# Transperitoneal Laparoscopic Partial Nephrectomy Using a New Technique

Akbar Nouralizadeh, Seyed Amirmohsen Ziaee, Abbas Basiri, Nasser Simforoosh, Hamidreza Abdi, Nastaran Mahmoudnejad, Amir H Kashi

**Introduction:** We report our experience with a new technique for transperitoneal laparoscopic partial nephrectomy with the kidney turned upside down intraoperatively.
**Materials and Methods:** Laparoscopic partial nephrectomy was performed in 10 patients with upper pole lesions through a transperitoneal approach. Once complete mobilization of the kidney was achieved, it was rotated 180 degrees around the horizontal axis, so that the upper pole was positioned inferiorly. After performing partial nephrectomy, the resection bed was sutured by 2-0 polyglactin sutures and application of Hem-o-Lok clips. Then, the kidney was returned into its normal position and fixed to the abdominal wall.
**Results:** We performed laparoscopic partial nephrectomy on 9 patients with a contrast-enhancing upper pole kidney mass and 1 patient with a nonfunctioning upper pole. The median tumor size was 58 mm (range, 41 mm to 92 mm). The median operative time was 206 minutes (range, 114 to 262 minutes) and the mean warm ischemia time was 30 minutes (range, 22 to 35 minutes). One patient underwent surgical exploration due to bleeding 6 hours after the operation. Prolonged urine leakage (more than 7 days) was observed in 1 patient, which responded to ureteral stent insertion. Surgical margins were negative in all of the patients. Renal cell carcinoma was histologically diagnosed in patients with a kidney tumor.
**Conclusion:** Laparoscopic upper pole partial nephrectomy had acceptable results while the kidney was turned upside down intraoperatively, in terms of operative time and complications. This approach facilitates the procedure by achieving a better field of vision.

*Keywords: nephrectomy, laparoscopy, renal cell carcinoma, urologic surgical procedures*

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*Urology and Nephrology Research Center and Shaheed Labbafinejad Medical Center, Shaheed Beheshti University of Medical Sciences, Tehran, Iran*

*Corresponding Author:*
*Akbar Nouralizadeh, MD*
*Urology and Nephrology Research Center, No 101, 9th Boustan St, Pasdaran Ave, Tehran, Iran*
*Tel: +98 21 2256 7222*
*Fax: +98 21 2277 0954*
*E-mail: nouralizadeh@yahoo.com*

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## INTRODUCTION

Laparoscopic partial nephrectomy (LPN) is an acceptable alternative option for small kidney tumors,[1-3] and similar long-term outcomes in terms of oncology have been shown with LPN when compared to open partial nephrectomy (OPN).[4] However, greater intraoperative technical complexity of this operation and its perioperative complications have limited the spread of indications for LPN.[5]

Laparoscopic upper pole partial nephrectomy (LUPPN) is associated with difficulties in tumor visualization and resection.[1,3] Some authors have proposed modifications to facilitate LUPPN.[1] Since the inferior and anterior kidney masses are accessible for laparoscopic surgery with a good field of vision, we speculated that rotation of the kidney for operations on upper pole posterior tumors can provide the surgeon with the benefits from the advantages of operating laparoscopically on the inferior and anterior tumors. We present our experience with this new technique of rotating the kidney to facilitate tumor visualization and resection during LUPPN.

## MATERIALS AND METHODS

### Patients

Between September 2003 and October 2007, 9 patients with a contrast-enhancing upper pole mass in the kidney (Figure 1) and 1 patient with a nonfunctioning upper pole kidney and kidney calculus underwent LUPPN using a new technique. We had the experience of 246 laparoscopic radical nephrectomies and 56 LPNs through the study period and before then, and to facilitate LUPPN attempted a modified technique of rotating the kidney for the operation. The patients were evaluated preoperatively by history taking, physical examination, chest radiography, urinalysis, abdominal computed tomography (CT), and serum biochemistry tests including creatinine, calcium, phosphorus, aspartate aminotransferase, alanine aminotransferase, alkaline phosphatase, and the total and direct bilirubin.

