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ORIGINAL ARTICLE

Retrospective Study

Incidental renal cell carcinoma post bilateral nephrectomy in autosomal dominant polycystic kidney disease

Min-Ho Shin, Nam-Kyu Choi

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Abstract

BACKGROUND

Renal cell carcinoma (RCC) is more common in patients with autosomal dominant polycystic kidney disease (ADPKD) than in the general population. Diagnosing RCC in ADPKD is challenging due to the presence of multiple renal cysts, often leading to delays and difficulties in distinguishing RCC from cyst infection or hemorrhage.

AIM

To analyze the prevalence and characterize the clinical features of RCC in patients with ADPKD undergoing simultaneous bilateral native nephrectomy.

METHODS

Between May 2017 and April 2024, 19 ADPKD patients undergoing hemodialysis and awaiting kidney transplantation due to end-stage renal disease (ESRD) underwent bilateral nephrectomies in a single center. Parameters such as patient characteristics, intraoperative blood loss, blood transfusion volume, length of hospital stay, and postoperative complications were documented. Pathological findings for RCC were reviewed.

RESULTS

A total of 38 kidneys were excised from 19 patients, with a mean age of 56.8 years and an average hemodialysis duration of 84.2 months. Eight patients underwent open nephrectomies, and 11 underwent hand-assisted laparoscopic nephrectomies. RCC was detected in 15.8% of kidneys, affecting 21.1% of patients. Two patients had multifocal RCC in both kidneys. All RCC cases were pT1 stage, with the largest lesion averaging 16.5 mm in diameter. The average operative duration was 120 minutes, with intraoperative blood loss averaging 184.2 mL. Five patients required blood transfusions. Postoperative complications occurred in five

patients, with a mean hospital stay of 17.1 days. The mean follow-up period was 28.1 months.

CONCLUSION
The prevalence of RCC is higher in patients with ADPKD with ESRD than in those with ESRD alone. Thus, clinicians should be cautious and implement surveillance programs to monitor the development of RCC in patients with ADPKD, particularly those on dialysis.

Key Words: Renal cell carcinoma; Autosomal dominant polycystic kidney disease; End-stage renal disease; Kidney transplantation; Nephrectomy

Core Tip: Autosomal dominant polycystic kidney disease (ADPKD) is a genetic disorder that leads to kidney and liver cysts, with a prevalence of 1 in 1000–2500 individuals. It often progresses to end-stage renal disease (ESRD). Incidence of renal cell carcinoma (RCC) is higher in patients with ADPKD than in the general population. Diagnosing RCC in ADPKD is challenging due to overlapping symptoms and distorted renal anatomy. In a study of 19 ADPKD patients undergoing nephrectomy, RCC was found in 21.1% of patients. The study highlights the need for vigilant RCC monitoring in patients with ADPKD, especially those with ESRD.

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INTRODUCTION

Autosomal dominant polycystic kidney disease (ADPKD) represents the foremost autosomal dominant hereditary renal ailment and a multisystem genetic disorder typified by the development of cysts in the ductal organs, principally affecting the kidneys and liver. The etiology stems from mutations occurring in polycystic kidney disease (PKD) 1 located on chromosome 16 and PKD2 on chromosome 4, with an incidence rate approximating 1 in 400 to 1000 individuals[1]. A third, albeit rare, genetic locus, PKD3, may also potentially contribute to the pathology. The projected prevalence of ADPKD stands at 1 in 1000–2500 individuals[2].

Clinical presentations of ADPKD predominantly encompass abdominal discomfort, flank pain, hematuria, and hypertension, afflicting approximately 60% of affected individuals. The progressive enlargement of bilateral renal cysts, persisting even after the commencement of dialysis, results in a gradual decline in renal function, culminating in end-stage renal disease (ESRD) for nearly half of the patients with ADPKD by the age of 60[3-5]. Additional disorders linked with ADPKD encompass inguinal and abdominal hernias, cardiac valvular anomalies, as well as aneurysms affecting coronary arteries, the aorta, and cerebral arteries[6]. At the juncture of transplantation, these nonfunctional kidneys undergo considerable enlargement[7]. Consequently, preemptive native nephrectomy is undertaken to facilitate pelvic space optimization, alleviate compression exerted by the enlarged polycystic kidney, and prevent the emergence of diverse symptomatic manifestations.

