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The Outcome of Laparoscopic Surgery With and Without Short Gastric Vessel Division for Achalasia

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Short gastric vessel division (SGVD) has been performed as a part of fundoplication for achalasia. However, whether or not SGVD is necessary is still unknown. Forty-six patients with achalasia who underwent a laparoscopic surgery with or without SGVD were analyzed. A questionnaire was administered to assess the postoperative improvement. Regarding improvement of dysphagia and postoperative reflux, there were no significant differences between SGVD (+) group and SGVD (–) group ($P = 0.588$ and $P = 0.686$, respectively). Nineteen patients (95%) in the SGVD (+) group and 24 (92%) in the SGVD (–) group answered that the surgery was satisfactory ($P = 0.756$). In the SGVD (+) group, the pre- and postsurgical body weight increase was +7.3%. In the SGVD (–) group, it was 8.2%. There was no significant difference of body weight increase between the 2 groups ($P = 0.354$). SGVD is not always required in laparoscopic surgery for achalasia.

Key words: Achalasia – Fundoplication – Short gastric vessels – Heller-Dor

Achalasia is a well-known functional disorder of the esophagus. Although its causes have not yet been clearly revealed, the main mechanism is thought to be the degeneration of the Auerbach's plexus, which causes the insufficiency of relaxation of the lower esophageal sphincter muscle. The first surgical case of achalasia was reported by Rumpel in 1987,[1] and today's standard therapeutic procedure consists of myotomy to improve the passage and half-fundoplication to avoid reflux after surgery.[2,3]

As of result of the recent developments in laparoscopic surgery, the surgical procedure has also been changed for achalasia surgery, and laparoscopic

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surgical procedures such as laparoscopic Heller-Dor for achalasia, which provide results compatible to open surgery, have been reported.[4] The long-term results of the procedure are good,[5] and a laparoscopic procedure is currently considered to be the appropriate choice for treatment.[6] As a standard procedure, short gastric vessel division (SGVD) has been performed as a part of fundoplication. A meta-analysis by Catarci revealed that SGVD is not always necessary for a Nissen fundoplication for gastro-esophageal reflux disease (GERD).[7] However, in laparoscopic surgery for achalasia, the differences in the outcomes of fundoplication with or without SGVD have not yet been examined. Therefore, it is unknown whether SGVD is necessary during this procedure. We herein performed a retrospective comparison of the surgical outcome of a single procedure, the laparoscopic Heller-Dor method, with and without SGVD, in a single facility.

Patients and Methods

Patient eligibility

A total of 55 patients with achalasia underwent the laparoscopic Heller-Dor surgery at Chiba University Hospital from 1998 to 2009, and a questionnaire was sent to all of them. Of 55 patients, 46 patients (83.6%) responded and were analyzed in this study. The patients were diagnosed based on the results of esophagography and manometry, accompanied by additional evidence from computed tomography and esophageal endoscopy. The cases with other diseases, which required simultaneous operations, such as cholecystolithiasis in surgery and single-port laparoscopic surgery were excluded from this study.

As preoperative patient characteristics, the patient age, sex, height, body weight, frequency of bougie use, and duration of symptoms were collected. Then, the body mass index (BMI) was calculated. As a classification of the degree of dilatation, patients were divided into 3 categories according to the diameter of the esophagus (grade 1: $<$3.5 cm; grade 2: $>=$3.5 cm, $<$6.0 cm; grade 3: $\geq$6.0 cm). Next, the patients were divided into 3 categories according to the shape of the esophagus: spindle type (Sp), flask type (F), and sigmoid type (S). All categories were defined according to *The Japanese Classification of Esophageal Achalasia*, 3rd edition.[8]

Data collection

The data of surgical complications were collected from medical records. To obtain postoperative data such as symptoms of dysphagia and reflux, body weight, and comprehensive patient satisfaction, a questionnaire was administered to each patient 1 or more years after the surgery. When patients felt more than their expected improvement of symptoms, the satisfaction was determined "excellent," and when they felt relatively good improvement of their symptoms but less than expected, it was determined "good." Besides these, it was determined "not satisfactory." All the patients included in this study provided their informed consent prior to the analysis.

Surgical procedure

The surgery was performed by Heller-Dor method under general anesthesia. First, the abdominal esophagus was exposed with vagal nerve preservation. Thereafter, a myotomy was performed in the abdominal esophagus more than 5 cm proximal from the esophago-gastric junction (EGJ) and 2 cm distal from the EGJ. Then, fundoplication was performed with SGVD in 20 cases [SGVD (+) group] and without SGVD in 26 cases [SGVD (–) group].

