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The establishment of KORCC (KOrean Renal Cell Carcinoma) database

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Purpose: The purpose of this article is to report establishment of the 1st Web-based database (DB) system to collect renal cell carcinoma (RCC) data in Korea.

Materials and Methods: The new Web-based DB system was established to collect basic demographic and clinicopahtological characteristics of a large cohort of patients with RCC in Korea. Data from a total of 6,849 patients were collected from 8 tertiary care hospitals that agreed to participate in organizing the Korean Renal Cell Carcinoma (KORCC) study group as of 1 July 2015. Basic demographic and clinicopathological characteristics were collected. The data of patients who underwent surgical treatments were analyzed to characterize Korean RCC.

Results: We established the 1st Web-based DB of Korean RCC, a database comprising renal mass management cases from multiple centers in Korea. The data of 5,281 patients who underwent surgical management (mean follow-up, 32 months) were analyzed. The most common symptom was incidentally detected renal mass (76.9%). Clinical T1a was the most common (54.3%) stage and mean tumor size was 4.8±4.2 cm. Radical nephrectomy accounted for 62.7% of cases and an open approach was used in 50.7% and 52.2% of radical and partial nephrectomies, respectively. The 5-year overall, cancer-specific and recurrence-free survival rates were 88.1%, 92.2%, and 88.0%, respectively.

Conclusions: We report the 1st establishment of a Web-based DB system to collect RCC data in Korea. This DB system will provide a solid basis for the characterization of Korean RCC.

Keywords: Database; Kidney neoplasms; Population characteristics

INTRODUCTION

Renal cell carcinoma (RCC) is the most common malignancy of the kidney and a cancer of increasing incidence [1]. In Korea, RCC accounted for 1.85% of the total cancer occurrence in 2012, and the incidence rate was

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8.2 per 100,000 people [2]. The incidence of this cancer is relatively low among genitourinary malignancy, leading to the management of a lower volume of RCC cases in most hospitals. Therefore, it is difficult to make generalizations based on studies of RCC performed by single center due to the lower number of cases and the possibility of selection bias. Therefore, it is necessary to establish a well-qualified multi-institutional database (DB) system comprising a large cohort to conduct clinical RCC researches due to the lower incidence of this neoplasm. And this database should include more variable data than the cancer statistics of National Cancer Center or Health Insurance Review & Assessment service.

Some international groups have performed RCC studies based on multi-institutional RCC DBs. Examples include the renal mass study of CROES (Clinical Research Office of the Endourological Society) [3,4], CORONA (Collaborative Research On Renal Neoplasms Association) Project [5-9], SATURN (Surveillance and Treatment Update Renal Neoplasms) Projects [8,9] and Japanese multicenter studies [10,11], which have reported high-quality research results. Some multi-institutional retrospective studies on RCC have also been conducted in Korea [12-14], but there have been no large DB systems to collect data on Korean RCC. Here, we report the establishment of the 1st Web-based RCC DB system in Korea (KOrean Renal Cell Carcinoma, KORCC) and summarize the basic characteristics of Korean patients with RCC who underwent surgical management.

MATERIALS AND METHODS

The new Web-based DB system was established to collect basic demographic and clinicopathological characteristics of a large cohort of patients with RCC in Korea. This project was approved by local ethics committee at Seoul National University Bundang Hospital (IRB number: B1202/145-102). The data included basic demographic (such as age, gender, height, and weight) and clinicopathological characteristics (such as clinical stage, perioperative parameters, pathological stage, Fuhrman nuclear grade and survival data) (Tables 1–5). AJCC cancer staging manual was used for TNM staging [15]. Private information (such as resident registration number and hospital ID number) was excluded to protect the patients' personal information.

Data from a total of 6,849 patients were collected from 8 tertiary care hospitals that agreed to participate in organizing KORCC study group as of 1 July 2015. These hospitals were Chonnam National University Hwasun Hospital (308 cases), Chungbuk National University Hospital (178 cases), Korea University Anam Hospital (105 cases), Kyungpook University Medical Center (890 cases), National Cancer Center (618 cases), Seoul St. Mary's Hospital (883 cases), Seoul National University Bundang Hospital (1,440 cases) and Seoul National University Hospital (2,427 cases). Data were collected for the management of renal masses of all tumor stages (pT1–4, N0–2, M0–1) at the Department of Urology at each hospital from 1990 to present (time frame varies among hospitals due to differences in their own DB collections). Hospitals have contributed to the database by adding all consecutive patients until now.

