Prognostic Significance of Body Mass Index and Other Tumor and Patient Characteristics in Non-Metastatic Renal Cell Carcinoma

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Purpose: In this retrospective study, we aimed to investigate the prognostic effect of body mass index (BMI) in localized renal cell carcinoma (RCC) cases who underwent surgical treatment. Furthermore, the assessment of various patient and tumor characteristics and surgical methods on survival has been identified as additional targets.

Materials and Methods: Three hundred and eighty patients with localised, non-metastatic, unilateral RCC who underwent radical or partial nephrectomy in our clinic between January 2007 and December 2016 were enrolled in this study. Age, gender, height, weight, BMI, operation type and method, pathology results and tumor stage of the patients were recorded. Patients were divided into 3 groups according to body mass index (BMI): Normal weight (< 25 kg/m^2), overweight (25-30 kg/m^2) and obese (> 30 kg/m^2) as groups 1, 2 and 3, respectively. We analyzed the relation between the BMI, gender, smoking, hypertension, type and method of surgical treatment, histologic subtype, tumor stage, estimated glomerular filtration rate (eGFR) and cancer-specific (CSS) and recurrence free survival (RFS). All data analysis was performed using SPSS® Statistical Software for Windows (Version 13.0) and a *P* value less than 0.05 was considered to be significant.

Results: The effect of BMI on both CSS and RFS was statistically significant ($P < .001$). There was also a significant relation between smoking, operation type (partial/radical), eGFR and tumor stage and CSS and RFS.

Conclusion: Our findings show that overweight and obese RCC patients according to the BMI have a more favorable prognosis. Multicenter, prospective studies with more cases and longer oncological follow-up period are needed to support these findings.

Keywords: body mass index; prognosis; renal cell carcinoma; recurrence; survival.

INTRODUCTION

Renal cell carcinoma (RCC) accounts for 2-3 % of all cancers[1]. The incidence of RCC increases around the world in the last decades and it has been reported that 20-40 % of patients will develop local recurrence or distant metastases after localized RCC treatment with partial or radical nephrectomy[2].

RCC is a very heterogeneous and complex disease with a widely varying prognosis. In cases of kidney cancer, it is very important to be able to predict the prognosis and the response to selected treatments prior to disease management. However, some problems are anticipated in predicting the prognosis of RCC. The main causes of these are as follows; natural course of kidney cancer is highly complicated and significantly differs between the patients, many defined prognostic variables are present and these variables interact with each other. Factors affecting prognosis of RCC are tumor-related (anatomical and histological features) and patient-related factors (clinical findings, symptoms, general health status, laboratory findings, and molecular factors). At present, the pathologic stage (pT), lymph node status (pN) and histologic grade of the tumor represent the most important prognostic variables. However, some other characteristics of the patient and the tumor have been shown to be associated with renal cancer outcomes. Recently, several systems have been designed by combining various prognostic factors to obtain a powerful and important prognostic model for RCC[3-5]. Many epidemiological studies have shown that obesity and family history are important risk factors for RCC[6-8]. Although obesity is a well-known risk factor for RCC, there are articles reporting that obesity improves or at least does not worsen the disease prognosis[9,10]. In this study, we aimed to analyze the prognostic effect of body mass index (BMI) in our localized RCC cohort managed with surgical treatment. We also evaluated the effect of gender, smoking, hypertension, surgical treatment type and method, histologic tumor subtype, estimated glomerular filtration rate (eGFR) and tumor stage on cancer-specific (CSS) and recurrence free survival (RFS).

PATIENTS AND METHODS

Patient selection

The study was initiated after the local ethics committee approval. Three hundred and eighty patients with localised, non-metastatic, unilateral renal cell carcinoma who underwent radical or partial nephrectomy in our clinic between January 2007 and December 2016 were enrolled in this retrospective study. These were consecutive cases and all of them were operated in the same clinic. Patients with metastatic renal tumor who underwent radical nephrectomy (n = 14) and patients with bi-

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Table 1. Proposed surveillance schedule following treatment for RCC, taking into account patient risk profile and treatment efficacy.

