Laparo-endoscopic single-site nephrectomy: initial experience

Laparo-endoskopik tek taraflı nefrektomi: İlk deneyim

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Abstract

Objective: Laparo-endoscopic single-site surgery (LESS), an attempt to further enhance the cosmetic benefits of minimally invasive surgery while minimizing the potential morbidity associated with multiple incisions, has been recently developed. The aim of this study was to report the results of our initial LESS-simple nephrectomy (LESS-SN) experience and to define potential benefits.

Materials and methods: Between December 2008 and December 2009, LESS-SN were performed in 15 patients requiring simple nephrectomy by a single experienced surgeon. Patient characteristics, operative details and time to return to work were recorded.

Results: The mean operative time was 119.6±15 (range 100-150) min, blood loss was 52±18 (range 20-80) mL, and hospitalization time was 2.06±0.2 (range 2-3) day. The mean time to return to normal activities was 10.86±1.84 (range 9-15) days. No significant intraoperative or postoperative complications occured.

Conclusion: The main advantages of LESS-SN are better cosmetic results and minimal postoperative pain. LESS-SN may take the place of conventional transperitoneal laparoscopic-simple nephrectomy and may be considered a routine, safe, and effective surgical procedure in simple nephrectomy for benign renal diseases.

Key words: Laparo-endoscopic single-site surgery; laparoscopy; nephrectomy; single port.

Özet

Amaç: Laparo-endoskopik tek taraflı cerrahi (*Laparo-endoscopic single-site surgery,* LESS) multipl insizyonlarla ilişkili potansiyel morbiditeyi azaltırken minimal invazif cerrahinin kozmetik faydalarını daha da iyileştirmeye çalışan yakın zamanda gelişmiş bir cerrahidir. Bu çalışmanın amacı ilk LESS-basit nefrektomi (*LESS-simple nephrectomy,* LESS-SN) deneyimi sonuçlarımızı bildirmek ve potansiyel faydalarını tanımlamaktır.

Gereç ve yöntem: Aralık 2008 ile Aralık 2009 tarihleri arasında, basit nefrektomi gereken 15 hastaya bu konuda deneyimli aynı cerrah LESS-SN uygulandı. Hasta karakteristikleri, operasyon detayları ve hastaların normal aktivitelerine dönüş zamanları kayıt edildi.

Bulgular: Ortalama operasyon süresi 119.6±15 (dağılım 100-150) dk, kan kaybı 52±18 (dağılım 20-80) mL ve hastanede kalış süresi 2.06±0.2 (dağılım 2-3) gün idi. Normal aktiviteye dönüş zamanı 10.86±1.84 (dağılım 9-15) gün idi. Belirgin intraoperatif veya postoperatif komplikasyon oluşmadı.

Sonuç: Başlıca avantajları daha iyi kozmetik sonuç ve minimal postoperatif ağrı olan LESS-SN, benign böbrek hastalıklarının tedavisinde rutin olarak kullanılabilecek ve *conventional transperitoneal laparoscopic-simple nephrectomy*'nin yerini alabilecek etkin ve güvenli bir cerrahi işlem olabilir.

Anahtar sözcükler: Laparo-endoskopik tek taraflı cerrahi; laparoskopi; nefrektomi; tek port.

Submitted (Geliş tarihi): 10.02.2010 *Accepted after revision (Düzeltme sonrası kabul tarihi):* 12.04.2010

Laparoscopic nephrectomy has gained popularity because of decreased morbidity, shorter length of hospital stay, rapid convalescence, faster return to normal activity, reduced pain, and better cosmetic results compared with open nephrectomy. Since the introduction of laparoscopy in the early 1990s ushered in a new area in the surgical treatment of human diseases, there has been a trend toward minimizing the number of incisions and ports required and this has led to the description of laparo-endoscopic single-site surgery (LESS). In published literature various terms have been used for this procedure, but the LESS consortium for assessment and research (LESS-CAR) accepted the term LESS for all single

incision procedures to avoid confusion with multiple terminologies.[1]

Since the initial report of single-port nephrectomy in 2008 by Rane et al.,[2] single-port laparoscopic procedures such as donor nephrectomy,[3] pyeloplasty,[4] and ureterolithotomy[2] have been performed. Only a few retrospective studies comparing the results of the LESS-nephrectomy procedure to conventional laparoscopic nephrectomy technique are currently available.[5,6] The aim of this study was to evaluate the results of our initial LESS-simple nephrectomy (LESS-SN) experience.

