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Clinical Evaluation of Laparoscopic-Assisted Percutaneous Endoscopic Gastrostomy (LAPEG)

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Percutaneous endoscopic gastrostomy (PEG) is the standard modality for long-term enteral nutrition; however, complications are common. To avoid these complications, we introduce laparoscopic-assisted PEG (LAPEG) and describe its advantages. The aim of this study was to describe the advantages of LAPEG relative to other procedures. We retrospectively reviewed the records of 19 patients who underwent LAPEG at our institution from June 2008 to February 2013. They were thought to be difficult cases for PEG. LAPEG was successfully performed in 18 patients (average age, 78.5 years; range, 50–98 years). The average surgical duration was 32.4 ± 6.2 minutes. No major intraoperative or postoperative complications were observed. Feeding tubes were successfully placed in all patients within some days. LAPEG is a safe, effective, and simple procedure. The strongest advantage of LAPEG is the possibility of observing the intraperitoneal condition and the ability to perform PEG safely without any complications. LAPEG should be the first-choice procedure if it is difficult to accomplish conventional PEG.

Key words: LAPEG – Laparoscopic – Percutaneous – Endoscopic – Gastrostomy

Enteral feeding is considered the optimal treatment for malnourished patients. Percutaneous endoscopic gastrostomy (PEG), first introduced in the 1980s,[1] has become the standard modality for long-term enteral nutrition because the technique is associated with fewer complications compared with gastrostomy. However, PEG is a blind procedure, and it is difficult to detect organs between the

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stomach and the abdominal wall, such as the colon, small intestine, greater omentum, and so forth. We had actually encountered complications in 4 cases while performing PEG at our institution, including erroneous injury to the transverse colon. To avoid accidental complications, we introduce the laparoscopic-assisted PEG (LAPEG) technique, which is extremely useful and safe. Here we report 19 cases of LAPEG and analyze our experience with this technique.

Materials and Methods

We retrospectively reviewed the medical records of 19 cases of LAPEG performed at our institution from June 2008 to February 2013. All patients were unable to ingest because of brain infarction or cerebral hemorrhage and were identified as candidates for LAPEG for various reasons. In all patients, we routinely performed abdominal X-ray photograph (XP) or computed tomography (CT) and checked the transmitted light of an endoscope through the body wall and the deformation of the stomach by pressing the body wall while attempting PEG. Through these checks, we ascertained whether or not there were other organs between the stomach and the abdominal wall. If there were organs, LAPEG was employed to avoid the risk of complications.

Technical factors that may preclude adherence to any one of these principles include intra-abdominal adhesions, overriding organs, intra-abdominal masses, hepatomegaly, hiatal hernias, obesity, and ascites.[2,3]

LAPEG was performed in the operating theater with the patient in the supine position under general anesthesia. First, an incision to the umbilicus was made to place a 5-mm optical trocar (Fig. 1). A pneumoperitoneum with CO_2 was sustained at 4 to 8 mmHg. If there were previous incisions to the surrounding navel, the trocar position was placed beside the scar. Almost all procedures were performed using only 1 trocar. However, an additional trocar was inserted to remove organs between the gastric wall and abdominal wall in some cases. After identifying and cleaning the stomach, an endoscope was inserted and the stomach was insufflated, using a laparoscope, to observe its shape (Fig. 2a). Then, PEG placement was performed using the pull technique, as described by Gauderer *et al*,[1] using the One-Step Button Gastrostomy Device (Boston Scientific, Tokyo, Japan) (Fig. 2b).

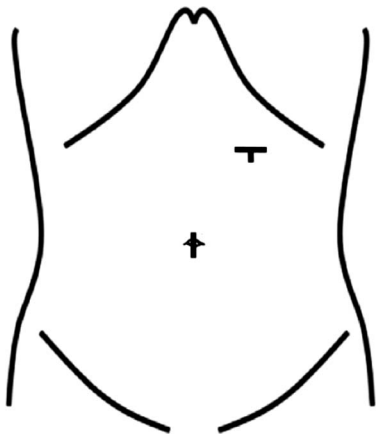

Fig. 1 The mark of the navel is the incision of the first trocar. The mark of the left upper quadrant abdomen is the incision of the gastrostomy.