Risk profile	Follow-up[a]						
	6	12	24	36	48	60	> 60
Low	US	CT	US	CT	US	CT	Discharge
Intermediate	CT	CT	CT	US	CT	CT	CT once every 2 years
High	CT	CT	CT	CT	CT	CT	CT once every 2 years

[a] Numbers indicate the month.
CT: computed tomography of chest and abdomen, alternatively use MRI;
US: ultrasound of abdomen, kidneys and renal bed.

lateral renal tumor who underwent partial nephrectomy (n = 4) were excluded from the study. Seventy-seven patients with papillary histology were excluded from the study since it may be hereditary. Also, patients whose pathologic report revealed end-stage angiomyolipoma, oncocytoma and unclassified carcinoma were not included in the study (n = 8), 6 patients had missing data and 7 patients were lost to follow-up (**Figure 1**).

Database and Patient Groups

Age, gender, height, weight, BMI, operation type and method, pathology results and tumor stage of the patients were recorded. Tumor staging was established according to 2010 tumor, node, metastasis classification [11]. The results of preoperative and postoperative laboratory examinations such as chest X-ray, abdominal ultrasonography, thorax and abdominal tomography, magnetic resonance imaging, brain tomography and bone scintigraphy were reviewed from patient files.

The weight and height of the patients were recorded at the first visit. Patients were divided into 3 groups according to BMI: Normal weight (< 25 kg/m^2), overweight (25-30 kg/m^2) and obese (> 30 kg/m^2) as groups 1, 2 and 3, respectively. The abbreviated Modified Diet and Renal Disease equation was used to measure eGFR using the last serum creatinine before surgery[12]. Patients were classified as having a baseline eGFR of above 60, between 45-60 and less than 45 mL/min per 1.73 m2. Recurrences detected at the site of the surgery in patients who underwent radical nephrectomy and recurrences detected in the residue kidney in patients who underwent partial nephrectomy were accepted as local. In cases of partial nephrectomy, recurrences at different locations in the same kidney were also accepted as local. Elsewhere in the body, masses that are associated with kidney tumors were considered as distant recurrences. All recurrences were detected by cross-sectional imaging in the postoperative follow-up period. Patients were stratified according to the American Society of Anesthesiologists (ASA) score.

Preoperative preparation

Before surgery, all patients underwent physical examination, routine blood and urine examinations, two-dimensional chest radiography, abdominal ultrasonography and tomography. Preoperative imaging of the patients did not reveal any regional (retroperitoneal adenopathy) or distant metastasis. Where necessary, diagnostic tests such as Doppler ultrasonography, magnetic resonance imaging and bone scintigraphy were added. Written, informed consent of the patients was obtained before surgery. All patients underwent detailed anesthesia examination before the operation.

Surgical treatment and follow-up

Patients underwent radical or partial nephrectomy with open or laparoscopic methods under general anesthesia. Tumor size (4 cm) was typically the determining factor in the selection of partial or radical nephrectomy. However, this criterion was not strictly determinative,