Statistical analysis

The statistical analyses were performed using *t* tests for comparisons between the SGVD (+) group and the SGVD (–) group regarding age, height, body weight, BMI, duration of symptoms, and using Fisher's exact test for preoperative bougie use, the proportion of sex, degree of dilatation, morphologic type, surgical complications, proportion of postoperative dysphagia, postoperative reflux. Next, Mann-Whitney *U* test was applied for the analysis of comprehensive patient satisfaction. The analysis of the increase in body weight before and after surgery was performed using 2-way repeated measures of analysis of variance (ANOVA). In the SGVD (–) group, postoperative data of body weight could not be obtained from 1 patient, therefore, a total of 25 paired data sets were used for the analysis of the body weight increase after surgery in SGVD (–) patients. All statistical analyses were performed using the SPSS Version 18 software program (IBM Japan, Tokyo, Japan) in a 2-sided manner. A *P* value $<$0.05 was considered to be statistically significant.

Results

Patient characteristics

Of the 46 cases, 20 were in the SGVD (+) group and 26 were in the SGVD (–) group. Comparing the 2

groups, there were no statistically significant differences regarding age ($P = 0.664$), sex ($P = 0.412$), height ($P = 0.510$), body weight ($P = 0.306$), BMI ($P = 0.417$), duration of symptoms ($P = 0.736$), frequency of preoperative bougie use ($P = 0.391$), degree of dilatation ($P = 0.552$), or morphologic type ($P = 0.068$). The details of the patients' characteristics are shown in Table 1. More advanced cases were present in the SGVD (–) group, as cases of grade 3 dilatation and cases of the sigmoid type were more frequently observed. This study was retrospectively performed, therefore, patient characteristics were not completely equal. The median follow-up period was 3.5 years (range, 1.2–11.5 years).

Surgical complications

In 20 cases of SGVD (+), mucosal injury occurred in 5 cases. In 25 patients of SGVD (–), 4 cases of mucosal injury, 2 cases of subcutaneous emphysema, and 1 case of port-site bleeding occurred during surgery. There were no complications related to SGVD (Table 2).

Table 2 Surgical complications

	SGVD (+) (n = 20)	SGVD (–) (n = 26)	*P* value
Mucosal injury	5	4	0.472
Subcutaneous emphysema	0	2	0.498
Port-site bleeding	0	1	1.000

Clinical improvements

Results of clinical improvements are shown in Table 3. From the questionnaires, there were no patients who were still suffering from the same level of severe dysphagia postoperatively as they had preoperatively. In 11 cases (55%) in the SGCD (+) group, the symptoms had vanished completely. Similarly, the symptoms had completely disappeared in 14 cases (54%) in the SGVD (–) group. There were no significant differences between these 2 groups ($P = 0.588$). Although 1 patient in each group answered that they had occasional gastroesophago reflux, reflux was not observed in most patients, and there were no statistically significant differences between the 2 groups ($P = 0.686$). With regard to comprehensive patient satisfaction, 19 patients (95%) in the SGVD (+) group and 24 (92%) in the SGVD (–) group answered that the surgery was satisfactory, and this rate was not significantly different between the groups ($P = 0.756$). Based on the above results regarding clinical improvements after surgery, there were no significant differences between the SGVD (+) and SGVD (–) groups.

Body weight increase after surgery

Almost all patients showed marked improvement of their aphagia, were able to eat food, and showed an increase in body weight after surgery. A comparison

Table 1 The patient backgrounds

	SGVD (+) (n = 20)	SGVD (–) (n = 26)	*P* value
Age (years)	40.1 ± 11.8	45.2 ± 16.2	0.664
Sex (male/female)	10/10	11/15	0.412
Height (cm)	163.4 ± 6.1	161.5 ± 11.7	0.510
BW (kg)	56.1 ± 1.0	52.6 ± 12.5	0.306
BMI (kg/m^2)	21.0 ± 3.3	20.2 ± 2.8	0.417
Duration of symptoms (years)	4.1 ± 4.1	4.6 ± 5.3	0.736
Preoperative bougie (time)			
0	12	17	0.391
1–3	6	9	
4 or more	2	0	
Degree of dilatation			
Grade 1	1	3	0.552
Grade 2	16	17	
Grade 3	3	6	
Morphologic type			
Sp	17	13	0.068
F	2	8	
S	1	5	

BW, body weight.

Table 3 The clinical improvements obtained based on the questionnaire

	SGVD (+) (n = 20)	SGVD (−) (n = 26)	*P* value
Frequency of dysphagia			
Occasional	9	12	0.588
None	11	14	
Frequency of reflux			
Occasional	1	1	0.686
None	19	25	
Patient satisfaction			
Excellent	19	24	0.756
Good	0	2	
Not satisfactory	1	0	

of the increment pattern between the SGVD (+) and SGVD (−) groups was made using 2-way repeated measures of ANOVA. As seen in Fig. 1, in the SGVD (+) group, the pre- and postsurgical body weights were 56.1 kg and 60.2 kg, respectively, and the increase was therefore 7.3%. In the SGVD (−) group, the pre- and postsurgical body weights were 53.7 kg and 58.1 kg, respectively, and the increase was 8.2%. There was no significant difference between the increases in the 2 groups ($P = 0.354$).