We analyzed the data of patients who underwent

Table 1. Basic characteristics (n=5,281)

Characteristic	Value
Follow-up (mo), mean (IQR)	32 (12–61)
Age (y)	55.7±12.7
Gender	
Male	3,758 (71.2)
Female	1,523 (28.8)
Height (cm)	165.0±9.5
Weight (kg)	66.6±11.7
Body mass index (kg/m^2)	24.4±3.3
Hypertension	1,883 (38.5)
Diabetes mellitus	736 (14.9)
Chronic kidney disease	915 (19.4)
Smoking	
Nonsmoker	2,570 (68.2)
Ex-smoker	458 (12.2)
Current smoker	738 (19.6)
ECOG performance status	
0	2,876 (65.4)
1	883 (20.1)
2	559 (12.7)
3	74 (1.7)
4	6 (0.1)
ASA classification	
1	1,510 (41.9)
2	1,884 (52.2)
3	206 (5.7)
4	8 (0.2)
Symptom presentation at diagnosis	
Incidentally detected	4,048 (76.9)
Hematuria	551 (10.4)
Flank pain	524 (8.2)
Palpable mass	52 (0.9)
Etc	184 (3.5)

Values are presented as mean±standard deviation or number (%) unless otherwise indicated.
IQR, interquartile range; ECOG, Eastern Cooperative Oncology Group; ASA, American Society of Anesthesiologists.

Table 2. Preoperative findings

Variable	Value
Preop Hb (g/dL)	13.7±1.9
Preop serum Cr (mg/dL)	1.12±1.1
Preop eGFR (mL/min/1.73 m^2)	75.0±28.2
Clinical T stage	
T1a	2,757 (54.3)
T1b	1,130 (22.3)
T2a	453 (8.9)
T2b	127 (2.5)
T3a	470 (9.3)
T3b	66 (1.3)
T3c	10 (0.2)
T4	65 (1.3)
Clinical N stage	
N0	4,890 (96.3)
N1	188 (3.7)
Clinical M stage	
M0	4,759 (93.7)
M1	319 (6.3)
Tumor size (cm)	4.8±4.2
Tumor laterality	
Left	2,507 (49.4)
Right	2,541 (50.0)
Bilateral	30 (0.6)
Tumor location	
Exophytic	1,922 (48.1)
Mesophytic	696 (17.4)
Endophytic	846 (21.2)
Hilar	535 (13.4)

Values are presented as mean±standard deviation or number (%).
Preop, preoperative; Hb, hemoglobin; Cr, creatinine; eGFR, estimated glomerular filtration rate.

surgical treatments. They were compared with those of previous international studies to characterize Korean RCC. Some data were excluded from the analysis due to insufficient or missing variables.

RESULTS

We established the 1st Web-based DB of KORCC, a database comprising renal mass management cases from multiple centers in Korea (www.mebica.net). A total of 6,849 patients were collected nationwide from 8 tertiary care hospitals in Korea.

We analyzed data of 5,281 patients with surgical management (mean follow-up [FU], 32 months) (Tables 1–5). The patients' mean age was 55.7±12.7 years, and 71.2% of the patients were male (Fig. 1). Hypertension, diabetes mellitus and chronic kidney disease (defined as grade 3 or more) were identified in 38.5%, 14.9%, and 19.4% of the patients, respectively. The most common symptom was incidentally detected renal mass (4,048 cases, 76.9%), and the 2nd most common was gross hematuria, which accounted for 10.4%.

Preoperative characteristics—such as clinical stage, tumor size, laterality, and location—were described in Table 2. Clinical T1a was the most common (54.3%) stage, and the mean tumor size was 4.8±4.2 cm.

Radical nephrectomy accounted for 62.7% of the total cases, and an open approach was used in 50.7% and 52.2% of radical and partial nephrectomies, respectively (Table 3). Warm ischemia was the most common type of ischemia (83.0%) and mean ischemic time was 25.2±11.3 minutes.

Table 3. Type of surgery and ischemia

Variable	Radical nephrectomy	Partial nephrectomy
No. of patient	3,311 (62.7)	1,970 (37.3)
Type of surgery		
Laparoscopic	1,309 (39.5)	464 (23.6)
HALS	210 (6.3)	9 (0.5)
Open	1,680 (50.7)	1,029 (52.2)
Robotic	103 (3.1)	468 (23.8)
LESS	9 (0.3)	0 (0)
Type of ischemia		
Warm	-	1,591 (83.0)
Ice slush	-	185 (9.6)
Retrograde cold Saline irrigation	-	12 (0.6)
Cold, otherwise	-	30 (1.6)
None	-	100 (5.2)
Ischemic time (min)	-	25.2±11.3

Values are presented as number (%) or mean±standard deviation.
HALS, hand-assisted laparoscopic surgery; LESS, laparo-endoscopic single-site surgery.

