Transumbilical laparoendoscopic single-site partial nephrectomy using a microwave tissue coagulator

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Abstract Transumbilical single-port laparoscopy has emerged as a method to further enhance cosmetic benefits and reduce morbidity. We present an initial experience with transumbilical laparoendoscopic single-site partial nephrectomy (LESS-PN). A 36-year-old woman visited our hospital for the treatment of a left exophytic renal cell carcinoma, 17 mm in diameter, located at the lower pole. We decided to use transumbilical LESS-PN to treat this case. A multichannel port was placed through the center of the umbilicus, and the tumor was exposed using bent laparoscopic instruments. The tumor was then removed after microwave tissue coagulation. All procedures were performed without renal artery occlusion, and only slight bleeding occurred. Transumbilical LESS-PN using a microwave tissue coagulator was performed with an excellent cosmetic outcome and no complications. To the best of our knowledge, this is the first report of LESS-PN using a microwave tissue coagulator.

Keywords LESS · Laparoscopy · Partial nephrectomy · Microwave tissue coagulator · Renal cell carcinoma

Introduction

Transumbilical laparoendoscopic single-site surgery (LESS), also known as embryonic natural orifice transumbilical

endoscopic surgery, has emerged as a method with which to attempt to further enhance cosmetic benefits and reduce wound morbidity. LESS is a technically difficult procedure because the surgical instruments have a limited range of motion and instruments often clash unless surgeons use a crossover technique and bent instruments [1]. Recently, LESS has also been used in urological procedures such as nephrectomy, adrenalectomy [2], and prostatectomy [3]. LESS partial nephrectomy (LESS-PN) has been performed by some experienced laparoscopic surgeons [4–7], and they reported that LESS-PN was technically feasible, albeit more challenging than conventional laparoscopic partial nephrectomy (LPN) and that proper case selection was essential.

Herein, we present our initial experience with transumbilical LESS-PN. To the best of our knowledge, this is the first report of LESS-PN using a microwave tissue coagulator.

Case report

A 36-year-old woman visited our hospital for surgery related to a left renal tumor that had been detected during an annual health checkup. Computed tomography showed a well-enhanced exophytic tumor. The tumor was small, 17 mm in diameter, and located at the lower pole of the left kidney (Fig. 1). The preoperative diagnosis was renal cell carcinoma (cT1a N0 M0), and transumbilical LESS-PN was planned. Her height and weight were 157.5 cm and 43 kg (body mass index 17.3 kg/m²). Under general anesthesia, the patient was placed in the right lateral decubitus 60° flank position. A multichannel port (SILSTM port, Covidien, Mansfield, USA) was inserted through a vertical 2-cm skin and fascial incision placed directly

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Fig. 1 CT demonstrated a left renal tumor at the lower pole (*arrow*)

Fig. 2 Intraoperative photograph of microwave tissue coagulation around the renal tumor. The *arrow* indicates the microwave tissue coagulator, and the *arrowhead* the renal tumor

through the center of the umbilicus. Pneumoperitoneum was established through the gas inlet of the SILS™ port. A 5-mm flexible laparoscope (Olympus Surgical, Tokyo), bent laparoscopic instruments (Roticulator, Endo Mini-Shears, Covidien), and laparoscopic electrodes (Opti 4, Covidien) were used. The descending colon was dissected from Gerota's fascia and retracted medially. Although we anticipated that the tumor could be resected without renal artery clamping, it was dissected enough to enable us to clamp in preparation for unexpected bleeding. Gerota's fascia was incised and the kidney was defatted at an adequate distance from the tumor. A 10-mm flexible ultrasound probe was inserted through the SILS™ port, and the size and depth of the tumor were identified. The planned sites of puncture were 5 mm from the tumor margin, and every 7 mm along the demarcation line to make the coagulated surfaces overlap each other. Under ultrasound guidance, microwave tissue coagulation was performed with a Microtase AZM-520 (Alfresa-Pharma, Osaka, Japan) (Fig. 2). Each session consisted of 45 s of

Fig. 3 Postoperative photograph of skin incision

coagulation at 50 W and 15 s of dissociation. After coagulation, the tumor was resected using cold scissors. Even though all procedures were performed without renal artery occlusion, only a slight degree of bleeding from the resected site was observed. The resected site was coagulated with an argon beam coagulator (APC300, Erbe, Marietta, USA) and sealed with Bolheal (The Chemo-Sero-Therapeutic Research Institute, Kumamoto, Japan). The specimen was removed using an EndoCatch bag (Covidien). No drainage tube was inserted. The peritoneum and rectus fascia were closed with absorbable sutures and the skin was closed with a subcuticular suture (Fig. 3). The operative time was 119 min. The postoperative serum creatinine value was 0.5 mg/dL, which had not changed from the preoperative value. She was discharged on postoperative day 5. The histopathological diagnosis was clear cell carcinoma, G1 > G2, pT1a, and the surgical margin was negative.

