Quality of Life Survey Following Laparoscopic and Open Radical Nephrectomy

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Purpose: To compare the quality of life (QoL) of renal cancer patients following laparoscopic and open radical nephrectomy.

Materials and Methods: Seventy-two (64.9%) patients who were treated with open radical nephrectomy (ORN group) and 39 (35.1%) patients who were treated with laparoscopic radical nephrectomy (LRN group) were included in this study. QoL was evaluated by Short Form-36 (SF-36) physical domain scores obtained before surgery, 1 and 6 months after surgery. Analgesic requirement and visual analog scale (VAS) pain scores following surgeries were recorded.

Results: The demographic features of the groups were similar. There was a significant difference in tumor size between the ORN group (71.59 ± 29.83 mm) and LRN group (57.08 ± 19.33 mm) (P = .011). In the LRN group there was less blood loss, a lower transfusion rate, earlier ambulation, more rapid convalescence and shorter hospitalization; however, the difference in surgical duration between the ORN group (122.86 ± 36.8 min) and LRN group (140.17 ± 50.71 min) was not significant (P = .383). Analgesic requirement and VAS pain scores were similar in both groups. In terms of SF-36 physical domain scores, the general health perception score in the LRN group was higher than that in the ORN group at pre-surgery, 1 and 6 months after surgery. SF-36 physical functioning and general health perception scores in both groups were significantly lower in 1 month after surgery and were higher in 6 months after surgery, as compare to before surgery. Bodily pain scores in LRN group did not change significantly after surgery (P = .376).

Conclusion: LRN exhibited some technical advantages, including less blood loss, shorter hospitalization and more rapid recovery. Although the ORN patients had relatively larger tumors, analgesic requirement, postoperative complications, body pain, and physical functioning weren't significantly different between the groups. QoL was higher 6 months after surgery than before surgery in both groups.

Keywords: kidney diseases; surgery; nephrectomy; methods; treatment outcome; kidney neoplasms; laparoscopy; quality of life.

INTRODUCTION

Renal cell carcinoma (RCC) is the third most common malignancy of the genitourinary tract and accounts for 2-3% of all cancers.[1] Open radical nephrectomy (ORN) has been accepted as the standard curative treatment for resectable renal tumors for many years. With the advent of minimally invasive surgery, laparoscopic radical nephrectomy (LRN) has become a feasible treatment alternative for localized RCC, following the first report of its use by Clayman and colleagues in 1991. According to the findings of long term oncological studies, LRN is associated with a cancer-free survival rate similar to that of ORN.[2,3] Following worldwide acceptance of the kidney function preservation concept, nephron-sparing surgical techniques (open, laparoscopic and robotic) have emerged as viable options for the treatment of small renal tumors (< 4 cm and T1a) in cases with a normal contralateral kidney. According to recently published guidelines, LRN is recommended as the standard of care for patients with localized RCC and a small renal mass that can't be treated with nephron-sparing surgery.[4] Studies that compared ORN and LRN reported that LRN has some advantages with regard to all perioperative morbidity indexes, including blood loss, postoperative analgesic requirement, duration of hospitalization and convalescence.[5-7] Patients should be counseled concerning the course of disease, treatment options, oncological outcome and treatment complications, as well as the effects on quality of life (QoL) of each treatment option. To date, health-related quality of life (HRQoL) has had only a marginal impact on the decision-making process of patients with kidney tumors. Specifically, QoL questionnaires are essential for determining the extent of a

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Received February 2014 & Accepted August 2014

Table 1. Comparison of demographic features and tumor characteristics of the patients.

