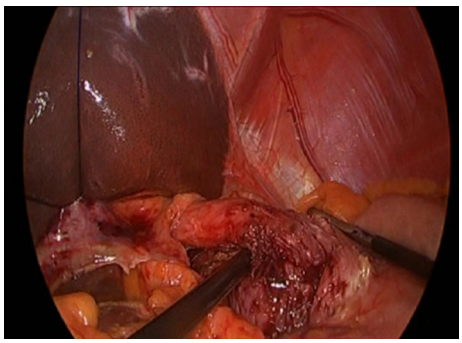

Fig. 8 Operative view around the gastroesophageal junction using the prolene hanging-up method without additional liver retraction

could be obtained with this technique (Fig. 8). We named this technique the prolene hanging-up method.

Results

The technique was performed in 76 patients (47 males, 29 females) who underwent liver retraction in various types of laparoscopic upper gastrointestinal surgeries. Table 1 shows the patient characteristics and operative outcomes. The mean age of the patients was 59.1 ± 12.6 years, and the mean BMI was 24.8 ± 4.8 kg/m^2. There were 58 cases of distal gastrectomy, nine cases of total gastrectomy, fives cases of antireflux surgery, three cases of bariatric surgery, and one case of gastric wedge resection. Table 2 presents a summary of the patient characteristics and operative outcomes with the prolene hanging-up method for the morbidly obese patients.

Table 1 Clinical characteristics and operative results for the prolene hanging-up method

Mean age	59.1 ± 12.6
Gender	
Men	47
Women	29
BMI (kg/m^2)	24.8 ± 4.8
Type of Laparoscopic operation	
Total gastrectomy	9
Subtotal gastrectomy	58
Nissen fundoplication	5
Resectional Roux enY gastric bypass	1
Sleeve gastrectomy	2
Gastric wedge resection	1
Operation time (min)	162.3 ± 58.4
Liver retraction time (min)	2.7 ± 0.6
Liver retraction failure	1
Requirement for additional procedures	1
Complications	
Puncture site bleeding on the abdominal wall	1

The mean operative time was 162.3 ± 58.4 min, and the mean procedure time for the liver retraction was 2.7 ± 0.6 min. The prolene hanging-up method was successful in maintaining a sufficient operative view in all but two cases. The method was unsuccessful in one case because of a damaged pars condensa of the gastrohepatic ligament. This was probably due to the friable soft tissue of the patient. In another case, it was unable to provide sufficient surgical view because of a huge lateral section of the left lobe of the liver. In this case, additional intermittent manual liver retraction was required by first assistant to adequately expose the operative field. In one case, the liver retraction resulted in puncture site bleeding on the abdominal wall. However, the bleeding was managed by direct manual compression. The mean levels of ALT and AST on the day of the surgery were 54.9 ± 26.3 U/L and 45.2 ± 23.1 U/L, respectively, and these had decreased to 22.4 ± 13.2 U/L and 21.8 ± 14.0 U/L, respectively, on the fourth POD and were within normal range.

Table 2 Patient characteristics and operative outcomes with the prolene hanging-up method in morbidly obese patients

Sex/Age	BMI (kg/m^2)	Type of laparoscopic operation	Procedure time	Peak AST/ALT level (U/L)	Complication
F/41	51.5	Resectional Roux enY gastric bypass	3 min 5 s	85/70	None
M/39	36.9	Sleeve gastrectomy	3 min 18 s	43/65	None
F/50	36.7	Sleeve gastrectomy	2 min 45 s	61/61	None

Discussion

As laparoscopic surgery for gastric cancer has increased, various methods have been devised to perform minimally invasive liver retraction. An ideal liver retraction method should lift the liver out of the operative field in a minimally invasive nontraumatic manner and maintain sufficient exposure without additional ports or equipment until the operation is finished [3]. The method should also be simple and time-efficient without liver parenchymal damage.

Our prolene hanging-up method may offer such advantages. First, the prolene hanging-up method is simple and can be performed quickly. It uses only a 2–0 prolene suture with a double straight needles; the suture is passed through the abdominal wall and fixed at the pars condensa of the gastrohepatic ligament. Shibao and colleagues reported a disk suspension method, which lifted a segment of the liver with a silicon disk and a snake retractor [4]. This method required additional trocar insertion to hold the snake retractor and a commercial product (silicon disk). Huang and colleagues reported a liver retraction technique in which a Penrose drain was fixed at the pars condensa of the gastrohepatic ligament and two points of the parietal peritoneum with Endo hernia staples [5]. However, additional dissection around the staples caused damage to normal tissue, and additional time was acquired to remove the Penrose drain after surgery. Almost all the methods devised for liver retraction require additional equipment, such as gauze pads and Penrose drains to support the liver, hemoclips, and surgical clips to fix these, and suture passer to pass through the abdominal wall. As these methods are more complicated, the time spent in retracting the liver is much longer.

Second, in addition to retracting the liver without any additional protective material or procedures, the prolene hanging-up method results in only a slight increase liver enzyme levels after surgery without any liver parenchymal injury. Needle puncture sites are required at only two points of the abdominal wall, and there is no need for any additional incision or trocar insertion. Woo and colleagues reported a liver-lifting retraction method involving prolene suture-threaded gauze pads [3]. The gauze pads were used to prevent trauma to the liver. However, the gauze pads covered some areas of the surgical field and interfered with the surgical view. Lee and colleagues reported a liver retraction method called a triangle method during laparoscopic gastrectomy [6]. They anchored the suture through the right diaphragmatic crus and the pars condensa of the gastrohepatic ligament. The suture was then exteriorized by a suture-passer after removing the needle. Because of this step, larger puncture wounds were made on both sides of the xiphoid process than that of the site it would occur when we passed just straight needle. These wounds may require postoperative wound managements unlike just needle puncture site in our case.

Liver retraction methods are needed to satisfy the requirements of the various types of laparoscopic upper gastrointestinal surgeries that are performed today (e.g., antireflux surgery and bariatric surgery, in addition to gastrectomy). In antireflux surgery, the liver retraction method must be able to expose the gastroesophageal junction, the abdominal esophagus, and the diaphragmatic hiatus. In bariatric surgery for morbidly obese patients, the liver retraction method must ensure an adequate operative view and be capable of lifting the heavy and fatty liver [7]. In our study, the prolene hanging-up method was applied in various types of laparoscopic upper gastrointestinal surgeries including antireflux and bariatric surgeries. The procedure was particularly useful in obtaining a sufficient surgical view around gastroesophageal junction needed for both antireflux and bariatric surgeries. The liver was hung up by lifting the deep portion of the pars condensa of the gastrohepatic ligament, making it possible to obtain a sufficient surgical view around the hiatus and to minimize liver congestion. The maximal BMI of the morbidly obese patients who underwent the prolene hanging-up procedure was 51.5 (kg/m^2). In this patient, no complications occurred, and the surgical view was sufficient.

In conclusion, the prolene hanging-up method was safe, rapid, and easy liver retraction technique which enabled a sufficient surgical field. The effectiveness of the method was verified in various types of laparoscopic upper gastrointestinal surgeries, including bariatric and antireflux surgeries.

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