The incidence of renal cell carcinoma (RCC) among individuals with ADPKD is notably elevated[2,8]. The etiology, whether attributable to chronic dialysis or the underlying disease itself, remains conjectural. Although the association between ADPKD and RCC remains contentious, distinct from ESRD secondary to ADPKD, the diagnosis of RCC in patients with ADPKD often proves arduous and delayed, owing to the nonspecific nature of the symptoms and the distorted renal anatomy, despite the utilization of contrast-enhanced computed tomography (CT) and magnetic resonance imaging[9]. Furthermore, clinical presentations indicative of RCC, such as the emergence of abdominal or flank masses accompanied by pain, hematuria, fever, and fatigue, commonly overlap with those observed in ADPKD-associated cyst infection and hemorrhage, exacerbating the challenges associated with early RCC diagnosis in patients with ADPKD. The role of prophylactic bilateral native nephrectomy to eliminate the potential risk of RCC in patients with ADPKD remains a subject of ongoing debate.

Data pertaining to the prevalence of RCC in ADPKD are notably scarce, particularly on a large-scale population basis. The primary objective of this investigation was to scrutinize the prevalence of RCC in ADPKD-afflicted kidneys and delineate the clinical characteristics associated with this co-occurrence.

MATERIALS AND METHODS

Between May 2017 and April 2024, 19 patients diagnosed with ADPKD and ESRD underwent nephrectomies at our single

institution; both kidneys were removed from each patient, translating to a total of 38 kidney specimens. All patients presented with chronic renal failure (CRF) and were in a pretransplantation state, receiving hemodialysis. Diagnosis of ADPKD was based on bilateral kidney enlargement and cystic transformation, with the exclusion of other renal cystic diseases such as von-Hippel–Lindau disease, tuberous sclerosis complex, or acquired cystic disease of renal failure. The diagnoses of ADPKD were established within nephrology departments, adhering to established clinical criteria. These criteria included either a positive family history along with bilateral renal cysts, in the absence of familial background, the presence of at least two of the following symptoms associated with renal cysts: Bilateral renal enlargement, hepatic cysts, cerebral artery aneurysm, and solitary cysts of the arachnoid, pineal gland, pancreas, or spleen. Indications for nephrectomy varied and included large kidneys occupying both iliac fossa, pre-kidney transplantation status, suspicion of tumors on imaging studies, or the presence of specific benign complications such as pain, hemorrhage, or recurrent infections. A thorough chart review was conducted as needed, supplemented by scrutiny of pathological slides and reports by an additional histopathologist, particularly those pertaining to microscopic tumors, adenomas, and papillary hyperplasia.

Furthermore, a comprehensive review of published MEDLINE data was undertaken, utilizing keywords such as polycystic kidney disease, RCC, ESRD, kidney transplantation, and laparoscopic nephrectomy. This search was augmented by the inclusion of relevant articles extracted from bibliographic references of milestone publications.

This study was approved by the Institutional Review Board of Chosun University Hospital in Gwangju, South Korea (No. 2023-04-009). Informed consent was waived because of the retrospective nature of the study.

Data management and analysis were performed using Statistical Package for the Social Sciences 21.0 (IBM Corp., Armonk, NY, United States). Mann–Whitney *U* test was used to compare quantitative variables between the two groups. Categorical variables were assessed using Fisher's exact test. The significance of the results was set at 5%.

RESULTS

Bilateral nephrectomies were conducted in 19 patients, comprising 14 males and 5 females, with a mean age of 56.8 years (range from 42 years to 63 years). All these patients diagnosed with ESRD, had been undergoing dialysis for an average duration of 84.2 months (range from 1 month to 333 months). Hypertension was prevalent in 17 patients (89.5%), while diabetes mellitus was observed in 6 patients (31.6%). While 17 patients presented symptoms consistent with ADPKD such as gastrointestinal symptoms, hematuria, or recurrent infection, two patients exhibited suspicious lesions of RCC on CT scan or ultrasonographic (US) surveillance. No RCC was found in the pathological examination after the nephrectomy in the patient with suspicious findings on the CT scan. However, patients with suspicious findings on US (Figure 1) had bilateral RCC. The characteristics of nineteen patients are summerized in Table 1.