Variables	Open Nephrectomy (n = 72)	Laparoscopic Nephrectomy (n = 39)	*P* Value
Demographic features			
Age (year) (mean ± SD)	55.79 ± 10.82	54.33 ± 11.9	.512
Gender, no (%)			
Male	47 (65.3)	23 (59)	.511
Female	25 (34.7)	16 (41)	
Body Mass Index (kg/m^2) (mean ± SD)	28.16 ± 3.46	27.86 ± 4.54	.841
ASA scores, no (%)			
1	38 (60.3)	23 (60.5)	.05
2	23 (36.5)	9 (23.7)	
3	2 (3.2)	6 (15.8)	
Comorbid diseases, no (%)			
1	19 (26.4)	12 (30.8)	.466
2	8 (11.1)	1 (2.6)	
3	4 (5.6)	2 (5.1)	
Tumor characteristics			
Clinical tumor size (mm) (mean ± SD)	71.59 ± 29.83	57.08 ± 19.33	.011
Tumor side, no (%)			
Right	36 (51.4)	28 (73.7)	.025
Left	34 (48.6)	10 (26.3)	
Clinical T stage, no (%)			
1a	6 (8.3)	7 (17.9)	.119
1b	28 (38.9)	18 (46.2)	
2a	22 (30.6)	10 (25.6)	
2b	12 (16.6)	1 (2.6)	
3a	2 (2.8)	0 (0)	
3b	0 (0)	0 (0)	
4	0 (0)	1 (2.6)	
Missing	2 (2.8)	2 (5.1)	
Clinical N stage, no (%)			
N0	66 (91.7)	35 (89.7)	.816
N1	5 (6.1)	2 (5)	
Missing	2 (2.8)	2 (5.1)	
Pathological T stage, no (%)			
1a	6 (9.2)	2 (6.4)	.001
1b	19 (29.2)	21 (68)	
2a	18 (27.7)	4 (12.8)	
2b	6 (9.2)	0 (0)	
3a	8 (12.3)	2 (6.4)	
4	8 (12.3)	2 (6.4)	
Pathological N stage, no (%)			
N0	62 (95.4)	30 (96.7)	.194
N1	3 (4.6)	1 (3.3)	
Pathology, no (%)			
Renal cell carcinoma	65 (93)	31 (79.4)	.114
Oncocitoma	1 (1.4)	4 (10.3)	
Others	4 (4.9)	4 (10)	
Histology, no (%)			
Clear cell	40 (61.5)	23 (74.2)	.416
Papillary	10 (15.3)	2 (6.5)	
Chromophobe	8 (12.3)	3 (9.7)	
Mixed	1 (1.6)	1 (3.2)	
Other	5 (7.7)	1 (3.2)	
Non-classified	1 (1.6)	0 (0.0)	
Missing	0 (0.0)	1 (3.2)	
Fuhrman Grade, no (%)			
1	10 (14.9)	1 (3.3)	.074
2	36 (53.7)	24 (80)	
3	14 (20.9)	5 (13.4)	
4	7 (10.5)	1 (3.3)	

Abbreviation: ASA, American Society of Anesthesiologists.

patient's usual or expected physical, emotional and social well-being following the diagnosis of a medical condition and/or its treatment;[8] however, few researchers have studied post-surgical HRQoL in patients with kidney tumors.[9-14] In addition, survey analyses of diseases or interventions provide more accurate information about patient health by assessing every individual patient on their health condition. Only a few studies, which determined the post-operative course of renal tumors on HRQoL compared with baseline values, were conducted. Most such studies were limited by biases, including the absence of baseline HRQoL assessment, small patient population,[14] retrospective design and low treatment response rates.[12,15]

The present multicenter prospective study aimed to evaluate whether different techniques (LRN and ORN) of radical nephrectomy might affect HRQoL based on QoL survey in patients with non-metastatic renal cancer. Secondarily, we aimed to assess the effect of surgical techniques on perioperative morbidity indices.