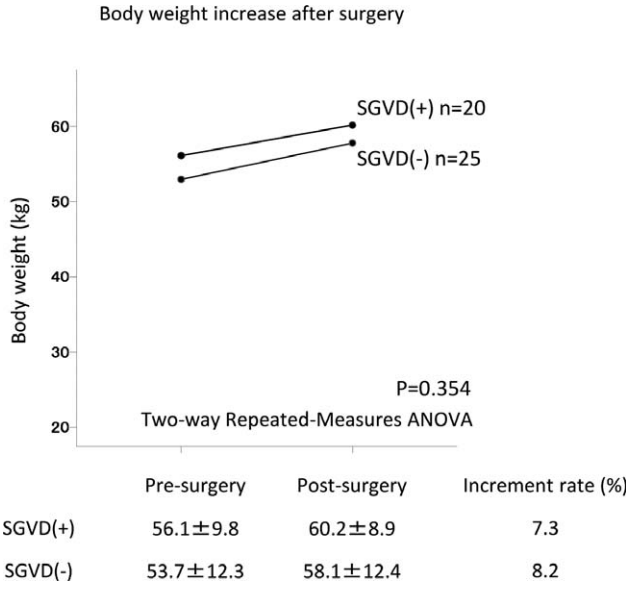

Fig. 1 Body weight increases after surgery. Upper line: the mean body weight of the SGVD (+) patients before and after surgery. Lower line: the mean body weight of the SGVD (−) patients before and after surgery. The increase was 7.3% in the SGVD (+) group and 8.2% in the SGVD (−) group. There was no statistically significant difference between the 2 groups.

Discussion

SGVD has been routinely performed for GERD for decades. In the early 2000s, there were a few randomized controlled trials that concluded that there were no statistically significant differences regarding morbidity, dysphagia, and recurrence in Nissen fundoplication between procedures using SGVD and those that did not.[9–12] A recent meta-analysis showed that SGVD is actually followed by a slightly poorer clinical outcome at late follow-up after Nissen fundoplication.[13] Therefore, SGVD in Nissen fundoplication during surgery for GERD is unnecessary; however, the need for the procedure during surgery for achalasia is unclear, because while the Nissen fundoplication involves whole wrapping as the main procedure, anterior partial wrapping is preferably performed during surgery for achalasia.[14] Because the range of wrapping for achalasia is about half of the Nissen fundoplication, the necessity of the procedure for GERD is expected to be lower. However, there were no data regarding the necessity of SGVD during the fundoplication in the surgery for achalasia.

From our data, there were no differences regarding surgical complications between SGVD (+) and (−) groups (Table 2). This means that SGVD does not increase surgical complications and can be performed safely. Of interest, however, when comparing the 2 groups, the duration of postoperative fever (over 37°C) was 3.7 days in the SGVD (+) group and 2.6 days in the SGVD (−) group (data not shown). Moreover, the duration of postoperative hospital stay was 9.1 days in the SGVD (+) group and 7.3 days in the SGVD (−) group (data not shown). The postoperative course seemed to be better in the SGVD (−) patients. This may be, in part, because we applied the clinical path mainly to the SGVD (−) group. However, not having undergone SGVD is a less-invasive surgical procedure, and it can contribute to a good postoperative course and also reduces the cost of medical treatment.

Surgery with myotomy and half-fundoplication for achalasia does not directly deal with a dilated thoracic esophagus; therefore, the disappearance of symptoms such as dysphagia, regurgitation, and chest pain is not complete in all cases.[15,16] However, as Table 3 shows, complete disappearance was observed in 11 cases (55%) in the SGVD (+) group and 14 cases (54%) in the SGVD (−) group. The difference in the rate between the 2 groups did not differ significantly, because the improvement mainly depends on the myotomy, not on the fundopli-

cation. With regard to postoperative reflux, there was also no difference after surgery between the 2 groups ($P = 0.686$). Moreover, the patients' comprehensive satisfaction was "excellent" and "good" in 100% of the patients in the SGVD (–) group. Therefore, not performing SGVD does not have any significant influence on the clinical improvement. To assess the differences between the 2 groups objectively, the body weight increase was examined, as shown in Fig. 1. The results of this examination were also not significantly different between the 2 groups.