Preoperatively, patients displayed a mean hemoglobin level of 11.09 g/dL (range from 9.7 g/dL to 13.9 g/dL), platelet count of 168 × 10^3/μL (range from 65 × 10^3/μL to 278 × 10^3/μL), blood urea nitrogen level of 47.7 mg/dL (range from 13.5 mg/dL to 87.5 mg/dL), serum creatinine level of 8.61 mg/dL (range from 2.70 mg/dL to 14.20 mg/dL), and serum potassium level of 5.09 mEq/L (range from 3.54 mEq/L to 7.40 mEq/L). Among the patients, eight underwent open nephrectomies while 11 underwent hand-assisted laparoscopic nephrectomies without open conversion. Operative durations averaged 120 minutes (range from 55 minutes to 220 minutes), with intraoperative blood loss averaging 184.2 mL (range from 20 mL to 650 mL). Five patients required blood transfusions, with an average volume of 304 mL required per patient. Postoperative complications were observed in 5 patients, including one medical complication manifesting as pneumonia and five surgical complications encompassing wound infections and operative bed hematomas in three and two, respectively. All patients recovered without the need for surgical, endoscopic, or radiologic interventions. The mean duration of hospital stay post-surgery was 17.1 days, ranging from 6 days to 32 days. Patients were followed up for a mean period of 28.1 months, ranging from 1.6 months to 73.4 months.

Histologic examination revealed RCC in 15.8% (6/38) of the kidneys, affecting 21.1% (4/19) of the patients. Two patients exhibited bilateral tumors (four kidneys), with multifocal tumors identified within each kidney. Clear cell carcinoma constituted one out of six diagnoses, while the remaining were classified as tubulopapillary carcinomas. Detailed demographic data regarding patients diagnosed with renal carcinomas are delineated in Table 2. All cases were classified as pT1 stage according to the 1997 TNM classification. There were no significant differences in the clinical characteristics and surgical outcomes between patients with and without RCC (Table 3). One patient with RCC underwent diseased-donor kidney transplantation 6 months after nephrectomy and has not shown recurrence or metastasis of RCC to date (28 months post-transplant).

DISCUSSION

The annual incidence of RCC in European countries ranges 5–20 per 100000 male inhabitants and 2–11 per 100000 female inhabitants[10]. In the United States, the incidence of RCC is reported to be 11.281 per 100000 person-years[11]. However, the precise relationship between ADPKD and RCC remains unconfirmed. Previous studies have suggested a surprisingly high prevalence of RCC in patients with ADPKD[2,12]. Conversely, a recent study in the United States involving 10166 kidney recipients with PKD and 107339 without PKD found that the incidence of RCC, after multivariable adjustment, was lower in patients with than in those without PKD[13].

Table 1 Characteristics of patients with autosomal dominant polycystic kidney disease who underwent bilateral nephrectomy, *n* (%)

Characteristics	Patients
Age (years) (mean ± SD)	56.8 ± 5.71
Sex (male/female)	14/5
Comorbidity	
Hypertension	17 (89.5)
Diabetes mellitus	6 (31.6)
Cerebrovascular accident	3 (15.8)
Cardiovascular disease	4 (21.1)
Arrhythmia	2 (10.5)
Chronic obstructive pulmonary disease	1 (5.3)
American society of anesthesiologists physical status grade	
3	17 (89.5)
4	2 (10.5)
Reason for nephrectomy	
Hematuria	3 (15.8)
Infection	1 (5.3)
Gastrointestinal symptoms	13 (68.4)
Suspicious of renal cell carcinoma	2 (10.5)
Duration of hemodialysis (months) (mean ± SD)	84.2 ± 89.58
Largest diameter of kidney (cm) (mean ± SD)	16.1 ± 6.46
Type of surgery	
Open	8 (42.1)
Hand-assisted laparoscopic surgery	11 (57.9)
Length of hospital stay (days) (mean ± SD)	17.1 ± 6.1
Follow-up period after nephrectomy (months) (mean ± SD)	28.1 ± 20.40

Table 2 Characteristics of patients with renal cell carcinoma

	Patient 1	Patient 2	Patient 3	Patient 4
Age (years)	56	50	53	56
Sex	Male	Male	Male	Male
Reason of nephrectomy	GI symptoms	Frequent infection	GI symptoms	Suspicious RCC on ultrasonographic
Bilaterality	Yes	No	No	Yes
Multifocality	Yes	No	No	Yes
Histology	Tubulopapillary carcinomas	Clear cell carcinoma	Tubulopapillary carcinomas	Tubulopapillary carcinomas
Diameter of RCC (cm)	1.2 × 1.0 and 1.3 × 1.0	2.6 × 1.5	1.8 × 1.6	1.5 × 1.0 and 1.5 × 0.5
Duration of hemodialysis (months)	175	159	7	101

RCC: Renal cell carcinoma; GI: Gastrointestinal.