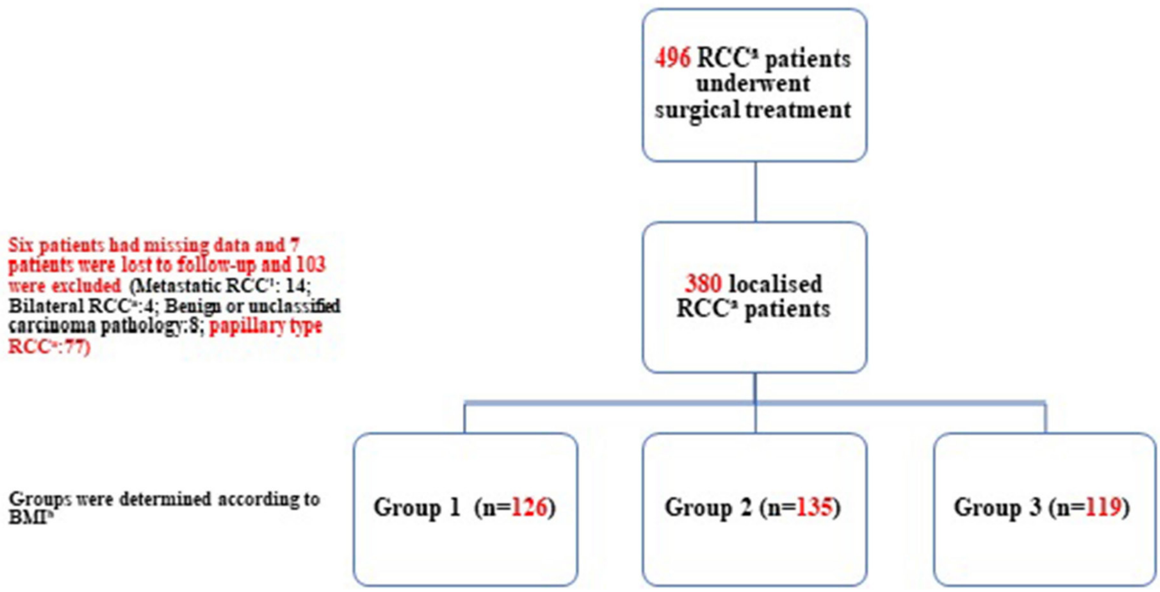

Figure 1. Study flow chart
[a]Renal cell carcinoma, [b]Body mass index

Table 2. Patient and operation characteristics

Variables		Number (n)	Ratio (%)	Mean(±SD)
Sex	Male	241	63.4	
	Female	139	36.6	
Age (year)	Male			61.6 ± 10.8
	Female			39.2 ± 12.3
BMI[a] (kg / m^2)				25.6 ± 2.9
Height (cm)				162.8
Body weight (kg)				75.4
Smoking	Yes	191	50.2	
	Amount (cigarettes/day)			
	1-10	55		
	10-20	61		
	> 20	75		
	Duration (years)			
	1-10	60		
	11-20	92		
	No	189	49.8	
Hypertension	Yes	27	7.1	
	No	353	92.9	
Operation type	Partial nephrectomy	85	22.3	
	Radical nephrectomy	295	77.7	
Operation method	Laparoscopy	74	19.4	
	Open	306	80.6	
eGFRb	< 45	88	23.1	
	45-60	143	37.6	
	> 60	149	39.3	
Tumor characteristics				
Stage	T1a	138	36.3	
	T1b	128	33.6	
	T2a	38	10.0	
	T2b	6	1.57	
	T3a	70	18.4	
Localization	Upper pole	115	30.2	
	Middle pole	128	33.6	
	Lower pole	122	32.1	
	Hilar	15	3.94	
Side	Right	194	51.1	
	Left	186	48.9	
Histological subtypes	Clear cell	316	83.1	
	Chromophobe	59	15.5	
	Mucinous tubular spindle cell	4	1.05	
	Multilocular cystic	1	0.26	

[a]Body mass index
[b]Estimated glomerular filtration rate (mL/min per 1.73 m^2)

and surgical decision was made according to factors such as surgeon preference and experience, tumor location, size and patient comorbidities. Patients were divided into groups according to type and method of surgery, and the difference between survival rates was examined. The protocol recommended by the Guidelines of the European Urological Association[13] was used to follow-up the patients (**Table 1**).

Outcome measures

Our primary outcome measurement was the relation between the BMI and survival rates and our secondary outcome measurement was the relation between gender, smoking, hypertension, type and method of surgical treatment, histologic subtype, tumor stage and survival rates. We calculated the CSS ratios by calculating the percentage of patients who did not die from the RCC in the follow-up period. Patients who died from causes other than the disease being studied are not counted in this measurement. The length of time after primary treatment for RCC ends that the patient survives without any signs or symptoms of cancer was calculated as RFS.

Statistical analysis

The Kolmogorov-Smirnov test was used to determine whether the variables met the normal distribution. Normal distribution-matching data were shown by mean and standard deviation while the non-matching data were shown by median and between the quarters. The student test was used to compare the variables and survival analysis was performed by univariate and multivariate Cox proportional hazards model and Kaplan-Meier method. All data analysis was performed using SPSS® Statistical Software for Windows (Version 13.0). *P* value less than 0.05 was considered to be significant.

RESULTS

Two hundred and forty-one (63.4 %) of the 380 patients were male and 139 (36.6 %) were female. The vast majority of patients (306, 80.5%) were in the ASA I-II group. Sixty-two patients (16.3%) were in ASA III group and 12 patients (3.1%) were in ASA IV group. The mean follow-up period of the patients was 62.28 ± 1.16 months (0-98). According to the follow-up protocol proposed in **Table 1**, 72 patients were followed up at 6 months, 68 at 12 months, 62 at 24 months, 58 at 36 months, 51 at 48 months, 42 at 60 months and 27 at > 60 months. Seven patients who did not comply with the protocol were excluded from the follow-up. When BMI

Table 3. Effects of patient and tumor characteristics on survival.

