

# Laparoscopically assisted gastric surgery using Dexterity Pneumo Sleeve

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## Abstract

**Background:** Laparoscopic surgery has been successfully applied to several gastrointestinal procedures. Although the totally laparoscopic gastrectomy is feasible, tactile sensation and manipulation of the organ as well as the lesion are decreased when compared to open surgery. The Dexterity Pneumo Sleeve is a new device which allows the surgeon to insert a hand into the abdominal cavity while preserving the pneumoperitoneum. This device was used for patients who underwent laparoscopic gastric surgery.

**Methods:** The first patient presented with a non-Hodgkin's lymphoma of the stomach. A laparoscopically assisted distal gastrectomy was performed with Roux-en-Y reconstruction. The second patient had a 5-cm leiomyoma involving the greater curve of the stomach, and this device was used for manipulation of the tumor. The last patient suffered from morbid obesity with its associated medical complications and a ventral hernia. The Sleeve was applied at the hernia site and a laparoscopically assisted gastric bypass was performed.

**Results:** The Pneumo Sleeve was useful in these cases for tactile localization of the tumor and for retraction and manipulation of the stomach and surrounding upper abdominal organs.

**Conclusions:** The utilization of this device resulted in a more easily performed dissection, resection, and anastomosis and was felt to decrease operation time.

**Key words:** Gastric surgery — Lymphoma — Leiomyoma — Morbid obesity — Laparoscopic surgery — Surgical device

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Laparoscopic surgery has been recently applied to several gastrointestinal procedures to reduce pain and effect a faster recovery and better cosmetic result. Gastric surgery is no

exception. Goh et al. reported two cases of totally intra-abdominal laparoscopic Billroth II gastrectomy in 1992 [5]. Watson et al. described the technique of totally laparoscopic Billroth II gastrectomy for early gastric cancer in 1995 [14].

Although the totally laparoscopic gastrectomy for carcinoma is feasible, there are still some concerns about detection of other lesions and surgical margins [3, 8]. A persistent problem with laparoscopic surgery is the inability of the surgeon to palpate the abdominal contents during the operation. This lack of tactile sensation can lead to poor general abdominal exploration, difficulty in extraction of organs, or a relatively long operation time compared to conventional open procedures.

The Dexterity Pneumo Sleeve (Dexterity, Research Triangle Park, NC) is a new device which allows the surgeon to insert a hand into the abdominal cavity through a relatively small incision while preserving the ability to work under pneumoperitoneum [15]. The use of this product provides the possibility of hand assistance during laparoscopic surgery and tactile sensation of the lesion which might not be apparent with the use of instrumentation alone. This product was recently approved for clinical use in the United States. During our early experience in this project, we had three patients who underwent laparoscopically assisted gastric surgery using the Dexterity Pneumo Sleeve.

## Description of Dexterity Pneumo Sleeve

The device has two main components: the Protector Retractor and the Pneumo Sleeve (Fig. 1).

The Protector Retractor is an open-ended cylinder with a flexible ring at each end. One ring is inserted through the incision into the peritoneal cavity while the other remains outside of the incision. The retractor lines the wound and acts to keep the incision open and to protect against wound contamination.

The Pneumo Sleeve is approximately 34 inches long and 9½ inches wide and is made of a biocompatible, sealable polyolefin-type material. The distal side of the sleeve has a fenestration and an adhesive flange for attaching to the pa-



**Fig. 1.** The Dexterity Pneumo Sleeve set, which allows the surgeon to insert a hand into the abdominal cavity while preserving an ability to work under pneumoperitoneum.

tient's abdomen. The proximal end of the sleeve has a cuff (constructed of Velcro or molded plastic) which is designed to secure the sleeve around the surgeon's arm and prevent leakage of pneumoperitoneum gas.

Generally, the length of the skin incision (in centimeters) required to insert the surgeon's hand is almost equal to the surgeon's glove size.

## Surgical technique

The patients who underwent laparoscopic-assisted gastric surgery using the Dexterity Pneumo Sleeve signed a specific informed consent which was approved by the Institutional Review Board of the Cleveland Clinic Foundation.