MATERIALS AND METHODS

Patient Selection

This prospective study consecutively included 152 patients with non-metastatic RCC that underwent ORN or LRN between 2007 and 2010 at 5 different hospitals. Patients with clinically determined T4 disease, vena cava thrombus, cognitive dysfunction, neuromuscular diseases and history of abdominal or retroperitoneal surgery were excluded from the study. Patients with metastatic disease during post-surgery follow-up [5 (3.1%)], incomplete or missing Short Form-36 (SF-36) questionnaires [17 (11.1%)] and lost to follow-up [19 (12.5%)] were also excluded. In all, 72 (64.9%) patients that underwent ORN (ORN group) and 39 (35.1%) patients that underwent LRN (LRN group) were analyzed. Tumor, Node, and Metastasis (TNM)-2009 classification was used for staging the patients based on preoperative thoracic and abdominal computed tomography (CT) scan. Systemic comorbid diseases of the patients were recorded including diabetes mellitus, chronic heart failure, hypertension, asthma and hypo/hyperthyroidism . They grouped as number of comorbidities, which existed in particular patients.

Surgery

LRN was performed using a standard transperitoneal or retroperitoneal approach.[16] Specimens were removed intact without using morcellation through a 5-7 cm oblique lower abdominal incision (Gibson). ORN was performed via a transperitoneal or retroperitoneal approach, with a subcostal incision.[17] Experienced academic surgeons performed all surgeries according to the standard criteria for ORN (each surgeon had performed $\geq$ 150 ORNs as the lead surgeon) and LRN (each moderately experienced surgeon performed $\geq$ 75 LRNs).

Type of surgery (open or laparoscopic), length of subcostal and Gibson incisions and trocar placement for LRN were determined based on patient characteristics, tumor characteristics, and surgeon preference. All specimens were analyzed according to standard pathology procedures in each of the hospitals in which the surgery was performed. Tumor nuclear grading was performed according to Fuhrman classification. No central pathologic slide review was performed; however, a senior pathologist at each hospital confirmed the pathological slides. Patient demographic characteristics, including age, gender, body mass index and American Society of Anesthesiologists (ASA) Score, were recorded. Tumor characteristics and surgical variables were also analyzed and compared.

The SF-36 Questionnaire

General HRQoL was measured using the SF-36 health survey.[18] SF-36 consists of 8 subscale scores that are the weighted sums of the questions in each section. Each subscale is directly transformed into a 0-100 scale based on the assumption that each question carries equal weight. In the present study, QoL was evaluated by self-administered SF-36 questionnaire obtained preoperatively and the end of first and 6th months after surgery. Physical domains were used to compare the effects of surgery on QoL, including physical functioning (PF), bodily pain (BP) and general health perception (GHP).

To optimize analgesic usage, paracetamol infusion (10 mg/mL) was administered 3 times (8 hours apart) during the first 24h post-surgery; afterwards, patient-controlled analgesia (PCA) was used according to need by preparing 400 mg pethidine hydrochloride in 100 mL saline with a dose of 10-15 mg infusion per hour. Analgesic requirement was defined as necessity of using PCA by the patients. Pain was assessed using a visual analog scale (VAS) 48h post-surgery (0 = no pain and 10 = extreme pain). Postoperative complications were graded using the Clavien-Dindo classification system.[19]

Statistical Analysis

Statistical analysis was performed using a computer-based statistical program. The Mann-Whitney *U* test and Kruskal Wallis test were used for continuous variables, and the chi-square test was used for categorical variables. Correlations between age and SF-36 physical domain scores were analyzed based on Spearman's correlation coefficient. Friedman variance analysis was used for dependent variables. Multiple linear regression was run to predict SF-36 PF, BP and GHP scores from gender, age, tumor size, tumor stage, preoperative and postoperative hemoglobin (Hb) and serum creatinine levels, BMI, ASA, number of comorbidities, complications and hospital readmission in 6-month postoperatively. The level of statistical significance was set at $P < .05$.

RESULTS

Mean age of the patients was 55.27 ± 11.19 years (range: 27-80 years); 70 (63.1%) of the patients were male and 41 (36.9%) were female. Demographic features and tumor characteristics of the patients in both groups are shown in **Table 1**. In the LRN group 28 (71.8%) patients were treated via a transperitoneal approach, 10 (25.6%) via a retroperitoneal approach and only one (2.6%) via a hand-assisted technique, whereas all surgeries in the ORN group were performed via anterior subcostal incision. There was a statistically significant difference in mean tumor size between the ORN (71.59 ± 29.83 mm) and LRN (57.08 ± 19.33 mm) groups ($P = .011$). According to pathological T (pT) staging, there were more patients in the LRN group with pT1 tumors than in the ORN group ($P = .001$).