### Surgical Technique

Our surgical approach was transperitoneal LPN. The patients were secured in the flank position. Four trocars (5 mm and 10 mm) were placed through the umbilicus, pararectal, subcostal, and midline areas. After mobilization of the colon, the renal artery and vein were exposed. The surrounding tissues were dissected from the kidney and the kidney was mobilized. The perinephric fat was dissected off the kidney except for the fat overlying the tumoral tissue. A bulldog clamp was applied on the renal artery before rotating the kidney. Then, we rotated the kidney 180 degrees over its pedicular axis, so that the upper pole was located inferiorly (Figure 2). As a result, the posterior upper pole mass was located anteriorly and inferiorly, allowing complete visualization of the tumor and easy recognition of the dissection plane that facilitated dissection by rigid laparoscopic instruments. The tumor mass was dissected off the kidney by a cold knife, maintaining a safety margin of 5 mm. The specimen was extracted by an endobag. The adrenal gland was removed together with upper pole nephrectomy in patients with upper pole renal mass. Resection bed was sutured by polyglactin 2-0 sutures and application of Hem-o-Lok clips. The pyelocaliceal system was repaired by freehand suturing with 4-0 polyglactin sutures. No bolster or ureteral stent is used in the LPN operations performed in this center, as indicated before.[6] The clamp on the renal artery was removed and after confirming homeostasis, the kidney was returned to its original position (Figure 3), and it was sutured to the abdominal wall with 2-0 polyglactin sutures.

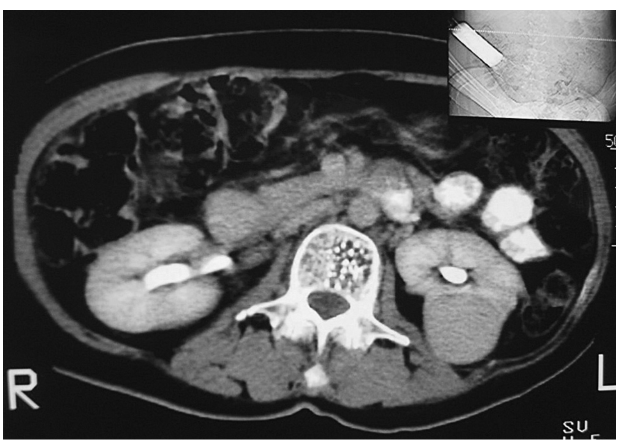


**Figure 1.** Computed tomography showed an upper pole left kidney mass.

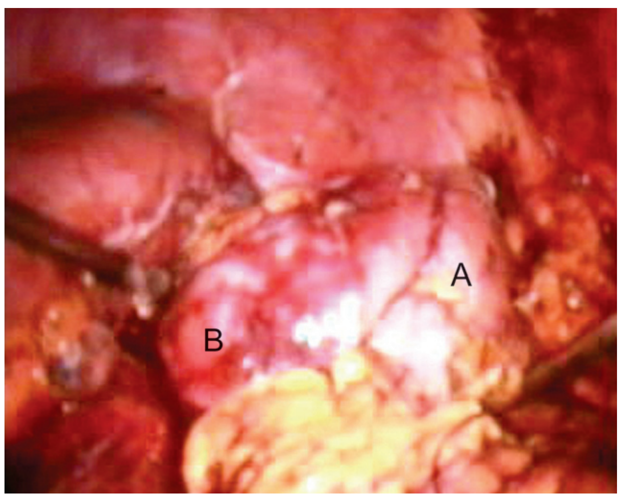


**Figure 2.** Complete excision of the tumor while the kidney was rotated upside down. A indicates the upper pole after excision of tumor and B, the lower pole.

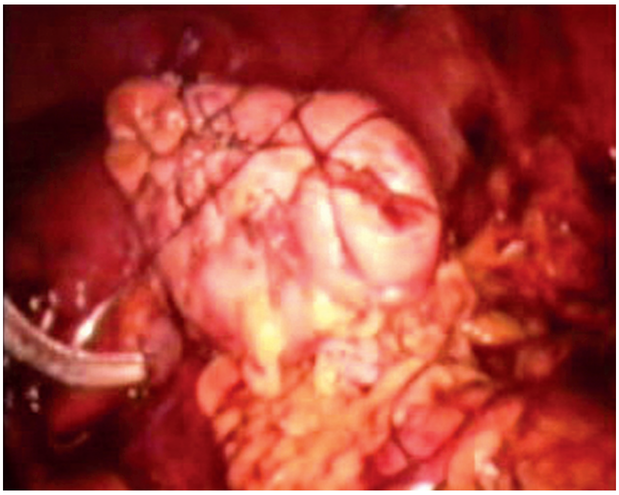

**Figure 3.** Rotating the kidney to its normal position after excision of the tumoral mass.

## Follow-up

Kidney specimens were evaluated and renal cell carcinoma (RCC) was graded according to the Fuhrman grading system.[7] The patients were visited at the urology clinic 2 weeks after discharge. In patients with RCC, follow-up visits included clinic visits 6 and 12 months after the operation, and then every year. Abdominal CT was done 12 months after the operation and then every year in order to assess local recurrence. Chest radiography and biochemical laboratory studies including serum calcium, phosphorus, aspartate aminotransferase, alanine aminotransferase, alkaline phsophatase, and direct and total bilirubin were tested in every clinic visits.