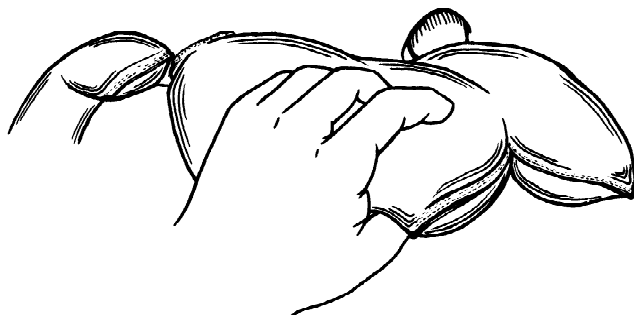
### Case 1

The patient is 66-year-old female who weighed 119 kg and was 170 cm tall. She presented with upper gastrointestinal bleeding due to ulceration of a non-Hodgkin's lymphoma of the stomach. The lymphoma was on the lesser curvature of the gastric body starting at approximately 5 cm distal to the gastroesophageal (GE) junction; the ulcer was approximately 7 cm in diameter. She was scheduled to undergo laparoscopically assisted distal gastrectomy with Roux-en-Y gastroenterostomy.

Surgery was performed with the patient supine with legs in the split position. The surgeon stood between the legs and an assistant was on each side. An 8-cm skin incision was made in the lower midline and the Dexterity set was applied to the skin surrounding the wound. A 10-mm trocar was inserted in the left flank and pneumoperitoneum was created. A 10-mm and a 12-mm trocar were then inserted in the left subcostal region as well as a 10-mm trocar in the right subcostal area.

The left hand of the surgeon was inserted into the abdominal cavity through the Pneumo Sleeve, and the tumor was easily palpable, as were its margins. Using the Harmonic Scalpel (UltraCision Inc., Smithfield, RI), the gastrocolic ligament was taken down to mobilize the greater curvature of the stomach. The right gastroepiploic artery was transected after applying clips. Then the duodenum bulb was dissected and the first portion of the duodenum was transected with an endoscopic linear stapler. While retracting the stomach inferiorly with the left hand, the lesser curvature was dissected with the Harmonic Scalpel until a point just distal to the GE junction. The short gastric arteries were taken in a similar fashion. Clips were utilized to control the larger vessels. Then, using the endoscopic linear stapler with several cartridges, the distal stomach was divided (Fig. 2). This specimen was taken out through the Sleeve and sent to pathology.

Next, the jejunum was divided with an endoscopic linear stapler ap-



**Fig. 2.** Stomach was retracted with the inserted hand and transected with endoscopic linear staplers.

proximately 20 to 25 cm from the ligament of Treitz and the distal loop was brought up over the transverse colon. After putting a stay suture between the stomach and jejunum, a small incision was made in the anterior wall of the stomach and antimesenteric side of the jejunum, respectively. The endoscopic linear stapler was inserted through the hole and fired twice to create a 6-cm gastrojejunostomy. The remaining enterotomy was closed with 3-0 running suture using the hand-assisted intracorporeal knot-tying technique. Then a loop of more distal jejunum was selected and pulled through the skin incision of the Pneumo Sleeve; the jejunojunctionostomy was created extracorporeally.

The abdominal cavity was irrigated and two drains were left next to the anastomosis. Trocars were all removed, and all fascial wounds were closed with 0 Polyglactin 910 sutures and 4-0 sutures for subcutaneous.

Approximate blood loss was 150 ml and duration of operation was 360 min. The patient started normal diet on 5th postoperative day and was discharged on postoperative day 8 without complications.

### Case 2

A 78-year-old male who was otherwise in good health presented with a history of gastrointestinal bleeding. The examination and subsequent workup revealed a 5-cm submucosal tumor of the stomach which was involving the anterior wall of the gastric body. Biopsies returned probable leiomyoma and computerized tomography demonstrated the lesion without any signs of malignancy or metastasis. A 1.5-cm gallstone was also seen in the gallbladder.

