Supplemental Digital Content, Table S1

A literature search in PubMed with the search words including “kidney transplant recipient” or “renal transplant recipient” and “renal cell carcinoma” was performed July 28th 2020. This search identified 659 articles on human subjects. Titles and abstracts were screened by the first author, identifying 219 articles of relevance to the subject. These are listed below according to the following categories:

1. Case reports/series reporting on RCC in native kidney (n=29)

2. Case reports/series reporting on RCC in allograft (n=48)

3. Cohort studies reporting on RCC in allograft (n=19)

4. Cohort studies reporting on RCC in native kidney and allograft (n=25)

5. Cohort studies reporting on RCC in native kidney (n=52)

6. Studies on pre-tx RCC in recipient (n=7)

7. Studies reporting on ACKD (n=25; includes 20 references from above categories)

8. Studies reporting on miscellaneous risk factors (n=7)

9. Reviews and guidelines (n=28)

10. References (n=219)

Abbreviations: ACKD, acquired cystic kidney disease. ADPKD, autosomal dominant polycystic kidney disease. CsA, ciclosporin A. CTTR, Cincinnati Transplant Tumor Registry. ESKD, end-stage kidney disease. KTR, kidney transplant recipient. KTx, kidney transplantation. mTOR, mammalian target of rapamycin. NSS, nephron sparing surgery. PET/CT, positron emission tomography/computed tomography. PTLD, posttransplant lymphoproliferative disease. RCC, renal cell carcinoma. SIR, standardized incidence ratio.

First author, year, reference	Description
1. Case reports/series reporting on RCC in native kidney	
Ng, 1980[1]	KTR after graft loss, ADPKD, RCC in native kidney.
Penn, 1986[2]	On difference between ciclosporin and conventional immunosuppressive therapy, mentions increased RCC
O'Donnell, 1988[3]	2 KTRs presenting with metastatic RCC from native kidneys
Yoshimura, 1988[4]	KTR with metastatic disease, RCC in native kidney detected post mortem.
Lien, 1991[5]	KTR 15 yrs after tx, RCC in native left kidney, ACKD in atrophic right kidney. Refers to 101 cases of RCC in native kidney reported to CTTR 1968-1987, and reviews ACKD-associated RCCs in KTRs.
Nakamoto, 1994[6]	KTR, paraplegia, pathologic fracture 3rd vertebra. RCC primary right native kidney. Resection, CsA discontinued, treated with interferon alpha, resolution of bone metastasis and no rejection 1 yr later.
Katai, 1997[7]	KTR 1 yr after tx, liver and bone metastases, death 8 mths later. RCC with sarcomatoid component, native kidney.
Lobbedez, 1997[8]	Two patients with bilateral RCC treated with bilateral nephrectomy, 2-yr observation period, then KTx. No recurrence after additional 6 yrs. Proposes no observation period for early-stage low grade RCC.
Goldfarb, 1997[9]	Case series from USA/Germany (1974-1996) of 32 patients with von Hippel-Lindau (VHL) disease who were anephric after treated RCC and transplanted. Compared to matched control group of 32 non-VHL KTRs no significant difference in graft or patient survival. 5 deaths in both groups after median 48 mths follow-up. 3/5 deaths in VHL group from metastatic cancer. No difference of dialysis duration before tx between patients developing metastatic disease and those who did not.
Nahas, 2002[10]	São Paulo, Brazil, 1995-2001. Retrospective review of 100 nephrectomies before or after KTx for various reasons, of which 7 had RCC.
Fukatsu, 2004[11]	2 KTRs with allograft failure, both with bilateral ACKD of native kidneys. RCC detected in native kidney. Additional review of 26 cases reported in Japan.
Ghasemian, 2005[12]	A report of bilateral laparascopic native nephrectomy in 9 KTx candidates and 1 KTR who had ACKD and suspicious lesions for RCC. 7 patients had unilateral RCC, 2 bilateral RCC, 1 bilateral benign complex cysts.
Nguyen, 2006[13]	KTR with concomitant PTLD and papillary RCC in native kidney, demonstrated by PET/CT imaging.
Boratyńska, 2007[14]	Wroclav, Poland. 20 KTRs with malignancy, of whom 2 RCC in native kidney, treated by switch to sirolimus and nephrectomy, no recurrence.
Hasegawa, 2009[15]	KTR, 10 yrs after tx. RCC native kidney, bone metastasis. Nephrectomy. Interferon-alpha caused allograft dysfunction and was discontinued. Zoledronic acid and sorafenib stabilized the disease for 18 mths. First report of sorafenib in KTR with metastatic RCC.
Manuelli, 2010[16]	Rome, Italy. 15 KTRs with malignancy, of whom 1 clear cell RCC. Treatment not discussed except switch to sirolimus.
Ruangkanchanasetr, 2011[17]	KTR 10 yrs after tx. 13 cm clear cell RCC native kidney and pulmonary metastasis. Nephrectomy. Sorafenib. Switch to low-dose cyclosporine and

	high-level everolimus (20-30 ng/mL), ditiazem for blood pressure control and sparing the dose of everolimus (due to interaction). Regression of pulmonary lesions at 28 months.
Suson, 2011[18]	Baltimore, USA. Retrospective. 18 RCCs in 17 native kidneys removed from 13 KTRs, of which 11 papillary, 4 clear cell, 3 chromophobe.
Choi, 2012[19]	KTR 3 mths after tx. Disseminated sarcomatoid carcinoma, death within few days. In retrospect, a preexisting Bosniak IIF cyst was identified 6 yrs previously in recipient's right kidney.
Kitajima, 2012[20]	KTR with sarcomatoid carcinoma in native kidney.
Noce, 2012[21]	KTR 4 yrs after tx. Ultrasound detected bilateral masses in native kidneys, nephrecomty revealed clear cell RCC.
Javaid, 2013[22]	2 KTRs with advanced RCC in native kidneys. Discussion on sirolimus.
Tian, 2013[23]	Beijing, China. Of 3370 KTRs, 169 had urothelial carcinoma and paper focuses on subgroup of 9 KTRs with concurrent other cancer, 1 of whom had concurrent chromophobe RCC.
Chueh, 2014[24]	KTR 14 yrs after tx. Clear cell RCC in native kidney, nephrectomy, metastasis. Maintained on temsirolimus and steroids. At 2 yrs still graft function and partial remission.
Park, 2014[25]	KTR 15 yrs after tx. Incidental adrenal cortical carcinoma and papillary RCC native kidney.
Tan, 2018[26]	KTR 4 yrs after tx. Spontaneous hemorrhage of mucinous tubular and spindle cell carcinoma in native kidney.
Basic-Jukic, 2019[27]	KTR 12 yrs after tx. RCC presenting with metastatic skin nodule from native kidney. Treated with temsirolimus and later sorafenib but died 13 mths after presentation, with functional allograft.
Juric, 2019[28]	KTR with gastrointestinal stromal tumor and concurrent RCC in native kidney.
Rangan, 2019[29]	KTR 18 yrs after tx. RCC in native kidney with metastasis characterized by PET/CT.
2. Case reports/series reporting on RCC in allograft	
Feldman, 1992[30]	KTR 156 mths after tx, Alport, RCC in allograft. Refers to 169 RCC in KTRs reported to CTTR, majority in native kidney, 17 in allograft.
Agrawal, 1994[31]	KTR 15 yr old, 7 yrs after tx from 25 yr donor. Incidental RCC in allograft.
Cohen, 1994[32]	Potential kidney donor to sibling with bilateral RCC; was himself found to have bilateral RCC. Review of familial RCC.
Williams, 1995[33]	KTR 228 mths after tx, RCC in allograft with ACKD. Refers that 19 de novo RCCs in allograft (including current) have been reported.
Kooistra, 1995[34]	2 KTRs with same donor, both developed metastatic RCC.
Lotan, 1995[35]	KTR 17 yrs old, obstructive uropathy, deceased donor kidney, painless microscopic hematuria 2 yrs after tx. Metastatic RCC of donor origin. Transplant nephrectomy, cessation of immunosuppression, with complete regression of multiple pulmonary metastases.
Park, 1997[36]	KTR 258 mths after tx, RCC in allograft, NSS, donor origin confirmed.
Krishnamurthi, 1997[37]	KTR 18 yrs after tx, hypertension, RCC in allograft. NSS, preserved renal function.
Weiss, 1998[38]	Kidney donor multilocular cystic RCC, NSS. Recipient without recurrence at 10 yrs.
Siebels, 2000[39]	KTR 10 yrs after tx. 6 cm de novo RCC in allograft. NSS. No recurrence at 2 yrs.