## RESULTS

The Table outlines characteristics of the patients and their perioperative and pathology data. The patients were 5 men and 5 women and their median age was 45 years (range, 34 to 70 years). The side of the operation was right in 5 patients and left in 5. Indications for LPN were elective in all patients, and no imperative indications were recorded. The median of the greatest diameter of the tumor on pathology examination was 58 mm (range, 41 mm to 92 mm). All of the tumors were larger than 40 mm. The median operative time was 206 minutes (range, 114 to 262 minutes), and the median hospital stay was 6 days (range, 4 to 16 days). The median warm ischemia time in the

Demographic and Perioperative Data*

| Patient | Age, y | Sex | Hospital Stay, d | Operative time, min | Clamp Time, min | Hemoglobin, g/dL | | Serum Creatinine, mg/dL | | Tumor size, mm | Transfusion, U | Pathology |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Preoperative | Postoperative | Preoperative | Postoperative | | | |
| 1† | 44 | F | 16 | 238 | 28 | 12.3 | 9.2 | 1.1 | 0.6 | 51 | 2 | RCC, Grade 2 |
| 2 | 58 | F | 12 | 242 | 25 | 10.0 | 8.3 | 0.6 | 0.7 | 44 | 2 | Leiomyoma |
| 3 | 36 | M | 4 | 178 | 30 | 15.0 | 13.4 | 1.1 | 2.1 | 92 | 0 | RCC, Grade 2 |
| 4 | 34 | M | 8 | 235 | 24 | 16.2 | 13.2 | 1.1 | 1.6 | 45 | 2 | RCC, Grade 2 |
| 5‡ | 45 | M | 4 | 206 | ... | 15.1 | 14.3 | 1.2 | 1.4 | ... | 0 | NUP |
| 6 | 40 | F | 5 | 176 | 35 | 13.2 | 9.8 | 1.2 | 1.3 | 58 | 0 | RCC, Grade 2 |
| 7 | 45 | F | 6 | 114 | 32 | 13.5 | 9.0 | 0.9 | 1.3 | 62 | 0 | RCC, Grade 2 |
| 8 | 50 | F | 6 | 206 | 30 | 14.2 | 12.1 | 1.0 | 1.3 | 41 | 0 | RCC, Grade 2 |
| 9 | 70 | M | 6 | 144 | 22 | 10.9 | 9.7 | 1.4 | 1.4 | 62 | 0 | RCC, Grade 2 |
| 10 | 45 | M | 6 | 262 | 35 | 13.4 | 9.5 | 1.1 | 1.5 | 71 | 0 | RCC, Grade 2 |

*RCC, indicates renal cell carcinoma; F, female; M, male; NUP, nonfunctioning upper pole kidney.
†This patient underwent surgical exploration 6 hours after operation due to continued bleeding from the Hemovac drain.
‡This patient underwent laparoscopic partial nephrectomy for a nonfunctioning upper pole kidney, and the renal artery was not clamped.

patients with renal tumor was 30 minutes (range, 22 to 35 minutes). The median hemoglobin drop until the 2nd postoperative day was 2.55 g/dL (range, 0.8 g/dL to 4.5 g/dL). Three patients required transfusion (two units for each one), based on the judgment by the anesthesiologist. One patient with grade 2 RCC underwent surgical exploration due to bleeding and hemoglobin drop on the operation day (6 hours after operation). The bleeding source was a tiny artery located in the adrenal bed. In this patient, urinary leakage lasted more than 1 week and led to ureteral stent insertion.

Pathology diagnoses are shown in the Table. Surgical margins were free of tumor in all of the patients. One of the tumors was a renal leiomyoma and other tumors were RCC. Figure 4 depicts proper function and anatomy of the remaining kidney mass in one patient 8 weeks after operation. Follow-up data including CT on the 1st postoperative year and later was indicated in 8 patients with RCC. No local recurrence was observed in the follow-up studies. No complications were observed in follow-up studies of the two patients with nonfunctioning upper pole and leiomyoma.

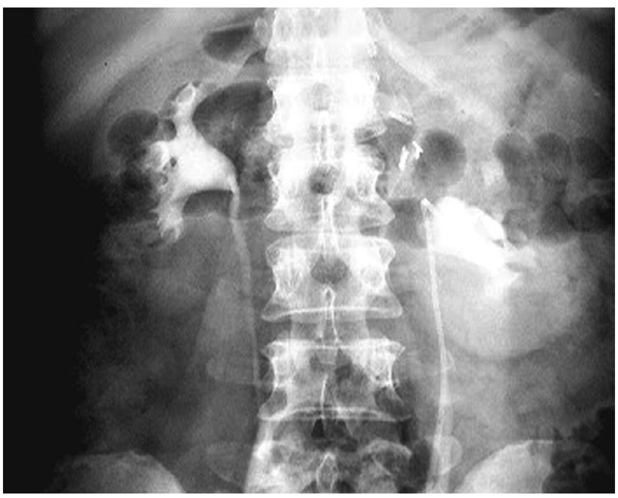

**Figure 4.** Intravenous urography of the patient presented in Figure 3, eight weeks after the operation. Upper pole removal is evident with intact middle and lower pole calyxes.