Materials and methods

Patient selection

Between December 2008 and December 2009, 15 patients requiring simple nephrectomy underwent LESS-SN. All procedures were performed by the first author who is experienced on laparoscopic surgery. The indications for the LESS-SN were benign disease of the kidney. Patients had surgery after obtaining informed consent.

Surgical procedures

All patients were operated under general anesthesia. The LESS-SN procedure was carried out with the patient positioned in a 45^0 flank position for transperitoneal surgery, a 2-cm semilunar-shaped skin incision was concealed completely within the umbilicus, and deepened to the anterior rectus fascia, where a 2.5-cm fascial incision was made, the peritoneum was incised, and the SILS-Port (Covidien, Norwalk, CT, USA) was deployed. SILS-Port was placed intraperitoneally with the help of clamp (Fig. 1). A pneumoperitoneum was created by carbon dioxide insufflation and the pressure was kept at 10-15 mmHg. For LESS-SN procedures a 5 mm, 30^0 high-definition rigid laparoscope with integrated different cameras (Karl Storz, Tuttlingen, Germany and Gimmi, Tuttlingen, Germany) were used along with two working instruments. During operations a combination of flexible forceps and scissors (Cambridge Endoscopic Devices, Cambridge, MA, USA and Tyco Healthcare Group LP, North Haven, CT, USA) and a conventional laparoscopic (straight) instruments (eg. scissors, ultrasonography scissors, bipolar forceps) were used to perform the procedures as necessary. During operations the straight instrument in the left hand was used to dissect the tissue, while roticulating laparoscopic graspers hold in the right hand were used to retract the tissues. In all stages we used one straight and one angulated instrument. Operation time was calculated beginning from first skin incision.

Figure 1 Placement of the single incision laparoscopic surgery-port.

All LESS procedures were performed through an intraumbilical single-access multichannel laparoscopic port, the SILS-Port (Covidien, Norwalk, USA). During LESS procedures no additional port was used for tissue retraction, and all procedures were purely performed through SILS-Port. In this procedure, an additional prolene mesh was designed as a hammock and attached to the abdominal wall with the help of sutures. Hem-o-lok clips was used for liver retraction during right nephrectomies. Sutures for liver retraction were passed transabdominally by 60-mm straight needle (Caprosyn, Covidien, Norwalk, US). During operations the straight instrument in the left hand was used to dissect the tissue while the peritoneal incision along the line of Toldt was performed with a roticulating laparoscopic scissors hold in the right hand (Cambridge Endoscopic Devices, Cambridge, MA, US) (Fig. 2). The pedicle was controlled by clipping the artery and vein separately using Hem-o-lock XL or L size clips. The morcellated specimens were removed through the umbilical incision. Histopathological examination was performed for all specimens. The drain was removed in the next day morning after the procedure. For standart laparoscopic cases, routine postoperative care was followed.

The main perioperative parameters evaluated were operative time, blood loss, transfusion rates, postoperative pain, perioperative complications (occuring within

the first month of nephrectomy procedure), hospitalization time and the time to return to normal activities.

The visual analogue scale (VAS) and the required analgesic during the postoperative course were used to evaulate the postoperative pain. The evaluation of pain was achieved with the documentation of the patient's perceived pain on VAS scale that ranged from 1 to 10. VAS was measured at 3 days and 3 months postoperatively. The analgesic medication for the first two postoperative days was recorded.

The medication used for analgesia was meperidine and was administered intramuscularly at 50 mg each time, if necessary. The patient's satisfaction was assessed postoperatively. We have not yet quantified or compared scar satisfaction with a validated questionaire, therefore the scar satisfaction was not used in the present study.

Postoperative assessments include ultrasonography, urinalysis, and serum creatinine assay, which were performed routinely after the operation on the 1st month (Fig. 3).

The values were presented as mean±standart deviation (minimum-maximum).

Results

Baseline characteristics and perioperative data of patients are shown in Table 1. All LESS-SN procedures were completed succesfully with no conversions to conventional laparoscopic or open surgery. There was no mortality. All patients were ambulatory and accepted oral foods on the day after the operation.