Variables		Number (n)	Number of deaths (n)	Number of recurrences (n) local	distant	Mean cancer-specific survival (month)	Mean recurrence-free survival (month)	95% CI[a]	95% CI[b]	*P* value[a]	*P* value[b]
BMIc groups	1	126	48	32	10	58.6	58.2	51.8–66.9	51.6–67.8	< 001	< 001
	2	135	11	11	6	82.5	77.3	80.1–88.2	72.3–83.6		
	3	119	7	7	2	84.6	82.8	82.1–89.7	79.6–89.7		
Sex	Male	241	41	22	16	74.7	72.9	71.8–81.4	68.6–78.8	0.540	0.648
	Female	139	25	22	8	74.2	73.8	70.2–81.3	67.8–80.4		
Smoking	Yes	191	49	31	13	64.6	69.8	62.1-74.0	61.2-73.4		
	Amount (cigarettes/ day)										
	1-10	72	8	5	2	78.3	74.3		68.2-78.5		
	10-20	61	13	7	4	62.8	64.2	71.5-80.5	60.4-68.9		
	> 20	58	28	20	6	44.6	52.2	57.8-64.1	48.4-56.8	< 001	< 001
	Duration (years)	121	15	8	5	67.5	70.2	65.2-70.6	65.5-74.1		
	1-10	70	34	22	9	42.2	62.1	39.2-46.4	58.2-65.4		
	11-20										
	No	189	17	17	7	84.2	89.6	80.1–88.2	78.7–91.8		
Hypertension	Yes	27	12	23	8	62.6	56.2	56.7–71.6	49.6–64.4	0.488	0.089
	No	353	54	22	15	74.4	74.6	72.7–81.4	70.8–79.2		
Operation type	Partial	85	8	6	3	88.6	88.4	83.1–91.6	82.8–91.6	< 001	< 001
	Radical	295	58	44	15	73.7	68.4	67.2–77.1	63.5–72.2		
Operation method	Open	306	38	24	9	76.7	75.2	72.1–81.3	70.7–79.5	0.720	0.680
	Laparoscopic	74	28	23	12	76.1	76.8	69.2–81.9	68.3–82.8		
Histological subtypes	Clear cell	316	42	24	7	75.6	74.7	71.1–79.8	69.8–78.8	0.442	0.584
	Chromophobe	59	24	23	14	82.2	79.6	76.7–92.6	73.8–92.1		
Stage	T1a	138	3	5	2	88.1	87.9	82.2–90.2	83.4–90.6	< 001	< 001
	T1b	128	8	6	3	77.8	76.4	71.8–82.5	71.8–82.2		
	T2a	38	12	8	3	71.3	71.6	66.5–80.1	69.1–81.3		
	T2b	6	16	10	5	58.5	56.4	48.9–66.6	46.1–62.8		
	T3a	70	27	18	8	48.9	46.1	42.8–63.6	38.4–54.3		
eGFRd	< 45	88	37	25	7	45.8	52.9	38.8-48.1	50.8-54.3	< 001	< 001
	45-60	143	23	17	5	59.6	61.8	52.2-61.4	59.7-63.3		
	> 60	149	6	11	3	82.1	84.3	78.3-86.8	82.8-86.5		

[a]Confidence interval and *P* values for cancer-specific survival
[b]Confidence interval and *P* values for recurrence-free survival
[c]Body mass index
[d]Estimated glomerular filtration rate (mL/min per 1.73 m^2)

and histologic subtype relation were examined, clear cell pathology was higher in the first group compared to the other two groups, but it was not statistically significant (P = .0822).

The mean tumor size was 5.3 cm (IQR = 3.92). The mean follow-up period of the patients was 50.8 ± 18.1 months. Surgical margin positivity was confirmed in 33 patients (8.68%). Local or distant recurrence was observed in 82 of 380 patients (21.57%). The mean time to recurrence was 30.2 ± 21.4 months. Eighty-two of the patients (21.57%) died in follow-up. The mean time to exitus was 29.6 ± 12.4 months. Demographic and operation data and tumor characteristics are shown in **Table 2**.