Table 4. Perioperative findings

Variable	Value
Operation time (min)	182.7±72.1
EBL (mL)	344.8±513.9
Intraop transfusion	381 (7.2)
Intraop complication	
Colon	12 (0.2)
Duodenum	4 (0.1)
Liver	10 (0.2)
Pancreas	11 (0.2)
Spleen	18 (0.3)
Pleura	113 (2.1)
Major vessel	41 (0.8)
Ureter	4 (0.1)
Etc	152 (2.9)
Postop transfusion	189 (3.6)
Postop Hb (g/dL)	12.3±2.0
Postop complication	
Cardiovascular	9 (0.2)
Respiratory	42 (0.8)
Neurologic	3 (0.1)
Gastrointestinal	49 (0.9)
Urologic	72 (1.4)
Etc	369 (7.0)
Postop complication grade[a]	
Grade I	189 (38.0)
Grade II	153 (30.8)
Grade III	3 (0.6)
Grade IIIa	114 (22.9)
Grade IIIb	26 (5.2)
Grade IV	6 (1.2)
Grade IVa	3 (0.6)
Grade IVb	0 (0)
Grade V	3 (0.6)

Values are presented as mean±standard deviation or number (%).
EBL, estimated blood loss; Intraop, intraoperative; Postop, postoperative; Hb, hemoglobin.
[a]:Proportion in complicated cases.

Table 5. Pathologic characteristics

Variable	Value
Pathologic T stage	
T1a	2,915 (55.2)
T1b	1,052 (19.9)
T2a	387 (7.3)
T2b	117 (2.2)
T3a	619 (11.7)
T3b	105 (2)
T3c	13 (0.2)
T4	73 (1.4)
Pathologic N stage	
N0	2,776 (52.7)
N1	165 (3.1)
Nx	2,331 (44.2)
Pathologic M stage	
M0	4,925 (94.0)
M1	312 (6.0)
Fuhrman nuclear grade	
1	238 (4.8)
2	2,586 (51.8)
3	1,867 (37.4)
4	306 (6.1)
Histologic type	
Clear cell	4,432 (85.2)
Papillary	81 (1.6)
Papillary type 1	86 (1.7)
Papillary type 2	127 (2.4)
Chromophobe	331 (6.4)
Collecting duct	19 (0.4)
Unclassified	55 (1.1)
Multilocular cystic	27 (0.5)
Mixed	22 (0.4)
Xp11.2 translocation	18 (0.3)
Clear cell papillary	5 (0.1)
Positive surgical margin (PNx)	79 (4.0)
Tumor size (mm)	44.4±32.0
Sarcomatoid deferentiation	89 (2.5)
Necrosis	
Microscopic	191 (5.2)
Macroscopic	283 (7.8)
Lymphovascular invasion	241 (5.2)
Capsular invasion	816 (25.0)

Values are presented as number (%) or mean±standard deviation.
PNx, partial nephrectomy.

Intraoperative and postoperative transfusions were done in 7.2% and 3.6% of the patients, respectively (Table 4). Intraoperative and postoperative complications occurred in 6.9% and 10.3% of the patients, respectively. A total of 2.9% of severe postoperative complications were of Clavien-Dindo grade ≥3 [16].

Pathological characteristics are shown in Table 5. T1a accounted for 55.2% of the total cases. The most common nuclear grade was Fuhrman grade 2 (51.8%) and the most common histological type was clear cell (85.2%). Positive surgical margins were identified in 4.0% of the patients undergoing partial nephrectomy.

The 5-year overall, cancer-specific and recurrence-free survival rates were 88.1%, 92.2%, and 88.0%, respectively (Table 6). Kaplan-Meier survival curves according to stage, nuclear grade and histologic type are shown in Figs. 1, 2.

