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ORIGINAL ARTICLE

Comparison of efficacy and long-term survival of laparoscopic radical nephrectomy with partial nephrectomy in the treatment of patients with early renal cell carcinoma

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Summary

Purpose: *To compare the efficacy and long-term survival of laparoscopic radical nephrectomy (LRN) with laparoscopic partial nephrectomy (LPN) in the treatment of patients with early renal cell carcinoma (RCC).*

Methods: *A retrospective analysis was performed on the medical records of 146 patients, aged 40-60 years, with T1bN0M0 RCC admitted to Chongqing Three Gorges Central Hospital. The patients were divided into a study group (n=62) treated with LPN and a control group (n=84) treated with LRN according to surgical methods. The renal function, one month after operation and surgery-related indicators and the incidence of postoperative complications were analyzed. R).*

Results: *One month after operation GFR was significantly higher in the study group than in the control group (p<0.05), which was lower than that before operation in the two groups (p<0.05).*

Conclusion: *The short- and long-term efficacy of LPN is similar to that of LRN in the treatment of T1bN0M0 RCC, but LPN better preserves the renal function, which has a potential value in reducing cardiovascular events.*

Key words: *efficacy, partial nephrectomy, radical nephrectomy, renal cell carcinoma*

Introduction

Renal cell carcinoma (RCC), the 14th most common cancer, accounts for approximately 2.5% of all malignant tumors, and male patients are approximately twice as many than female patients [1,2]. The incidence and mortality rates of the disease are high. Based on global epidemiological statistics in 2008, 273,518 people were estimated to have RCC, and 72,019 patients were estimated to die, with a standardized mortality rate of 2.2 per 100,000 people annually [3]. According to epidemiological statistics in the United States, there were 74,000 new patients in 2016 [4]. The decrease in RCC-related mortality rates in recent years is related to the early diagnosis of RCC and the increased nephrectomy rate.

With the application and development of laparoscopic techniques, laparoscopic partial nephrectomy (LPN) has become the standard method for the surgical treatment of T1a RCC, which aims to destroy the tumor tissue and minimize damages to the surrounding tissue, and the postoperative recovery of the renal function is closely related to the prognosis of patients [5,6]. For patients with T1b RCC, the long-term efficacy of LPN is similar to that of laparoscopic radical nephrectomy (LRN), but LPN has a better effect on the preservation of renal function, so it is becoming an alternative to LRN in the treatment of T1b tumors [7]. However, LPN is controversial in the treatment of T1b RCC according to studies in recent years. The 5-year

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and 10-year cancer-specific mortality rates of LPN are 4.4% and 6.1%, and those of LRN are 6.0% and 10.4%, with statistically significant differences. Based on the regression analysis of competing-risks data, after mortality rates of other causes are adjusted, there is no statistically significant correlation of nephrectomy type with cancer-specific mortality rate [8]. Moreover, minimally invasive surgery may prolong ischemic time and increase hemorrhage, so LPN of most T1b tumors is performed through open surgery [9], which limits the application of LPN.

Therefore, the efficacy of LPN and LRN in the treatment of early RCC was compared in this retrospective study, so as to provide references for the clinical treatment of RCC.

Methods

Research objects

A retrospective analysis was performed on the medical records of 146 patients, aged 40-60 years, with T1b-N0M0 RCC admitted to Chongqing Three Gorges Central Hospital. The patients were divided into the study group (n=62) treated with LPN and the control group (n=84) treated with LRN according to surgical methods.

Inclusion criteria and exclusion criteria

Inclusion criteria: Patients with unilateral renal tumor confirmed by postoperative pathology were included who had not received radiotherapy, chemotherapy and related immunotherapy before the serum was obtained, and with complete clinical data and 5-year follow-up data.

Exclusion criteria: Patients with renal failure, kidney stone and history of kidney stone; patients with active digestive system diseases; patients with hypercorticism; patients with hepatic and cardiopulmonary dysfunction; pregnant or lactating women; patients with mental disorders or abnormal judgement.

This study was approved by the Medical Ethics Committee of Chongqing Three Gorges Central Hospital. Patients and their families were informed through letter or telephone, and signed an informed consent form.

