


# Single-Access Transumbilical Laparoscopic Nissen Fundoplication Performed With New Curved Reusable Instruments

Surgical Innovation  
18(1) 61–65  
© The Author(s) 2011  
Reprints and permission: <http://www.sagepub.com/journalsPermissions.nav>  
DOI: 10.1177/1553350610384406  
<http://sri.sagepub.com>  


Giovanni Dapri, MD, FACS,<sup>1</sup> Jean Bruyns, MD,<sup>1</sup>  
Jacques Himpens, MD,<sup>1</sup> and Guy Bernard Cadière, MD, PhD<sup>1</sup>

## Abstract

**Introduction:** The authors report a single-access laparoscopic Nissen fundoplication (SALN) performed with new curved reusable instruments. **Case report:** A 21-year-old woman sought care for symptomatic grade B esophagitis and hiatal hernia. A reusable 11-mm trocar was inserted in the umbilicus and a 10-mm, 30° angled, nonflexible, standard length scope was used. Curved reusable instruments (Karl Storz-Endoskope) were transumbilically introduced without trocars. The left hepatic lobe was retracted thanks to the distal curve of the grasper. The cruraplasty and wrap were performed using curved needle holder and intracorporeal sutures. **Results:** No extraumbilical trocar was necessary. Laparoscopic time was 108 minutes, and umbilical scar length was 16 mm. Discharge was allowed after 48 hours. **Conclusions:** SALN is feasible to be performed with curved reusable instruments, which avoid the conflict between the instruments' tips inside the abdomen or between the surgeon's hands outside. Cost of the procedure remains similar to standard laparoscopy because only reusable material is used.

## Keywords

single access, single incision, single port, laparoscopy, Nissen fundoplication

## Introduction

The procedure of Nissen fundoplication was first performed by Rudolf Nissen in 1956 by open access.<sup>1</sup> With the introduction of minimally invasive techniques, this procedure was first performed by laparoscopy in 1991 by Dallemagne et al.<sup>2</sup> Since 2004, with the advent of the natural orifice transluminal endoscopic surgery (NOTES), surgeons were stimulated to perform procedures with invasiveness. Hence the fundoplication was first described using the transoral endoluminal approach in 2005 by Cadière et al.<sup>3</sup> Furthermore, through classic laparoscopy, less invasivity could be achieved with the decrease of abdominal scars number, using single-access laparoscopy (SAL). The authors report a laparoscopic Nissen fundoplication performed with curved reusable instruments through a single umbilical incision.

## Case Report and Surgical Technique

A 21-year-old woman sought care for symptomatic gastroesophageal reflux disease since 3 years. Preoperative workup, including gastroscopy, barium swallow, manometry, and pH-metry evidenced grade B esophagitis, besides a

small sliding hiatal hernia. A single-access laparoscopic Nissen fundoplication (SALN) through the umbilical scar was proposed to the patient. The technique was approved by our institutional surgical review board, and the patient consented for the operation. General anesthesia was used, and the patient was positioned supine with the arms alongside the body and the legs abducted. Surgeon stood between the patient's legs, camera assistant to the patient's right, and scrub-nurse to the patient's left. The video monitor was placed in front of the surgeon. The umbilicus was incised, and the peritoneal cavity was entered using the Hasson technique. A purse-string suture of 1 polydioxane (PDS) was placed in the umbilical fascia at 2, 4, 6, 8, 10, and 12 o'clock positions, respectively. After the

<sup>1</sup>Department of Gastrointestinal Surgery, European School of Laparoscopic Surgery, Saint-Pierre University Hospital, Brussels, Belgium