Table 6. Overall, cancer specific and recurrence free survival rates at 2, 5, and 10 years after nephrectomy

|	2 Years	5 Years	10 Years
Overall survival rate (%)	94.1	88.0	76.3
Cancer specific survival rate (%)	96.1	92.2	86.1
Recurrence free survival rate (%)	92.6	88.0	78.4
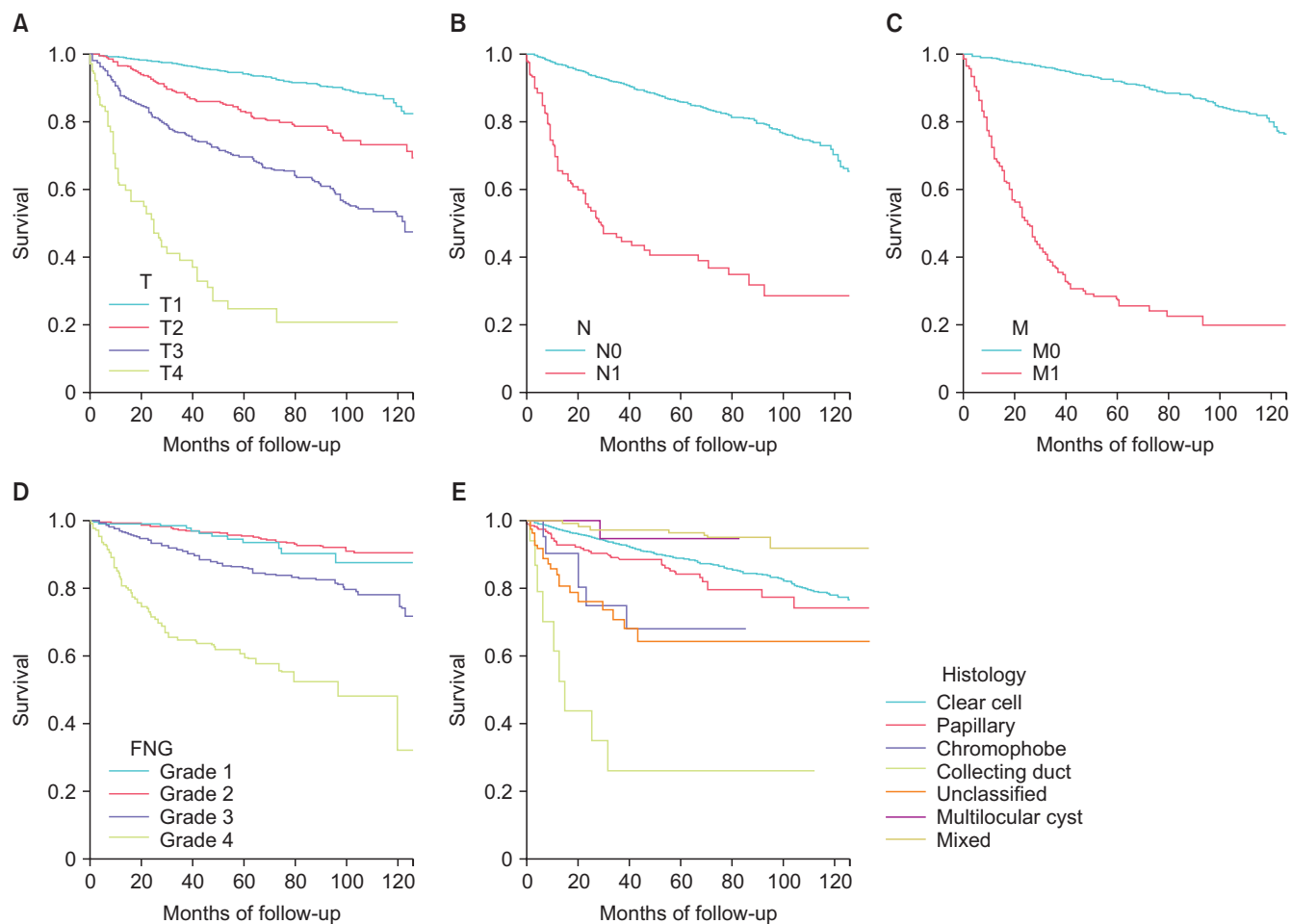
Fig. 1. Kaplan-Meier curves of overall survival according to pathologic T stage (A), N stage (B), M stage (C), Fuhrman nuclear grade (D), and histologic type (E).

DISCUSSION

We report the 1st establishment of a Web-based DB system to collect clinicopathological characteristics of RCC in Korea. This project was initiated with the aid of 5 participating centers in 2011. The KORCC Web-based DB system was launched in 2013, finally leading to the participation of 8 centers nationwide in 2014. There are already some publications through the use of this DB [14,17,18]. It is necessary to collect data from a large cohort of RCC patients to provide better analysis of RCC data in Korea. Data from approximately 7,000 RCC cases were collected, and this project remains ongoing to collect more cases. We believe that this DB can represent Korean RCC

due to its large cohort size and nationwide distribution.

