TRANSPLANTATION

Original Article

Kidneys with small renal masses: Can they be utilized for kidney transplantation in the era of partial nephrectomy?

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ABSTRACT

Objective: To retrospectively evaluate our database to determine our partial nephrectomy and radical nephrectomy rates and to see percentage of the discarded kidneys which were suitable for transplantation after radical nephrectomy.

Material and methods: Patients who underwent radical or partial nephrectomy between January 2000 and December 2016 were identified. Only stage I tumors according to tumor, node, metastasis classification were included in this review. Tumor size, location, proximity to renal collecting system and hilum were considered while deciding the suitability of a kidney for transplantation.

Results: A statistically significant gradual increase in the number of patients treated with partial nephrectomy was observed (p=0.00001). Only 17 out of 181 kidneys with a tumor size smaller than 3 cm could be an appropriate candidate for a renal transplantation if they were to be transplanted.

Conclusion: Exact number of the discarded kidneys with small renal masses which can be used for kidney transplantation should be determined by large scale studies. A national or governmental policy may only be developed to utilize these discarded organs after the magnitude of the wasted kidneys can be determined.

Keywords: Kidney transplantation; partial nephrectomy; renal mass

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Introduction

The disparity between the demand and supply of organs for kidney transplantation represents a vital problem today. New donor resources including extended criteria donors (ECD), donation after cardiac death donors (DCDD), non-related living donors, altruistic donors, and living donors with single medical abnormalities have been used to fill this steadily increasing gap of organ shortage. However, many patients are still on waiting lists and many of them will either die or drop out of the waiting lists because of comorbid illnesses until they find a chance for kidney transplantation. Use of marginal organs such as kidneys with small renal masses has been suggested for kidney transplantation as a new source for transplantation.[1-3]

In this study, the data of patients who underwent radical nephrectomy (RN) for the treatment of renal masses were reviewed and we tried to answer the question of what percentage of discarded kidneys could be used after radical nephrectomy if they were to be transplanted.

Material and methods

After obtaining ethics committee approval from Goztepe Training and Research Hospital of Istanbul Medeniyet University School of Medicine and patients' informed consents, we performed a retrospective review of pro-

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Table 1. Clinical characteristics of the patients diagnosed with small renal cortical masses

	Open partial nephrectomy	Open radical nephrectomy	Laparoscopic partial nephrectomy	Laparoscopic radical nephrectomy	Total
Number of patients	58	46	55	22	181
Sex (M/F)	38/20	30/16	33/22	13/9	114/67
Age (Years)	57.5±12.7	56.1±12.4	57.4±12.6	59.5±12.6	57.6±12.5
Number of Pts with a T1a Tm.	45	38	53	16	152
Number of Pts with a T1b Tm.	13	8	2	6	29
Number of Recurrence	3	2	1	None	6
Tumor size (mm.)	30±9.2	36.6±7.2	30.3±9	37.2±6.3	32.7±9
Tumor type					
• Clear cell	37	43	30	17	127
• Papillary	7	1	11	3	22
• Chromophobe	7	1	4	-	12
• Others	7	1	10	2	20

Tm: tumor; Pts: patients; M: male; F: female

spectively collected data from patients who underwent surgery for renal masses between January 2000 and December 2016 at a single institution. Patient characteristics including age, sex, tumor size on computed tomography scans, tumor size in pathologic specimens, and the pathology of the tumor were evaluated. Data related to the type of surgery and tumor recurrence during follow-up were also extracted from the medical records. Only stage I tumors according to tumor, node, metastasis (TNM) classification (Stage I tumors: $T_1N_0M_0$) were included in this review. Tumor size, location, proximity to the renal collecting system and main renal vessels were evaluated on a contrast-enhanced computed tomography (CT) scan while deciding the suitability of a kidney for transplantation. Only final pathology results were noted because intraoperative frozen sections were not performed routinely in every operation. Tumors very close to the hilum or larger than 3 cm were regarded as ineligible for transplantation.[2] Patients without available CT scans were excluded from the study. Patients were stratified into 5-year periods in order to determine the impact of era on the surgical approach for the treatment of renal masses (Table 1).

Statistical analysis

The Mann-Whitney U test was used for the analysis of nonparametric continuous variables. Categorical data were compared using the chi-square test. Statistical significance was accepted as $p<0.05$.