Results

Nineteen adult patients underwent LAPEG during the study period (only one operation was aborted midcourse) (Table 1), and no conversions to open gastrostomy were necessary. PEG was considered either not feasible or too difficult in each case. Of these cases, PEG was aborted and converted to LAPEG in 7 patients for various reasons, including multiple gastric adenoma, colonic volvulus, severe stomach deformation, and thickness of the gastric wall.

With regard to primary disease, 10 patients were admitted for stroke, 2 for severe head trauma, and 7 for various other conditions. Three patients previously underwent abdominal surgery. The average patient age was 78.5 years (range, 50–98 years), and 9 patients were male. The average surgical duration was 32.4 $\pm$ 6.2 minutes. In one patient, we employed an additional port to remove the greater omentum and transverse colon (Fig. 2c and 2d). No major intraoperative or postoperative complications were observed. In one patient, the small intestine was injured while inserting the first port because of adhesions between the abdominal wall and small intestine. However, the injury was safely repaired using absorbable sutures, and there were no postoperative complications. Feeding tubes were successfully implanted in all the patients within some days. Approximately 3 months after the operation, the button was exchanged via endoscopy.

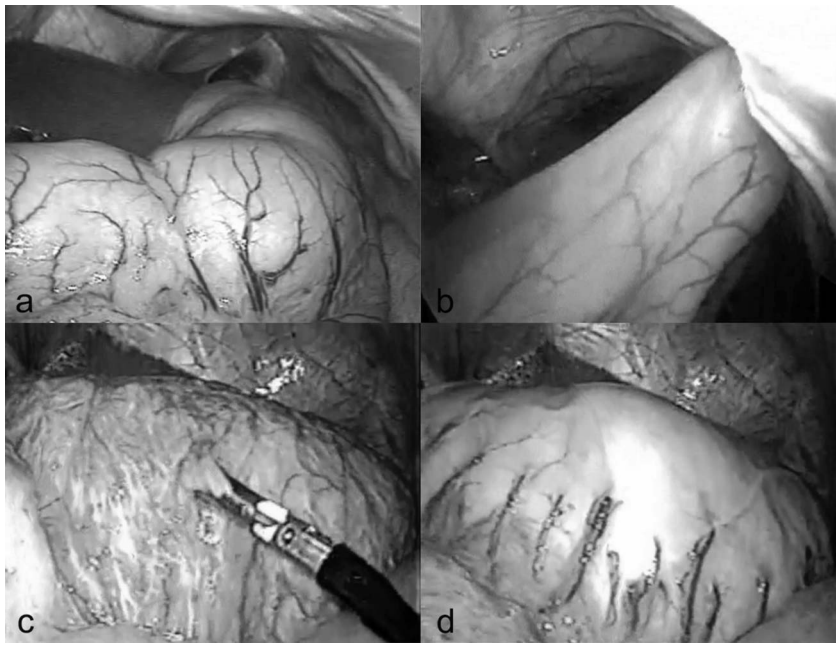

Fig. 2 (a) Laparoscopic observation of the stomach. (b) Completion of PEG via the pull technique. (c) The stomach is covered with the greater omentum. (d) The greater omentum was removed via laparoscopy.

Discussion

PEG is required to sustain long-term enteral nutrition for patients incapable of oral feeding. Compared with open surgery, PEG is useful, safe, and less invasive; however, procedure-related complications are common.[4] A large meta-analysis of PEG reported an overall complication rate of 9.2%, morbidity rate of 9.4%, and mortality rate of 0.53%.[4,5] The most fatal and risky complication is perforation of the colon or other organs because of the blind nature of the procedure. Actually, preoperative abdominal XP and CT revealed that the transverse colon was beyond the stomach in nine patients. Therefore, if we chose to perform PEG, the colon could become skewered or perforated. In such cases, PEG can be safely performed using a