Surgical methods

LRN: Endotracheal intubation and general anesthesia were carried out on patients under a lateral position with the normal side down to fully expose the surgical field of the affected side. With a Trocar approach, a 10 mm Trocar was placed at 2 cm above the spina iliace, and a laparoscope was inserted to make pneumoperitoneum so as to expand the surgical space. The perirenal fascia was opened with an ultrasonic scalpel to completely dissociate the kidney on the affected side from bottom to

Table 1. General information

	Control group (n=84) *n (%)*	*Study group (n=62)* *n (%)*	x^2/t	*p*
Gender			0.019	0.891
Male	56 (66.67)	42 (67.74)		
Female	28 (33.33)	20 (32.26)		
Age (years), mean±SD	50.89±5.78	49.77±5.58	1.174	0.242
BMI (kg/m^2), mean±SD	25.19±3.99	24.73±4.59	0.646	0.520
Tumor location			0.087	0.769
Left	40 (47.62)	28 (45.16)		
Right	44 (52.38)	34 (54.84)		
Tumor size, mean±SD	5.58±0.87	5.59±0.93	0.067	0.947
Histological classification			0.058	0.810
Clear cell carcinoma	72 (85.71)	54 (87.10)		
Non-clear cell carcinoma	12 (14.29)	8 (12.90)		
Smoking			0.186	0.667
Yes	23 (27.38)	19 (30.64)		
No	61 (72.62)	43 (69.35)		
SCR			0.181	0.670
Normal	74 (88.10)	56 (90.32)		
Increased	10 (11.90)	6 (9.68)		
Combined hypertension			0.079	0.778
Yes	7 (8.33)	6 (9.68)		
No	77 (91.67)	56 (90.32)		
Combined diabetes			0.117	0.732
Yes	17 (20.24)	14 (22.58)		
No	67 (79.76)	48 (77.42)		

Table 2. Analysis of surgery-related indicators (mean±SD)

	Control group (n=84)	*Study group (n=62)*	x^2/t	*p*
Operative time (Min)	101.60±22.97	103.68±32.09	0.457	0.649
Intraoperative bleeding (mL)	103.14±2.72	107.94±18.92	2.296	0.023
Postoperative recovery time of gastrointestinal function (days)	2.27±1.42	1.97±0.30	1.635	0.104
Postoperative drainage volume (days)	4.91±1.04	5.12±1.12	1.167	0.245
Postoperative hospital stay (days)	7.15±1.40	7.63±1.72	1.857	0.065
Incidence rate of postoperative complications, n (%)	10 (11.90)	6 (9.68)	0.181	0.670

top, so as to expose renal tumors. After the renal artery on the affected side was blocked, the kidney, the surrounding tissue and the fascia were completely excised, and then the ruptured blood vessels were sutured. The wound edge stopped bleeding after electrocoagulation, and then the renal artery blocking was released. The pneumoperitoneum was closed after there was no abnormality, the Trocar was withdrawn, and the drainage tube was placed beside the kidney. Finally, the puncture was closed to finish the surgery.

LPN: Endotracheal intubation and general anesthesia were carried out on patients under a lateral position with the normal side down to fully expose the surgical field of the affected side. With a Trocar approach, a 10 mm Trocar was placed at 2 cm above the spina iliace, and a laparoscope was inserted to make pneumoperitoneum so as to expand the surgical space. The perirenal fascia was opened with an ultrasonic scalpel to completely dissociate the kidney on the affected side from bottom to top, so as to expose renal tumors. After the renal artery on the affected side was blocked, the tumor was completely removed from 0.5-1 cm at the edge of the tumor. The wound edge stopped bleeding after electrocoagulation, the ruptured blood vessels were sutured with absorbable sutures, and then the renal artery blocking was released. The pneumoperitoneum was closed after there was no abnormality, the Trocar was withdrawn, and the drainage tube was placed beside the kidney. Finally, the puncture was closed to finish the surgery.

Observational indexes

The general information of patients in the two groups were collected and compared in terms of gender, age, body mass index (BMI), tumor location, tumor size, histological classification, smoking, serum creatinine (SCR), combined hypertension and combined diabetes. The renal function, glomerular filtration rate (GFR), one month after operation and surgery-related indicators, including operative time, intraoperative bleeding, postoperative recovery time of gastrointestinal function, postoperative drainage volume, postoperative hospital stay, and incidence rate of postoperative complications, were statistically analyzed. The 5-year overall survival rate (OSR), recurrence-free survival rate, tumor recurrence rate and tumor metastasis rate were counted. Cox regression analysis was used to analyze the prognostic risk factors for patients.

Table 3. Glomerular filtration rate (mL/min/1.73m^2), mean±SD

	Control group (n=84)	*Study group (n=62)*	*t*	*p*
Before treatment	83.56±13.66	83.07±10.47	0.814	0.236
After treatment	55.73±18.56	70.49±21.00	4.491	<0.001
t	11.068	4.221		
P	<0.001	<0.001		

Statistics

SPSS19.0 (Asia Analytics Formerly SPSS China) was used to analyze the data. Measurement data were expressed by percents and x^2 test was used for comparison of ratio between the two groups. Count data were expressed by mean±standard deviation (mean±SD), and independent sample t-test was used for comparison between the two groups. Kaplan-Meier survival analysis with log rank test were used for the 5-year OSR. Univariate and multivariate Cox regression analyses were used for the prognostic risk factors of patients. P<0.05 indicated a statistically significant difference.