	Refers to 24 RCC in allografts reported to CTTR; 4 treated with NSS.
Tydén, 2000[40]	2 KTR children 9 and 11 yrs after living donor tx. ACKD and RCC in allograft. Potential contribution of growth hormone treatment. Their living donors did not develop ACKD or RCC.
Marco, 2000[41]	Editorial to Tydén, 2000, [40] stating ultrasound screening is likely not cost effective.
Gunji, 2001[42]	KTR 9 mths after tx. RCC in allograft from deceased donor. Nephrectomy. No recurrence at 3 yrs.
Wunderlich, 2002[43]	Jena, Germany. Description of 23 renal tumors, of which 8 clear cell RCC, in kidney donors regarding cytogenetic characteristics.
DeLong, 2003[44]	KTR 13 yrs after tx. Incidentally diagnosed mass in allograft. Nephrectomy. Multicentric papillary RCC (29 separate lesions).
Mengel, 2004[45]	6 KTRs with allograft tumor (2 metanephric adenomas, 2 clear cell RCCs, 1 transitional cell carcinoma, 1 renal cortical adenoma) assessed by DNA fingerprinting to detect potential donor/recipient chimerism. The 2 metanephric adenomas demonstrated microchimerism, while the remaining tumors were all found to be of donor origin.
Barama, 2005[46]	5 KTRs 4 to 17 yrs after tx. Incidentally detected 4 clear cell RCC and 1 papillary RCC in allograft, all <4 cm. NSS in 4 with graft function for >2 yrs and no recurrence. The fifth patient had a secondary radical nephrectomy.
Greco, 2005[47]	KTR 13 yrs old, 5 yrs after tx from living-related donor. Incidentally detected chromophobe RCC in allograft.
Neipp, 2006[48]	KTR accidentally transplanted with cystic RCC from living donor, NSS, no recurrence after 1 yr.
Ribal, 2006[49]	3 KTRs with RCC in allograft treated by NSS.
Rotman, 2006[50]	KTR 13 yrs after transplant. Incidentally detected concomitant papillary RCC and angiomyoplipoma, treated by allograft nephrectomy.
Dainys, 2007[51]	Restored kidney (ie, NSS and tx), no recurrence after 6 yrs.
Ghafari, 2007[52]	Restored kidney (ie, NSS and tx), 5mm RCC, no recurrence after 15 mths.
Mundel, 2007[53]	KTR, RCC in allograft, NSS with harmonic scalpel. DNA microsatellite analysis demonstrated donor origin.
Whitson, 2007[54]	Restored kidney (ie, NSS and tx), 20 mm RCC, no recurrence after 2 yrs.
Chambade, 2008[55]	Paris, France, 2002-2006. Among 2050 KTRs, 7 RCC in allograft, of which 5 T1a who underwent NSS. All pT1aNoM0 and negative margins. No complications. Immunosuppression unaltered. No impairment of kidney function. No recurrence after mean 17.4 mths follow-up.
Matevossian, 2008[56]	KTR 12 yrs after tx. RCC in allograft, 17 mm. Radiofrequency ablation. Graft function good and no recurrence at 6 mths.
Boix, 2009[57]	KTR 14 yrs after tx. RCC in allograft, clear cell with sarcomatiod changes. Microsatellite DNA assay confirmed recipient origin. First report of recipient origin RCC in allograft.
Llamas, 2009[58]	2 KTRs, same deceased donor. First KTR died 9 mths after tx from disseminated sarcomatoid RCC. This triggered examination of the other KTR, revealing allograft RCC, treated by transplant nephrectomy, was alive without recurrence at 18 mths.
Sener, 2009[59]	3 restored kidneys (ie, NSS and tx); cystic, clear cell and papillary RCC; Fuhrman grade II, II and III, respectively. No recurrence at median 15 mths.
Takahara, 2010[60]	A report from the Japan Society for Transplantation concerning 42 transplantations from deceased donors who had kidney disease, performed by one doctor without ethical discussion; 5 of whom had RCC and 5 ureteral cancer; very limited data on the recipients, except higher mortality after tx

	from donor with malignancy
Chakera, 2010[61]	KTR 8 yrs after tx. ADPKD. Incidentally detected 55 mm clear cell RCC in allograft. Treated with 2 sessions of high-intensity focused ultrasound, then partial nephrectomy. DNA analysis revealed recipient origin. PET scan did not detect other tumor. Stable graft function at 12 mths.
Hill, 2010[62]	KTR (male) 11 yrs after tx from mother. 70 mm clear cell RCC in allograft, transplant nephrectomy. Chromogenic in situ hybridization (CISH) for Y chromosome found tumor cells negative for Y chormosome (ie, of donor origin), but endothelial cells of the tumor vasculature were positive for Y-chromosome (ie, of recipient origin). In nontumor allograft kidney the endothelial cells of glomerular and other vasculature were negative for Y chromosome (ie, of donor origin). Infiltrating leukocytes and occasional tubular epithelial cells positive for Y-chromosome (ie, recipient origin).
Lentini, 2011[63]	KTR. Ultrasound screening detected 32 mm RCC in allograft, NSS, no recurrence at 5 yrs.
Olivani, 2011[64]	KTR 11 yrs after tx. RCC in allograft treated by ultrasound-guided radiofrequency ablation. Preserved graft function.
Valente, 2012[65]	3 donors with clear cell RCC, 2 contralateral and 1 affected kidney used after tumor excision, no transmission (14-48 mths follow-up).
Ali, 2012[66]	2 restored kidneys (ie, NSS and tx), no recurrence, functional grafts.
Ignee, 2012[67]	KTR with papillary RCC in allograft, characterized by contrast enhanced ultrasound.
Verine, 2013[68]	5 KTRs with papillary adenomas and papillary RCCs in allograft. Molecular and DNA analysis revealed 1) 1 case of papillary RCC of recipient origin, 2) identical origin of papillary adenoma and papillary RCC, and 3) additional genetic changes in papillary RCC vs papillary adenomas.
Akioka, 2014[69]	RCC in allograft 16 yrs after functional graft loss.
Cienfuegos-Belmonte, 2015[70]	3 clear cell RCC treated by NSS and 1 papillary RCC treated by graftectomy. Withdrew calcineurin inhibitors and instituted mTOR inhibitors.
Christensen, 2015[71]	KTR 4 days after deceased donor tx. 3 cm papillary RCC in allograft. Radiofrequency ablation. Everolimus-based immunosuppression. Recurrence-free and excellent graft function at 4.5 yrs.
Moris, 2015[72]	Papillary RCC in deceased donor, contralateral kidney transplanted without recurrence after 48 mths follow-up.
Althaf, 2016[73]	KTR, chromophobe RCC in allograft presenting with weight loss.
Moris, 2016[74]	Deceased donor, left kidney discarded due to clear cell RCC, right kidney not accepted by any recipient, pathology showed papillary RCC.
Robin, 2016[75]	A report on genetic methodology to analyze donor vs recipient origin of RCC in allograft
Minnee, 2017[76]	A living donor kidney with Bosniak 2F cyst containing multilocular cystic RCC restored and transplanted
Harriman, 2019[77]	KTR 19 yrs after tx. 11.2 cm clear cell papillary RCC in allograft. Embolization prior to nephrectomy.
3. Cohort studies reporting on RCC in allograft	
Carver, 1999[78]	Louisiana, USA, 1991-1997. 553 deceased donors, 5 (0.9%) had RCC (stage T1 or T2, no metastasis). In 4 all organs were discarded. In 1 organs except affected kidney were used inadvertently. Follow-up in Carver, 2001,[79] below.
Carver, 2001[79]	1 KTR and 1 liver recipient, common donor had RCC in contralateral kidney