Cancer-specific survival

The mean cancer-specific survival time of the patients after diagnosis was 73.5 ± 1.2 months. When the relation between BMI and survival time was analyzed, the mean survival time in group 1 was 58.6 ± 2.8 months, 82.5 ± 1.5 months in group 2 and 84.6 ± 1.4 months in group 3 (P < .001) (**Figure 2**). The mean survival time was 64.6±2.4 months in smokers and 84.2 ± 1.2 months in non-smokers (P < .001). The number of cigarettes smoked per day and the duration of smoking also significantly affected survival rates (P < .001). Mean survival time was 88.6 ± 1.1 months in patients undergoing partial nephrectomy and 73.7 ± 1.8 months in patients undergoing radical nephrectomy (P = .001). Multilocular cystic and mucinous tubular spindle cell carcinoma tumors were excluded from the analysis due to low number of cases. Mean survival time was 75.6 ± 2.0 months in patients with clear cell pathology and 82.2 ± 3.6 months in patients with chromophobe pathology (P = .442). A statistically significant difference was also observed between tumor stage and survival time (P < .001). We found that preoperative eGFR significantly affected the CSS (P < .001). Because tumor stage is a very important determinant of cancer-specific survival, CSS analysis according to the stage is shown in **Figure 3**.

Recurrence-free survival

The mean recurrence-free survival time of the patients was 74.8 ± 1.8 months. When the relation between BMI and recurrence-free survival was examined, the mean recurrence-free survival time was 58.2 ± 3.4 months in group 1, 77.3 ± 2.5 months in group 2 and 82.8±1.9 months in group 3 (P < .001) (**Figure 4**). Mean recurrence-free survival time was 69.8 ± 2.6 months in smokers and 89.6 ± 1.8 months in non-smokers (P = .001). The number of cigarettes smoked and the smoking duration significantly affected RFS (P < .001). The mean recurrence-free survival time was 88.4 ± 1.3 months in patients undergoing partial nephrectomy and 68.4 ± 2.2 months in patients undergoing radical nephrectomy (P

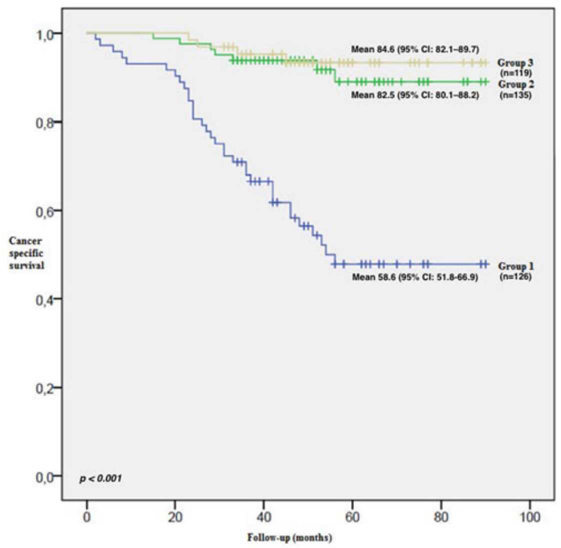

Figure 2. Kaplan-Meier analysis of the cancer-specific survival of individuals in terms of body mass index.

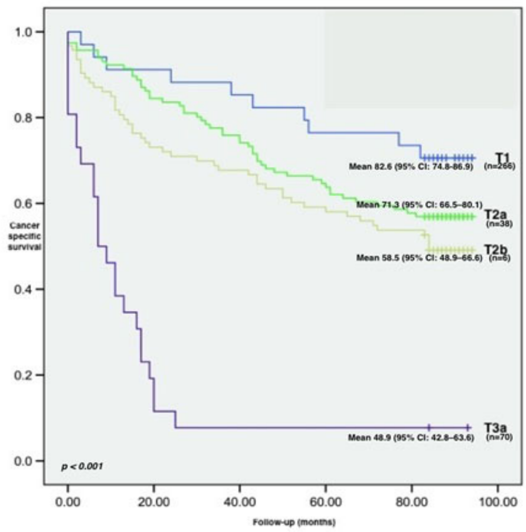

Figure 3. Kaplan-Meier analysis of the cancer-specific survival of individuals in terms of tumor stage.