Results

General information

The control group consisted of 56 males (66.67%) and 28 females (33.33%), aged 50.89±5.78 years, and the study group consisted of 42 males (67.74%) and 20 females (32.26%), aged 49.77±5.58 years. There were no statistically significant differences between the two groups in gender and age (p>0.05), as well as in BMI, tumor location and other information (p>0.05). More details are shown in Table 1.

Analysis of surgery-related indicators

There were no statistically significant differences between the two groups in terms of operative time, intraoperative bleeding, postoperative recovery time of gastrointestinal function, postoperative drainage volume, postoperative hospital stay, and

Table 4. Analysis of long-term prognosis

	Control group (n=84) n (%)	*Study group (n=62) n (%)*	x^2	*p*
OSR	75 (89.29)	55 (88.71)	0.012	0.912
Recurrence-free survival rate	70 (83.33)	46 (74.19)	1.825	0.177
Tumor metastasis rate	11 (13.10)	4 (6.45)	1.708	0.191

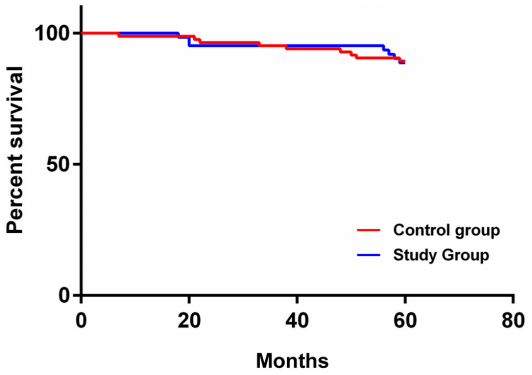

Figure 1. Analysis of 5-year OSR. According to the Kaplan-Meier survival curve, there was no difference in the 5-year OSR between the two groups (p>0.05).

Table 5. Assignment table

Variables	*Assignment*
Gender	Male=1, female=0
Age	A continuous variable
BMI	A continuous variable
Tumor location	Left=1, right=0
Tumor size	A continuous variable
Histological classification	Clear cell carcinoma=1, non-clear cell carcinoma=0
Smoking	Yes=1, no=0
SCR	Normal=1, increased=0
Combined hypertension	Yes=1, no=0
Combined diabetes	Yes=1, no=0
GFR	A continuous variable
Surgical methods	LRN=1, LPN=0

incidence of postoperative complications (p>0.05). More details are shown in Table 2.

Analysis of renal function index

There was no statistically significant difference in preoperative GFR between the two groups (p>0.05). GFR one month after operation was 55.73±18.56 mL/min/1.73m^2 in the control group, significantly lower than 70.49±21.00 mL/min/1.73m^2 in the observation group (p<0.05), which was lower than that before operation in the two groups (p<0.05). More details are shown in Table 3.

Analysis of long-term prognosis

There were no statistically significant differences between the two groups in the 5-year OSR, recurrence-free survival rate and tumor metastasis rate (p>0.05). More details are shown in Table 4 and Figure 1.

Analysis of prognostic risk factors

According to Cox univariate analysis, gender, age, BMI, tumor location, tumor size, histological classification, smoking, SCR, combined hypertension, combined diabetes and GFR were not prognostic risk factors for early RCC (p>0.05). More details are shown in Tables 5 and 6.

Discussion

RCC is the most common renal malignant tumor, including renal clear cell and renal non-clear cell carcinoma. The standard methods for the treatment of T1 RCC are LRN and LPN [10,11], and their short-term and long-term efficacy is controversial in the treatment of small RCC in recent years. The efficacy and the long-term survival of LPN and LRN in the treatment of patients with early RCC were analyzed in this study, in order to provide references for the clinical treatment of RCC.