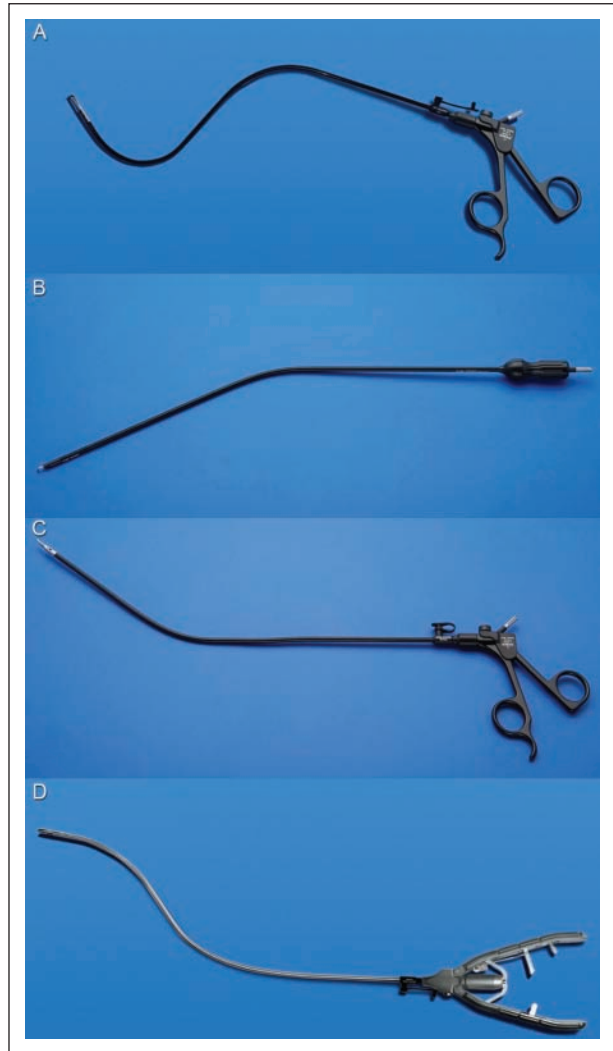
### Corresponding Author:

Giovanni Dapri, Department of Gastrointestinal Surgery, European School of Laparoscopic Surgery, Saint-Pierre University Hospital, 322, Rue Haute, 1000 Brussels, Belgium  
Email: [giovanni@dapri.net](mailto:giovanni@dapri.net)

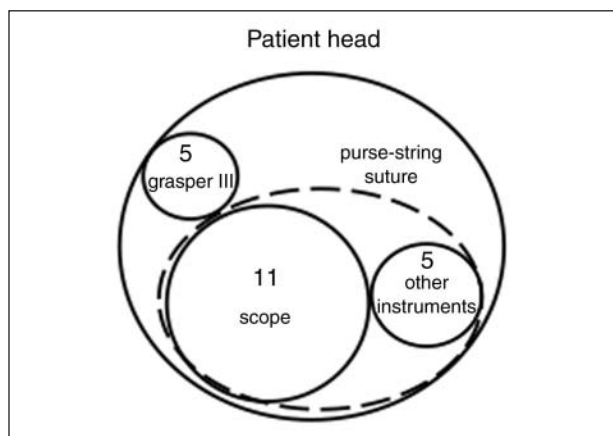
introduction of a reusable 11-mm trocar in the umbilicus, the pneumoperitoneum was established. A 10-mm, 30° angled, nonflexible, standard length scope was used (Karl Storz-Endoskope, Tuttlingen, Germany). Curved reusable instruments (Karl Storz-Endoskope, Tuttlingen, Germany) were inserted in the abdomen through the umbilicus without trocars. The curved grasping forceps III (Figure 1A) was advanced through a separate opening, 5 mm outside the purse-string suture at 10 o'clock, in the umbilical fascia. Other instruments such as curved coagulating hook (Figure 1B), curved scissors (Figure 1C), curved needle holder II (Figure 1D), curved suction device were introduced alongside the 11-mm trocar and inside the purse-string suture (Figure 2). Using the distal curve of the grasper, the left liver lobe was retracted exposing the opening of the hepatogastric ligament. The latter was opened close to the hepatic segment I, and the phrenogastric ligament was incised. The right crus was freed from bottom to top (Figure 3), as well as the left crus. The lower esophagus was encircled and suspended by a piece of umbilical tape using the curved grasper. A figure of 8 stitch using 2/0 silk was used to close the crura. Thanks to the peculiar shape of the instruments, the optical system never appeared in conflict with the instruments' tips (Figure 4A), and the conflict between the surgeon's hands and the scope was avoided (Figure 4B). The upper part of the gastric fundus was moved behind the lower esophagus and the short gastric vessels were dissected "à la demand." After having inserted a 34 Fr orogastric bougie, a floppy 360° fundoplication was performed using 2/0 silk sutures (Figure 5). The orogastric bougie, the piece of umbilical tape, and the instruments were finally removed under visual control. The purse-string suture was tied, and supplementary sutures were placed to close the separate opening for the grasper and to reinforce the access site.