Results

One hundred eighty-one patients underwent surgery with a diagnosis of Stage I renal tumor (Table 1). Sixty-seven (37%) patients were female and 114 were male (63%). The mean ages of the male patients and female patients were 58.4±12 and 58.8±12 years, respectively. The mean follow-up period was 6.3±4.2 years. All tumors were incidentally found and CT scans were used to measure the dimensions of the tumors. Of these masses, 162 were found to be renal carcinomas (RCC), 9 angiomyolipomas, and 10 oncocytomas. When RCCs were pathologically evaluated, 127 were found to be clear cell carcinomas, 22 were papillary cell carcinomas, and the remainder comprised other subtypes (twelve chromophobe RCCs and one multilocular cystic RCC, not shown at the table) (Table 1). There were 68 patients in the RN and 113 patients in the partial nephrectomy (PN) groups. Of the 113 patients treated with PN, 102 were stage T1 cases, and 58 patients from the RN group were staged as T1a. Tumor diameter was 28.7±7.8 mm in the PN, and 33.6±5.8 mm in the RN group. The diameters of the tumors in the RN group were significantly larger than those in the PN group ($p=0.0001$). When the numbers of patients were stratified according to the years for each treatment group, a statistically significant gradual increase in the number of patients treated with PN was observed ($p<0.00001$) (Table 2). The overall recurrence rate during the follow-up period was 3 percent.

After we scrutinized all renal masses from the RN group, we saw that only 17 kidneys had a tumor size smaller than 3 cm and at an appropriate location suitable for renal transplantation (Table 3). The mean diameter of the tumors in this group was 27.5±3.8 mm. These 17 tumoral masses were located at the upper (n=3), lower (n=6) and the mid-pole n=8) poles, Clear cell carcinoma was detected in 14, oncocytoma in 1, and papillary type RCC in 2 patients. No recurrence was observed in these 17 patients during the follow-up period.

Table 2. Distribution of radical and partial nephrectomies within various time periods

	2000-2005	2006-2010	2011-2016
Radical nephrectomy	26 (87%)	21 (58%)	21 (18%)
Partial nephrectomy	4 (13%)	15 (42%)	94 (82%)

Table 3. Distribution and percentage of kidneys from the radical nephrectomy group that could be candidates for renal transplantation in terms of tumor location and size

2000-2005	2006-2010	2011-2016
7 (27%)	6 (28.5%)	4 (19%)

Discussion

It is a well-known reality that patients with end-stage renal disease (ESRD) have a higher mortality risk compared with the general population despite the improvements in medicine and renal replacement therapies.[4-6] Cardiovascular disease accounts for 40-50% of these elevated mortality rates in patients with ESRD.[7-9] Fluid and electrolyte imbalances and uremia-related problems deteriorate patients' health and contribute to morbidity and mortality. In particular, patients aged between 65 and 75 years are at higher risk for mortality. According to the European Renal Registry, 5-year survival in this age group is 50% shorter than in the general population of the same age.[7]

Moreover, the older population on dialysis have higher mortality risk, and the United Kingdom Registry revealed that even patients aged 25-29 years had significantly shorter life expectancy when compared with the general population without ESRD.[10] The validity of these findings was proven with the improved survival of renal transplant patients when compared with the survival of patients on dialysis.[11,12] In addition to this survival benefit, kidney transplantation has been reported to be more cost-effective and provide better quality of life.[11,13] Thus, it is not surprising to see a progressively increasing demand for kidney transplantation. However, there has not been a concordant increase in organ supply.[14] Efforts to raise the number of kidney transplants with marginal donors and living donors have been limited so far. Hence, every effort should be made to increase the potential kidney pool for kidney transplantation.

Kidneys with small renal masses diagnosed during routine donor evaluation or from patients apt to undergo a RN were advocated for kidney transplantation.[2,15-18] Nicol et al.[2] published their experience about transplanting kidneys with a renal mass <3 cm from 38 patients who were referred to urologists with a radiologically detected renal lesions. These organs had been previously allocated to high-risk recipients of older age. Pathologic evaluation showed that 31 out of 38 patients had malignant tumors. The authors reported only one possible tumor recurrence in the long term.[2] Their study was criticized for ethical considerations and the possible negative impact on well-established living donor protocols.[1] Moreover, their study included the period between 1996 and 2007 during which the diagnosis and treatment of renal tumors changed tremendously.