Table 3 Comparison between patients with and without renal cell carcinoma, *n* (%)

	With RCC	Without RCC	*P* value
Age (years) (mean ± SD)	53.8 ± 2.87	57.6 ± 6.07	0.097
Sex (male)	4 (100)	10 (66.7)	0.530
Comorbidity			
Hypertension	4 (100)	13 (86.7)	1.0
Diabetes mellitus	1 (25.0)	5 (33.3)	1.0
Cerebrovascular accident	0	4 (26.7)	0.530
Cardiovascular disease	0	4 (26.7)	0.530
Arrhythmia	0	2 (13.3)	1.0
Chronic obstructive pulmonary disease	0	1 (6.7)	1.0
American society of anesthesiologists physical status grade			1.0
3	4 (100)	13 (86.7)	
4	0	2 (13.3)	
Reason for nephrectomy			0.118
Hematuria	0	3 (20)	
Infection	1 (25)	0	
Gastrointestinal symptoms	2 (50)	11 (73.3)	
Suspicious of RCC	1 (25)	1 (6.7)	
Duration of hemodialysis (months)	110.5 ± 75.97	77.2 ± 93.97	0.368
Type of surgery			0.603
Open	1 (25)	7 (46.7)	
Hand-assisted laparoscopic surgery	3 (75)	9 (53.3)	
Length of hospital stay (days)	13.2 ± 6.70	18.1 ± 5.73	0.160
Follow-up period after nephrectomy (months)	26.2 ± 7.09	28.6 ± 22.86	0.841
Largest kidney diameter (cm)	14.1 ± 6.05	16.5 ± 6.56	0.522

RCC: Renal cell carcinoma.

Epidemiological analysis is complicated by confounding factors such as ESRD, which is closely related to both ADPKD and RCC. ESRD, particularly when associated with acquired cystic kidney disease, is a known risk factor for RCC[14]. Denton *et al*[15]. reported an RCC prevalence rate of 4.2% in a 2003 study of 260 native nephrectomies in patients with ESRD undergoing transplantation. In a study by Keith *et al*[9]. examining 25 patients with ADPKD with RCC, four patients had CRF, two of whom received dialysis. The authors concluded there was no clear evidence of an association between RCC and CRF in patients with ADPKD. However, a more recent large population-based study[2] found RCC in 10 of 79 (12%) patients with ADPKD with CRF, seven of whom had been on dialysis for 1–13 years, and two had kidney transplants. Nishimura *et al*[16]. Identified RCC in 10 of 510 (2%) patients with ADPKD, all of whom had been receiving dialysis for 5–17 years.

In our study, the prevalence of RCC was 21.1% among 19 patients, representing one of the highest rates reported in this population. However, we lack sufficient data to perform adequate adjustments for confounding factors, such as the duration of hemodialysis before nephrectomy, to allow for a valid rate comparison. Thus, the association between ADPKD and RCC remains speculative; however, high RCC rates in previous studies may be attributable to ESRD resulting from ADPKD.

A literature review conducted over two decades ago indicated that RCC in patients with ADPKD was more frequently bilateral (12%) and multifocal (28%) compared to that in the general population (1%–5% and 6%, respectively), likely due to delayed diagnosis[9]. The prevalence of RCC in ADPKD patients reported thus far is likely underestimated, as these studies relied on radiologic diagnosis or autopsy, both of which are less sensitive than routine pathological analysis. Keith *et al*[9], also suggested that RCC associated with ADPKD had distinct clinical and pathological features, such as earlier onset, frequent bilaterality and multifocality, as well as a higher incidence of the sarcomatoid type. Among the 4 patients in their study, one exhibited multifocality, but none showed bilaterality. In our study, among the 4 patients, two exhibited bilateral RCC with multifocality without sarcomatoid type. RCC in patients with ADPKD is associated with multifocality.