	(stage T1). This is a follow-up of reference [78]. No tumor found in these recipients after 4 yrs.
Rouprêt, 2004[80]	Paris, France 1968-2002. Among 1250 KTRs, 3 RCC in allograft.
Buell, 2005[81]	Israel Penn CTTR data. Mentions 11 restored (ie, NSS and tx) living donor kidneys and 3 restored deceased donor kidneys. Tumor size median 2 cm (range 0.5 to 4 cm), all Furhman I or II and negative margins. Median follow-up 69 mths (range 14-200 mths). No recurrence.
Altaee, 2006[82]	Baghdad, Iraq, 1994-2004. Among 273 KTRs, 16 developed any cancer, of whom 1 RCC in allograft.
Ulu, 2007[83]	Ankara, Turkey, 1994-2006. Review of abdominal CT scans. Among 568 KTRs, 12 malignancies of which 1 RCC in allograft.
Cornelis, 2011[84]	Retrospective study through European Society of Urogenital Radiology network on outcomes after percutaneous thermal ablation for de novo RCC in kidney allografts between 2003-2010. 24 tumors in allograft of 20 patients from 11 institutions were treated by radiofrequency ablation (n=19) or cryoablation (n=5), diameter 6-40 mm (median 20 mm). No recurrence after mean 28 mths.
Desai, 2012[85]	United Kingdom, 2001-2010. 30'765 solid organ recipients from 14'986 donors. 18 recipients developed donor origin cancer from 16 donors (0.06%). 6 were RCC, none of these 6 caused patient death.
Tillou, 2012[86]	Survey of 32 French tx centers. From 1988 to 2009, 79 RCC in allograft among 41806 KTRs (0.19%). Most (n=60; 76%) detected by annual screening (recommended in France since 2007). Mean time tx to RCC 131.7 mths. Mean tumor size 27.8 mm. Organ confined (T1-2) in 74 (94%). Low grade (G1-2) in 53 (67%). Papillary RCC in 44 (56%). NSS in 35 (44%). Radiofrequency ablation in 5 (6%). Death from RCC in 4 (5%). Estimated 5-yr cancer specific survival 94%.
Fiaschetti, 2012[87]	Roma, Italy, 2003-2010. 28 deceased donors with malignancy, of whom 7 with RCC, no transmission of tumor.
Musquera, 2013[88]	Barcelona, Spain, 2007-2012. Retrospective analysis of donors with incidental small renal mass. 8 donors with incidental renal mass (4 deceased, 4 living), 11 transplantations, 8 affected kidneys used after tumor excision, 3 contralateral kidneys, all stage T1, 5 clear cell RCC, 2 chromophobe RCC, 1 lipoma, negative surgical margins, no transmission after mean 32 mths follow-up.
Lugo-Baruqui, 2015[89]	Miami, USA, 2009-2013. Of 435 living donor KTR, 4 donor kidneys incidental RCC (2 clear cell, 1 papillary, 1 multilocular), all stage 1. Backtable NSS. No transmission after median 36 mths follow-up.
Ogawa, 2015[90]	Tokyo, Japan. Prospective study 10 restored kidneys, all stage T1 RCC. No recurrence after 32-58 mths follow-up.
Saleeb, 2015[91]	Toronto, Canada. 1584 KTRs, of whom 4 allograft cancers: 1 urothelial and 3 RCC (1 clear cell, 1 papillary, 1 translocation).
Wang, 2018[92]	Shandong, China, 2012-2017. 7 restored living donor kidneys with small (<3.5 cm) RCC, no recurrence after 31-58 mths of follow-up.
Ploussard, 2012[93]	Paris, France, 1984-2006. Retrospective study of RCC in allograft. Yearly ultrasound screening. Allograft removed if tumor >40mm, NSS or cryoablation considered for smaller tumors. Among 2396 KTRs, 17 RCCs in allograft of 12 (0.5%) patients. Mean time since tx 13 yrs. Mean diameter 23 mm. 9 papillary RCC, 5 clear cell RCC, 1 chromophobe RCC. 4 graft nephrectomy, 6 NSS, 2 cryoablation. 100% concordance between biopsy and surgical specimens for nuclear grade and pathological type. Mean follow-up

	43 mths. One local recurrence after NSS.
Tuzuner, 2013[94]	Ankara, Turkey, 1978-2012. 804 KTRs, 2 RCC in allograft (RCC in native kidneys not reported). NSS.
Végső, 2013[95]	Budapest, Hungary, 1973-2012. Among 3530 KTRs, 9 RCC in allograft, of whom 8 stage 1. 6 clear cell, 2 papillary and 1 sarcomatoid. 4 nephrectomies, 5 radiofrequency ablations, latter without affecting graft function. After mean 23 mths follow-up, 6/9 alive and free of tumors, including the 5 radiofrequency ablated patients; 3 deaths (1 tumor progression, 1 pneumonia, 1 sepsis).
Troxell, 2016[96]	Stanford University and Oregon Health & Science University, 2000-2015. Search of pathology files for kidney allograft RCC. Among an estimated 4200 transplants, 11 KTRs (of about 4200; ie, 0.26%) demonstrated 12 RCCs in allograft, of which 6 papillary, 4 clear cell, 1 clear cell (tubule)papillary, 1 chromophobe. None had recurrence or metastasis.
4. Cohort studies reporting on RCC in native kidney and allograft	
Heinz-Peer, 1995[97]	Vienna, Austria, cross-sectional study during 1992-1994. Among 504 KTRs, routine yearly abdominal ultrasound and chest X-ray. Identified 11 cancers in 11 patients (2.2%), of which 6 RCCs in native kidney, 2 RCC in allograft, 2 non-Hodgkin lymphomas in liver and renal allograft, 1 ovarial carcinoma. ACKD seemed associated with development of RCC.
Wunderlich, 2001[98]	Germany, questionnaire to 38 tx centers about RCC 1990-1998, 27 (71%) responded. Among 10 997 KTRs, 30 had RCC detected in donor kidney at time of tx, mean size 2.2 cm (0.4-6cm), outcomes not stated. In addition, 16 KTRs developed RCC 3-12 yrs after tx.
Sheil, 2001[99]	Israel Penn CTTR data. Of 8943 tx recipients with cancer reported to CTTR, 328 (3%) of 9525 cancers were renal, 297 (91%) in native kidney. 40 allograft cancers (31 RCC, 7 transitional cell, 2 sarcoma). Mentions 7 restored (ie, NSS and tx) deceased donor kidneys and 6 restored living donor kidneys without recurrence.
Rascente, 2005[100]	L'Aquila, Italy, 1968-2004. 265 KTRs, of whom 2 RCC in native kidney treated by nephrectomy, and 1 RCC in allograft treated by NSS.
Diller, 2005[101]	Münster, Germany, 1979-2001. Among 1804 KTRs, 34 patients experienced genitourinary cancers, of whom 15 RCC (13 native, 2 allograft). 3/15 had recurrence or persistence of tumor. 1- and 5-yr mortality due to RCC was 13% and 23%, respectively.
Zhou, 2006[102]	Shanghai, China, 1978-2006. 3150 KTRs, 33 malignancies, of which 1 RCC in native kidney and 1 RCC in allograft.
Shum, 2006[103]	Singapore, 1993-2002. Among 440 KTRs, 7 RCC in native kidney and 1 in allograft.
Schwarz[104]	Hannover, Germany. Focus on ACKD. Patients transplanted 1970-1998 and prospectively screened by ultrasound during 1997-2003. Among 916 KTRs, 561 were sreened. 129 (23%) had ACKD, 46 (8.2%) had complex renal cysts (Bosniak IIF to III), 8 (1.5%) had newly diagnosed RCC, 7 of which were associated with ACKD (Bosniak IV). 1 RCC in allograft. 19 had a former RCC diagnosed (18 associated with ACKD). Overall prevalence of RCC 4.8%, among those with ACKD 19.4%, without ACKD 0.5%, and among patients with complex renal cysts (Bosniak IIF to III) 54.4%. RCC was bilateral in 26% of