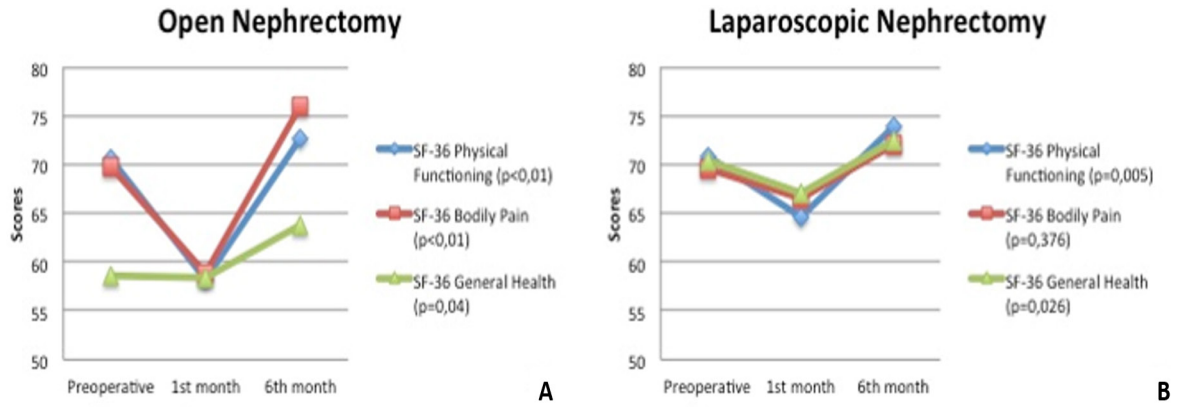

Figure. Variance analyses of Short Form-36 (SF-36) physical domains in open nephrectomy group (A) and laparoscopic nephrectomy group (B).

Pathological examination in all patients with pT4 disease showed adrenal involvement of the tumors. In all, 5 patients (6.9%) in the ORN group and 2 patients (5.1%) in the LRN group that were clinically diagnosed as N1 disease underwent para-aortic lymph node dissection. In the LRN group there was significantly less blood loss, a lower transfusion rate, earlier ambulation, shorter hospitalization and more rapid convalescence ($P < .001$, $P = .007$, $P = .023$, $P < .001$ and $P < .001$, respectively) (**Table 2**). None of the patients was needed to admit intensive care unit during convalescence period. The 30 days hospital readmission rates are shown in **Table 2**. None of the patients in LRN group admitted to the hospital while 9 of 39 patients hospitalized due to wound infection [5 (12.8%)], retroperitoneal hematoma [1 (2.5)], low Hb level [1 (2.5%)], incisional hernia [1 (2.5)] and appendicitis [1 (2.5%)]. None of the patients died during follow-up. The difference in surgical duration between the ORN (122.86 ± 36.8 min) and LRN (140.17 ± 50.71 min) groups was not significant ($P = .383$). Analgesic requirement and VAS pain scores were similar in both groups ($P = .536$ and $P = .900$, respectively). In terms of SF-36 physical domains, GHP scores in the LRN group were higher than in the ORN group pre surgery, 1 and 6 months after surgery (**Table 3**). Preoperative PF and GHP scores in the male patients were higher than those in the female patients ($P = .003$ and $P = .011$, respectively). There was not a correlation between age and preoperative SF-36 physical domain scores (PF: $P = .149$, $r = -0,132$; BP: $P = .132$, $r = -0,138$; GHP: $P = .561$, $r = -0.05$). PF and GHP scores were significantly lower in 1 month after surgery and higher in 6 months after surgery than pre surgery in both groups (**Figure**). The changes in BP scores in the LRN group were not statistically significant in both first and 6th months after surgery when compared with baseline values ($P = .376$) whereas the changes of PF and GHP scores in LRN group and, PF, BP and GHP scores in ORN group was significantly different (**Figure, A**).