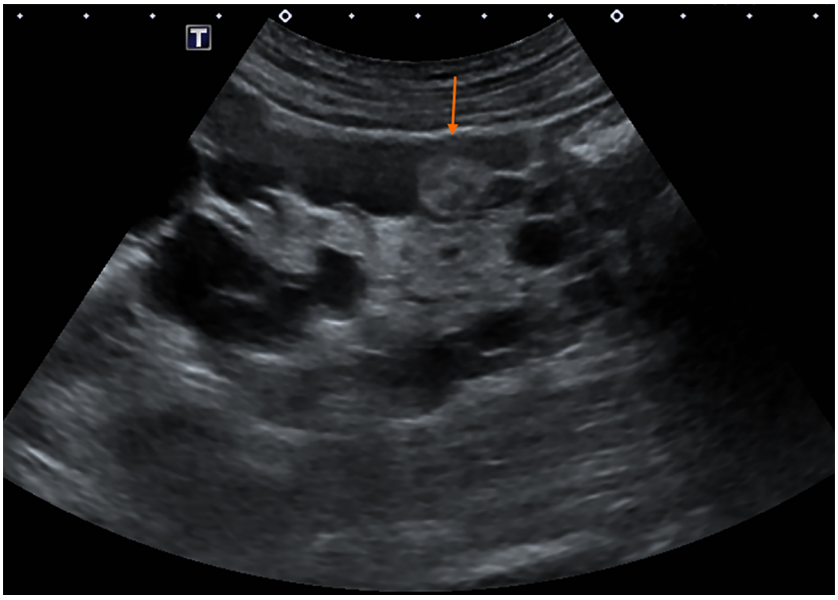

Figure 1 Ultrasonography revealing a 1.5-cm hyperechoic nodule in the left kidney.

Small tumors are frequently missed in preoperative imaging studies due to architectural distortion, intracystic hemorrhage, infection, and renal failure precluding the use of intravenous contrast. Thus, technical considerations are essential during operations, particularly with the increasing use of laparoscopic cyst deroofing, decortication, or nephrectomy, which often require multiple cyst punctures and aspiration, as well as specimen morcellation for extraction [17-19].

A previous review indicated that the average age of RCC onset in patients with ADPKD was earlier than that in the general population (45 years *vs* 62 years)[2]. Current cases have shown that RCC is frequently diagnosed in patients with CRF in their 50 seconds or 60 seconds[20-23]. Although the pathogenesis of RCC in patients with ADPKD is still unclear, chronic kidney injury may contribute to the development of RCC. In our study, patients with ADPKD with RCC (mean age: 53.8 years) were younger than the general population with RCC (mean age: 62 years)[24]. This observation could result from either a predisposition to RCC in patients with ADPKD or earlier diagnosis due to frequent radiologic studies and nephrectomies performed for other reasons, leading to the incidental discovery of small tumors (mean tumor size: 1.65 cm in our study).

Accepted indications for nephrectomy in ADPKD include recurrent pyelonephritis, cyst hemorrhage requiring repeated transfusions, pain unresponsive to medical management, and massively enlarged kidneys causing early satiety or extending into the true pelvis[25]. Previous studies have shown that pretransplant nephrectomy in patients with ADPKD patients increases perioperative morbidity, including fluid overload, congestive heart failure, hyperkalemia, anemia, and renal osteodystrophy[26]. However, patients undergoing bilateral nephrectomy in our study did not exhibit these symptoms. Staging nephrectomy and transplantation require additional operations with associated anesthetic exposure and hospitalization. Recent studies have indicated that concurrent nephrectomy with renal transplantation does not increase mortality or morbidity[27-29]. Unilateral nephrectomy can avoid peritoneal violations, likely shorten operative time, and reduce blood loss[25]. However, pyelonephritis associated with ADPKD can cause fatal sepsis in immunosuppressed patients. Bilateral nephrectomy eliminates this risk in patients with recurrent infections, as well as reduces cyst hemorrhage and chronic pain associated with ADPKD, significantly reducing patient morbidity.

While some authors[30] have recommended prophylactic bilateral nephrectomy in the past, we do not support this practice due to advancements in imaging technologies allowing accurate visualization of smaller tumors and complex cysts with minimal metastatic risk. Additionally, bilateral nephrectomy is associated with high morbidity and reduced quality of life due to the resultant anuric state and lifelong need for erythropoietin supplementation[31,32]. Transcatheter arterial embolization (TAE) of the renal artery has recently been reported as an effective and less invasive method for reducing kidney volume in patients with ADPKD. Volume reduction of up to 60% has been achieved after 6 months[33]. TAE has been proposed as an alternative to nephrectomy before renal transplantation. However, excessive kidney volume (> 5000 cm^3) necessitates careful consideration due to the high risk of insufficient volume reduction[34]. The efficacy of TAE as a renal contraction therapy for ADPKD remains controversial[35,36].