	cases. Clear cell RCC in 58% and papillary RCC in 42%, 1 patient had both. Only 1 patient had lung metastasis. No patient died. Suggests screening due to high prevalence, and that because ACKD is more prevalent in dialysis patients, tx may prevent ACKD and RCC. Cohort extended in reference Eggers, 2019[105] below.
di Capua Sacoto, 2010[106]	Valencia, Spain, 1980-2006. Among 1751 KTRs, 21 developed urologic cancer, of whom 6 (0.34%) RCC in native kidney and 5 (0.29%) RCC in allograft, with a median survival of 59 mths and 86 mths, respectively.
Elkentaoui, 2010[107]	Bordeaux, France, 1998-2008. Periodic ultrasound screening of native kidneys and allograft. Among 1350 KTRs, 39 patients developed 42 urological cancers, of which 13 RCC in native kidney in 10 patients (ie, 3 bilateral synchronous RCC), and 3 RCC in allograft. For RCC in native kidney, all were pT1 except 1 pT2. Radical nephrectomy in all. No recurrence after 35 (8-78) mths, and 100% 5-yr survival. For RCC in allograft, 1 NSS and 2 radiofrequency ablation, no recurrence after NSS (105 mths) or ablation (6 mths).
Leveridge, 2011[108]	Toronto, Canada, 1966-2009. Since 2007 yearly ultrasound screening imaging of native kidneys and allograft. Among 3568 KTRs, 45 RCCs in native kidneys of 39 KTRs (1.1%) and in 8 (0.2%) allografts. Of native RCC, 17 (38%) detected after screening commenced, with no difference in tumor size from previous era. All allograft RCC were detected on screening. Among native and allograft RCC, respectively, clear cell type found in 21 and 3, and papillary in 20 and 5. After mean follow-up of 6.6 and 3.6 yrs in groups with native and allograft RCC, respectively, 32 and 7 KTRs were still alive, and no death was attributed to RCC. Authors state no justifiable recommendation can be made regarding screening.
Melchior, 2011[109]	Bremen, Germany, 1988-2009. Among 802 KTRs, 9 RCC in native kidney (8 clear cell) and 3 in allograft (2 clear cell, 1 sarcomatoid). The latter detected 3 mths after tx leading to patient death.
Tsaur, 2011[110]	Frankfurt, Germany, 1979-2010. Among 2001 KTRs, 30 RCC in 26 patients (1.5%) of which 25 in native kidney and 5 in allograft. After mean follow-up 59 mths, 15% died from cancer and 58% in complete remission.
Blagojević-Lazić, 2012[111]	Belgrade, Serbia. 411 KTRs during 16 yrs. 7 malignancies, 1 RCC in allograft.
Karczewski, 2012[112]	Poznan, Poland, 1994-2011. Among 836 KTRs, 63 malignancies. 11 RCC native kidney (1.3%) and 2 in allograft (0.2%). 8 clear cell, 2 papillary, 2 tubulopapillary, 1 tubulopapillary/clear cell. pT1 in 10. Mean time from tx to RCC diagnosis 3 ± 2.6 yrs. Male sex and smoking associated with RCC. After mean follow-up of 10 yrs, 1 died from RCC.
Karczewski, 2012[113]	Same cohort as above Karczewski, 2012 [112] (duplicate publication)
Smith, 2013[114]	North American Pediatric Renal Transplant and Collaborative Studies (NAPRTCS)-registry (120 centers in US, Canada, Mexico, Costa Rica; data on pediatric KTRs until 21st birthday), 1987-2009?. Among 10 474 pediatric KTRs and 48 549 person-years of follow-up, 35 nonlymphoproliferative solid cancers were detected, of which 3 RCC in native kidney and 2 RCC in allograft.
Viart, 2013[115]	Amiens, France, 1989-2012. Annual CT or ultrasound screening. Among 1037 KTRs, 38 RCC in native kidney, 7 RCC in allograft. Of latter, 5 papillary RCC, 2 clear cell RCC and no tumor-related 5-yr mortality.
Hevia, 2014[116]	Madrid, Spain, 1977-2010. Periodic screening for cancer. Among 1365 KTRs, 8 RCC in native kidney and 3 RCC in allograft. 2 of the RCC native kidney had metastasis at diagnosis, other pts curatively treated.
Moon, 2015[117]	Newcastle Upon Tyne, UK, 2002-2014. Among 1386 KTRs, 17 developed RCC

	in native kidney and 2 in allograft. 4 required contralateral native nephrectomy for RCC (totaling 23 tumors). Histology known in 20 tumors: 10 clear cell RCC, 8 papillary RCC, 1 chromophobe, 1 sarcomatoid. Majority pT1. Median follow-up 2.6 yrs, 4/19 patients died, of whom 3 from RCC.
Kato, 2016[118]	Osaka, Japan, 1972-2013. Since 1993 annual screening of skin and computed tomography of thorax and abdomen, as well as abdominal and neck ultrasound, mammography, gastroscopy, and cervical PAP smear. Among 750 KTRs, 77 cancers detected. 10/750 (1.3%) had RCC in native kidney and 2/750 (0.3%) in allograft. A majority of RCC (10/12) detected through screening and not from symptoms. In Cox regression, nonscreened were at higher risk of mortality (not adjusted for era effects).
Karami, 2016[119]	US, The Transplant Cancer Match Study, 1987-2010. Among 116 208 KTRs, 683 RCCs. SIR vs general population 5.7 (95% CI 5.3-6.1) overall; SIR 13.3 for papillary RCC and SIR 4.0 for clear cell RCC. Higher risk of RCC in blacks vs whites (HR 1.50), lower in females vs males (HR 0.56), increased with dialysis duration pre-tx ($p<0.0001$). Subset analysis indicated majority of RCC in native kidney, only 11% in allograft. First study of SIR for subtype of RCC (ie, clear cell and papillary). Not known if detected by screening or symptomatic.
Ranasinghe, 2016[120]	ANZDATA, 2000-2012. Among 8850 KTRs, 47 RCC in native kidney and 8 in allograft. 14 cancer-specific deaths in KTRs with RCC in native kidney, none in KTRs with RCC in allograft. Survival for KTRs with RCC in native kidney 71% at 5 yrs and 59% at 10 yrs. Not known if detected by screening or symptomatic.
Antunes, 2018[121]	Coimbra, Portugal, 1987-2016. Of 2897 KTRs, 23 (0.8%) developed 25 RCC (22 native kidney, 3 allograft). All except 1 detected by annual screening. Median time tx to RCC 54 mths (range 4 to 294 mths). Treated by nephrectomy (native kidney) or NSS (allograft). Papillary RCC in 12 (48%), clear cell RCC in 10 (40%). Survival at 1, 5 and 10 yrs after RCC diagnosis was 96%, 91% and 87%, respectively.
Eggers, 2019[105]	Hannover, Germany, from 1970 to undefined date. Not specified if RCC detected by screening. Among 5250 KTRs, a pre-tx RCC in 43 (0.8%), a post-tx RCC in native kidney in 61 (1.2%) and RCC in allograft in 20 (0.4% of all patients; 25% of post-tx RCCs). Stage T1-2 in 75%, whereas all RCC in allograft were stage T1. Clear cell RCC in 33 (27%), papillary RCC in 31(25%), chromophobe in 5 (4%), not specified in 55 (44%). Analysis of risk factors for survival and recurrence included all RCCs (both pre- and post-tx), with potential selection bias in the pre-tx RCC group (ie, patients with advanced RCC are not transplanted). After matching 1:2 patients with to those without RCC, survival was predicted by tumor stage and hemoglobin, whereas recurrence predicted by tumor grading. Overall, recurrence in 4.8%.
5. Cohort studies reporting on RCC in native kidney	
Hoover, 1973[122]	Multinational transplant registry study, 1951-1971. Among 6297 KTRs, increased lymphoma and skin cancer risk. RCC not specified, though category "other" has 12 cancer cases.
Matas, 1975[123]	Minneapolis, USA, 1963-1975. Among 656 dialysis/KTRs, 10 cancers, of which 2 kidney cancers.
Sheil, 1977[124]	Australia and New Zealand. Among 1884 KTRs, 126 developed any cancer during 11 yrs.
Sheil, 1979[125]	Australia and New Zealand. Among 471 KTRs, 99 developed any cancer.