According to multiple linear regression analysis, the factors that predicting low SF-36 PF scores were female gender [odds ratio (OR) = 14.2, 95% confidence interval (CI): 23.78-4.64; $P = .004$], low preoperative Hb (OR = 4.5, 95% CI: 8.68-0.39, $P = .033$) and high T stage (OR = 2.16, 95% CI: 4.2-0.08; $P = .042$). For SF-36 BP, the model was not found statistically significant ($P = .061$). The performing LRN (OR = 13.1, 95% CI: 6.09-20.2; $P < .001$) and young age (OR = 0.39, 95% CI: 0.65-0.122; $P = .005$) were the factors that positively affected the SF-36 GHP scores.

DISCUSSION

The present findings show that physical aspects of HRQoL were significantly lower in 1 month after surgery and improved in 6 months after surgery in patients that underwent ORN and LRN. Indeed, investigated SF-36 domain scores at 6 months after surgery were higher than at baseline. LRN was not better than ORN in terms of analgesic requirement and VAS pain score at 48h post-surgery, even though mean tumor size and pathological T stage were higher in the ORN group. Nevertheless, GHP scores were higher in the LRN group and BP scores in the LRN group didn't change significantly both in 1 and 6 months after surgery. LRN was better than ORN in terms of perioperative indices, including blood loss, the transfusion rate, ambulation, duration of hospitalization and convalescence; however, surgical duration and the postoperative complication rate did not differ significantly between the groups.

The literature contains insufficient data concerning HRQoL in RCC patients treated LRN and ORN, as most of the relevant studies were retrospective and cross-sectional in design. It may be more advantageous to conduct survey studies to determine the exact value of LRN, because the factors affecting baseline HRQoL in patients with renal tumors vary patient by patient; therefore, the present study prospectively evaluated QoL in patients that underwent ORN and LRN. The present study in particular could show the alterations and differences in HRQoL after the radical nephrectomy techniques with its prospective design.

Recently, 2 prospective studies compared radical nephrectomy (RN) and other treatment options in terms of HRQoL in RCC patients.[9,14] Onishi and colleagues reported that radiofrequency ablation had significantly less of an effect on HRQoL than LRN during the first week post-surgery;[14] however, the study included 37 patients

and evaluated only patients with tumors < 4 cm. Novara and colleagues evaluated HRQoL in patients that underwent open partial nephrectomy (OPN) and RN 12 months after surgery, and investigated the prognostic factors predictive of post-surgical HRQoL.[9] At 6 months post-surgery 59-81% of the patients' scores returned the baseline values across the different domains. They reported that New York Hearth Association class in the role physical functioning (RPF) domain, mode of presentation in the GHP domain, indications for nephron-sparing surgery in the PF domain and tumor histology in the BP domain were significantly associated with recovery of baseline SF-36 scores 6 months after surgery. Other retrospective study focused primarily on HRQoL. Gratzke and colleagues reported that patients with postoperative complications (regardless of the type of surgery) tended to have lower QoL scores (especially GHP) than patients without complications.[13] On the other hand, Clark and colleagues did not observe any significant differences in SF-36 physical or mental domain scores according to type of surgery.[15] Parker and colleagues evaluated the general and cancer specific QoL of 172 patients with renal tumors who underwent laparoscopic/open radical and partial nephrectomy with a follow-up of 12 months. They used SF-36 for general QoL and the Cancer Rehabilitation Evaluation System-Short Form for cancer specific QoL. They demonstrated that QoL scores of the patients treated with laparoscopy is higher than open surgery and better cancer specific QoL was reported in patients who underwent radical nephrectomy. They concluded there were significant differences in QoL and psychosocial adjustment outcomes during 1 year in patients treated with all kind of renal surgery. Finally, they stated the QoL outcomes must be evaluated in the context of tumor characteristics, cancer specific outcomes and renal function. In the present study SF-36 GHP scores in the LRN group were higher than those in the ORN group, which may have been due smaller mean tumor size and the presence of more pT1 tumors in the LRN group, whereas age, body mass index, gender and ASA scores did not differ significantly between the groups. In multiple linear regression analysis, performing LRN and young age are the predicting factors for high SF-36 GHP scores. In addition, female gender and higher *t* stage had worse outcome for SF-36 PF. We can explain the effect of gender that we found high preoperative PF and GHP scores in the male patients than those in the female patients. Furthermore, we think that the positive impact of cancer treatment on physical and general QoL may have led to improvement in SF-36 physical domain scores between baseline and 6 months post-surgery.