## Results

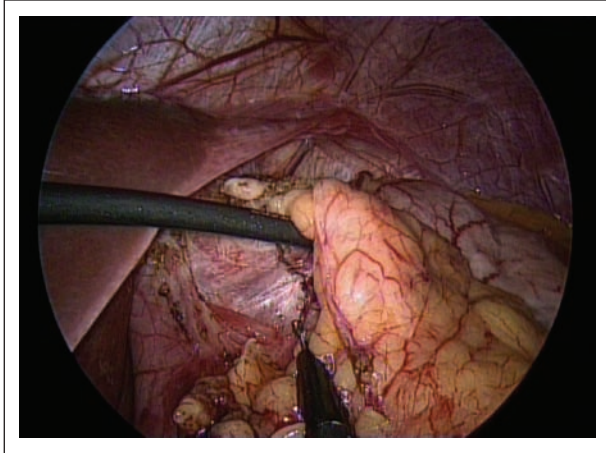
No conversion to standard laparoscopy with an extraumbilical trocar was necessary, and there were no perioperative complications. Blood loss was insignificant. Total operative time (between skin incision and fascia closure) was 122 minutes, and laparoscopic time (between the beginning of pneumoperitoneum and the removal of the instruments and trocar) was 108 minutes. The final scar length was 16 mm (Figure 6). The gastrograftin swallow on the first postoperative day showed good passage of the contrast through the wrap. Use of pain killers consisted of 1-g paracetamol intravenously pushed 3 times in the first 24 hours, and 1 time in the following 24 hours. The patient was allowed to leave the hospital on second postoperative day. On discharge, 500 mg paracetamol perorally was used 3 times par day for following 3 days. After 6 months the patient was doing well, and the cosmetic result was satisfactory.



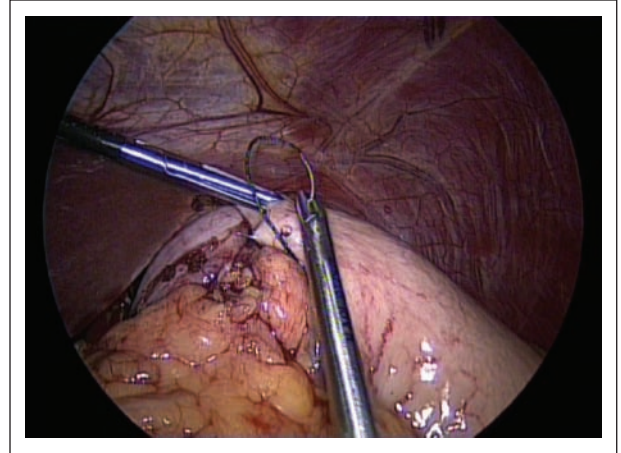
**Figure 1.** Curved reusable instruments according to DAPRI (courtesy of Karl Storz-Endoskope, Tuttlingen, Germany): grasping forceps III (A), coagulating hook (B), scissors (C), and needle holder II (D)



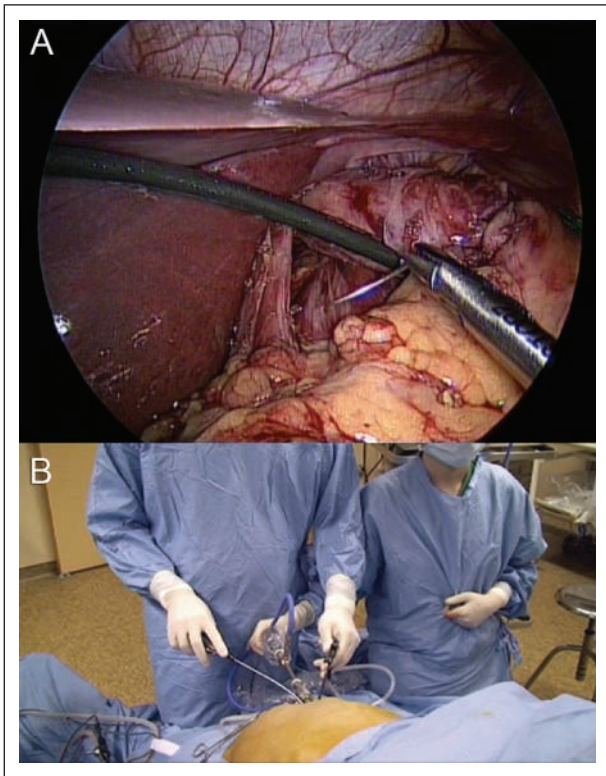
**Figure 2.** Placement of the curved instruments, scope, and purse-string suture through the umbilicus



**Figure 3.** Curved instruments' tips at the hiatus



**Figure 5.** 360° wrap performed by intracorporeal sutures with curved instruments



**Figure 4.** Absence of the conflict between the instruments' tips inside the abdomen (A) or between the surgeon's hands outside (B)

## Discussion

In recent years, thanks to the introduction of NOTES, a series of procedures performed through SAL has been published.