Renal carcinomas was reported to be the third most commonly diagnosed genitourinary malignancy with an increasing incidence in the United States.[19-21] There has been a shift in clinical stage and primary tumor size during past decades likely due to the more prevalent use of cross-sectional imaging techniques.[22] This downstaging has changed the approach to renal masses. Radical nephrectomy had been the standard treatment for renal tumors for a long time. However, given the reported cardiac and metabolic benefits of partial nephrectomy (PN) over RN along with similar oncologic results, the American Urological Association (AUA) and European Association of Urology (EAU) updated their guidelines and recommended PN for T1a renal tumors as the standard treatment choice.[23-26] Currently, the use of PN for small renal tumors has been reported to be around 40-50% in the United States despite a steady increase over time.[27-29] Hospital and surgeon-related factors seem to influence treatment of a patient with a T1 renal tumor.[30-32] Although the majority of patients with a T1 renal tumor undergo PN at tertiary care centers and hospitals with high volume, RN is more prevalent in hospitals in rural areas and non-teaching settings.[27,30] Despite all the medical and ethical considerations and guideline recommendations with regard to partial versus RN for the treatment of small renal masses, underuse of PN still remains a medical fact in the era of nephron-sparing surgery. Although most studies that have investigated the trends in the use of PN for the management of small renal masses were from the United States, authors from other countries also have emphasized their concerns about the underuse of PN from other parts of the world.[33-35]

Our oncologic results in terms of recurrence of T1 tumors were comparable to the literature.[36-38] There were 6 (3%) recurrences during the follow-up period, 3 of which occurred in the open partial nephrectomy group (Table 1). There was no recurrence in the aforementioned 17 patients who underwent RN. However, we think that it is not possible to predict what would happen if they underwent PN or these kidneys were transplanted. The percentages of the tumor types were also similar to previous reports.[39] Concordant with the literature, 70% of the tumors were clear cell carcinomas.[40] Our results are also consistent with the current trends in PN use. We can clearly see that the percentage of radical nephrectomies performed for T1a tumors has decreased significantly over 15 years. Only 4 kidneys were theoretically transplantable during the last 6 years (Table 3).

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Because our data are from a tertiary care center with high-volume, our single center results should not be generalized to the whole country and may not reflect the overall magnitude of discarded kidneys with which PN could have been performed or were theoretically suitable for transplantation. Therefore, nationwide multicenter studies are needed to extrapolate the exact trend of PN use for kidneys with small renal masses. However, considering the improving technical experience in performing PN, patient age at diagnosis, ethical and legal concerns, one can conclude that these kidneys with small renal tumors will not be an important source to meet the organ shortage in the near future. As mentioned by Flechner et al.[1], very few patients who have emotional or personal concerns and are insistent on removal of the tumor bearing kidney could be regarded as candidates for organ donation.

On the other hand, this ideal recommendation has some shortcomings given that a sizeable number of patients with small renal masses still undergo RN due to the underuse of PN.[29] Social factors, as mentioned before, including hospital location (urban vs. rural), hospital volume, and patient's income were reported to play roles in surgical preference.[27] Currently, there are no data showing the exact number of discarded kidneys after RN performed for small renal masses. Further studies are needed to understand the underlying causes for this underuse of PN and to obtain the exact number of discarded kidneys that could be used for kidney transplantation. We believe that unless these data are obtained, we will not be able to know the importance of these discarded kidneys as a novel source for transplantation. A national or governmental policy may only be developed to use these discarded organs after the magnitude of the wasted kidneys is determined.

Patients referred to a urologist with a small renal tumor are different to those with a small renal tumor found during living donor evaluation. Although PN is accepted as the most appropriate treatment modality for T1a renal tumors as mentioned by the current guidelines, the reality of kidney loss due to underuse of PN still seems to exist according to recent reports.[27,29] We think that factors causing the underuse of PN and considering these discarded kidneys with small renal masses for transplantation should be regarded as two different concepts.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Goztepe Training and Research Hospital of Istanbul Medeniyet University School of Medicine (Date:24.08.2017 No:2017/0279).

Informed Consent: Written informed consent was obtained from patients who participated in this study.