Cassidy, 1982[126]	Cape Town, South Africa, 1967-1979. Among 209 KTRs, 8 developed any cancer.
Matson, 1990[127]	Milwaukee, USA, 1967-1989. Study on ACKD and RCC. ACKD prevalence increased with time in dialysis, equal between HD and PD. 80% of RCC in patients with ACKD. 5-yr survival of patients with RCC and ESKD 35%, similar to nondialysis patients.
Vogt, 1990[128]	Hannover, Germany, 1981-1986. Last follow-up 1989. Among 598 KTRs, 18 cancers, of which 2 RCC. Cohort extended in reference Eggers, 2019 [105], above.
Chen, 1995[129]	Keelung, Taiwan, 1981-1990. Among 1165 dialysis patients, 28 cancers of which 4 in kidney and ureter, whereas none such cancers in 290 KTRs.
Escribano Patiño, 1995[130]	Madrid, Spain, 4-yr period. Among 171 KTRs, 5 cancers, no RCC.
Heinz-Peer, 1995[131]	Vienna, Austria. Prevalence of ACKD in native kidneys of KTRs by ultrasound. Among 385 KTRs, 96 ACKD, associated with duration of dialysis, but not time with functioning graft. 6 RCC, of which 5 in ACKD. Similar cohort as reference.[97]
London, 1995[132]	Leeds, United Kingdom, 1967-1991. Among 918 KTRs, 70 had cancer, no RCC.
Smith, 1995[133]	Columbia, USA, 1979-1989. Data on 94 of 236 KTRs, of whom 24/94 had skin cancer and 6/94 had nonskin cancer. No details on RCC in abstract.
Mihalov, 1996[134]	Illinois, USA. Among 305 KTRs, 9.2% developed cancer, whereas among 307 heart tx recipients 11.7% developed cancer. No details on RCC in abstract.
Doublet, 1997[135]	Paris, France, 1993-1995. 129 KTRs screened by ultrasound detected 5 (3.9%) RCC, 100 times greater vs general population. No association with type and duration of dialysis, or ACKD.
Kliem, 1997[136]	Hannover, Germany, 1968-1995. Among 2372 KTRs, 154 (6.5%) developed cancer, of which 12 RCC in native kidney (7.8% ie, 0.5% of total population). 2/12 RCC had analgesic nephropathy, 1/12 ADPKD. 73% of RCC in patients with ACKD. 4 died from RCC. Cohort extended in reference Eggers, 2019,[105] above.
Wiesel, 1997[137]	Heidelberg, Germany, 1980-1995. Reporting on 788 patients with RCC undergoing radical nephrectomy of whom 14 were in dialysis and 7 KTRs. 5 of the 7 KTRs with RCC had advanced disease, 4/7 had ACKD, 3/7 died from RCC.
Ishikawa, 1998[138]	Japan 1971-1995. Reporting on 1206 tx in 1181 KTRs. 10 RCC in native kidney diagnosed at or after KTx. Mean duration HD 106 mths. 6 of 10 RCC in ACKD. 90% 5-yr disease-specific survival.
Yang, 1998[139]	Taiwan, 1983-1996. Among 390 KTRs, 25 incident cancers of any type. No details on RCC in abstract.
Jamil, 1999[140]	Melbourne, Australia, 1985-1996. Among 599 KTRs, antirejection treatment was associated with increased rates of infection, lymphoma and mortality. No RCC.
Ondrus, 1999[141]	Bratislava, Slovakia, 1972-1999. Among 620 KTRs, 18 developed cancer, of whom 2 RCC.
McGeown, 2000[142]	Belfast, Northern Ireland, 1968-1999. Among 868 KTRs, 94 had any cancer. No details on RCC in abstract.
Vatazin, 2000[143]	Russian. Among 718 KTRs, 33 developed any cancer. No details on RCC in abstract.
Gunji, 2001[144]	Chiba, Japan, 1975-1998. Among 183 KTRs, 10 cancers, of which 1 RCC.
Szmidt, 2002[145]	Warsaw, Poland, 1990-2000. 808 KTRs. 5 (0.62%) developed malignancy in native kidneys. Median 38 mths (range 1-71 mths) after tx. 4 diagnosed by routine ultrasound, no symptoms. Nephrectomy. 4 clear cell, 1 papillary. All

