

Laparoendoscopic single-site simultaneous bilateral nephrectomy: first reported case series

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Bilateral renal tumors in patients on dialysis are usually managed with bilateral nephrectomy. With traditional laparoscopy, this procedure requires the insertion of multiple trocars. Laparoendoscopic single-site surgery (LESS) uses a single umbilical incision to insert multiple instruments and is also employed for extraction of specimens. This technique appears especially useful for bilateral nephrectomy, since many access ports can be spared. We describe 5 cases of simultaneous bilateral radical nephrectomies performed at a single academic institution. We had no intraoperative complications and a mean operating time of 155 minutes. Four patients could be resected using this approach; one case was converted to a traditional laparoscopy. One case had a postoperative complication. We believe this technique is feasible, and can be accomplished with acceptable morbidity and adequate operative time.

Key Words: laparoendoscopic single-site surgery ↔ single-port laparoscopy
↔ bilateral nephrectomy ↔ renal neoplasms

INTRODUCTION

The incidence of renal cell carcinoma (RCC) in patients with end-stage renal disease (ESRD) is higher than in the general population, with a 5–20-fold relative risk [1]. Bilateral involvement occurs in 2–4% of sporadic cases of RCC, but in ESRD patients it occurs up to 36% of cases [2]. The standard management for these patients is bilateral nephrectomy. Laparoscopy is widely used in renal surgery, but in bilateral cases, it would require the insertion of multiple trocars. In an attempt to reduce pain and improve cosmesis, new minimally invasive techniques, like laparoendoscopic single-site surgery (LESS) have been developed. LESS uses a single umbilical incision to insert multiple instruments and

is also employed for extraction of specimens. Since 2007 when the first LESS urologic procedure was described [3], this technique has evolved and many reports have been published [4] confirming its feasibility. This access appears especially useful for bilateral nephrectomy, since many access ports can be spared. We describe a case series of LESS bilateral simultaneous radical nephrectomies performed in ESRD patients at a single academic institution.

MATERIAL AND METHODS

A retrospective review of our surgical registry was performed, identifying every patient undergoing LESS bilateral simultaneous radical nephrectomies from 2008 to 2018. Patients and surgical

characteristics, intra and postoperative complications were described.

Patients were positioned in semi-lateral decubitus. After induction with general anesthesia, a four centimeters umbilical incision was created making room for the single-site access device. At the beginning Quadport® and then Quadport+® (Olympus, Orangeburg, New York) were used. With regular straight laparoscopic instruments, the line of Toldt was incised exposing Gerota's fascia. The renal hilum was dissected and controlled using Hem-o-lok (Teleflex Medical, Research Triangle Park, NC). Specimens were extracted using an endoscopic bag. After finishing one side, while keeping the access device in-situ, patients were draped covering the abdomen and making sure to keep sterility. Afterwards they were changed to the contralateral position for the second nephrectomy. Patients on peritoneal dialysis (PD) were transiently transferred to hemodialysis. We describe the preoperative features and postoperative evolution of the patients.

RESULTS

During the mentioned period, five patients were treated using this approach. The patients' mean age was 50 years. The average body mass index (BMI) was 23 kg/m². Mean Charlson comorbidity index was 6.2 points. Forty percent had diabetes. All patients had ESRD, 60% on hemodialysis and 40% on PD. Two patients were previously transplanted with non-functioning grafts at the time of surgery. Patient's characteristics are summarized in Table 1. The mean size of the biggest tumor in the preoperative CT-scan was 28 (11–70) mm. Mean operative time was 155 (125–240) minutes. We did not observe any intraoperative complications. One case was converted to a conventional laparoscopic surgery due to difficult dissection in both sides. This same patient had a postoperative Clavien-Dindo grade IIIb complication that is described later. Median hospital stay was 8 (5–21) days. Pathologic report confirmed RCC in four cases and, and the remaining one showed bilateral oncocytomas.

On postoperative day one, a patient presented with signs of bleeding. A retroperitoneal hematoma was shown on CT-scan in the left renal fossa. Patient underwent a first angiography study that showed active bleeding but could not locate the site of origin. Patient was explored performing a laparotomy. Clots were evacuated, but no active bleeding was observed. Since transfusion requirements were maintained, the patient was once again submitted to an angiography. This time, a dissection of the common left iliac artery was seen. Even though no active bleed-

ing was observed, a covert stent was displaced. The patient was discharged in good condition at postoperative day 21.

Operative and postoperative outcomes are summarized in Table 2. Patient n° 2 could resume PD a few weeks after surgery. On the other hand, patient n° 5 could not, since he had been submitted to a laparotomy. He had his PD catheter removed a few months later.

DISCUSSION

The first bilateral LESS simple nephrectomy was performed in 2009 [5] in a transplanted patient with uncontrollable renin-dependent hypertension using a Tri-port® (Advanced Surgical Concepts, Bray, Ireland) single incision system. In 2011, the first LESS radical nephrectomy was carried out using a Gel-Point® (Applied Medical, Rancho Santa Margarita, CA) [6]. Since then, no case series in adult patients have been reported. There is only a pediatric series of 4 cases in pre-transplant population (18 months–18 years), these were attempted with the SILS® port (Covidien, Dublin, Ireland). No intraoperative, nor postoperative complications were reported [7].