Studies that evaluated pain following ORN and LRN reported that analgesic requirement was significantly lower in the LRN group;[7] however, the present findings indicate that analgesic requirement and VAS pain score at 48h post-surgery were similar in the ORN and LRN groups. In our study all ORNs were performed via subcostal incision, so as to standardize the patients. It may well be speculated that morbidity associated with subcostal incision might be low in the ORN group. Indeed, Novara and colleagues reported that flank incision was associated with a higher morbidity rate than anterior incision.[9] As compared to baseline, BP scores in the present study's ORN group were significantly lower in one month after surgery and higher in 6 months after surgery, whereas in the LRN group the change in BP was not significant. On the other hand postoperative VAS pain scores and analgesic requirement were similar in the ORN and LRN groups, which might show be indicative of the positive effect of short convalescence period of the laparoscopic

Table 2. Comparison of operative variables of the study groups according to surgery type.*

Variables	Open Nephrectomy (n = 72)	Laparoscopic Nephrectomy (n = 39)	*P* Value
Hemoglobin (g/dL)			
Preoperative	13.21 ± 1.92	13.19 ± 1.79	.887
Postoperative	11.87 ± 1.66	12.12 ± 1.67	.733
Creatinine (mg/dL)			
Preoperative	1.04 ± 0.38	0.96 ± 0.33	.268
Postoperative	1.42 ± 1	1.13 ± 0.3	.051
Operative time (min)	122.86 ± 36 .8	140.17 ± 50.71	.383
Blood Loss (mL)	359 ± 416.1	150 ± 177.7	< .001
Blood transfusion (unit)	0.4 ± 0.816	0.08 ± 0.35	.007
Analgesic requirement, no (%)			
No	18 (28.1)	10 (34.5)	.536
Yes	55 (71.9)	16 (65.5)	
Ambulation (hour)	16.97 ± 10.29	13.79 ± 2.52	.023
Time to start oral intake (hour)	23.98 ± 13.36	19 ± 10.94	< .001
Time to removal of drain (day)	3.71 ± 1.73	1.85 ± 0.53	< .001
Hospitalization (day)	6.26 ± 3	3.36 ± 1.34	< .001
Convalescence time (week)	3.24 ± 1.04	1.71 ± 0.69	< .001
Clavien-Dindo Grade (30 days), no (%)			
1	8 (9.9)	0.0	< .001
2	1 (1.2)	0.0	
3b	2 (2.5)	1 (2.5)	
30 days hospital readmission, no (%)	9 (23)	0.0	.02

* Data are presented as mean ± SD.

Table 3. Comparison of VAS scores and SF-36 physical domains of the patients according to surgery type.*

Variables	Open Nephrectomy (n = 72)	Laparoscopic Nephrectomy (n = 39)	*P* Value
Postoperative VAS scores at 48 hours	3.92 ± 1.49	3.9 ± 1.57	.900
Preoperative SF-36 physical domains			
Physical functioning	71.74 ± 25.27	70.87 ± 25.23	.896
Bodily pain	70.56 ± 20.57	69.56 ± 23.47	.980
General health	58.78 ± 15.85	70.31 ± 19.38	< .001
Postoperative 1 month SF-36 physical domains			
Physical functioning	58.19 ± 23.9	64.64 ± 23.44	.230
Bodily pain	58.42 ± 19.59	66.56 ± 1.55	.058
General health	58.24 ± 15.17	67.05 ± 15.97	.011
Postoperative 6-month SF-36 physical domains			
Physical functioning	74.11 ± 16.74	73.9 ± 24.21	.521
Bodily pain	77.43 ± 17.44	72.15 ± 20.33	.440
General health	64.81 ± 14.45	72.44 ± 15	.55

Abbreviations: VAS, visual analog scale; SF-36, Short Form-36 questionnaire.
* Data are presented as mean ± SD.

approach on BP. The present study's findings might be useful for counseling patients before surgery concerning the probability of and time necessary to return to preoperative HRQoL.

