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Original Article

Robot assisted partial nephrectomy: Single center our experiences

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Abstract

Aim: In this study, we aimed to present the functional and oncologic results of robotic assisted partial nephrectomy (RAPN) in clinical stage T1 tumors.

Material and Methods: Fifteen patients who had undergone RAPN for T1a-b kidney tumor between July 2017 and January 2019 were included in the study. The demographic data, mean operation time, estimated blood loss, duration of warm ischemia, length of hospital stay and oncologic results were evaluated retrospectively.

Results: Ten male and five female patients with a mean age of 55.4±7.6 (48-71) years were included in the study. A 4-port trans peritoneal approach was applied to all the patients. Nine right and six left renal masses with a mean tm diameter of 2.8±0.4 (2.4-3.6) cm were operated. The mean operation time was 217 (185-250) minutes, the mean blood loss was 225.6 (180-265) cc. Bleeding requiring transfusion was seen in one patient and a spontaneously resolved ileus was seen in another patient. Urethral stents were placed into two patients because the collector system was opened. 8 (53%) of renal masses were reported as renal cell carcinoma. Surgical margin positivity was identified in 2 (13%) of the patients. No local recurrence or distant metastasis was observed in any of the patients. None of the patients experienced incisional hernia and late complications.

Conclusion: Robot-assisted partial nephrectomy is presently the gold standard treatment for patients with clinical stage T1 renal tumor. RAPN is an effective, safe and minimally invasive treatment modality in patients eligible for partial nephrectomy.

Keywords: Nephrectomy; partial; renal cell carcinomas; robot-assisted laparoscopy

INTRODUCTION

Renal cell carcinomas constitute 2-3% of all adult cancers in our country (1). Today, the widespread use of imaging methods and technological advances has increased the incidence of diagnosis of renal masses smaller than 4 cm (2). In particular, the increase in T1a and T1b tumors has led to the widespread use of nephron-sparing surgery among urologists and it has been observed that long-term oncologic outcomes are similar to those of radical nephrectomy and exhibit better functional outcomes (3-5).

These operations, which were previously performed openly, have been started to be performed laparoscopically to reduce surgical morbidity and shorten the length of hospital stay (6). Laparoscopic partial nephrectomy (LPN) has been performed mostly by experienced surgeons because of the difficult surgical technique and intracorporeal suturing.

Thanks to the technological advances, the first robotic-assisted laparoscopic partial nephrectomy (RALPN) was performed in 2004 (7). It has been an applicable method thanks to the instruments that simplify suturing, mimic wrist movements and provide three-dimensional imaging (7). In RALPN, the same basic principles are applied as in open surgery, such as early vascular control, complete tumor excision with free margins, duration of warm ischemia, control of hemorrhage, repair of the collecting system and renal parenchymal reconstruction, if necessary.

In this study, we aimed to evaluate the oncological and functional results of RALPN cases in our clinic.

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MATERIAL and METHODS

Fifteen patients who underwent RALPN for renal masses in our clinic between July 2017 and January 2019 were included in the study. The local ethical committee approval was obtained to conduct the study. All patients were informed about their diseases and treatments and informed consent was obtained. Triphasic abdominal computed tomography (CT) was performed as a standard procedure in patients with normal renal function in order to deter-mine the exact localization and clinical stage of the renal tumor. Magnetic resonance imaging (MRI) was performed in patients with impaired renal function or tumor thrombus and renal vein invasion. Patients receiving antiageragan or anticoagulant therapy were discontinued one week before the operation under the supervision of relevant clinics. Knee compression stockings were used to reduce the risk of deep vein thrombosis. Low-molecular-weight heparins were only used in patients with comorbidities.

The patients mean operation time, estimated blood loss, warm ischemia time, length of hospital stay, postoperative renal function values and oncologic results were obtained from the hospital database. The evaluation of renal func-tions was performed by comparing the preoperative serum creatine values with the values measured within 90 days. The pathological evaluation was performed according to the American Cancer Committee (AJCC) TNM criteria. All cases were monitored by the same experienced surgical team.

Surgical Technique

The patients were placed in the modified flank position (45 degrees) under general anesthesia. A veres needle was used to create pneumoperitoneum. All operations were performed by means of a transperitoneal route using da Vinci XI robotic system. After the pneumoperitoneum was created with the help of a veres needle, an 8 mm camera port was inserted from the lateral rectus muscle. Three robotic working ports (8mm) and one assistant port (12mm) were placed under direct vision. There were some differences in the port location depending on tumor localization and side. The intraabdominal pressure was adjusted as 12-15 mm hg. The robotic tower was approached from the patient's back. 30 degrees optics were used throughout the operation.