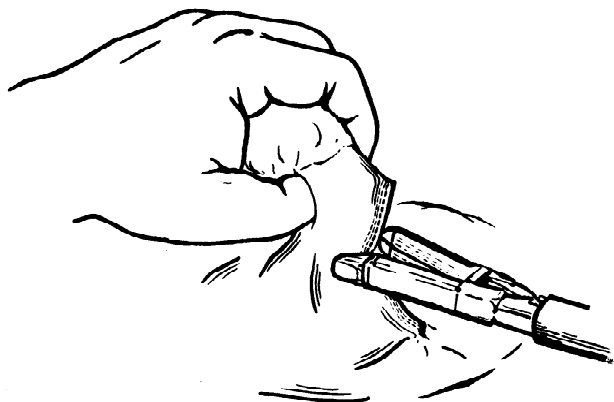
After usual laparoscopic cholecystectomy, an 8-cm skin incision was made in the infraumbilical area. The Dexterity Pneumo Sleeve was applied to the skin, and the left hand of the operator was inserted inside of the abdominal cavity. After insufflation of carbon dioxide gas up to 15 mmHg, a 10-mm trocar was inserted in the left subcostal area, and a 12-mm trocar for the insertion of the endoscopic linear stapler was inserted in the left paramedian area. Using 10-mm 30° angle laparoscope, the lesion was taken by the inserted hand and lifted up to the anterior abdomen. Confirming the adequate margins with manual palpation, a wedge resection of the stomach was performed with four cartridges of the endoscopic linear stapler, 12 mm in diameter, 30 mm in length (Fig. 3). The specimen was retrieved through the Pneumo Sleeve and sent to pathology for immediate examination. It was confirmed to be leiomyoma with clear margins.

One stitch of 2-0 silk was applied with a laparoscopic needle holder, using intracorporeal knot tying technique, to the superior staple line to control bleeding in that area. The Pneumo Sleeve and trocars were all removed and wounds were closed with 0 Polyglactin 910 sutures for fascia and 4-0 for the skin. Duration of the procedures was 140 min. Estimated blood loss was about 20 ml.

A postoperative course was uncomplicated. The patient started normal diet on the 4th postoperative day and was discharged on the 7th postoperative day.

### Case 3

The patient was a morbidly obese 44-year-old male who presented with a ventral hernia. He weighed 172 kg and was 170 cm tall. He had required coronary artery bypass grafting in 1992 and subsequently developed a



**Fig. 3.** The tumor was taken by the inserted hand, and a wedge resection was performed with staplers.

ventral hernia in the epigastric region. The hernia was repaired in 1995 but recurred shortly thereafter. The patient was felt to be a proper surgical candidate for both his morbid obesity as well as the ventral hernia. The patient was scheduled for a laparoscopically assisted gastric bypass with gastric division [10], Roux-en-Y gastrojejunostomy (Fig. 4), tube gastrostomy for feeding, and ventral hernia repair.

Under general anesthesia an 8-cm upper midline incision was made in the hernia site, and all adhesions were lysed. The Dexterity Pneumo Sleeve was then applied on the skin. The left hand of the surgeon was inserted and a left paramedian trocar, 10 mm in diameter, was inserted. After insufflation of carbon dioxide gas, two more 10-mm trocars were inserted in the left lower paramedian area.

The greater curvature of the stomach was mobilized to the GE junction using the Harmonic Scalpel. The tissue surrounding the distal esophagus and proximal stomach was dissected and the stomach was divided into two pouches 1 cm distal of the GE junction using the endoscopic linear stapler.

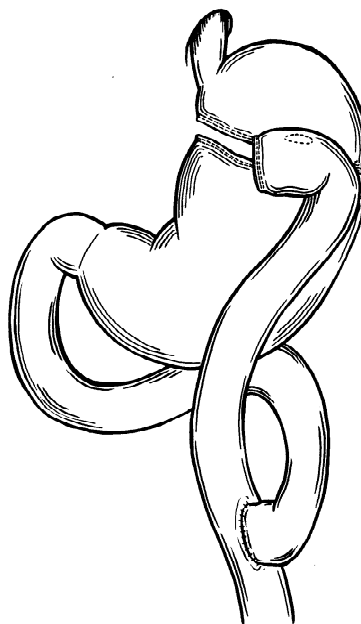
The jejunum was divided 20 cm distal to the ligament of Treitz, and the distal limb of jejunum was brought up over the transverse colon. The gastrojejunostomy was performed end to side with interrupted 2-0 silk sutures using a laparoscopic needle holder. The nasogastric tube was passed through the anastomosis and into the jejunal limb prior to completion of the anterior row of sutures. The Pneumo Sleeve was removed and the Roux-en-Y jejunojunctionostomy was made extracorporeally through the upper abdominal incision.

