

Laparoendoscopic Single-Site Nephrectomy Using Standard Laparoscopic Instruments

Our Initial Experience

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Purpose: To report our initial experience with laparoendoscopic single-site (LESS) nephrectomy using a GelPOINT single port and standard laparoscopic instruments.

Materials and Methods: Laparoendoscopic single-site transperitoneal nephrectomy was done for 6 adult patients with a poorly functioning small or hydronephrotic kidney. The procedure was done with the GelPOINT system, which consisted of a wound retractor (Alexis) and GelSeal cap. Standard laparoscopic instruments were used and the renal pedicle was controlled with 10-mm Hem-o-Lok clips.

Results: The participants were 3 men and 3 women with the median age of 29.5 years. Laparoendoscopic single-site nephrectomy was successfully done in all the patients without any major complications. Median operation time was 110 minutes (range, 90 to 130 minutes). There was no need for blood transfusion in any patient. The recovery phase was uneventful and all the patients were discharged after a median hospital stay of 2.5 days (range, 2 to 3 days). Renal function remained stable in all the patients after the operation. The incision site healed well on postoperative follow-up.

Conclusion: Our initial experience with LESS nephrectomy was successful with the use of a GelPOINT single port and standard laparoscopic instruments. This report may remove barriers to further work with the LESS technique and may offer a strategy to help surgeons gain experience with this novel technology.

Keywords: laparoscopy, nephrectomy, kidney diseases, methods, adverse effects

INTRODUCTION

Recently, laparoscopic single-site (LESS) surgery has become a popular advance in laparoscopic surgery. Using multichannel single ports inserted via a single incision and applying articulating devices or robotic systems, LESS surgery aims to offer a less morbid procedure with a better cosmetic outcome compared to standard laparoscopy.⁽¹⁾ The cosmetic benefits of LESS nephrectomy have been documented in multiple trials while improvement in convalescence measures remains questionable.^(2,3)

The main obstacle to the widespread use of LESS nephrectomy is its inherent technical difficulty, since this technique does not follow the triangulation principle of conventional laparoscopy. Various single port systems, along with specialized curved, articulating, or robotic systems, have been proposed to overcome these difficulties. Brown-Clerk and colleagues compared the surgeon's performance on a surgical simulator with the three most widely available single port systems (TriPort, Olympus America Inc, Center Valley, PA, USA; SILS port, Covidien, Mansfield, MA, USA; and GelPOINT, Applied Medical, Rancho Santa Margarita, CA, USA). They showed that the GelPOINT system offered better results in terms of surgeon's performance and convenience.⁽⁴⁾

We report our experience with LESS nephrectomy using the GelPOINT single port approach and standard laparoscopic instruments. To the best of our knowledge, this is the first report of outcomes obtained with LESS nephrectomy in our region.

MATERIALS AND METHODS

From October 2011 to February 2012, we performed 6 LESS nephrectomy in adults. The benefits of this kind of surgery and the possible need for conversion to standard laparoscopy were explained to each patient before the operation.

All the patients had symptomatic poorly functioning small or hydronephrotic kidneys because of chronic pyelonephritis or chronic obstructive uropathy due to missed ureteropelvic junction obstruction or obstructive stone disease. Neither of them had previous abdominal surgeries. Functioning of the target kidney was evaluated by pre-operative intravenous urography and technetium-99m dimercaptosuccinic acid

scintigraphy.

After admitting the patients one night prior to their operation and pre-operative administration of a single intravenous dose of ceftriaxone and light bowel preparation, all the patients underwent LESS nephrectomy performed by the same surgeon (A.A.).