In the technique of SALN described here, a direct access without any disposable port was used. The curved grasping forceps III was introduced in the abdomen through a separate



**Figure 6.** Final umbilical scar length

opening in the umbilical fascia. This was a specific technical trick because the grasper was maintained in the nondominating surgeon's hand (left), and never changed during the entire procedure. In contrast, the curved instruments for the dominating surgeon's hand (right) were continuously changed during SALN. Hence the rationale of the placement of purse-string suture in the umbilical fascia, after opening of the peritoneal cavity. The suture was adjusted maintaining a tight seal around the 5-mm tools and the 11-mm trocar, and opened enough only for changing of the instruments or evacuation of the smoke, created during the dissection. The pneumoperitoneum was maintained during the entire procedure, thanks to the use of a trocar no smaller than 11 mm.

A nonflexible standard length scope was used during SALN as during classic Nissen fundoplication,<sup>4</sup> also if the umbilicus was lower for cosmetic concerns.

The curved grasping forceps III and the curved needle holder II mainly present 2 curves: at the umbilicus, avoiding



the conflict between the surgeon's hands and the scope outside the abdomen and between the umbilicus and the instruments' tips, establishing an internal working triangulation. The jaws opening of the curved needle holder II were placed at 45° in the respect of the main shaft. This trick permits just a quarter rotation of the surgeon's wrist to pass or to remove the stitch in the tissue, and it avoids the potential damage with the viscera inside the abdomen. Furthermore, the distal curve of the grasper permitted to push the left liver lobe anteriorly, thereby increasing the operative field exposure. This latter aspect remains one of the main problems during SAL.<sup>5</sup> Another valid option used to increase the exposure of the hiatus is the placement, under the liver, of a penrose drain suspended by percutaneous suture<sup>6</sup> or transhepatic percutaneous sutures.<sup>7</sup>

The curved coagulating hook and the curved scissors are similar in shape, and present only one curve, created to avoid the collision between the surgeon's hands outside the access.

Because of the curved shape, the surgeon was able to work in very ergonomic position, similar to classic laparoscopy. During the entire procedure there was no clashing of the instruments or crossing of the surgeon's hands, as frequently evidenced during SAL.<sup>5</sup> Obviously the surgeon needs a learning curve to maneuver the curved tools with a certain stability and safety as in classic laparoscopy. This aspect, coupled with the time to perform intracorporeal sutures, is a time-consuming factor, but in SAL it is known that the procedure improves over time while progressing through the learning curve.<sup>8-11</sup>

In the technique reported here, total operative time was less than that reported in literature with a similar access,<sup>6</sup> but compared with classic laparoscopy it can be considered quite long. These data can be explained by the partial time needed to enter the peritoneal cavity and to place the purse-string suture in the umbilicus, as well as the final time to close the umbilical fascia. The pure laparoscopic time, however, was influenced by the understanding of the way these instruments are manipulated, especially to perform intracorporeal sutures. These latter aspects were the main differences between SALN and classic laparoscopy. Hence we strongly believe in the selection of the patients for SALN<sup>12-14</sup>, with exclusion of those with body mass index greater than 35 kg/m<sup>2</sup> and those presenting a giant hiatal hernia. Otherwise the transumbilical approach becomes difficult and the operative time longer.

The wrap was fashioned using 2 stitches, which did not pass through the lower esophagus and the stomach, since the wrap was fixed more distally using the Rossetti stitches. This technique was chosen for a floppy Nissen benefitting of the natural position of the wrap.

The final umbilical scar was less than 2 cm because only one reusable 11-mm trocar was inserted in the umbilicus and the instruments were advanced without trocars. Hence,

no use of disposable ports was needed and the final scar length was kept similar to that in classic laparoscopy. This aspect, added to the fact that all the instruments used are reusable, kept the cost of SALN low and similar to the cost of classic laparoscopy.