First, the same side was incised with monopolar scissors along the line of Toldt and the colon was medialized. Hepa-torenal or splenorenal ligaments were dissected. In the second step, the renal hilum was exposed prior to the dissec-tion of renal artery and vein. Renal artery and vein were encircled with a vascular tape preserving Gerota's fascia. Perinephric adipose tissue was then dissected from the capsule leaving only the adipose tissue surrounding the tu-mor. The normal renal parenchyma was marked with the help of monopolar scissors, leaving a safe margin with a distance of 5-10 mm from the tumor and the adipose tissue. Subsequently, bulldog clamps placed through the assis-tant port were first placed on the renal artery, and then warm ischemia time was recorded. The tumor was excised with cold scissors according to open surgical principles. Then, it was placed in a secure Endobag and moved away from the surgical field. A needle holder was placed in arm number three after excision of the tumor. It was checked to see if there were defects in the tumor bed, collecting system and vascular structures. Hemostatic agents were placed at the resection site It was sutured with herringbone stitch material with a hem-o-lok clip. Subsequently, 2-0 Vicryl sutures with a Hem-o-lok clip were used to bring the renal parenchyma closer. These clips placed outside the renal parenchyma both provided tension and prevented the suture from rupturing the parenchyma. After the bull-dog clamps were opened, the adrenal Gerota's fascia was closed repositioning the colon to its original site. A vacu-umless drain was placed. The camera port was expanded and the specimen was taken out of the body.

RESULTS

The demographic data and preoperative tumor characteristics of the patients are given in Table 1. None of the patients had a history of bilateral kidney tumors or previous renal surgery. One of the patients presented with hemorrhage requiring blood transfusion in the postoperative period. Another patient had prolonged ileus, which was treated medically.

Table 1. Dermographic, preoperative and postoperative data

Variable	Average ± ss or number, ratio
Age(Year)	55.4±7.6(48-71)
BMI	25.7±1.7(23.6-29.4)
Gender (M / F)	10/5(15)
Side (right / left)	9/6(15)
Tumor Localization	
Lower	9
Medium	5
Upper	1
Operation Time (min)	217(185-250)
Warm Ischemia Time (min)	26.2(24-29)
Average Blood Loss (ml)	225.6(180-265)
Duration of Hospitalization (Day)	4.3(2.5-6)
Patology	
Tumor Size (cm)	2.8±0.4(2.4-3.6)
Malign(RCC)	8(%53)
Beningn	7(%47)
Anjiomyolipom	3/7(%42)
Simple Cyst	2/7(%28)
Oncositom	1/7(%14)
Metanefritic Aden.	1/7(%14)
Positive Surgical Margine	2(%13)

None of the patients required open surgery. Urethral stents were placed in 2 patients with pelvicalyceal system dilatation. The stents were removed 4 weeks later and the patients were discharged on the same day. One patient presented with multiple renal arteries. Only the artery feeding the pole at which the mass was located was clamped and no problems were observed.

Pathological data are given in Table 1. While renal cell carcinoma (RCC) was reported in 53% (8/15) of partial nephrectomy cases, a positive surgical margin was observed in 2 (%13) patients. 7 (%47) of them were benign. Anjiomyolipom was reported in 3/15. Simple Cyst was reported in 2/15. Oncositom was reported in 1/15. Metanefritic Adenoma was reported in 1/15. The mean follow-up period was 12 months and none of the patients had local recurrence or distant metastasis.

DISCUSSION

The standard treatment for localized renal cell carcinoma is surgical excision. Today, radical nephrectomy is not recommended in cases where partial nephrectomy (PN) can be performed instead (8). The European Urology Association 2017 guide recommends PN as the preferred treatment for stage 1 renal mass measuring up to 7 cm with amenable localization (9). Besides, many studies have shown that the oncologic outcomes of PN are similar to those of radical nephrectomy (RN) (10-13). In addition, it was detected that renal functions were better preserved and cardiac complications were less common in PN cases compared to RN (14,15).

LPN has proven to be a good alternative to open surgery for T1a and T1b tumors with its preoperative and oncologic outcomes in experienced hands (16,17). However, the technical difficulty of laparoscopy, the difficulty of intracorporeal suturing, the laparoscopic experience required for PN, and the length of the learning curve make LPN inconvenient to perform, except for centers with a high number of cases (18).