< .001). There was a statistically significant negative association between tumor stage and recurrence free survival (*P* < .001). Preoperative eGFR significantly affects RFS similarly to CSS (*P* < .001). The relation between patient and tumor characteristics and CSS and RFS is shown in **Table 3**. Univariate and multivariate analyzes indicating the relationship of variables with survival are presented in **Table 4**.

DISCUSSION

Nowadays, obesity is a very important public health problem and it is reported that in the United States more than one-third of adults and 17 % of youth are obese [14]. Obesity is indicated to be an important risk factor for sporadic RCC in the European Urological Association (EAU) Guideline and the risk of RCC is reported to be 3.6 times more in obese patients compared with the general population[15]. As already mentioned, the incidence of RCC is increasing every year worldwide. It is quite significant that this incidence shows parallelism with the increase in the incidence of obesity.

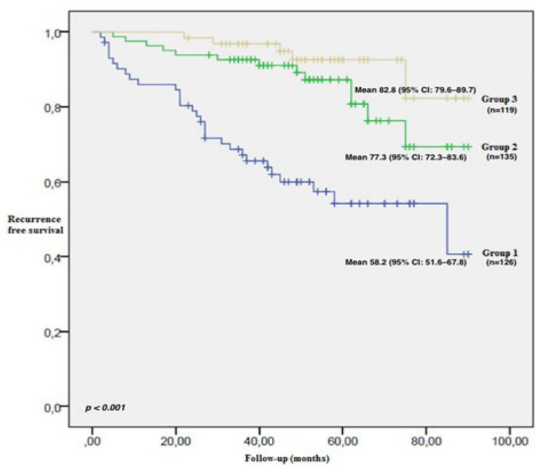

Figure 4. Kaplan-Meier analysis of the recurence-free survival of individuals in terms of body mass index.

Several community-based case-controlled epidemiological and clinical, prospective studies have been conducted to establish the relationship between obesity and renal cancer. Many epidemiological studies have addressed the relationship between obesity and renal cancer. The upregulation of leptin and downregulation of adiponectin pathways has largely explained the pathogenesis of RCC[16]. Obese people have more health problems than normal weight people, so they are subjected to more frequent health controls and this may be the reason of more frequent occurrence of incidental masses. However, in our study, such information is not available. Also, filling the questionnaires by the patients and in case of patients' tending to report lower body weighs in some studies and some methodological differences such as the use of waist circumference or hip circumference parameters instead of body mass index in some other studies have resulted in different outcomes reporting different risk ratios and suggesting that obesity is only a risk factor for women and even that obesity is not a risk factor for kidney cancer. However, outcomes of the studies conducted by the European Prospective Investigation into Cancer and Nutrition Research Group (EPIC) on about 350.000 Europeans have shown that obesity is an important risk factor for RCC [6]. In this study, it was reported that while all of the parameters used for obesity evaluation in women (such as BMI, body weight, waist circumference, waist circumference) increased the risk of kidney cancer, only the hip circumference as a risk factor in men was reported to have a predictive value.

Many hypotheses have been proposed to explain why obesity is a risk factor for RCC cases. Scacchi et al showed high serum concentrations of free insulin-like growth factor-I in obese patients[17]. This factor affects cell cycle and is an important mutagenic factor associated with many cancers, including breast, prostate, lung and colorectal. It is stated that obesity may increase

Table 4. Univariate and multivariate analysis model for overall survival.