Several factors were of concern in the establishment of this system. First, we aimed to collect data that was representative of Korean RCC. Therefore, we invited 8 nationwide tertiary care centers to participate in this project, and they all agreed to join. This led to the creation of a DB that represents RCC characteristics of Korean patients. Second, because this system is Web-based, there is possibility that patients' data could be leaked due to security problems. Therefore, we chose an experienced company that has built many Web-based clinical trial DB systems (Mebixon Co., Seoul, Korea). Personal information—such as resident registration number and hospital identification number—was not included in our DB system. This led to the
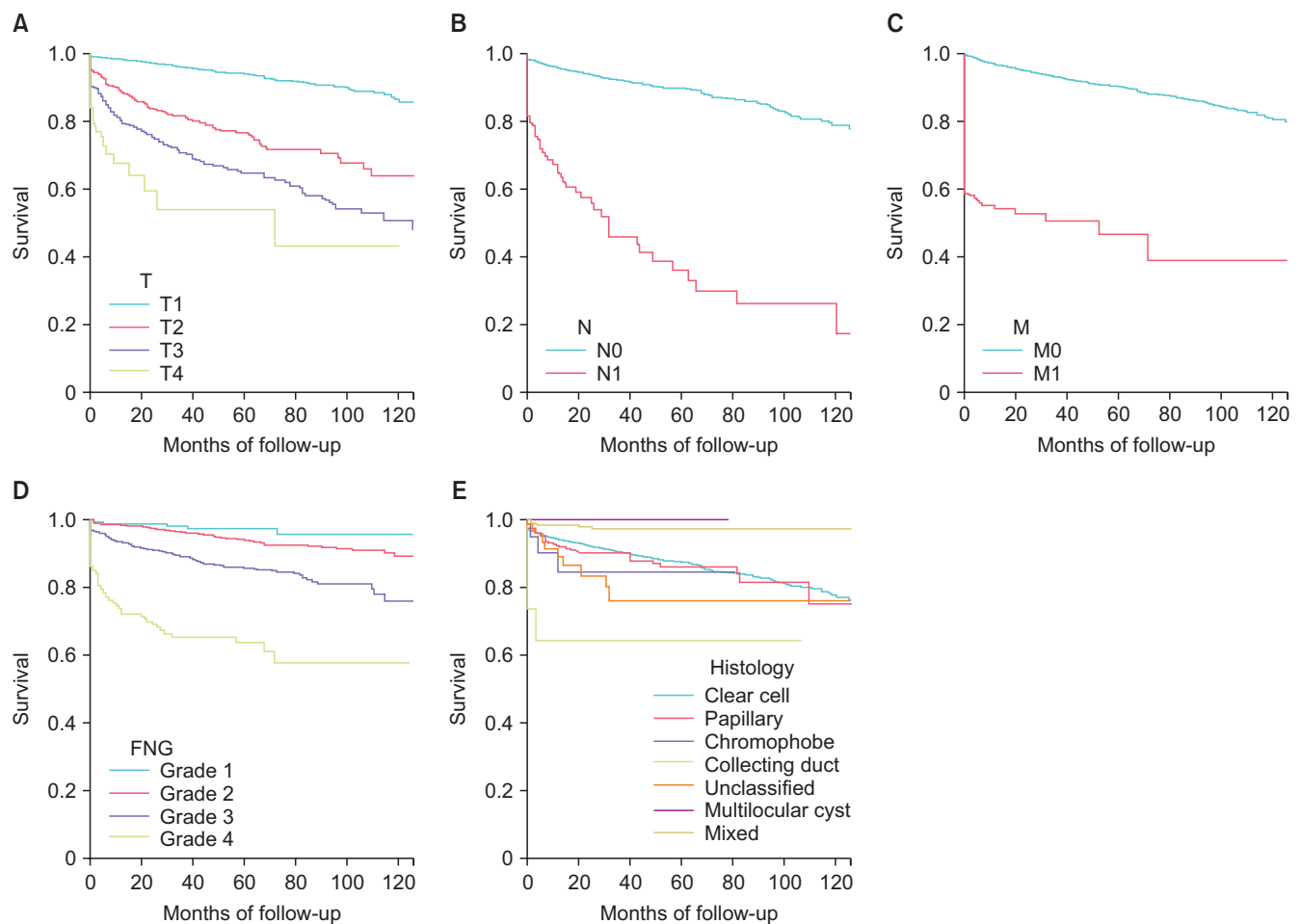
Fig. 2. Kaplan-Meier curves of recurrence free survival according to pathologic T stage (A), N stage (B), M stage (C), Fuhrman nuclear grade (D), and histologic type (E).

establishment of a secure Web-based DB system of RCC in Korea.