## DISCUSSION

Currently nephron-sparing surgery is considered the standard therapy for small kidney masses.[2,8,9] Long-term tumor control has been reported not different with laparoscopic radical nephrectomy,[8,10-12] and LPN has been introduced as an alternative option to OPN for small tumors.[1,3] Recently, LPN has expanded its indications to include larger T1b tumors.[2] However, intraoperative difficulties and perioperative complications has limited LPN acceptance as the standard treatment for nephron-sparing surgery.[5] Complications rate LPN were reported by Gill and coworkers to be higher than that in OPN.[13] The tumor location plays an important role in the complexity of the operation and its postoperative complications. It has been reported that LPN for upper pole kidney tumors is associated with higher complications relative to lower pole and middle pole tumors.[12,14]

Achieving a good field of vision for resection of upper pole kidney tumors results in longer operative time and more bleeding.[1] Limited field of vision and difficulties in kidney positioning for suturing of the resection bed are important impediments for surgery of these tumors.[3] Because of the endoscope angle, these tumors are not easily found by rigid laparoscopes and their resection and suturing is more complicated.[1] As a result of the aforementioned difficulties, some urologists prefer to perform laparoscopic radical nephrectomy or OPN for tumors amenable to management by laparoscopic nephron-sparing surgery.[15]

Some authors have proposed methods to tackle these challenges. Kim and associates used a gauze sling in their report of 2 cases to elevate the kidney from its bed, in order to achieve a better field of vision for the laparoscopic operation of upper pole kidney masses.[1] Large tumors are not suitable for percutaneous and ablative procedures.[16,17] Retroperitoneal approach may be promising for posterior tumors, but not suitable for upper pole tumors as they will not be easily accessible in this approach. The necessity of a direct vision in robotic surgery makes suturing of upper pole resection bed difficult. Laparoscopic partial nephrectomy for lower pole tumors and anterior tumors has been associated with least intraoperative complexity and postoperative complications.[12,14] Based on this idea, if the kidney is rotated 180 degrees over its pedicular axis, the upper/posterior pole tumors are located inferiorly and anteriorly, and their surgery will be accomplished with considerable ease. Therefore, after clamping the renal artery and completely mobilizing the kidney, we used a180-degree rotation of the kidney around its pedicular axis to locate the upper pole posterior tumors in an inferior and anterior location. One patient was explored by open surgery 6 hours after the operation, because of continued bleeding from the Hemovac drain. This patient was the first who was operated on using this technique. Bleeding originated form an artery in adrenal resection bed.

All tumors operated by this technique were larger than 40 mm. Patard and coworkers reported longer operative time, more bleeding and transfusion, and more frequent urinary fistula for partial nephrectomy of tumors larger than 40 mm compared to smaller tumors.[12] Longer warm ischemia time and pyelocaliceal system repair were reported by Simmons and associates[2] in LPN of tumors larger than 40 mm, compared to smaller tumors. In their study, however, statistical significance was not observed for operative time and bleeding volume.

Warm ischemia time and operative time in this series is comparable and slightly shorter compared with the figures reported by Simmons and colleagues[2] for LPN of tumors larger than 40 mm (32 minutes versus 38 minutes and 210 minutes versus 228 minutes, respectively). However, transfusion frequency in this study was more than that in many reported series. Nevertheless, all patients who received blood transfusion were the first 4 patients operated on using the new technique. No transfusion was needed in the last 6 patients. Prolonged leakage (more than 7 days) was observed in 1 patient, which responded to ureteral stent insertion. Two patients had urine leakage from the peritoneal drain for 5 days. Other patients had no leakage or leakage duration shorter than or equal to 5 days. Follow-up CT scans were uneventful in all of the patients.

We learned the following tips in our experience: first, the ureter should be dissected free from the surrounding tissues up to the ureteropelvic junction. This makes kidney rotation easier and eliminates the need to release the distal ureter in order to compensate for ureter length shortage in kidney rotation. Second, dissecting the adrenal gland free from the surrounding tissues and rotating it with the tumor facilitates kidney rotation.

## CONCLUSION

We described a new technique for LPN for upper pole kidney tumors by rotating the kidney 180 degrees over its pedicular axis. We reported satisfactory results in 10 patients. We believe that this technique will bring considerable ease in surgery of upper pole kidney tumors, and its intraoperative and postoperative results are acceptable. We admit that this technique needs to “come to maturity” and should be attempted in larger series.

## CONFLICT OF INTEREST

None declared.

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