The drainage tube was removed in the next day morning in all cases, while we did not place any drain in our first patient. The patient who had no drain suffered from abdominal pain and discomfort in early postoperative period. Both the VAS and the postoperative use of analgesic were assessed during postoperative days 1, 2, and 3 (Table 2).

The mean operative time was 119.6±15 (range 100-150) min, blood loss was 52±18 (range 20-80) mL, and hospitalization time was 2.06±0.2 (range 2-3) day. The mean time to return to normal activities was 10.86±1.84 (range 9-15) days (Table 1). No significant intraoperative or postoperative complications occured.

LESS-SN clearly resulted in excellent cosmesis without visible scars. Although our patients seem extremely satisfied with their postoperative cosmetic outcomes, scar satisfaction was not used in the present study. We have not yet quantified or compared scar satisfaction with a validated questionaire.

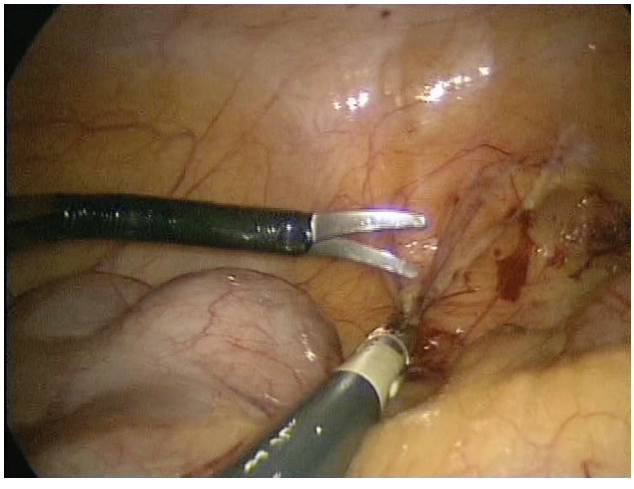

Figure 2 Incision along the line of Toldt with a roticulating laparoscopic scissor hold in the right hand and straight instrument in the left hand.

Figure 3 Postoperative view after laparoendoscopic single-site surgery-simple nephrectomy on day 30.

Nephrectomy was performed for benign kidney diseases in all cases consistent with chronic pyelonephritis and interstitial fibrosis without evidence of malignancy. Indications for nephrectomy included chronic pyelonephritis in 2 (13.3%) patients, hydronephrotic atrophy due to ureteropelvic junction obstruction in 2 (13.3%) patients, calculous kidney with chronic pyelonephritis in 3 (20%) patients, renal vascular hypertension in 1 (6.6%) patient, atrophic kidney in 3 (20%) patients, and protracted loin pain in non-functioning kidney in 4 (26.6%) patients. The mean period of follow-up was 3 months.

Table 1. Demographic parameters, perioperative variables, and short-term measures of convalescence [mean±standard deviation (min-max) or n (%)]

Number of patients	15
Age (years)	38.73±10.27 (19-56)
Gender	
Male	7 (46.6%)
Female	8 (53.4%)
Body mass index (kg/m^2)	27.46±3.15 (21-32)
Operative time (min)	119.66±15.17 (100-150)
Estimated blood loss (mL)	52±18.68 (20-80)
Kidney size (cm)	9.8±3.03 (4-14)
Time to return to normal activities (day)	10.86±1.84 (9-15)

Table 2. Average values of postoperative pain perception and analgesia requirement (mean±standard deviation)

Average value of the pain score	
On the day of operation	3.13±1.12
First postoperative day	2.4±0.63
Second postoperative day	1.6±0.63
Third postoperative day	0.86±0.63
Average consumption of meperidine (mg) after the operation	
On the day of operation	66.66±24.39
First postoperative day	50.00±0.00
Second postoperative day	20.00±25.35

Postoperative assessments were normal. All patients were symptom-free on follow-up.

Discussion

In the past few years the laparoscopic approach to nephrectomy has gained widespread acceptance in the manegement of benign and malignant kidney diseases. New techniques have been developed to decrease the number of ports needed for safe laparoscopic surgery. As a result, interest in the introduction of LESS in various urologic surgeries has increased.[2,7]

Recently, a few retrospective studies comparing LESS-nephrectomy with conventional transperitoneal laparoscopic-nephrectomy (CTL-N) have been reported.[5,8] The purpose of the present study was to evaluate the feasibility of LESS-SN to define potential benefits of LESS-SN.