	stage T1 (<4cm), grade I-II.
Grochowiecki, 2002[146]	Warsaw, Poland. Matched study of 6 RCC in KTRs and a non-tx group. No recurrence in either group after median 32 mths (range 8-131) follow-up.
Veroux, 2003[147]	Catania, Italy, 2000-2002. Among 138 KTx, 16 cancers in 10 KTRs of which 1 RCC.
Langer, 2003[148]	Budapest, Hungary, 1973-2001. Among 2159 KTRs, 115 (5.3%) developed cancer, of whom 14 urogenital (not further specified).
Neuzillet, 2005[149]	Marseille, France, 1987-2003. No screening for native kidney RCC. Among 933 KTRs, 11 patients developed 12 RCCs. 10 incidentally discovered, 2 symptomatic. Mean size 37 mm (range 10-90). 2 patients died, 1 from cancer, median 39 mths follow-up.
Samhan, 2005[150]	Hawally, Kuwait, 1972-2004. Among 1171 KTRs, 51 developed cancer, of whom 3 RCC.
Moudouni, 2006[151]	Paris, France, 1993-2004. No screening for native kidney RCC. Among 373 KTRs, 10 developed 12 RCCs in native kidney. 8 discovered incidentally, 4 symptomatic. All tumors were stage T1a. 1 patient died from progressive cancer 6 yrs after diagnosis, 1 had local recurrence 2 yrs after diagnosis, other 8 patients no recurrence.
Einollahi, 2009[152]	Iran, 5 tx centers, 1984-2008. Among 5532 KTRs, genitourinary cancer in 21, of whom RCC in 5.
Filocamo, 2009[153]	Florence, Italy, 1991-2007. Ultrasound screening every 6 mths. Among 604 KTRs, 145 (24%) had ACKD and 10 (1.7%) developed RCC, of whom 8 in ACKD. All pT1a. 4 clear cell RCC, 6 papillary RCC, all unifocal and monolateral. Radical nephrectomy in all. 3 died of other cause, remaining alive without recurrence at 41 (12-96) mths follow-up.
Tillou, 2009[154]	Amiens, France, 1989-2007. Annual screening by ultrasound or CT. Among 800 KTRs, 33 nephrectomies performed for suspect lesions in 31 patients. 11 had no cancer (7 benign cyst, 2 hemorrhagic cyst, 2 chronic pyelonephritis). 21 patients had 22 RCC (2 asynchronous RCC in 1 patient), none with symptoms. All pT1, 15 clear cell RCC and 7 papillary RCC. 1 died of bone metastasis after 8 mths. Remaining alive at 34 (3-114) mths follow-up. Five-yr survival 93.3%.
Akbarzadehpasha, 2010[155]	Babol, Iran, 1999-2005. Among 380 KTRs, 12 developed any cancer, no RCC reported.
Hurst, 2010[156]	United States Renal Data System, 2000-2005, based on billing claims for RCC and cysts (surrogate for ACKD). Among 40 821 Medicare KTRs, 368 (0.9%) diagnosed with RCC within 3 yrs after tx (3.16 per 1000 person years). No data if RCC was in native kidney or allograft. Pre-tx cysts in 1264 (3.1%) of total, 29/368 (7.9%) of KTRs with RCC and 1235/40'453 (3.1%) of KTRs without RCC. Post-tx cysts in 1265 (3.1%) of total, 53/368 (14.4%) of KTRs with RCC and 1212 (3.0%) of KTRs without RCC. ie, cysts (pre- or post-tx) in 82/368 (22.3%) of RCC. Pre-tx cysts associated with early RCC (first 6 mths after tx), likewise post-tx cysts associated with RCC first 6 mths after diagnosis of cyst (potential surveillance bias). Other risk factors for RCC: male, older age, donor age, African American, dialysis time, rejection; whereas no risk for RCC associated with ADPKD, smoking, immunosuppression or induction. RCC associated with death, HR 2.44 (1.91-3.11), p<0.001.
Klatte, 2010[157]	Vienna, Austria, 1989-2008. Retrospective study of 28 surgically treated RCCs (native kidney) in 24 KTRs and a comparison group of 671 nontransplanted patients with RCCs. ACKD in 83% of KTRs with RCC. Of note, only 2 symptomatic KTRs with RCC, and these were the only that had metastasized

	at diagnosis. RCCs in KTRs (vs comparison group) were more often incidentally detected (92% vs 77%, P=0.09), multifocal (39% vs 15%, P<0.001), bilateral (17% vs 4%, P = 0.006), of lower T stage (P = 0.040), smaller (P = 0.027), of lower grades (P = 0.010), papillary (43% vs 19%, P = 0.019) and detected at younger age (P = 0.022). After median 6.7 yrs 8 KTRs died, but only 2 from RCC. In multivariate analysis, KTx status not associated with mortality.
Cheung, 2011[158]	Hong Kong, China, 2000-2009. Retrospective. Among 1003 KTRs, 12 KTRs had nephrectomy for 13 RCCs. One symptomatic, remaining incidentally detected. ACKD in 6/12. pT1 in 10/12. Clear cell RCC in 7/13, papillary RCC in 6/13. After median 38 mths, 1 death of RCC.
Hwang, 2011[159]	Seoul, Korea, 1969-2009. Retrospective. Among 1695 KTRs, 136 had a post-tx malignancy, of which 7 RCC (10-fold vs general population).
Végsö, 2011[160]	Budapest, Hungary, 1973-2010. Among 3003 KTRs, 43 (1.4%) RCC in native kidney. Multifocal in 8. Clear cell in 27, papillary in 13, chromophobe in 2, sarcomatoid in 1. Stage I in 38. 6 died from RCC.
Goh, 2011[161]	Singapore, 1995-2007. Native kidney screening by ultrasound every 5 yrs, or every 2 yrs if cysts developed. Among 1036 KTRs, 10 RCC in native kidney, all in patients with cysts, no 5-yr mortality. Time in dialysis and presence of cysts were risk factors for RCC.
Gigante, 2012[162]	24 French Tx centers, 1985-2009. Retrospective analysis of RCC in native kidneys of KTR or dialysis patients. Identified 303 RCC (206 men, 64 women; 213 KTRs, 90 dialysis patients). Not stated total population of KTR or dialysis patients. Mean (SD) time from tx to RCC in KTRs 91 (82) mths. After median follow-up 36 mths, 6 (3%) and 21 (23%) died from RCC in KTR and dialysis group. 5-yr cancer-specific survival 97% and 77% in KTR and dialysis group. In multivariable analysis, T-stage (but not KTR/dialysis status) independently associated with cancer-specific survival. Surveillance of KTRs may explain identification of lower-stage tumors with better prognosis.
Ruangkanchanasetr, 2012[163]	Bangkok, Thailand, 1987-2009. Among 168 KTRs, 2 RCC in native kidney.
Sun, 2013[164]	Seoul, Korea, 1991-2010. 1424 KTRs. 5 RCC (0.35%) in native kidney, ACKD in all. Median time tx to RCC 16.2 yrs (range 9 to 20). Radical nephrectomy in 4 without recurrence at median 2.9 yrs. One refused nephrectomy and developed spinal metastasis 6 yrs later.
Tsivian, 2013[165]	Durham, USA, 2000-2008. Single-center retrospective review of renal tumors in transplant recipients (n=19, of whom 11 KTRs) vs general population (n=931). Transplant group presented incidental renal masses of smaller size, lower stage and grade and higher proportion of papillary histology (35% vs 20%) than general population. Among 11 KTRs, 6 clear cell RCC, 5 papillary RCC. After median 48 mths follow-up of KTRs, no recurrence or progression.
Zhang, 2014[166]	China, 1974-2014, various databases. According to ethical guidelines for China. Among 30632 KTRs, RCC in 42.
Ryosaka, 2015[167]	Tokyo, Japan, 2000-2013. Retrospective. Incidental hemodialysis-related RCC (id-RCC) in 202 patients treated by nephrectomy, none with metastasis. 17 of these were KTRs with solid-type RCC, 27 were KTRs with cystic-type RCC, remaining non-tx patients. States worse cancer-specific survival with solid-type RCC in KTRs vs non-tx patients, though based on only 2 deaths among 17 patients in former group, and high competing risk of noncancer mortality in latter group.
Kalil, 2015[168]	US Cancer Transplant Match Study. Comparing cancer incidence among