The present study also evaluated perioperative morbidity indices, including operative variables, pathological features, postoperative course and complications associated with ORN and LRN. As previously reported, the LRN group of present study had significantly less blood loss, a lower transfusion rate, earlier ambulation, more rapid convalescence and shorter hospitalization than the ORN group. Studies reported that mean duration of hospitalization and convalescence time were significantly shorter in the LRN group than in the ORN group.[7,13] Blood loss and the transfusion rate were also found to be significantly lower in the LRN group.[4] Although the surgical complication rate found to be low in the LRN group, there wasn't a difference in such complications as surgical site infection, pneumonia, hemorrhage, or postoperative mortality.[4]

The present study has several limitations. First, it employed a prospective, non-randomized design; however, randomization is very difficult with multicenter studies that are affected by such factors as patient characteristics, tumor characteristics and surgeon experience. We realized that the number of ORN has been increased over LRN during the study period due to the patient and/or surgeon preferences. During run-in period of the patients, some clinics had only performed ORN that changed distribution of the patients in the study groups. It could affect the sample size and statistical power because the sample size assumed as 50 patients to each group according to the priori statistical power analysis of the study. Second, longer follow-up of HRQoL might yield more information and more accurately indicate the natural history of cancer after surgery, even though disease progression probably impairs QoL components. On the other hand, the present study investigated HRQoL in patients with a good-intermediate prognosis in whom disease-free survival is really high. Another important limitation was use of SF-36 instead of a disease-specific QoL questionnaire. Although SF-36 can measure both physical and mental QoL, a specific questionnaire for RCC might have more accurately indicated the effect of each surgical technique on QoL. On the other hand, Kim and colleagues evaluated HRQoL outcome after renal surgery with 2 patient-reported HRQoL instruments, Convalescence and Recovery Evaluation (CARE), and SF-12 in 71 patients. The CARE pain, gastrointestinal (GI) and activity domain scores and the SF-12 physical composite score (PCS) were sensitive to changes in HRQoL. Interestingly, they found postsurgical HRQoL effects detected by the questionnaires were most evident at 2 weeks and, 74% and 50% of patients returned to within 90% of baseline 4 weeks after radical and partial nephrectomy, respectively. They concluded that the activity, pain and GI domains of CARE and PCS sub scores of the SF-12 are sensitive measures of HRQoL outcome of renal surgery and they recommended these questionnaires for appropriate measures of HRQoL in renal surgery.[20] Finally, The Functional Assessment of Cancer Therapy Kidney Symptom Index (FKSI-15) was recently developed for this purpose,[21] but this questionnaire was designed for evaluating advanced and recurrent kidney cancer and was not considered appropriate for use in the present study.

CONCLUSION

The investigated QoL parameters didn't differ significantly between the LRN and ORN groups, except for the GHP domain score. Minor changes in SF-36 BP scores in the LRN group could be considered indicative of the superiority of LRN. Although the patients in the ORN group had relatively larger tumors and/or higher pathologic stage, these factors had no effect on analgesic requirement, postoperative complications, or physical functioning. The higher physical and general QoL scores at 6 months post-surgery in both groups let us think the positive impact of cancer treatment, regardless the type of surgical treatment. Lastly, LRN exhibited explicit technical advantages over ORN, including less blood loss, shorter hospitalization and more rapid recovery.

ACKNOWLEDGEMENTS

All authors are members of Turkish Uro-oncology Society and the present study was conducted under approval of general council of the society.

CONFLICT OF INTEREST

None declared.

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