CONCLUSION

In this study, RCC was detected in 15.8% of kidneys, affecting 21.1% of patients and two patients had multifocal RCC in both kidneys. Mounting evidence suggests that RCC occurs in patients with ADPKD and ESRD. Given that ADPKD is a common cause of CRF, vigilant monitoring for the potential development of RCC should be mandatory in patients with ADPKD. High-volume, randomized, multicenter studies adjusted for the duration of dialysis, transplantation, and other

risk factors are necessary to confirm these findings. While we do not advocate for bilateral prophylactic nephrectomy, we strongly recommend heightened awareness of RCC during the follow-up of ADPKD patients, especially those with ESRD and those with known unilateral RCC.

FOOTNOTES

Author contributions: Choi NK contributed to the design and implementation of the study; Shin MH contributed to the analysis of the results and to the writing of the manuscript.

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REFERENCES

1 **Wing AJ**, Brunner FP, Brynger H, Chantler C, Donckerwolcke RA, Gurland HJ, Hathway RA, Jacobs C, Selwood NH. Combined report on regular dialysis and transplantation in Europe, VIII, 1977. *Proc Eur Dial Transplant Assoc* 1978; **15**: 2-76 [PMID: 368773]
2 **Hajj P**, Ferlicot S, Massoud W, Awad A, Hammoudi Y, Charpentier B, Durrbach A, Droupy S, Benoît G. Prevalence of renal cell carcinoma in patients with autosomal dominant polycystic kidney disease and chronic renal failure. *Urology* 2009; **74**: 631-634 [PMID: 19616833 DOI: 10.1016/j.urology.2009.02.078]
3 **Li X**. Polycystic Kidney Disease [Internet]. Brisbane: Codon Publications, 2015 [PMID: 27512748 DOI: 10.15586/codon.pkd.2015]
4 **Simon P**, Ang KS, Cam G, Ramee MP. [Epidemiology of chronic renal insufficiency treated by dialysis in a region in France. Changes in a 12-year period]. *Presse Med* 1988; **17**: 2225-2228 [PMID: 2974586]
5 **Torres VE**, Harris PC, Pirson Y. Autosomal dominant polycystic kidney disease. *Lancet* 2007; **369**: 1287-1301 [PMID: 17434405 DOI: 10.1016/S0140-6736(07)60601-1]
6 **Martinez JR**, Grantham JJ. Polycystic kidney disease: etiology, pathogenesis, and treatment. *Dis Mon* 1995; **41**: 693-765 [PMID: 7587886 DOI: 10.1016/s0011-5029(05)80007-0]
7 **Bendavid Y**, Moloo H, Klein L, Burpee S, Schlachta CM, Poulin EC, Mamazza J. Laparoscopic nephrectomy for autosomal dominant polycystic kidney disease. *Surg Endosc* 2004; **18**: 751-754 [PMID: 15026905 DOI: 10.1007/s00464-003-9172-z]
8 **Hakozaki Y**, Uchiyama K, Yanai A, Yamada D, Kamijo Y, Ishibashi Y. Sarcomatoid renal cell carcinoma with autosomal dominant polycystic kidney disease: a case report and literature review. *CEN Case Rep* 2021; **10**: 199-207 [PMID: 33064294 DOI: 10.1007/s13730-020-00544-z]
9 **Keith DS**, Torres VE, King BF, Zincki H, Farrow GM. Renal cell carcinoma in autosomal dominant polycystic kidney disease. *J Am Soc Nephrol* 1994; **4**: 1661-1669 [PMID: 8011975 DOI: 10.1681/ASN.V491661]
10 **Black RJ**, Bray F, Ferlay J, Parkin DM. Cancer incidence and mortality in the European Union: cancer registry data and estimates of national incidence for 1990. *Eur J Cancer* 1997; **33**: 1075-1107 [PMID: 9376190 DOI: 10.1016/s0959-8049(96)00492-3]
11 **Saad AM**, Gad MM, Al-Husseini MJ, Ruhban IA, Sonbol MB, Ho TH. Trends in Renal-Cell Carcinoma Incidence and Mortality in the United States in the Last 2 Decades: A SEER-Based Study. *Clin Genitourin Cancer* 2019; **17**: 46-57 [PMID: 30391138 DOI: 10.1016/j.clgc.2018.10.002]
12 **Jilg CA**, Drendel V, Bacher J, Pisarski P, Neeff H, Drognitz O, Schwardt M, Gläsker S, Malinoc A, Erlic Z, Nunez M, Weber A, Azurmendi P, Schultze-Seemann W, Werner M, Neumann HP. Autosomal dominant polycystic kidney disease: prevalence of renal neoplasias in surgical kidney specimens. *Nephron Clin Pract* 2013; **123**: 13-21 [PMID: 23752029 DOI: 10.1159/000351049]
13 **Wetmore JB**, Calvet JP, Yu AS, Lynch CF, Wang CJ, Kasiske BL, Engels EA. Polycystic kidney disease and cancer after renal transplantation. *J Am Soc Nephrol* 2014; **25**: 2335-2341 [PMID: 24854270 DOI: 10.1681/ASN.2013101122]
14 **Hughson MD**, Buchwald D, Fox M. Renal neoplasia and acquired cystic kidney disease in patients receiving long-term dialysis. *Arch Pathol*