	109 224 primary transplants and 6621 retransplants. Found overall similar cancer incidence, though higher risk of RCC (adjusted IRR 2.03 [95%CI 1.45-2.77]), among retransplants vs primary transplants. May be explained by ACKD and more time on dialysis among retransplants.
Bieniasz, 2016[169]	Warsaw, Poland, 2010-2014. Description of 13 RCC in KTRs, total number of KTRs not stated.
Schrem, 2016[170]	Hannover, Germany, 2000-2012. Among 1655 KTRs, 37 patients developed 40 RCCs, 2 deaths. Cohort extended in reference Eggers, 2019,[105] above.
Moris, 2017[171]	Athens, Greece, 1983-2015. Among 2173 KTRs, 11 RCCs (0.5%) in native kidneys. Semiyearly ultrasound screening. 4 patients died from metastatic disease.
Zilinska, 2017[172]	Slovak Republik, 2007-2015. Among 1421 KTRs, 14 RCC in native kidneys (1.0%)
Kleine-Döpke, 2018[173]	Hannover, Germany, 2000-2012. Yearly ultrasound screening. Among 1655 KTRs, 31 RCCs. Excluded 5 RCC occurring first post-tx yr. Remaining 26 cases matched 1:2 to other KTRs. Independent risk factors for RCC were duration of hemodialysis, time of prednisolone treatment, CsA and mycophenolate usage. Cohort extended in reference Eggers, 2019,[105] above.
6. Studies on pre-tx RCC in recipient	
Sheashaa, 2011[174]	258 KTRs from 1997-2008 who had ipsilateral native nephrectomy at time of tx. Histopathology of the native nephrectomy revealed RCC in 12 (4.7%), of which ccRCC in 9, chromophobe in 1, combined clear cell and papillary in 2. RCC presented in the remaining native kidney in 3/12 (25%) patients. 1/12 (8.3%) developed metastatic RCC compared to 8/246 (3.3%) of the KTRs without RCC at tx (P<.001), though patient and graft survival was similar.
Chiu, 2016[175]	Taiwan, 1999-2009. Among 4350 KTRs, 95 patients had a pre-tx cancer, with urinary tract, kidney cancer and breast cancer most common, though exact numbers not stated. 3 RCC recurred.
Beksac, 2017[176]	A survey of US transplant centers on required treatment of small renal masses before tx. Response rate 25%.
Dahle, 2017[177]	Norway, 1963-2010. Among 5867 KTRs, 377 had a pre-tx cancer, of which 100 were pre-tx kidney cancers. KTRs with a pre-tx kidney cancer experienced 70 deaths, of which 22 deaths from cancer, of which 13 from cancer recurrence. Compared to KTRs without cancer, those with a pre-tx kidney cancer had a trend for increased mortality (HR 1.26, P=0.054) and an increased cancer mortality (HR 3.05, P<0.001). No cancer recurrence death occurred in patients with a short (<2 year) observation period between their pre-tx kidney cancer and tx. No data on tumor stage.
Nguyen, 2017[178]	USRDS 1983-2007. Among 1 374 175 patients with ESRD, 228 984 received tx, of whom 501 had a renal malignancy-associated ESRD (RM-ESRD). KTRs with RM-ESRD and a short waiting duration (0-2 yrs) had better survival than KTRs with RM-ESRD who waited longer (10-yr survival 69% vs 47%, P<0.0001), with similar cancer-specific mortality.
Boissier, 2018[179]	Systematic review on pre-tx urological cancer in ESRD, until 2017. Identified 17 studies on kidney cancer enrolling 1810 patients (1371 dialysis, 439 KTRs). Similar risk of recurrence, cancer-specific and overall survival between dialysis and KTR groups.
Frascà, 2019[180]	Review of kidney tx in patients with previous RCC, recommending no observation period between treated cancer and tx in low-risk patients.

7. Studies reporting on ACKD (includes references from above categories)	*= also referenced above
Vaziri, 1984[181]	ACKD in native kidneys of 11 of 22 KTRs (on necropsy or nephrectomy). KTRs with ACKD had a longer time in dialysis before tx and shorter graft function vs noncystic group. Combined time in ESRD (dialysis + tx) was however similar. Thus suggested that functioning allograft retards cystic evolution in native kidneys. One patient in ACKD group developed multifocal clear cell RCC.
Matson, 1990[127]*	Milwaukee, USA, 1967-1989. Study on ACKD and RCC. ACKD prevalence increased with time in dialysis, equal between HD and PD. 80% of RCC in patients with ACKD. 5-yr survival of patients with RCC and ESRD 35%, similar to nondialysis patients.
Lien, 1991[5]*	KTR 15 yrs after tx, RCC in native left kidney, ACKD in atrophic right kidney. Refers to 101 cases of RCC in native kidney reported to CTTR 1968-1987, and reviews ACKD-associated RCCs in KTRs.
Lien, 1993[182]	Ultrasound study in 33 KTRs and 32 dialysis patients. KTRs had lower prevalence of ACKD (39% vs 56%). Two dialysis patients had RCC. CyA associated with ACKD in transplant patient s (57% in CyA-treated, 8% in non-CsA-treated).Thus suggested that tx reduces and CyA increases prevalence of ACKD.
Williams, 1995[33]*	KTR 228 mths after tx, RCC in allograft with ACKD. Refers that 19 de novo RCCs in allograft (including current) have been reported.
Heinz-Peer, 1995[97]*	Vienna, Austria, cross-sectional study during 1992-1994. Among 504 KTRs, routine yearly abdominal ultrasound and chest X-ray. Identified 11 cancers in 11 patients (2.2%), of which 6 RCCs in native kidney, 2 RCC in allograft, 2 non-Hodgkin lymphomas in liver and renal allograft, 1 ovarial carcinoma. ACKD seemed associated with development of RCC.
Heinz-Peer, 1995[131]*	Vienna, Austria. Prevalence of ACKD in native kidneys of KTRs by ultrasound. Among 385 KTRs, 96 ACKD, associated with duration of dialysis, but not time with functioning graft. 6 RCC, of which 5 in ACKD. Similar cohort as reference Heinz-Peer, 1995 [97], above.
Doublet, 1997[135]*	Paris, France, 1993-1995. 129 KTRs screened by ultrasound detected 5 (3.9%) RCC, 100 times greater vs general population. No association with type and duration of dialysis, or ACKD.
Kliem, 1997[136]*	Hannover, Germany, 1968-1995. Among 2372 KTRs, 154 (6.5%) developed cancer, of which 12 RCC in native kidney (7.8% ie, 0.5% of total population). 2/12 RCC had analgesic nephropathy, 1/12 ADPKD. 73% of RCC in patients with ACKD. 4 died from RCC. Cohort extended in reference Eggers, 2019,[105] above.
Wiesel, 1997[137]*	Heidelberg, Germany, 1980-1995. Reporting on 788 patients with RCC undergoing radical nephrectomy of whom 14 were in dialysis and 7 KTRs. 5 of the 7 KTRs with RCC had advanced disease, 4/7 had ACKD, 3/7 died from RCC.
Ishikawa, 1998[138]*	Japan 1971-1995. Reporting on 1206 tx in 1181 KTRs. 10 RCC in native kidney diagnosed at or after KTx. Mean duration HD 106 mths. 6 of 10 RCC in ACKD. 90% 5-yr disease-specific survival.
Tydén, 2000[40]*	2 KTR children 9 and 11 yrs after living donor tx. ACKD and RCC in allograft. Potential contribution of growth hormone treatment. Their living donors did not develop ACKD or RCC.
Fukatsu, 2004[11]*	2 KTRs with allograft failure, both with bilateral ACKD of native kidneys. RCC