In order to perform a classic laparoscopic bilateral nephrectomy, at least five or six ports are necessary, and one of those must be widened for kidney removal. Each additional port adds potential risk for bleeding, incisional hernia, internal organ damage, and decreases cosmetic results. An alternative to insert fewer trocars can be the use of a hand-port which requires at least a 7–8 cm incision for the hand to fit inside the abdomen, which is bigger than the 4 cm incision used for LESS. LESS approach offers a good solution for bilateral nephrectomies, permitting a unique incision for bilateral dissection and specimen removal. The main drawbacks of LESS are the lack of triangulation and the crowding of instruments. This phenomenon makes the dissection harder and causes instruments to clash. These difficulties can be overcome using extra 5 mm trocars and articulated instruments as done in some of our cases. In a multi-institutional report of more than a thousand cases of LESS urologic cases, 23% required an additional port, of these, one third was only a 2–3 mm port and the rest were 5–12 mm ports [8].

In the literature, we can find many randomized and non-randomized comparative studies, showing equivalence in terms of efficacy and safety between LESS unilateral nephrectomy and traditional laparoscopy. Even some studies show less pain, shorter recovery time, and better cosmetic outcome [9, 10, 11]. A recent randomized controlled trial compared

Table 1. Preoperative features of patients submitted to bilateral laparoendoscopic single-site surgery nephrectomy

	Sex	Age	BMI (kg/m ²)	CCI	Previous abdominal surgery	RRT
Patient 1	M	53	26.96	6	Cholecystectomy Renal transplant (4) Appendectomy Renal graft removal (1) Left partial nephrectomy Right partial nephrectomy	HD
Patient 2	M	35	22.12	4	PD catheter installation	PD
Patient 3	M	58	20.2	5	None	HD
Patient 4	M	46	22.15	8	None	HD
Patient 5	M	62	24.06	8	PD catheter installation Left partial nephrectomy Incisional hernia repair	PD

BMI – body mass index; CCI – Charlson comorbidity index; ESRD – end stage renal disease; RRT – renal replacement therapy; HD – hemodialysis; PD – peritoneal-dialysis

Table 2. Operative and postoperative outcomes

	RT size (mm)	LT size (mm)	OT (min)	Additional trocar	Histology	LOS	Complication (Clavien-Dindo)
Patient 1	9	24	145	No	Chromophobe renal carcinoma	10	No
Patient 2	15	19	135	No	Papillary renal carcinoma type II	5	No
Patient 3	8; 5	11	125	No	Papillary adenoma and oncocytomas	5	No
Patient 4	11; 17; 9	13; 8; 2; 11; 7	130	No	Eosinophilic chromophobe renal carcinoma	8	No
Patient 5	70	14; 25	240	Yes (Conversion to traditional laparoscopy)	Renal clear cell carcinoma and papillary adenoma	21	Retroperitoneal hemorrhage (IIIb)

RT – right kidney tumors; LT – left kidney tumors; OT – operative time; LOS – length of stay

these two techniques regarding quality of life. Perioperative outcomes, complication rates and pain were equivalent in both techniques. But in terms of quality of life: emotional status, physical comfort, psychological support and physical independence was significantly better in the LESS group [12].

The most robust evidence comparing LESS to traditional laparoscopy comes from the living-donor population. A meta-analysis showed that LESS is a safe and effective option for kidney donation surgery, even showing a slight decrease in analgesia requirement compared to the traditional approach [13]. A Cochrane Database review was conducted confirming that pain scores at discharge were significantly lower for LESS [14].

The mean operative time in our series was 155 min which is shorter than the reported cases [5, 6]. Our center has a vast experience in minimally invasive surgery especially in living donor nephrectomies which could account for this brief operative time. As already described in a meta-analysis there is no difference between the complications of LESS ne-

phrectomy and traditional laparoscopy [10]. Morbidity in LESS upper-tract surgery has been reported in the literature around 10–16%, slightly lesser than our series. These complications include splenic capsule tear, diaphragmatic injury, wound infections, port-site hematoma, bowel injury, neuropraxia, etc. [10, 15, 16]. We had no cases of conversion to open surgery but conversion to classic laparoscopy was required in one case. Adding more trocars has been associated with a higher risk of morbidity [16]. The complicated patient had a previous left partial nephrectomy which could have contributed to more difficult surgical planes.

There is no consensus about the optimal time for reinitiating PD. Reported cases of nephrectomy on PD patients have started dialysis between 5 days and 1 month after surgery [17]. Even though it has not been formally studied, higher body mass index may be associated with a higher risk of catheter leak, wound infection and peritonitis [18], making weight an important factor to consider when deciding to operate on a patient on PD.

Robotic LESS has been used for radical unilateral nephrectomies, showing less analgesia requirements and a shorter length of stay when compared to traditional laparoscopy [19]. Even though we could not find any report of bilateral radical nephrectomy using this approach, we are aware of only one case of bilateral robotic single-site partial nephrectomy [20]. This was performed using a home-made port made of an Alexis wound retractor and a glove. The authors managed to resect a 28 mm right tumor and a 6 mm enhancing cyst in the left kidney in 350 minutes with 238 minutes console time. Robotic-assisted surgery should be kept for complex tumors keeping in mind the cost associated with its use. In our cases of radical nephrectomies probably the major costs outweighs the advantages of robotics. There is lack of evidence comparing LESS bilateral nephrectomy to traditional laparoscopy. Prospective

randomized trials are necessary to determine the advantages and disadvantages of this technique especially in bilateral cases. Also a cost-effectiveness analysis comparing the expenses of both techniques would be of interest. That information would be of value to analyze which is the best way to go with these patients.

CONCLUSIONS

To our knowledge, this is the first case series of laparoendoscopic single-site surgery (LESS) bilateral nephrectomy in adults. In our opinion, this technique is feasible, and can be accomplished with acceptable morbidity and adequate operative time.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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