Robotic surgical systems have been aimed to reduce these disadvantages when compared to LPN (19). Conventional laparoscopic systems provide the surgeon with two-dimensional images, whereas robotic systems provide three-dimensional view and depth perception. In addition, it can stabilize surgical movements in a ratio of 1:1 or 5:1 and provide tremor filtration. Tremor filtration provides an advantage to the surgeon especially in surgical operations that require reconstruction such as PN (20).

The studies comparing robotic partial nephrectomy with LPN revealed no difference between the two methods in terms of operative data (21). On the other hand, a study conducted by Wang et al. in 2019 noted that RPN was superior to LPN with respect to warm ischemia duration, operative time and hospital stay.

Our study evaluated the surgical and oncologic outcomes of 15 patients who underwent RALPN. The mean operative time was 217 (185-250), close to the literature. We believe that the factor contributing to a slightly higher duration than the literature is that the patients were the first RALPN cases in our center. The mean length of hospital stay was 4.3 (2.5-6) days, which was consistent with the literature. The mean estimated blood loss was 225 (180-265) cc, again consistent with the literature. No intraoperative complications were observed in our series.

There is no clear consensus on the duration of warm ischemia during partial nephrectomy. The anecdotal data indicate that the duration of warm ischemia should be kept below 30 minutes (23). Recent studies have reported that shortening this period as much as possible (20 min) will result in better functional results (24,25). In our study, the mean duration of warm ischemia was 26.2 (24-29) min, which showed consistency with the literature. In recent years, alternative methods have been used to reduce the duration of warm ischemia; such as early opening of the hilar clamp and clapping the selective artery along which the tumor is located (26-28). Although a meta-analysis comparing robotic-assisted partial nephrectomy with LPN found no statistical difference between the two methods in terms of operative time, estimated blood loss, length of hospital stay, and complications, it was found that the duration of warm ischemia was longer in those who underwent LPN (29).

The positive surgical margin rate varies between 0-4% in patients undergoing RALPN (30). Recent studies have also emphasized that it is necessary to reduce the positive surgical margin rate. Optimal imaging of the surgical tumor margin, the use of laparoscopic ultrasound in cases where necessary and the use of cold scissors for tumor bed transection are recommended for this purpose (31). In our study, 2 (13%) patients had positive surgical margins. None of the patients had local recurrence during the follow-up period. In the literature, it has been reported that patients with positive surgical margins may not present with local recurrence, and it is sufficient to follow-up these patients closely (32).

CONCLUSION

Robotic-assisted partial nephrectomy is used in the treatment of renal tumors which are suitable for partial nephrectomy. It is a safe and an effective minimally invasive treatment alternative with oncological and functional results comparable to conventional methods.

Competing interests: The authors found that the conflict of interest did not fully coincide.
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REFERENCES