The patient experienced very little pain killers, probably because of the reduction in the number of the cutaneous incisions, as already reported.<sup>15-16</sup> These data need confirmation by randomized trial comparing SALN, needlescopic Nissen, and classic laparoscopic Nissen fundoplication.

In conclusion, SALN is feasible to be performed with curved instruments, which avoid the conflict between the instruments' tips inside the abdomen or between the surgeon's hands outside. The cosmetic result is improved, the postoperative pain is minimal, and the cost of the procedure is similar to standard laparoscopy.

### Authors' Note

This paper is presented as video presentation during the 96th Annual Clinical Congress of the American College of Surgeons, Washington D.C. (MA, US), October 3-7, 2010.

### Declaration of Conflicting Interests

The author(s) declared a potential conflict of interest (e.g., a financial relationship with the commercial organizations or products discussed in this article) as follows:

G. Dapri is a consultant for Karl Storz-Endoskope, Tuttlingen, Germany. Other authors have no conflict of interest or financial ties to disclose.

### Funding

The author(s) received no financial support for the research and/or authorship of this article.

### References

1. Nissen R. A simple operation for control of reflux esophagitis. *Schweiz Med Wochenschr* 1956;86:590-592.
2. Dallemagne B, Weerts JM, Jehaes C, Markiewicz S, Lombard R. Laparoscopic Nissen fundoplication: preliminary report. *Surg Laparosc Endosc*. 1991;1:138-143.
3. Cadière GB, Rajan A, Rqibate M, et al. Endoluminal fundoplication (ELF) - evolution of EsophyX, a new surgical device for transoral surgery. *Minim Invasive Ther Allied Technol*. 2006;15:348-355.
4. Cadière GB, Houben JJ, Bruyns J, Himpens J, Panzer JM, Gelin M. Laparoscopic Nissen fundoplication: technique and preliminary results. *Br J Surg*. 1994;81:400-403.
5. Romanelli JR, Earle DB. Single-port laparoscopic surgery: an overview. *Surg Endosc*. 2009;23:1419-1427.
6. Hamzaoglu I, Karahasanoglu T, Aytac E, Karatas A, Baca B. Transumbilical totally laparoscopic single-port Nissen

- fundoplication: a new method of liver retraction: the Istanbul technique. *J Gastrointest Surg*. 2010;14:1035-1039.
7. Huang CK, Houng JY, Chiang CJ, Chen YS, Lee PH. Single incision transumbilical laparoscopic Roux-en-Y gastric bypass: a first case report. *Obes Surg*. 2009;19:1711-1715.
  8. Saber AA, Elgamal MH, Itawi EA, Rao AJ. Single incision laparoscopic sleeve gastrectomy (SILS): a novel technique. *Obes Surg*. 2008;18:1338-1342.
  9. Tacchino R, Greco F, Matera D. Single-incision laparoscopic cholecystectomy: surgery without a visible scar. *Surg Endosc*. 2009;23:896-899.
  10. Romanelli JR, Roshek TB II, Lynn DC, Earle DB. Single-port laparoscopic cheolecystectomy: initial experience. *Surg Endosc*. 2010;24:1374-1379.
  11. Chow A, Purkayastha S, Paraskeva P. Appendectomy and cholecystectomy using single-incision laparoscopic surgery (SILS): the first UK experience. *Surg Innov* 2009;16:211-217
  12. Hong TH, You YK, Lee KH. Transumbilical single-port laparoscopic cholecystectomy: scarless cholecystectomy. *Surg Endosc*. 2009;23:1393-1397.
  13. Teixeira J, McGill K, Binenbaum S, Forrester G. Laparoscopic single-site surgery for placement of an adjustable gastric band: initial experience. *Surg Endosc*. 2009;23:1409-1414.
  14. Gill IS, Advincula AP, Aron M, et al. Consensus statement of the consortium for laparoendoscopic single-site surgery. *Surg Endosc*. 2010;24:762-768.
  15. Saber AA, El-Ghazaly TH, Dewoolkar AV, Slayton SA. Single-incision laparoscopic sleeve gastrectomy versus conventional multiport laparoscopic sleeve gastrectomy: technical considerations and strategic modifications [Published online ahead of print March 19, 2010]. *Surg Obes Relat Dis*. doi:10.1016/j.soard.2010.03.004.
  16. Raman S, Franco D, Holover S, Garber S. Transumbilical single incision laparoscopic adjustable gastric banding is safe and results in decreased pain medicine usage. *Surg Obes Relat Dis* 2010;6:S8 (abstract)