A 20-Fr gastrostomy tube was inserted into the anterior upper gastric pouch, and a feeding jejunostomy tube was inserted 40 cm distal to the Roux-en-Y anastomosis. A drain was left near the GE junction and the abdominal cavity was irrigated with saline. The hernia was repaired with mesh and nonabsorbable 0 sutures. The skin was closed with a 4-0 subcuticular stitch. Estimated blood loss was about 500 ml. Duration of procedure was 390 min.

The patient's hospital course was complicated by pneumonia and he was discharged on the 31st postoperative day tolerating a soft diet.

## Discussion

The fervor over laparoscopic cholecystectomy cultivated tremendous interest in expanding this type of minimally invasive surgery into other areas. The combinations of improved instrumentation, better operating room staff familiarity, and advanced surgical skills, along with patient education in this subject, have all been kindling factors. Several articles have reported the feasibility of laparoscopic gastric surgery. For example, Goh et al. reported two patients who underwent complete laparoscopic Billroth II gastrectomy for a gastric ulcer in 1992 [5]. Lointier et al. also reported a case with Billroth II gastrectomy for a gastric ulcer in 1993 [9]. For malignancy, Ablassmaier et al. described a laparoscopic distal gastrectomy for malignant lymphoma in 1994



**Fig. 4.** Stomach was transected using endoscopic linear staplers. Then gastrojejunostomy was created with intracorporeal suturing method. Finally the Roux-en-Y jejunojunctionostomy was made extracorporeally through the upper abdominal incision.

[1], and Watson and associates presented a case of laparoscopic distal gastrectomy for early gastric cancer in 1995 [14].

Based on our experiences in advanced laparoscopic surgery, we believe that performing totally laparoscopic gastric surgery, including resections, is complicated but feasible. Cases involving morbid obesity or gastric tumors, however, add an extra degree of difficulty. Especially when removing a mass in the stomach, the lack of tactile sensation may lead to misdiagnosis, lack of localization of the tumor, and inadequate assessment of lymphnode or liver metastasis. This is, indeed, one of the reasons why laparoscopic surgery has not been widely accepted in the oncologic setting [3]. Llorente reported a case with laparoscopic gastric resection due to gastric leiomyoma and explained that the tumor was identified by grasping with a Babcock clamp, but the center and perimeter of the lesion could not be ascertained [8]. In addition, laparoscopic gastrectomy requires extension of the skin incision to retrieve the specimen. Based on several case reports, range of the wound size for specimen retrieval is from 25 mm to 50 mm [1, 2, 4, 6-9, 11-14].

The Dexterity Pneumo Sleeve, in our laboratory and clinical investigation, appears to fill at least part of the void described above. The hand inserted into the abdominal cavity is an excellent instrument for retraction, suturing, knot tying, and gentle manipulation of the tumor. Even intracorporeal suturing, which many surgeons hesitate to do, can be done very easily and quickly. Using the Pneumo Sleeve, the size of the skin incision for the application of this device was 8 cm. Considering the benefit of using this device, the size of the skin incision is still acceptable. A 3- or 4-cm extension of the wound yields many advantages to laparoscopic surgeries such as tactile sensation, finger dissection, and retraction. These abilities improve the quality of the exploration of the abdominal cavity and decrease the opera-

tion time. In cases 1 and 3, operation times may not appear to be decreased significantly; however, considering the obesity of the patients, the severe adhesions, and difficulty of these procedures, we believe that the time saved in each case would have been measured in hours. Finally, the use of this device is not advanced for standard laparoscopic operations, such as cholecystectomy or hernioplasty, but it may be quite useful and suitable for advanced laparoscopic surgical cases.

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