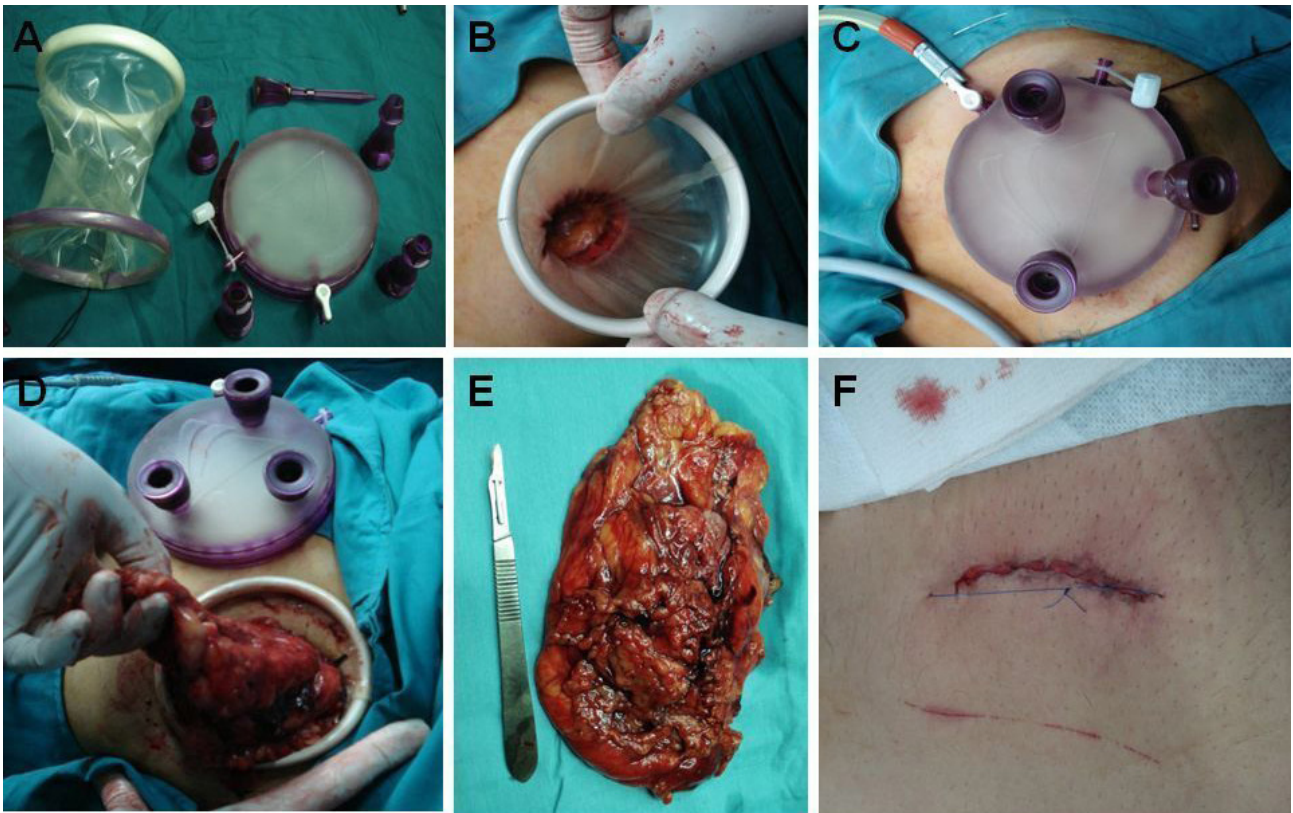
Surgical Technique

The patient was placed in the flank position and supported by adequate padding. Through a 3 to 4 cm incision in or lateral to the umbilicus, the peritoneal cavity was entered and the wound retractor of the GelPOINT system (Alexis) was fixed to the wound (Figure). Three multipurpose ports (instruments accepted: 4.7 to 10 mm) were built on the GelSeal cap; then the cap was attached to the wound retractor and pneumoperitoneum was established. A 10-mm, 30° laparoscope and two 5-mm standard laparoscopic scissors and dissector were used. For right side nephrectomy, a needloscopic instrument was passed through the subxiphoid area for the liver retraction.

The procedure was done according to a standard protocol. Briefly, after complete medial mobilization of the colon (and the duodenum on the right side), the ureter and renal pedicle were found. The renal artery and vein were fully dissected and double-clipped separately with 10-mm Hem-o-Lok clips (Weck Closure Systems, Research Triangle Park, NC, USA). If severe hydronephrosis was present, the collecting system was drained percutaneously with a Chiba needle to achieve better exposure of the renal pedicle. After division of the renal pedicle, the kidney was mobilized completely and extracted via the single port site, which was then closed securely.

RESULTS

The participants consisted of 3 men and 3 women with the median age of 29.5 years. Of 6 patients, 4 had poorly functioning kidneys due to missed ureteropelvic junction obstruction (Table). In all patients, LESS nephrectomy was completed successfully without any major complications, such as visceral or great vessel injury (Figure). Median operation time was 110 minutes (range, 90 to 130 minutes). Blood loss was minimal in all procedures. There was no need for blood transfusion in any patient.



(A) The GelPOINT system consists of a wound retractor/protector (Alexis) and 4 multipurpose ports that accept 4.7 to 10 mm instruments. The trocars can be built on the GelSeal cap containing a flexible polymer gel;
 (B) The wound retractor can be fixed to a 3 to 4-cm incision to provide a 360° atraumatic wound retraction;
 (C) The GelSeal cap is attached to the wound retractor and pneumoperitoneum is established;
 (D) Specimen retrieval from the site of single port;
 (E) The hydronephrotic kidney due to missed ureteropelvic junction obstruction, which was removed from the site of laparoendoscopic single-site nephrectomy; and
 (F) The site of laparoendoscopic single-site nephrectomy.

Peri-operative data for patients who underwent laparoendoscopic single-site nephrectomy.*

Patient No.	Age, y/ gender	Target kidney	Operation time, min	Body mass index, kg/m ²	Hematocrit Pre-op/Postop, %	Creatinine Pre-op/Postop, mg/dL
1	35/F	Right small size ^a (5 cm)	100	32	39.9/38.1	1.1/1.2
2	56/M	Left HN ^b (15 cm)	110	35	42.6/42.3	1.3/1.1
3	42/M	Right HN ^c (11 cm)	130	35	41.4/40.5	1.6/1.4
4	25/M	Left HN ^b (12 cm)	120	30	44.1/39.3	0.8/0.9
5	34/F	Left small size ^a (6 cm)	90	25	38.4/33	0.7/0.7
6	17/F	Left HN ^c (12 cm)	110	25	37.2/35.4	0.9/0.9

* F indicates female; M, male; and HN, hydronephrotic.