For the good quality of this database, we limited the number of hospital as above. In the future, if the database works well, we will invite other hospitals to participate in KORCC and provide chances to investigate with this database.

There have been many multicenter based studies on RCC, and CROES was the 1st group to establish an international electronic data management system [3]. The global renal mass study driven by CROES was started in 2008 to provide a prospective international study on the indications, treatment modalities and outcomes of the management of renal masses. Each center participating in this project included all of the patients with the diagnosis of renal mass during a one-year period. Other examples of international multi-center collections were the CORONA and SATURN projects [5-9], which were not Web-based. Nevertheless, this type of multicenter collection is necessary to obtain better knowledge on RCC through a DB with a large cohort.

Data from 5,281 patients who underwent radical or partial nephrectomy were analyzed. Interestingly, incidentally detected renal mass accounted for 76.9% of the total patients. This rate was much higher than the rate of approximately 50% in a previous report [19]. Recently, the more common applications of imaging modalities for the evaluation of a variety of nonspecific symptoms has led to higher rates of incidental mass detection and an increased proportion of early stage tumors. More than half of the patients (54.3%) presented with clinical T1a stage tumors and metastatic tumors were identified only in 6.3% of patients. It is probable that this rate overestimated the real pattern of presentation because patients with advanced stage disease who were managed by hematooncologic department were not included in our DB system. This relatively higher proportion of low clinical stage contributed to excellent overall and cancer-specific survival rates. We will likely find more incidental tumors with lower stages with the increasing use of imaging studies in the future.

Nowadays, the use of minimally invasive surgery is a growing trend. An open approach was used in 50.7% and 52.2% of radical and partial nephrectomies, respectively. Minimally invasive approaches—such as laparoscopic and robotic surgeries—were used for the remaining cases. Interestingly, robotic approach was used in 3.1% and 23.8% of radical and partial nephrectomies, respectively. It is well known that the application of robotic surgery in partial nephrectomy can provide good surgical quality including a reduced ischemic time, due to its enhanced 3-dimensional vision and excellent degree of freedom [20,21]. These factors contributed to nearly a quarter of the patients undergoing partial nephrectomy being managed by a robotic approach. Although it represented a relatively lower (3.1%) proportion, robotic technology was also used in radical nephrectomy. Pure laparoscopic surgery is a challenging procedure, and some surgeons find laparoscopic radical nephrectomy difficult to perform. Robotic radical nephrectomy can bridge the gap between open and pure laparoscopic approaches for some urologists. As the number of people with private insurance has increased and the cost barrier is not an issue for these patients, the application of robotic technology will continuously increase in the future.

Another notable finding was that proportion of clear cell type was higher (85.2%) in our DB compared to that in previous reports (60%–80%) [22,23]. Whether this phenomenon is Korean-specific is not known. The proportion of sarcomatoid differentiation has ranged from 2% to 5% in past reports; our DB revealed a proportion of 2.5%, which was equivalent to other reports [24,25].

There were some limitations in this DB. First, this type of retrospective collections could contain some errors in data entry. We crosschecked our data with alternate recorders to avoid some errors in data entry. In addition to this error, some patients' data were lacking, causing incomplete data collections for some individual patients. Second, the length of FU length was rather short (mean, 32 months) but this weak point will be solved with long-term FU in the future. Third, this collection was based on the department of urology at each center. Some patients with advanced stage disease could visit the department of internal medicine and they could be managed without surgical intervention. This could lead to incomplete observation of the whole RCC spectrum in Korea. We are planning to expand this database to include patients of hematooncologic department. Then, the database will be able to represent the whole cohorts of Korean RCC.

In conclusion, the 1st Web-based DB system to collect RCC data was established in Korea. This DB will provide a solid basis for the characterization of KORCC.

CONCLUSIONS

We report the 1st establishment of a Web-based DB system to collect RCC data in Korea. This DB will provide a solid basis for the characterization of KORCC.

CONFLICTS OF INTEREST

The authors have nothing to disclose.

ACKNOWLEDGMENTS

SUPPLEMENTARY MATERIAL

Supplementary Table 1 can be found via http://icurology.org/src/sm/icu-57-50-s001.pdf.

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