Table 1 Data from 19 cases of LAPEG

Patient No.	Age	Sex	Operation time (min)	Basic disease	Reason for adaptation	Notes
1	77	M	29	Cerebral infarction	Noncompletion of PEG	
2	83	F	28	Cerebral infarction	After an open surgery	
3	84	F	30	Cerebral infarction	After an open surgery	
4	98	M	45	Cerebral infarction	After an open surgery	
5	92	F	29	Cerebral infarction/hiatal hernia	Noncompletion of PEG	
6	83	M	30	Cerebral infarction	CT checking: colon in front of the stomach	
7	82	M	25	Alzheimer disease	CT checking: colon in front of the stomach	
8	82	F	40	Pneumonia	Noncompletion of PEG	
9	83	F	35	Dementia/dysphagia	CT checking: colon in front of the stomach	
10	83	M	36	Progressive supranuclear palsy	Noncompletion of PEG	
11	91	M	40	Cerebral infarction	CT checking: colon in front of the stomach	
12	77	M	20	Cerebral infarction	Noncompletion of PEG	Aborted in midcourse
13	80	F	40	Cerebral infarction	CT checking: colon in front of the stomach	
14	59	M	27	Cerebral infarction	Noncompletion of PEG	
15	80	M	25	Cerebral hemorrhage	CT checking: colon in front of the stomach	
16	73	F	30	Respiratory failure	CT checking: colon in front of the stomach	
17	50	F	36	Hypoxic encephalopathy	CT checking: colon in front of the stomach	
18	66	F	35	Meningioma	CT checking: colon in front of the stomach	
19	69	F	35	Cerebral hemorrhage	Noncompletion of PEG	

laparoscope. In addition, this procedure is effective for patients who underwent any previous abdominal surgery because the majority develop intraperitoneal synechia. In fact, we were able to safely and effectively perform LAPEG with no complications, as described by Stringel *et al* in 1995.[6] Other studies employing a similar procedure reported a complication rate of 12% to 23%; complications included minor postoperative complications such as superficial wound infection and premature dislodgment.[7,8]

In the present study, the complication rate was relatively very low because we carefully prepared for surgery by performing abdominal XP and CT. Moreover, we chose PEG or LAPEG as appropriate for each patient by performing the press test and light test via endoscopy. For cases with even a small possibility of complications, we switch to LAPEG without hesitation.

We believe that the rate of complications associated with LAPEG can be decreased by comprehensive preparation. In addition, LAPEG can be safely performed while confirming the intraperitoneal status, which is the strongest advantage of this procedure. LAPEG was regretfully abandoned in one patient because of severe esophageal hiatal hernia and the inability to view the stomach in the supine position.

The small incision in LAPEG presents a second advantage over open gastrostomy. In our procedure, only one 5-mm trocar is required in most cases, where the incision made in PEG is approximately 2 cm, and that made in open gastrostomy is approximately 5 to 10 cm. A minimal skin incision is useful to decrease the incidence of surgical-site infection. In addition, LAPEG can achieve excellent appearance and reduced postoperative pain. Furthermore, the average surgical duration in LAPEG is 32.4 minutes, which is acceptable in comparison with open gastrostomy.

With regard to cost, LAPEG is more expensive than PEG or open gastrostomy[9,10] and is therefore not performed as a primary procedure. However, LAPEG is safer and less expensive than other procedures in view of complications, particularly for cases in which PEG is deemed too difficult.

Our study has certain limitations. First, we performed LAPEG in only 19 patients in this study. A larger study, reviewing more cases, would be better to prove LAPEG is useful and safe. Second, we had no control group. Thus, we didn't perform a comparative study. Finally, there may be selection bias.

Conclusion

We performed LAPEG in 19 cases in which PEG was deemed too difficult. Our results showed that LAPEG is a safe, effective, and relatively simple procedure. The strongest advantage of LAPEG is the ability to observe the state of the intraperitoneal cavity and to perform PEG safely without complications. LAPEG should be considered as the first-choice procedure if conventional PEG presents the possibility of complications.

Acknowledgments

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