^a Chronic pyelonephritis

^b Chronic obstructive uropathy due to missed ureteropelvic junction obstruction

^c Chronic obstructive stone disease

The recovery phase was uncomplicated and all the patients were discharged after a median hospital stay of 2.5 days (range, 2 to 3 days). Mean hematocrit drop 6 hours after the surgery was 2.5 (from 40.6 before to 38.1 after the operation). Renal function remained stable in all the patients after the operation. The patients were followed up on regular clinical visits. Mean follow-up period was 2.7 months (range, 1 to 6 months). The incision site healed well on postoperative follow-up.

DISCUSSION

Since the first introduction in 1991, laparoscopic nephrectomy has become the accepted standard technique at many centers.⁽⁵⁾ The first LESS nephrectomy was reported by Rane and colleagues in 2007.⁽⁶⁾ This procedure opens new horizons towards improvement in endoscopic surgery in terms of cosmetic outcome and postoperative morbidity. With LESS nephrectomy, the port sites are located at a single incision, through which the specimen is later retrieved.

Although multiple comparative studies documented the potential cosmetic benefits of LESS nephrectomy, questions remain as whether LESS is superior to conventional laparoscopic nephrectomy in terms of postoperative morbidity.^(7,8)

Compared to conventional laparoscopic surgery, no advantages in terms of postoperative pain, hospital stay, or return to work have yet been proven.

The main disadvantages of LESS surgery are limited movement of the working instruments and ports, no triangulation, and the parallel axis of the camera and instruments. These obstacles can be overcome by special articulating or curved instruments in order to prevent instrument collision. This novel platform also poses challenges, such as instrument inversion and crossing over, since the surgeon's right hand controls the left instrument and vice versa. Furthermore, the articulating or prebent instruments currently available can be difficult to use because they are bulky and nonergonomic. Therefore, the learning curve is a potential challenge.⁽⁹⁾

Simforoosh and associates described their initial experience with mini-laparoscopic donor nephrectomy as a more ergonomic and user-friendly procedure compared with LESS nephrectomy. They performed laparoscopic donor nephrectomy using a 5-mm camera port in the umbilicus, two 3.5-

mm trocars over the abdomen, and a 10-mm working port on the suprapubic area, which was extended at the final step of the procedure as a Pfannenstiel abdominal incision on a hair growing area for specimen extraction. They showed that this configuration will bring about a favorable cosmetic outcome while the principles of standard laparoscopy would be appreciated. Furthermore, using standard laparoscopic instruments, a smooth learning curve could be anticipated with their novel technique.⁽¹⁰⁾

The wound retractor/protector (Alexis) plays a crucial role in the GelPOINT system. It can accommodate a 1.7 to 7-cm incision, and due to its 360° atraumatic wound retraction feature, it increases the standpoints of working instruments, which leads in turn to a wider range of motion and thus helps prevent instrument collision. With the Alexis instrument, the surgeon can adjust the incision size to the size of specimen.

A further advantage is that the GelSeal cap contains a flexible polymer gel. Since the surgeon can apply 10-mm universal trocars anywhere in the gel, greater flexibility is achieved. These features facilitate the use of standard laparoscopic instruments to perform the procedure in a familiar manner. As shown in Figure, we put the trocars in a triangular fashion. During the major parts of the operation, we used the lowermost trocar for the laparoscope, which remained between the two working instruments. This configuration is intuitive and mimics the conventional laparoscopy. With the use of 30° laparoscope, the camera holder was able to visualize the operative fields by rotational movements of the lens rather than moving the lens in axial plane. Therefore, the clashing between the laparoscope and instruments would be dramatically reduced.

Despite these advantages, we, as novice LESS surgeons, still have some difficulties during medial to lateral dissection and dissection of the upper pole of the kidneys. Previously, Chung and associates reported their experience with retroperitoneoscopic LESS radical nephrectomy using standard laparoscopic instruments. Compared with transperitoneal LESS nephrectomy, they found more limitations in working space, but the distance and the angle of the dissection of the upper pole were much easier in retroperitoneoscopic approach.⁽¹¹⁾ We found that switching the position of the surgeon and assistant as well as changing the camera port was

helpful in overcoming difficulties during dissection of the upper pole of the kidney or the adrenal gland.

This report, to the best of our knowledge, describes the first experience with LESS nephrectomy in our region. However, our sample (consisting of only 6 cases) is too small to draw definite conclusions. Comparative studies are needed to determine whether the LESS technique is superior to traditional laparoscopic nephrectomy in terms of postoperative morbidity. Despite these limitations, our report may be helpful to novice LESS laparoscopists, who wish to become more familiar with this emerging technology.

CONCLUSION

The GelPOINT system offers a suitable platform for single-site laparoscopic nephrectomy with standard laparoscopic instruments. The flexibility of this system helps novice LESS surgeons to overcome the limited range of movement and avoid instrument clashes.

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CONFLICT OF INTEREST

None declared.

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