Raman et al.[8] compared a series of 11 LESS-SN to a group of CTL-SN. Nephrectomy was performed for both non-functioning kidney and enhancing renal mass. No differences in operative time, complication rate, narcotic analgesic usage, postoperative hospitalization time, or transfusion requirement were observed between LESS-SN and CTL-SN. But, estimated blood loss was significantly lower in the LESS-SN group than in the CTL-SN group. Another similar study was reported by Raybourn et al.[5] Their study has many similarities with the study by Raman et al.[8] Raybourn et al.[5] also compared 11 LESS-SN cases with 10 CTL-SN cases. However, they matched the comparison for the specific surgery. All procedures were simple nephrectomies for non-functional kidneys in the study by Raybourn et al.[5] whereas in that by Raman et al.[8] they contributed 45%. Raybourn et al.[5] reported that operative time, complication rate, and narcotic analgesic usage showed no significant difference between study groups.

Canes et al.[6] recently reported a retrospective comparison of LESS and standart laparoscopic left donor nephrectomy. Their preliminary data suggest that LESS donor nephrectomy shortens convalescence, as measured by pain medication requirement after discharge, time-off work, and time to resolution of physical symptoms. Although the limitation of these studies is inherent in their retrospective natures, LESS donor nephrectomy is certainly comparable or preferable to the conventional laparoscopic nephrectomy with regard to the subjective cosmetic results and objective surgical results.

In the present stusy, all nephrectomy procedures were entirely performed by the first author who is experienced on laparoscopic surgery. Due to perirenal inflammation, scarring, and loss of anatomic landmarks; it is especially difficulty to perform the hilar dissection in these cases. Correspondingly, several authors have emphasized the higher conversion and complication rate in such cases of non-functioning kidneys with underlying stone and/or infectious pathologies.[9] Therefore, in such cases we did not open Gerota's facia to avoid complications and conversion to an open procedure.

From the technical point of view, there are two approaches for laparoscopic simple nephrectomy-transperitoneal and retroperitoneal. In retroperitoneal laparoscopy, the kidney and its blood vessels are relatively easier to reach, but the working space is smaller, the orientation is difficult, and the ergonomy

of the procedure is less than optimal due to the smaller working space and limitations by bony structures such as the ribs and iliac crest. We think that transperitoneal LESS-SN is easier to perform compared to retroperitoneal approach,[10] thus all LESS-SN procedures were performed transperitoneally in our study.

In the present study, there was no complication in patients undergoing LESS-SN procedure. We belive that operative complications related to trocar insertion such as epigastric vessel injury, visceral organ damage and herniation might be reduced by eliminating the need of ancillary ports. In standard laparoscopic surgery, three to six laparoscopic ports are needed, and each working port risks morbidity from pain, bleeding, hernia, and/or internal organ damage, and even undesirable cosmesis, even though trocar site incisions are small and usually do not cause a problem for the patient.[11,12]

The single incision may decrease other complications related to surgical incisions such as bleeding, internal organ damage, wound infection, and incisional hernia.[5,8] The operative complications related to trocar insertion such as epigastric vessel injury, visceral organ damage, wound infection, and port-site herniation would bring patients excessive suffering and cost. These intraoperative and postoperative complications might be reduced by performing LESS-SN procedure. In obese patients incidence of wound infection may increase secondary to fat necrosis. In one of our patients we observed wound infection secondary to fat necrosis. We think that obesity has no special affect on LESS operation as SILS-port is thick enough to pass the abdominal wall easily.

There are a few limitations of this study. Our study has small number of patients. Present study should have been performed on a larger series of patients. Although our patients seem extremely satisfied with their postoperative cosmetic outcomes, a standardized quality of life scores would also have been used to assess the patient's satisfaction.

The results of our study suggests that LESS-SN is a safe, effective, and minimally invasive alternative surgical option to CTL-SN. We think that LESS-SN will take place of CTL-SN in the near future with better cosmesis and patient satisfaction.

Conflict of interest

No conflict of interest was declared by the authors.

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doi:10.5152/tud.2010.024