Variables	Univariate HRa 95% CI[b]	*P* value	Multivariate[c] HRa 95% CI[b]
BMI[d]			
Group 1	1.28 (0.88-1.32)	0.004	1.34 (1.02-1.42)
Group 2	1.09 (0.92-1.22)	0.028	1.21 (0.96-1.39)
Group 3	0.92 (0.82-1.14)	0.036	1.22 (1.06-1.38)
Sex			
Male	1.06 (0.89-1.21)	0.584	-
Female	1.02 (0.91-1.21)	0.480	-
Smoking			
Yes	1.36 (1.21-1.58)	0.043	1.44 (1.22-1.56)
Amount (cigarettes/day)			
1-10	1.17 (0.88-1.21)	0.038	1.28 (1.19-1.32)
10-20	1.23 (1.15-1.32)	0.026	1.33 (1.26-1.42)
> 20	1.38 (1.24-1.43)	0.018	1.45 (1.39-1.56)
Duration (years)			
1-10	1.19 (1.11-1.25)	0.021	1.24 (1.18-1.31)
11-20	1.24 (1.17-1.41)	0.017	1.35 (1.22-1.43)
No	1.08 (1.03-1.22)	0.022	1.19 (1.09-1.24)
Hypertension			
Yes	1.02 (0.89-1.14)	0.086	-
No	1	-	-
Operation type			
Partial	1.68 (1.56-1.72)	0.004	1.72 (1.62-1.79)
Radical	2.13 (1.99-2.24)	0.023	2.34 (2.18-2.44)
Operation method			
Open	1.04 (0.96-1.12)	0.880	-
Laparoscopic	1.08 (0.99-1.19)	0.420	-
Histological subtypes			
Clear cell	1.14 (0.99-1.21)	0.560	-
Chromophobe	1.09 (1.03-1.14)	0.226	-
Stage			
T1a	1.17 (1.08-1.22)	0.004	1.22 (1.18-1.33)
T1b	1.39 (1.15-1.48)	0.021	1.49 (1.36-1.55)
T2a	1.69 (1.58-1.79)	0.019	1.75 (1.68-1.84)
T2b	1.98 (1.84-2.21)	0.024	2.28 (2.12-2.88)
T3a	2.23 (2.12-2.46)	0.038	2.49 (2.31-2.65)
eGFR			
< 45	2.16 (1.89-2.32)	0.012	2.38 (2.21-2.49)
45-60	1.86 (1.74-1.99)	0.005	2.04 (1.92-2.32)
> 60	1.62 (1.54-1.78)	0.049	1.92 (1.82-2.18)

[a] Hazard ratio
[b] Confidence interval
[c] Multivariate analysis included variables that were significant ($p < 0.05$) in univariate analysis

RCC risk by raising serum concentrations of free estrogens in animal studies[18]. Recently, it has been suggested that lipid peroxidation is a partially responsible mechanism for increased RCC risk in obese and hypertensive patients[19]. These data suggest that increased BMI may also cause poor prognosis in RCC cases. But the results of the studies are far from supporting this assumption.

Donat et al. retrospectively reviewed the data of 1137 RCC patients and reported that although an increased BMI was associated with a greater proportion of clear cell histology, comorbidity, and surgical morbidity, BMI did not adversely impact overall or progression-free survival[9]. Reeves et al.[20] followed up 1.2 million women on avarage for 5.4 years for cancer incidence and 7.0 years for cancer mortality. They found that increasing body mass index was associated with an increased incidence of kidney cancer in addition to many other cancers (trend in relative risk per 10 units=1.53, 95% confidence interval 1.27 to 1.84) and concluded that increasing body mass index is associated with a significant increase in the risk of cancer for 10 out of 17 specific types examined. Kamat et al.[10] reviewed the records of 400 patients who underwent nephrectomy for localized RCC. Their findings revealed that overweight and obese patients with renal cell carcinoma have a more favorable prognosis than patients with a normal BMI and they concluded that if others confirm their finding that a high BMI confers a survival advantage to patients undergoing nephrectomy, BMI may prove to be an important prognostic factor in renal cell carcinoma. We also found that a high BMI score leads to better prognosis in RCC patients in our study, similar to the results of Kamat et al. In a large cohort study conducted in Korea, the data of 1017 patients were retrospectively reviewed. After a mean follow-up of 76.9 months, the authors found that overweight and obese patients had less aggressive tumors, such as less lymph node and/or distant metastases, low pathological T stage and low Fuhrman grade vs normal weight patients. In terms of cancer specific survival and overall survival multivariate analysis showed that overweight and obese patients had good survival rates compared to those with a body mass index in the normal range in the cohort (T1-4NallMall) groups. In addition, overweight and obese status was significantly associated with cancer specific and overall survival in the T1-4N0M0 groups. They concluded that overweight and obese Korean patients with RCC have more favorable pathological features and a better prognosis than those with a normal BMI[21]. Similar results were obtained with the above studies in our study. We found that cancer-specific survival and recurrence-free survival were better in the overweight and obese patient group than in the normal group, but we did not find any significant difference between the genders.