Discussion

LPN is a generally accepted surgical procedure for treating localized small renal cell carcinomas 4 cm or less in size. Although a major problem associated with traditional LPN is the control of bleeding from the resected site, hemostasis has been safely obtained by various procedures such as tumor resection after radiofrequency ablation [8] or microwave tissue coagulation [9, 10] around a tumor, ultrasound dissection [11], hydro-jet dissection [11], and usage of argon beam coagulation [12] or a holmium:YAG laser [12] after tumor resection.

Recently, transumbilical LESS has emerged in an attempt to further advance minimally invasive surgery compared to traditional laparoscopic surgery, and more specifically the enhancement of cosmetic benefits and

reduction of wound morbidity. Although the parallel placement of surgical instruments during a single-port approach can hinder the surgeon [3], several clinical reports have recently emerged in the urologic literature. There have been also a few reports of transumbilical LESS-PN [4–7]. Intracorporeal suturing in LESS is more difficult than that in conventional laparoscopic surgery because of instrument clashing and limited range of motion; therefore, hemostasis of the resected site using an effective device is extremely important for LESS-PN. Some hemostatic methods such as tumor excision using a Harmonic Scalpel [5] and use of an argon beam coagulator after tumor resection [5] have been reported. To the best of our knowledge, LESS-PN using a microwave tissue coagulator has not been reported until now.

The microwave tissue coagulator, which was introduced by Tabuse [13], is useful for controlling parenchymal bleeding in solid vascular organs. Kagebayashi et al. [9] and Naito et al. [10] reported that this apparatus was also useful in PN, and some reports have described its effectiveness during LPN [14]. Microwaves cause thermal coagulation in renal tissues around the electrode, and a bloodless area is obtained through the vascular constriction caused by this thermal effect. Furthermore, it enables incision of the renal tissue without vascular clamping and intracorporeal suturing of renal parenchyma is unnecessary; thus, we thought that it might also be useful for LESS-PN. However, an adverse influence on residual renal function as a result of more extensive injury to the renal parenchyma by the microwave tissue coagulator was definitely a concern. Kondo et al. [15] compared the postoperative relative dimercaptosuccinic acid (DMSA) uptake between cold-ischemic PN with renal artery clamping and non-clamping PN using a microwave tissue coagulator, and concluded that there was no significant difference with regard to residual renal function between the two procedures. Meanwhile, concern regarding possible collateral damage to the surrounding arteries, veins, and the urinary collecting system by a microwave tissue coagulator has also been raised [16]. Once the urinary collecting system is opened during a PN using a microwave coagulator, surgical repair by suturing is difficult because of the fragility of heat-damaged tissue [10]. Also, unexpected massive renal infarction by heat damage to the main artery located near the tumor was reported [16]. Therefore, PN using a microwave tissue coagulator should be restricted in cases in which the tumor is situated near the renal hilum or urinary collecting system. We believe that an exophytic small tumor at a sufficient distance from the renal hilum and urinary collecting system is an indication for LESS-PN using a microwave tissue coagulator. If it is difficult to control the bleeding from the tumor resection site, conversion to conventional LPN should be considered

immediately and hemostasis should be promptly obtained by suturing the renal parenchyma after renal artery clamping. Thus, we think that a renal artery should be sufficiently dissected to a degree that enables the surgeon to clamp in preparation for unexpected bleeding in LESS-PN using a microwave tissue coagulator.

In the present case, the body mass index of the patient was 17.3 kg/m² and the amount of Gerota fat on imaging study was only slight. In addition, the exophytic tumor was located at the lower pole of the kidney. We were fortunate in that the conditions were favorable for us to perform our initial case of transumbilical LESS-PN. We chose a method using a microwave tissue coagulator, and it was performed with a tolerable level of hemostasis. Although our experience is limited, the tumor was easily identified, and all procedures were safely performed.

Conclusions

Transumbilical LESS-PN using a microwave tissue coagulator was performed with an excellent cosmetic outcome and no complications. Although our experience is limited, the safety and feasibility of LESS-PN using a microwave tissue coagulator was demonstrated in this case.

Conflict of interest The authors declare that they have no conflict of interest.

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