Lab Med 1986; **110**: 592-601 [PMID: 3521533]
15 **Denton MD**, Magee CC, Ovuworie C, Mauiyyedi S, Pascual M, Colvin RB, Cosimi AB, Tolkoff-Rubin N. Prevalence of renal cell carcinoma in patients with ESRD pre-transplantation: a pathologic analysis. *Kidney Int* 2002; **61**: 2201-2209 [PMID: 12028461 DOI: 10.1046/j.1523-1755.2002.00374.x]
16 **Nishimura H**, Ubara Y, Nakamura M, Nakanishi S, Sawa N, Hoshino J, Suwabe T, Takemoto F, Nakagawa M, Takaichi K, Tomikawa S. Renal cell carcinoma in autosomal dominant polycystic kidney disease. *Am J Kidney Dis* 2009; **54**: 165-168 [PMID: 19446940 DOI: 10.1053/j.ajkd.2009.01.270]
17 **Dunn MD**, Portis AJ, Elbahnasy AM, Shalhav AL, Rothstein M, McDougall EM, Clayman RV. Laparoscopic nephrectomy in patients with end-stage renal disease and autosomal dominant polycystic kidney disease. *Am J Kidney Dis* 2000; **35**: 720-725 [PMID: 10739795 DOI: 10.1016/s0272-6386(00)70021-7]
18 **Gamé X**, Vaessen C, Mouzin M, Mallet R, Malavaud B, Sarramon JP, Rischmann P. [Retroperitoneal laparoscopic nephrectomy fo polycystic kidney: preliminary results]. *Prog Urol* 2003; **13**: 215-221 [PMID: 12765054]
19 **Sebe P**, de la Taille A, Hoznek A, Chopin D, Abbou CC, Salomon L. [Simple nephrectomy with retroperitoneal laparoscopy]. *Prog Urol* 2003; **13**: 577-580 [PMID: 14650285]
20 **Caballero Alcántara J**, González Hermoso C, Padilla León M, Marchal Escalona C. [Renal-cell carcinoma and polycystic disease in an adult]. *Actas Urol Esp* 1997; **21**: 410-414 [PMID: 9265416]
21 **Chang YL**, Chung HJ, Chen KK. Bilateral renal cell carcinoma in a patient with autosomal dominant polycystic kidney disease. *J Chin Med Assoc* 2007; **70**: 403-405 [PMID: 17908657 DOI: 10.1016/S1726-4901(08)70029-7]
22 **Kato T**, Takahashi Y, Nakane K, Yokoi S, Ehara H, Shinoda I, Deguchi T. [Bilateral renal cell carcinoma associated with polycystic kidney disease: case report and literature review]. *Hinyokika Kiyo* 2007; **53**: 117-119 [PMID: 17352162]
23 **Lang EK**, Davis R. Autosomal dominant polycystic disease with renal cell carcinoma. *J Urol* 2005; **173**: 987 [PMID: 15711362 DOI: 10.1097/01.ju.0000153739.20733.6a]
24 **Coulange C**, Bretheau D. [The annual national epidemiologic survey of tumors of the kidney (April 1993-March 1994: 970 patients). The Committee of Oncology of the French Society of Urology]. *Prog Urol* 1995; **5**: 529-539 [PMID: 7581503]
25 **Sulikowski T**, Tejchman K, Zietek Z, Rózański J, Domański L, Kamiński M, Sieńko J, Romanowski M, Nowacki M, Pabisiak K, Kaczmarczyk M, Ciechanowski K, Ciechanowicz A, Ostrowski M. Experience with autosomal dominant polycystic kidney disease in patients before and after renal transplantation: a 7-year observation. *Transplant Proc* 2009; **41**: 177-180 [PMID: 19249508 DOI: 10.1016/j.transproceed.2008.10.034]