1. Gültekin M, Boztaş G. Türkiye kanser istatistikleri. Sağlık Bakanlığı, Türkiye Halk Sağlığı Kurumu 2014; Ankara s:43.
2. Chawla SN, Crispen PL, Hanlon AL, et al. The natural history of observed enhancing renal masses: Meta-analysis and review of the world literature. The J Urology 2006;175:425-31.
3. Gill IS, Kavoussi LR, Lane BR, et al. Comparison of 1,800 laparoscopic and open partial nephrectomies for single renal tumors. The J Urology 2007;178:41-6.
4. Weight CJ, Lieser G, Larson BT, et al. Partial nephrectomy is associated with improved overall survival compared to radical nephrectomy in patients with unanticipated benign renal tumours. European Urology 2010;58:293-8.
5. Mitchell RE, Gilbert SM, Murphy AM, et al. Partial nephrectomy and radical nephrectomy offer similar cancer outcomes in renal cortical tumors 4 cm or larger. Urology 2006;67:260-4.
6. Winfield HN, Donovan Jf, Godet AS, et al. Laparoscopic partial nephrectomy: initial case report for benign disease. J Endourol 1993;7:521-6.
7. Gettman MT, Blute ML, Chow GK, et al. Robotic-assisted laparoscopic partial nephrectomy:technique and initial clinical experience with daVinci rocotic system. Urology 2004;64:914-8.
8. Tan HJ, Norton EC, Ye Z, et al. Long-term survival following partial vs radical nephrec¬tomy among older patients with early-stage kidney cancer. JAMA 2012;307:1629-35.
9. Ljungberg B, Albiges L, Bensalah K, et al. EAU Guidelines on renal cell carcinoma. European Association of Urology 2017. Update March.
10. Marszalek M, Meixl H, Polajnar M, et al. Laparoscopic and open partial nephrectomy: A matched-pair comparison of 200 patients. Eur Urol 2009;55:1171-8.
11. Peycelon M, Hupertan V, Comperat E, et al. Long-term outcomes after neph¬ron sparing surgery for renal cell carcinoma larger than 4 cm. J Urol 2009;181:35-41.
12. Gill IS, Kavoussi LR, Lane BR, et al. Comparison of 1,800 laparoscopic and open partial nephrectomies for single renal tumors. J Urol 2007;178:41-6.
13. Delakas D, Karyotis I, Daskalopoulos G, et al. Nephron-sparing surgery for localized renal cell carcinoma with a normal contrala¬teral kidney: A European three-center experience. Urology 2002;60:998-1002.
14. Weight CJ, Larson BT, Gao T, et al. Elective partial nephrectomy in patients with clinical T1b renal tumors is associated with improved ove¬rall survival. Urology 2010;76:631-7.
15. Kim SP, Thompson RH, Boorjian SA, et al. Comparative effectiveness for survival and renal function of partial and radical nephrectomy for locali¬zed renal tumors: a systematic review and meta-analysis. J Urol 2012;188:51-7.
16. Simmons MN, Weight CJ, Gill IS. Laparoscopic radical versus partial nephrectomy for tumors> 4 cm: intermediate-term oncologic and functional outcomes. Urology 2009;73:1077-82.
17. Van Poppel H, Da Pozzo L, Albrecht W, et al. A prospective, randomised EORTC intergroup phase 3 study comparing the oncologic outcome of elective nephron-sparing surgery and radical nephrectomy for low-stage renal cell carcinoma. European Urology 2011;59:543-52.
18. Burgess NA, Koo BC, Calvert RC, et al. Randomized trial of laparoscopic v open nephrectomy. J Endourol 2007;21:610-3.
19. Png KS, Sundaram CP. Current status of robot-assisted laparoscopic partial nephrectomy. Indian J Surg Oncol 2012;3:91-5.
20. Başataç C, Boylu U, Turan T, et al. Trans¬peritoneal robotik piyeloplasti: İlk deneyimlerimiz. Turkish Journal of Urology 2011;37:118-22.
21. Caruso RP, Phillips CK, Kau E, et al. Robot assisted laparoscopic partial nephrectomy: initial ex-perience. J Urol 2006;176:36-9.
22. Wang AJ, Bjayani SB. Robotic partial nephrectomy versus laparoscopic partial phrectomy for renal cell carcinoma: single-surgeon analysis of >100 consecutive procedures. Urology 2009;73:306-10.
23. Shapiro E, Benway BM, Wang AJ, et al. The role of nephron-sparing robotic surgery in the management of renal malignancy. Curr Opin Urol 2009;19:76-80.
24. Mottrie A, De Naeyer G, Schatteman P, et al. Impact of the learning curve on peri¬operative outcomes in patients who underwent robotic par¬tial nephrectomy for parenchymal renal tumours. Eur Urol 2010; 58:127-32.
25. Ho H, Schwentner C, Neururer R, et al. Robotic-assisted laparoscopic partial nephrec¬tomy: surgical technique and clinical outcomes at 1 year. BJU Int 2009;103:663-8.
26. San Francisco IF, Sweeney MC, Wagner AA. Robot-assisted partial nephrectomy: early unclamping technique. J Endourol 2011;25:305-8.
27. Kreshover JE, Kavoussi LR, Richstone L. Hilar clamping versus off-clamp laparoscopic partial nephrectomy for T1b tumors. Curr Opin Urol 2013;23:399-402.
28. Rizkala ER, Khalifeh A, Autorino R, et al. Zero ischemia robotic partial neph¬rectomy: sequential preplaced suture renorrhaphy techni¬que. Urology 2013; 82:100-4.
29. Aboumarzouk OM, Stein RJ, Eyraud R, et al. Robotic Versus Laparoscopic Partial Nephrectomy: A Systematic Review and Meta-Analysis. Eur Urol 2012; 62:1023-33.
30. Dev HS, Sooriakumaran P, Stolzenburg JU, et al. Is robotic technology facilitating the minimally invasive app¬roach to partial nephrectomy? BJU Int 2012; 109:760-68.
31. Lam JS, Bergman J, Breda A, et al. Importance of surgical margins in the management of renal cell carcino¬ma. Nat Clin Pract Urol 2008;5:308-17.
32. VanPoppel H. Efficacy and safety of nephron-sparing surgery. Int J Urol 2010;17:314-26.