

LESS living donor nephrectomy: Surgical technique and results

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Abstract

Purpose: We present the findings of 50 patients undergoing pure trans-umbilical laparo-endoscopic single-site surgery (LESS) living donor nephrectomy (LDN), between February 2010 and May 2014.

Materials and Methods: Laparo-endoscopic single-site surgery LDN was performed through an umbilical incision. Different trocars were used, namely Gelpoint (Applied Médical, Rancho Santa Margarita, CA) SILS port (Covidien, Hamilton, Bermuda), R-port (Olympus Surgical, Orangeburg, NY) and standard trocars, inserted through the same skin incision but using separate fascial punctures. The standard laparoscopic technique was employed. The kidney was pre-entrapped in a retrieval bag and extracted trans-umbilically. Data were collected prospectively including questionnaires containing patient reported oral pain medication duration and time to recovery.

Results: LESS LDN was successful in all patients. Mean warm ischemia time was 6.2 min (3–15), mean procedure time was 233.2 min (172–300), and hospitalization stay was 3.94 days (3–7) with a visual analogue pain score at discharge of 1.32 (0–3). No intraoperative complications occurred. The mean time of oral pain medication was 8.72 days (1–20) and final scar length was 4.06 cm (3–5). Each allograft was functional.

Conclusion: Although challenging, trans-umbilical LESS LDN seems to be feasible and safe. Hence, LESS has the potential to improve cosmetic results and decrease morbidity.

Key Words: Laparo-endoscopic single-site surgery, laparoscopy, living donor nephrectomy, minimally invasive, single port

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INTRODUCTION

Since laparoscopic living donor nephrectomy (LDN) was described in 1995 by Ratner *et al.*,^[1] it has become the reference for many academic centers because it offers similar

rates of complication and transplant success.^[2,3] Classically, this technique uses three to five small incisions for the placement of the trocars as well as an iliac incision of about 6–8 cm to extract the kidney.

In 2007, a new minimally invasive approach was developed by using a single multi-trocar valve that allows interventions in a pure trans-umbilical way.^[4] The so-called laparo-endoscopic single-site surgery (LESS) LDN technique was first carried out at the Cleveland Clinic by using 2 mm instruments introduced with a Veress needle (Covidien, Hamilton, Bermuda).^[5] In this report, we present our experience of pure trans-umbilical LESS LDN.

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MATERIALS AND METHODS

Between February 2010 and May 2014, 50 patients that had volunteered to donate a kidney to a close relative underwent trans-umbilical LESS LDN. All donors were evaluated by a multidisciplinary team to gather donation criteria. Demographic and biological data, as well as complications (Clavien classification), were collected in a prospective way during the initial hospitalization and again during follow-up.

The functional evaluation was based on creatinine level and Modification of the Diet in Renal Disease (MDRD) clearance (MDRD = $186 * (\text{serum creatinine})^{-1.154} * (\text{age})^{0.203} * (0.742 \text{ for women}) * (1.212 \text{ for patients of African origin}) \text{ ml/min/1.73 m}^2$).^[6,7]

The pain was evaluated using the visual analogue pain scale based on four daily measures and a daily average. After discharge, patients completed a questionnaire concerning the duration of oral analgesic used, the occurrence of any complications, and the time to 100% recover from the physical after effects of the surgery. In the case of complications, patients were seen again for evaluation and treatment in addition to the control consultations at 1 and 3 months.

Trocars

For the first patient, two trocars were used: The SILS port (Covidien, Hamilton, Bermuda) and R-port (Olympus Surgical, Orangeburg, NY). For the subsequent six procedures, standard trocars were used (one 12 mm, one 10 mm, and two 5 mm). Then, for the remaining ones, we used either the SILS port or the Gelpoint (Applied Medical, Rancho Santa Margarita, CA).

Optics

During the first intervention, an Olympus Endoeye camera was used. For the subsequent six ones, we used a standard camera and one 10 mm optic, 30° (Storz, Tuttlingen, Germany). For the remaining ones, we used one 5 mm optic, 30° (Storz, Tuttlingen, Germany).

Instruments

Curved, but not articulated instruments were used for the first patient (HiQ LS hand instruments, Olympus Surgical). For the others, standard laparoscopic instruments were used.

Technique

Patients were placed in a 45° flank position. Skin incision was carried out in the umbilicus vertically at approximately 3 cm visually (smoothing out the umbilicus corresponded to a real length of 4–5 cm). The incision was slightly diverted at the bottom to avoid detaching the umbilicus. The 5–6 cm vertical

midline anterior rectus fasciotomy was then performed. The absence of adhesions was checked.

When the R-port or SILS port was used, the fascia was partially closed with an oversewing of vicryl to avoid CO₂ leakage around the single port and to prepare for the kidney extraction. The single port was then introduced by an incision (manually with the SILS port and with a dedicated ancillary for the R-port).

When using conventional trocars, the fascia was opened only to place the 10 mm trocar for the optics. Other trocars (2 mm × 5 mm; 1 mm × 12 mm) were placed through the same trans-umbilical cutaneous incision but used a separate fascia puncture. The usual LDN technique was then carried out. In doing so, the descending colon, spleen, and tail of the pancreas are mobilized generously, such that they retract medially.