26 **Rozanski J**, Kozlowska I, Myslak M, Domanski L, Sienko J, Ciechanowski K, Ostrowski M. Pretransplant nephrectomy in patients with autosomal dominant polycystic kidney disease. *Transplant Proc* 2005; **37**: 666-668 [PMID: 15848495 DOI: 10.1016/j.transproceed.2004.12.115]
27 **Kramer A**, Sausville J, Haririan A, Bartlett S, Cooper M, Phelan M. Simultaneous bilateral native nephrectomy and living donor renal transplantation are successful for polycystic kidney disease: the University of Maryland experience. *J Urol* 2009; **181**: 724-728 [PMID: 19091353 DOI: 10.1016/j.juro.2008.10.008]
28 **Nunes P**, Mota A, Alves R, Figueiredo A, Parada B, Macário F, Rolo F. Simultaneous renal transplantation and native nephrectomy in patients with autosomal-dominant polycystic kidney disease. *Transplant Proc* 2007; **39**: 2483-2485 [PMID: 17954154 DOI: 10.1016/j.transproceed.2007.07.035]
29 **Tabibi A**, Simforoosh N, Abadpour P, Gholamrezaie HR, Nafar M. Concomitant nephrectomy of massively enlarged kidneys and renal transplantation in autosomal dominant polycystic kidney disease. *Transplant Proc* 2005; **37**: 2939-2940 [PMID: 16213267 DOI: 10.1016/j.transproceed.2005.07.053]
30 **Regan RJ**, Abercrombie GF, Lee HA. Polycystic renal disease--occurrence of malignant change and role of nephrectomy in potential transplant recipients. *Br J Urol* 1977; **49**: 85-91 [PMID: 322785 DOI: 10.1111/j.1464-410x.1977.tb04076.x]
31 **Anderson GA**, Degroot D, Lawson RK. Polycystic renal disease. *Urology* 1993; **42**: 358-364 [PMID: 8212435 DOI: 10.1016/0090-4295(93)90358-h]
32 **Ho-Hsieh H**, Novick AC, Steinmuller D, Streem SB, Buszta C, Goormastic M. Renal transplantation for end-stage polycystic kidney disease. *Urology* 1987; **30**: 322-326 [PMID: 3310365 DOI: 10.1016/0090-4295(87)90293-7]
33 **Ubara Y**. New therapeutic option for autosomal dominant polycystic kidney disease patients with enlarged kidney and liver. *Ther Apher Dial* 2006; **10**: 333-341 [PMID: 16911186 DOI: 10.1111/j.1744-9987.2006.00386.x]
34 **Cornelis F**, Couzi L, Le Bras Y, Hubrecht R, Dodré E, Geneviève M, Pérot V, Wallerand H, Ferrière JM, Merville P, Grenier N. Embolization of polycystic kidneys as an alternative to nephrectomy before renal transplantation: a pilot study. *Am J Transplant* 2010; **10**: 2363-2369 [PMID: 21143393 DOI: 10.1111/j.1600-6143.2010.03251.x]
35 **Akabane M**, Nakamura Y, Miki K, Yokoyama T, Ubara Y, Ishii Y. Effectiveness of Nephrectomy and Transcatheter Arterial Embolization Before Kidney Transplantation in Autosomal Dominant Polycystic Kidney Disease. *Transplant Proc* 2020; **52**: 1680-1683 [PMID: 32336652 DOI: 10.1016/j.transproceed.2020.01.135]
36 **Suwabe T**, Ubara Y, Sekine A, Ueno T, Yamanouchi M, Hayami N, Hoshino J, Kawada M, Hiramatsu R, Hasegawa E, Sawa N, Takaichi K. Effect of renal transcatheter arterial embolization on quality of life in patients with autosomal dominant polycystic kidney disease. *Nephrol Dial Transplant* 2017; **32**: 1176-1183 [PMID: 28873973 DOI: 10.1093/ndt/gfx186]

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