The medical records of 146 patients with T1b RCC were enrolled in this study, and the patients were divided into two groups according to surgical methods. There was no statistically significant difference between the two groups in general information, as well as in operative time, intraoperative bleeding, postoperative recovery time of gastrointestinal function, postoperative drainage volume, postoperative hospital stay, and incidence rate of postoperative complications, but GFR one month after operation was significantly higher in the study group than in the control group. These findings indicate that the renal function of patients in the study group is better preserved after operation. According to the analysis of long-term prognosis, there were no differences between the two groups in the 5-year OSR, recurrence-free survival rate and tumor metastasis rate. According to Cox regression analysis, surgical methods and GFR were not prog-

Table 6. Univariate analysis of prognostic risk factors for patients with RCC

Variables	*B*	*SE*	*Wald*	*df*	*Sig.*	*Exp(B)*	*95.0% CI*	
							Lower part	*Upper part*
Gender	1.281	0.756	2.873	1	0.090	3.601	0.818	15.846
Age	-0.026	0.043	0.349	1	0.555	0.975	0.895	1.061
BMI	0.079	0.064	1.535	1	0.215	1.082	0.955	1.227
Tumor location	0.391	0.504	0.600	1	0.438	1.478	0.550	3.968
Tumor size	-0.100	0.281	0.127	1	0.722	0.905	0.522	1.569
Histological classification	0.169	0.756	0.050	1	0.823	1.184	0.269	5.210
Smoking	0.138	0.539	0.066	1	0.798	1.148	0.399	3.305
SCR	-0.159	0.756	0.045	1	0.833	0.853	0.194	3.752
Combined hypertension	-0.385	1.033	0.139	1	0.709	0.680	0.090	5.149
Combined diabetes	-1.438	1.033	1.939	1	0.164	0.237	0.031	1.797
GFR	-0.005	0.011	0.221	1	0.638	0.995	0.973	1.017
Surgical methods	-0.046	0.504	0.008	1	0.927	0.955	0.356	2.564

nostic risk factors for patients with T1b RCC. These findings indicate that the short-term and long-term efficacy of LRN is similar to that of LPN in the treatment of patients with T1b RCC.

Based on past reports, LRN, compared with LPN, increases the overall mortality and non-cancer related mortality rates of patients with T1a RCC [12,13]. In the treatment of T1b RCC, the hazard ratio of LRN to postoperative chronic kidney diseases is 3.40, whereas after propensity score is controlled, LPN is related to better OSR, with a risk ratio of 0.30 [14]. However, some reports in recent years have questioned whether LPN can improve the long-term prognosis and survival of patients with RCC. According to Scosyrev et al [15], the incidence rates of advanced renal disease and renal failure in patients after LPN are the same as those after LRN, and the improvement of renal function after LPN does not improve the survival rate of the patients. According to Jang et al [16], LPN cannot improve the cancer-specific and progression-free survival rates of patients with T1b RCC, but it is superior to LRN in the preservation of postoperative renal function and the improvement of OSR. Additionally, according to the meta analysis of 21 studies in a study by Tobert et al [17], compared with LRN, the all-cause mortality of patients after LPN decreases by 19% and the cancer-specific mortality decreases by 29%. However, according to the analysis of SEER data in that study, the survival rate of patients with RCC after LRN is similar to that of patients with non-cancerous nephropathy. Tobert and others believe that there has been selection bias in previous studies, so the application of LRN should not be limited in the absence of further evidence.

Tumor size has always been limiting the application of LPN in RCC, which was reported by Zhang and colleagues [18]. The OSR of patients with T1b-T2 RCC after LPN is basically the same as that after LRN, but the rate in T1b is better than that in T2. LPN is the gold standard for the treatment of renal tumors smaller than 4 cm [19], but it has been controversial in the treatment of tumors larger than 4 cm. Tumors between 4 cm and 7 cm indicate T1b RCC, while tumors larger than 7 cm indicate T2 RCC [20]. In a study related to short-term efficacy [21], LPN was correlated with increased hemorrhage (3.1 vs 1.2%), urinary fistula (4.4 vs 0%) and secondary operation due to adverse reactions (4.4 vs 2.4%). In this study, the complications of patients in the two groups were mainly wound infection, intestinal obstruction and urinary retention, and each one patient had acute renal failure in the two groups, without a difference in the total incidence rate of complications between the two groups. This may be related to surgeons' operative experience. For the removal of large renal tumors, LPN is technically challenging and requires rich experience.

Although this study has not confirmed the obvious short-term and long-term advantages of LPN in the treatment of T1bN0M0 RCC, its effect of preservation on the renal function cannot be ignored, which reduces postoperative cardiovascular diseases [22,23]. There are also deficiencies and selection bias in this retrospective study. The age range was narrowed, so only patients aged 40-60 years old were included. In addition, there was a lack of statistics on the causes of patient death and on cardiovascular events, as well as lack of an analysis of unknown potential factors affecting the

results of this study. Therefore, it is hoped that the deficiencies will be improved in future randomized-controlled trials with large samples.

To sum up, the short-term and long-term efficacy of LPN is similar to that of LRN in the treatment of T1bN0M0 RCC, but LPN better preserves the renal function, which has a potential value in reducing cardiovascular events.

Conflict of interests

The authors declare no conflict of interests.

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