The ureter and gonadal vein were then located and elevated off the psoas. The gonadal vein was left intact and followed to the renal vein. The renal vein was skeletonized, and the adrenal vein was clipped with a Hem-O-Lock® clips (Teleflex Medical, Research Triangle Park, NC, USA) and divided. The renal vein was then dissected until the level of the inter-aortocaval region and the artery was dissected to its aortic origin. The ureter was clipped and divided under the iliac artery, and the kidney was freed from its attachments.

The kidney was then placed in a retrieval bag that was partially closed, leaving only the artery and vein outside and taking care not to compromise its vascularization. The section of vessels began only when the table to prepare the transplant was ready with the transplanting surgeon available to prepare the kidney.

Two Hem-O-Lock® clips, as well as one metal clip (Endo clip by Covidien, Hamilton, Bermuda), were placed on the artery before transection. For the renal vein, two Hem-O-Lock® clips were placed before transection. The kidney was extracted by activate the closure of the extraction bag, having already loosened the fascial oversewing to allow for an extraction without compression. The transplanting surgeon was responsible for the preparation and transplantation.

When using several trocars, an incision was made between the two most distant trocars to open the fascia widely. For that purpose, the pneumoperitoneum was left in position to facilitate the incision. The fascia was then partially closed to allow for the establishment of a new single port to check for hemostasis.

Closure was carried out after parietal infiltration by the NAROPIN with two hemi oversewing of braided absorbable 0 suture for the fascia, an oversewing the subcutaneous tissue by

During LDN, the time of warm ischemia must be minimized to avoid kidney injury. The reported time of warm ischemia varies from 2.6 to 6 min.^[10-12] However, <10 min, no degradation of the kidney function is noticed.^[13] A previously published warm ischemia time under the LESS LDN approach was 6.31 min, which is similar to our series.^[14]

Various technical possibilities exist to reduce this time of warm ischemia. First, the fascia is open widely in order to minimize extraction time. When normal trocars or SILS ports are used, a temporary continuous suture is performed to avoid CO₂ leakage. When the Gelpoint is used, the fascia is left open ready for the kidney extraction. Then, the kidney is pretrapped in a retrieval bag before the pedicle transection. It is also essential not to compress the transplant during the extraction by opening the fascia and skin for an atraumatic extraction. In the near future, robotics may allow surgeons to bypass these technical difficulties with specific systems for LESS.^[15]

Concerning operating morbidity, the laparoscopic approach decreases the duration of hospitalization, postoperative pain, and blood loss while assuring a functional result similar to open surgery.^[16] Under the LESS approach, postoperative pain is further decreased compared with laparoscopy,^[14] where trocars can push into the abdominal muscles and cause pain during movement. The passage of trocars in a transmuscular way is thought to be responsible for postoperative pain. For example, a reduction in the size of the trocars used in classic laparoscopy decreases operating morbidity. Mostafa *et al.* compared patients who were operated on with 2 mm instruments with those operated on by using classic instruments. The former group had, on average, shorter hospital stays (1.3 vs. 3.2 days), a lower use of analgesic, and a faster return to normal activities.^[17] The average duration of analgesic intake was 8.72 days in our study, which is similar to the published results, compared with approximately 20 days for classic laparoscopies.^[5,14]

The psychological aspect of healthy patients is also important. Indeed, it is current practice to notice that the pain felt by living donors is more important than that felt by cancer patients, even when they underwent the same type of intervention. With the trans-umbilical LESS approach, the fact that the final scar is hidden in the umbilicus and thus almost invisible plays a role in the fast recovery of patients.

Convalescence is also shorter with LESS: 5 weeks in our study, 3 weeks in Gill *et al.*'s series, and 7 weeks with conventional laparoscopy.^[5,14] This decrease in convalescence time with a faster return to work can represent a socioeconomic advantage.

Other LESS LDN approaches have also been described. Andonian *et al.* presented a LESS technique that uses a

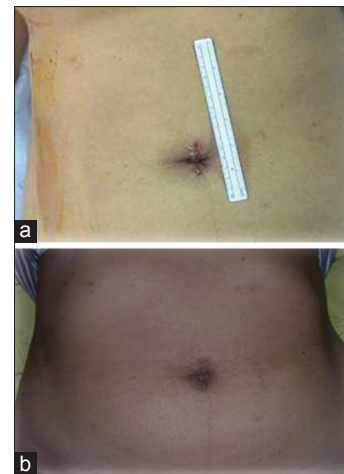


Figure 3: (a) Immediate postoperative scar. (b) After 6 months

Pfannenstiel incision.^[18] Although this technique seems to cause fewer hernias compared with classic iliac extraction, it can have a significant local neuropathy. Allaf *et al.* described an LDN with vaginal extraction.^[19] The initial results seem to be encouraging with a mean warm ischemia time of 3 min and a hospital stay of 24 h.

In addition, it is necessary to underline that in France in 2009, approximately 10,675 patients were awaiting kidney transplants with only 10% of allografts coming from living donors.^[20] We hope that an improved donation experience with the trans-umbilical LESS LDN approach will lead more people to become kidney donors.

CONCLUSION

Trans-umbilical LESS LDN, although technically difficult, provides very promising results. In addition to the cosmetic improvement [Figure 3], it seems to be less painful and have a shorter convalescence time. Nevertheless, a larger number of studies, particularly comparative and prospective studies, remain necessary to define the LESS.

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