	detected in native kidney. Additional review of 26 cases reported in Japan.
Ghasemian, 2005[12]*	A report of bilateral laparascopic native nephrectomy in 9 KTx candidates and 1 KTR who had ACKD and suspicious lesions for RCC. 7 patients had unilateral RCC, 2 bilateral RCC, 1 bilateral benign complex cysts.
Schwarz, 2007[104]*	Hannover, Germany. Focus on ACKD. Patients transplanted 1970-1998 and prospectively screened by ultrasound during 1997-2003. Among 916 KTRs, 561 were sreened. 129 (23%) had ACKD, 46 (8.2%) had complex renal cysts (Bosniak IIF to III), 8 (1.5%) had newly diagnosed RCC, 7 of which were associated with ACKD (Bosniak IV). 1 RCC in allograft. 19 had a former RCC diagnosed (18 associated with ACKD). Overall prevalence of RCC 4.8%, among those with ACKD 19.4%, without ACKD 0.5%, and among patients with complex renal cysts (Bosniak IIF to III) 54.4%. RCC was bilateral in 26% of cases. Clear cell RCC in 58% and papillary RCC in 42%, 1 patient had both. Only 1 patient had lung metastasis. No patient died. Suggests screening due to high prevalence, and that because ACKD is more prevalent in dialysis patients, tx may prevent ACKD and RCC. Cohort extended in reference Eggers, 2019 [105], above.
Ferda, 2007[183]	Retrospective study of computed tomography for detection of RCC in 10 patients with renal tumors in ESRD patients, compared with nephrectomy specimen. ACKD in 9, multifocal tumors in 7 and bilateral tumors in 6 patients.
Filocamo, 2009[153]*	Florence, Italy, 1991-2007. Ultrasound screening every 6 mths. Among 604 KTRs, 145 (24%) had ACKD and 10 (1.7%) developed RCC, of whom 8 in ACKD. All pT1a. 4 clear cell RCC, 6 papillary RCC, all unifocal and monolateral. Radical nephrectomy in all. 3 died of other cause, remaining alive without recurrence at 41 (12-96) mths follow-up.
Hurst, 2010[156]*	United States Renal Data System, 2000-2005, based on billing claims for RCC and cysts (surrogate for ACKD). Among 40 821 Medicare KTRs, 368 (0.9%) diagnosed with RCC within 3 yrs after tx (3.16 per 1000 person years). No data if RCC was in native kidney or allograft. Pre-tx cysts in 1264 (3.1%) of total, 29/368 (7.9%) of KTRs with RCC and 1235/40 453 (3.1%) of KTRs without RCC. Post-tx cysts in 1265 (3.1%) of total, 53/368 (14.4%) of KTRs with RCC and 1212 (3.0%) of KTRs without RCC. Ie, cysts (pre- or post-tx) in 82/368 (22.3%) of RCC. Pre-tx cysts associated with early RCC (first 6 mths after tx), likewise post-tx cysts associated with RCC first 6 mths after diagnosis of cyst (potential surveillance bias). Other risk factors for RCC: male, older age, donor age, African American, dialysis time, rejection; whereas no risk for RCC associated with ADPKD, smoking, immunosuppression or induction. RCC associated with death, HR 2.44 (1.91-3.11), p<0.001.
Klatte, 2010[157]*	Vienna, Austria, 1989-2008. Retrospective study of 28 surgically treated RCCs (native kidney) in 24 KTRs and a comparison group of 671 nontransplanted patients with RCCs. ACKD in 83% of KTRs with RCC. Of note, only 2 symptomatic KTRs with RCC, and these were the only that had metastasized at diagnosis. RCCs in KTRs (vs comparison group) were more often incidentally detected (92% vs 77%, P=0.09), multifocal (39% vs 15%, P<0.001), bilateral (17% vs 4%, P = 0.006), of lower T stage (P = 0.040), smaller (P = 0.027), of lower grades (P = 0.010), papillary (43% vs 19%, P = 0.019) and detected at younger age (P = 0.022). After median 6.7 yrs 8 KTRs died, but only 2 from RCC. In multivariate analysis, KTx status not associated with mortality.
Goh, 2011[161]*	Singapore, 1995-2007. Native kidney screening by ultrasound every 5 yrs, or

	every 2 yrs if cysts developed. Among 1036 KTRs, 10 RCC in native kidney, all in patients with cysts, no 5-yr mortality. Time in dialysis and presence of cysts were risk factors for RCC.
Cheung, 2011[158]*	Hong Kong, China, 2000-2009. Retrospective. Among 1003 KTRs, 12 KTRs had nephrectomy for 13 RCCs. One symptomatic, remaining incidentally detected. ACKD in 6/12. pT1 in 10/12. Clear cell RCC in 7/13, papillary RCC in 6/13. After median 38 mths, 1 death of RCC.
Paudice, 2012[184]	Description of contrast enhanced ultrasound to characterize ACKD in 15 KTRs with indeterminate ultrasound.
Mühlfeld, 2013[185]	Magnetic tomography pilot study in 30 KTRs with ACKD. RCC detected in 3/54 native kidneys, 1 of which was also detected by ultrasound.
Sun, 2013[164]*	Seoul, Korea, 1991-2010. 1424 KTRs. 5 RCC (0.35%) in native kidney, ACKD in all. Median time tx to RCC 16.2 yrs (range 9 to 20). Radical nephrectomy in 4 without recurrence at median 2.9 yrs. One refused nephrectomy and developed spinal metastasis 6 yrs later.
Kalil, 2015[168]*	US Cancer Transplant Match Study. Comparing cancer incidence among 109 224 primary transplants and 6621 retransplants. Found overall similar cancer incidence, though higher risk of RCC (adjusted IRR 2.03 [95%CI 1.45-2.77]), among retransplants vs primary transplants. May be explained by ACKD and more time on dialysis among retransplants.
8. Studies reporting on miscellaneous risk factors	
McDonald, 2004[186]	Study on persistent hematuria in KTRs. An explanation found in 21 of 85 patients, of whom 1 had RCC.
Gabusi, 2004[187]	mRNA monitoring in blood samples of recipients from donors with cancer. No positive test.
Chen, 2010[188]	Taiwan. Polyomavirus-associated nephropathy in 6 (BK:5, JC:1) of 864 KTRs. Malignancy occurred in 5 of these 6 KTRs, including 2 transitional cell carcinoma, 1 RCC, 1 squamous cell carcinoma, 1 Kaposi sarcoma.
Kim, 2010[189]	Detroit, US. 539 KTRs monitored for persistent microscopic hematuria. Urologic malignancies detected in 18 patients, of which 12 RCC of native kidney (10/12 had hematuria), 6 urothelial cancers (all with hematuria).
Bedke, 2010[190]	A review of immunologic mechanisms in RCC and allogeneic transplant rejection.
Wilk, 2017[191]	More heavy metals detected in kidneys from patients with RCC than kidney allografts.
Nickeleit, 2018[192]	Review on the role of BK-virus in oncogenesis.
9. Reviews and guidelines	
Penn, 1977[193]	Review of malignancies in KTRs.
Ishikawa, 1992[194]	Review of ACKD and RCC in KTRs.
Levine, 1992[195]	Review of ACKD in dialysis and KTRs. States that general screening for RCC is not justified due to lack of data.
Yang, 1994[196]	Advocates for screening ultrasound native kidneys of based on high risk for RCC.
Levine, 1996[197]	Review of ACKD in dialysis and KTRs. States that general screening for RCC is not justified due to lack of data.
Kawamura, 2000[198]	Review of ACKD. Japanese.

EBPG, 2002[199]	European best practice guidelines for renal transplantation. Advocates for screening.
Carrieri, 2004[200]	Review of RCC in KTRs. Italian. Abstract advocates for use of donor kidneys with small (<4 cm) tumors after resection.
Muruve, 2005[201]	Review of urological cancer in KTRs.
Gabardi, 2010[202]	Review of everolimus.
Klatte, 2011[203]	Review of RCC in native kidneys of KTRs.
Lewis, 2012[204]	Review of RCC in general population.
González-López, 2013[205]	Review of NSS and percutaneous thermal ablation in allograft RCC, identified 51 cases. Spanish.
Kaplan, 2014[206]	Review of management of mTOR inhibitor side effects.
Klintmalm, 2014[207]	Review of mTOR inhibitors in posttransplant malignancy.
Asch, 2014[208]	Review of cancer in KTRs.
Tillou, 2014[209]	Review of urological cancer in KTRs.
Piselli, 2014[210]	Review of malignancy in solid organ recipients.
Yu, 2014[211]	Systematic review of transplantation of 97 restored kidneys and 22 contralateral kidneys from donors with RCC. None and 1 transmission, respectively.
Zhang, 2014[212]	Review of utilization of donors with malignancy.
Giessing, 2015[213]	Review of urological follow-up of KTRs. German.
Hernández-Socorro, 2015[214]	Review ofradiofrequency ablation for RCC in KTRs. Spanish.
Rodríguez Faba, 2015[215]	Review of urological cancer in KTRs. Spanish.
Kleinclauss, 2016[216]	Review of urologic cancer in KTRs. French. Advocates that after nephrectomy for low-risk RCC, no waiting period before tx is needed.
Frascà, 2016[217]	Review of transplantation of kidneys with tumors.
Johnson, 2017[218]	Review of immune checkpoint inhibitors in challenging populations, including transplant recipients.
Hickman, 2018[219]	Review of urological cancer in KTRs.

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