As a result of the development of several new devices and surgical techniques,[17] laparoscopic surgery is now thought to be more feasible. Laparoscopic surgery for achalasia is well established; however, continuous efforts to improve the surgical procedure should, of course, be considered. In conclusion, our present study shows that SGVD is not always required. Achalasia is a benign esophageal disease, and from this point of view, unnecessary procedures should be avoided.

References

1. Rumpel T. Die Klinische Diagnosis der spindelformigen Spelseröhrener weiterung. *Minch Med Wschr* 1897;**44**(XX): 383–387
2. Dor J, Humbert P, Paoli JM, Miorclerc M, Aubert J. Treatment of reflux by the so-called modified Heller-Nissen technic [in French]. *Presse Med* 1967;**75**(50):2563–2565
3. Csendes A, Braghetto I, Burdiles P, Korn O, Csendes P, Henriquez A. Very late results of esophagomyotomy for patients with achalasia: clinical, endoscopic, histologic, manometric, and acid reflux studies in 67 patients for a mean follow-up of 190 months. *Ann Surg* 2006;**243**(2):196–203
4. Ancona E, Anselmino M, Zaninotto G, Costantini M, Rossi M, Bonavina L *et al*. Esophageal achalasia: laparoscopic versus conventional open Heller-Dor operation. *Am J Surg* 1995; **170**(3):265–270
5. Bonatti H, Hinder RA, Klocker J, Neuhauser B, Klaus A, Achem SR *et al*. Long-term results of laparoscopic Heller myotomy with partial fundoplication for the treatment of achalasia. *Am J Surg* 2005;**190**(6):874–878
6. Bello B, Herbella FA, Patti MG. Evolution of the minimally invasive treatment of esophageal achalasia. *World J Surg* 2011; **35**(7):1442–1446
7. Catarci M, Gentileschi P, Papi C, Carrara A, Marrese R, Gaspari AL *et al*. Evidence-based appraisal of antireflux fundoplication. *Ann Surg* 2004;**239**(3):325–337
8. Japanese Society for Esophageal Diseases. *Japanese Classification of Esophageal Achalasia*. 3rd ed. Tokyo, Japan: Kanehara & Co, Ltd, 1984
9. Watson DI, Pike GK, Baigrie RJ, Mathew G, Devitt PG, Britten-Jones R *et al*. Prospective double-blind randomized trial of laparoscopic Nissen fundoplication with division and without division of short gastric vessels. *Ann Surg* 1997;**226**(5):642–652
10. O'Boyle CJ, Watson DI, Jamieson GG, Myers JC, Game PA, Devitt PG. Division of short gastric vessels at laparoscopic nissen fundoplication: a prospective double-blind randomized trial with 5-year follow-up. *Ann Surg* 2002;**235**(2):165–170
11. Chrysos E, Tzortzinis A, Tsiaoussis J, Athanasakis H, Vasssilakis J, Xynos E. Prospective randomized trial comparing Nissen to Nissen-Rossetti technique for laparoscopic fundoplication. *Am J Surg* 2001;**182**(3):215–221
12. Kosek V, Wykypiel H, Weiss H, Höller E, Wetscher G, Margreiter R *et al*. Division of the short gastric vessels during laparoscopic Nissen fundoplication: clinical and functional outcome during long-term follow-up in a prospectively randomized trial. *Surg Endosc* 2009;**23**(10):2208–2213
13. Engstrom C, Jamieson GG, Devitt PG, Watson DI. Meta-analysis of two randomized controlled trials to identify long-term symptoms after division of the short gastric vessels during Nissen fundoplication. *Br J Surg* 2011;**98**(8):1063–1067
14. Tsuboi K, Omura N, Yano F, Kashiwagi H, Yanaga K. Results after laparoscopic Heller-Dor operation for esophageal achalasia in 100 consecutive patients. *Dis Esophagus* 2009;**22**(2):169–176
15. Sasaki A, Obuchi T, Nakajima J, Kimura Y, Koeda K, Wakabayashi G. Laparoscopic Heller myotomy with Dor fundoplication for achalasia: long-term outcomes and effect on chest pain. *Dis Esophagus* 2010;**23**(4):284–289
16. Omura N, Kashiwagi H, Yano F, Tsuboi K, Ishibashi Y, Hoshino M *et al*. Effect of laparoscopic esophagomyotomy on chest pain associated with achalasia and prediction of therapeutic outcomes. *Surg Endosc* 2011;**25**(4):1048–1053
17. Kroh M, El-Hayek K, Rosenblatt S, Chand B, Escobar P, Kaouk J *et al*. First human surgery with a novel single-port robotic system: cholecystectomy using the da Vinci Single-Site platform. *Surg Endosc* 2011;**25**(11):3566–3573