However this study allows us to obtain important information on the impact of BMI on the prognosis of RCC, it has several limitations. First of all, this study is a retrospective analysis of data collected from a single center; hence the number of cases is relatively small and limited to calculate the general population. In addition, the loss of body weight and preoperative nutritional status are also reported to be significant prognostic factors for RCC[22], but our study did not include these.

Smoking is also considered as an important risk factor for RCC. Several cancerous substances found in cigarettes cause cancers with different relative risk ratios in many other organs and increase the risk of developing RCC by 1.4-2.3 times[23]. The risk of developing kidney cancer is directly related to the number of cigarettes consumed per day and the duration of use. Smoking cessation decreases the risk of developing cancer and then this reduction rate reaches 30% in 10 years. In our study, we also found that the survival of smokers was lower than non-smokers.

The mean age of women in our study was significantly lower than that of men (38.3 vs 60.7). The birth rate in our country is quite high (2.3 - 4.2%)[24]. Accordingly, women are frequently exposed to physician control at a young age and are consulted to urologists with renal masses that the obstetricians identify incidentally at the ultrasound. We consider that the age difference mainly depends on this. We stratified the patients according to ASA groups as it could affect survival rates. We consider that the ASA score did not affect the survival rates because the vast majority of the patients (80.5%) were in low-risk group (ASA I-II).

Although preliminary reports of hypertension and diuretic use indicate different risk factors for kidney cancer, recent studies have shown that only hypertension is a risk factor and diuretics are not a risk factor[25]. In our study, there was no statistically significant difference between the two groups, although hypertensive patients had less mean survival time than those without hypertension.

As for surgical treatment, death and recurrence were observed in 5 patients after partial nephrectomy in our study. We found that survival rate was better in cases underwent partial nephrectomy than those underwent radical nephrectomy. We think that this is due to the larger tumor size of patients who underwent radical nephrectomy. For this reason, the number of deaths and recurrences was higher in radical nephrectomy group.

Decreased renal function in RCC patients is a common finding. It has been shown that low eGFR affects overall survival in patients undergoing surgery for RCC and nephron sparing surgery is recommended in these patients[26]. Similarly, we found that the low eGFR level significantly reduced CSS and RFS in our study. Lymph node involvement may be predicted by preoperative radiologic imaging and some predictive models[27]. In our clinic, we perform lymph node dissection (LND) in RCC patients who have lymph node enlargement in preoperative imaging and peroperative suspicious lymph node involvement. However, we did not include the LND effect in this analysis because the data of these patients are incomplete and we do not have a standard protocol.

Nowadays, in the treatment of renal tumors, laparoscopic radical nephrectomy and partial nephrectomy operations can be successfully performed with both transperitoneal and retroperitoneal approaches. When the EAU guidelines were analyzed, it has been stated that the laparoscopic approach resulted in lower morbidity, equivalent oncologic outcomes in T1-2 tumors in experienced hands, and possibly equivalent oncologic outcomes in T3a tumors (Grade of evidence: 3). Laparoscopic radical nephrectomy is recommended as a treatment option in experienced centers (Recommendation level: B). There was no significant difference in survival rates after open and laparoscopic surgery in our study. Based on this result, we concluded that laparoscopic method can be utilized as a standard approach in the treatment of kidney tumors.

RCC is known as a heterogeneous malignancy with different clinical and pathological subgroups. Papillary and chromophobe RCCs constitute approximately 15-25 % of total renal cancers and have a better prognosis than the clear cell RCC group[28,29]. In our study, no statistically significant difference was found between histologic subtypes in terms of survival.

Tumor stage is the most important factor determining RCC prognosis[30]. Tumor stage was also an important prognostic factor in our study. CSS and RFS decreased as tumor stage increased.

CONCLUSIONS

BMI was significantly associated with prognosis in patients with RCC. Our findings indicate that overweight and obese RCC cases, which are determined by BMI, have a more favorable prognosis. However, our findings need to be supported by multicentre, prospective studies including more number of patient groups and longer oncologic follow-up period.

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CONFLICT OF INTEREST

The authors report no conflict of interest.

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