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References

1. Flechner SM, Campbell SC. The use of kidneys with small renal tumors for transplantation: who is taking the risk? Am J Transplant 2012;12:48-54.
2. Nicol DL, Preston JM, Wall DR, Griffin AD, Campbell SB, Isbel NM, et al. Kidneys from patients with small renal tumours: a novel source of kidneys for transplantation. BJU Int 2008;102:188-192. [CrossRef]
3. Grover S, Adhikary SD, Kekre N. Transplantation of kidneys with small renal tumors: A novel idea? Indian J Urol 2009;25:278-9.
4. Go AS, Chertow GM, Fan D, McCulloch CE, Hsu CY. Chronic kidney disease and the risks of death, cardiovascular events, and hospitalization. N Engl J Med 2004;351:1296-305. [CrossRef]
5. Ross L, Banerjee D. Cardiovascular complications of chronic kidney disease. Int J Clin Pract 2013;67:4-5. [CrossRef]
6. Nordio M, Limido A, Maggiore U, Nichelatti M, Postorino M, Quintaliani G. Survival in patients treated by long-term dialysis compared with the general population. Am J Kidney Dis 2012;59:819-28. [CrossRef]
7. de Jager DJ, Grootendorst DC, Jager KJ, van Dijk PC, Tomas LM, Ansell D, et al. Cardiovascular and noncardiovascular mortality among patients starting dialysis. JAMA 2009;302:1782-9. [CrossRef]
8. Baigent C, Burbury K, Wheeler D. Premature cardiovascular disease in chronic renal failure. Lancet 2000;356:147-52. [CrossRef]
9. Cheung AK, Sarnak MJ, Yan G, Berkoben M, Heyka R, Kaufman A, et al. Cardiac diseases in maintenance hemodialysis patients: results of the HEMO Study. Kidney Int 2004;65:2380-9. [CrossRef]
10. Steenkamp R, Shaw C, Feest T. UK Renal Registry 15th annual report: Chapter 5 survival and causes of death of UK adult patients on renal replacement therapy in 2011: national and centre-specific analyses. Nephron Clin Pract 2013;123(Suppl 1):93-123.
11. Tonelli M, Wiebe N, Knoll G, Bello A, Browne S, Jadhav D, et al. Systematic review: kidney transplantation compared with dialysis in clinically relevant outcomes. Am J Transplant 2011;11:2093-109. [CrossRef]
12. Wolfe RA, Ashby VB, Milford EL, Ojo AO, Ettenger RE, Agodoa LY, et al. Comparison of mortality in all patients on dialysis, patients on dialysis awaiting transplantation, and recipients of a first cadaveric transplant. N Engl J Med 1999;341:1725-30. [CrossRef]
13. Laupacis A, Keown P, Pus N, Krueger H, Ferguson B, Wong C, et al. A study of the quality of life and cost-utility of renal transplantation. Kidney Int 1996;50:235-42. [CrossRef]

14. Hart A, Smith JM, Skeans MA, Gustafson SK, Stewart DE, Cherikh WS, et al. OPTN/SRTR 2015 Annual Data Report: Kidney. Am J Transplant 2017;17(Suppl 1):21-116.
15. Musquera M, Pérez M, Peri L, Esforzado N, Sebastià MC, Paredes D, et al. Kidneys from donors with incidental renal tumors: should they be considered acceptable option for transplantation? Transplantation 2013;95:1129-33.
16. Sener A, Uberoi V, Bartlett ST, Kramer AC, Phelan MW. Living-donor renal transplantation of grafts with incidental renal masses after ex-vivo partial nephrectomy. BJU Int 2009;104:1655-60. [CrossRef]
17. Mannami M, Mannami R, Mitsuhata N, Nishi M, Tsutsumi Y, Nanba K, et al. Last resort for renal transplant recipients, 'restored kidneys' from living donors/patients. Am J Transplant 2008;8:811-8. [CrossRef]
18. Lugo-Baruqui JA, Guerra G, Chen L, Burke GW, Gaite JA, Ciancio G. Living donor renal transplantation with incidental renal cell carcinoma from donor allograft. Transpl Int 2015;28:1126-30. [CrossRef]
19. Siegel RL, Miller KD, Jemal A. Cancer Statistics, 2017. CA Cancer J Clin 2017;67:7-30. [CrossRef]
20. Chow WH, Devesa SS, Warren JL, Fraumeni JF, Jr. Rising incidence of renal cell cancer in the United States. JAMA 1999;281:1628-31. [CrossRef]
21. Hollingsworth JM, Miller DC, Daignault S, Hollenbeck BK. Rising incidence of small renal masses: a need to reassess treatment effect. J Natl Cancer Inst 2006;98:1331-4. [CrossRef]
22. Kane CJ, Mallin K, Ritchey J, Cooperberg MR, Carroll PR. Renal cell cancer stage migration: analysis of the National Cancer Data Base. Cancer 2008;113:78-83. [CrossRef]
23. Weight CJ, Larson BT, Gao T, Campbell SC, Lane BR, Kaouk JH, et al. Elective partial nephrectomy in patients with clinical T1b renal tumors is associated with improved overall survival. Urology 2010;76:631-7. [CrossRef]
24. Weight CJ, Lieser G, Larson BT, Gao T, Lane BR, Campbell SC, et al. Partial nephrectomy is associated with improved overall survival compared to radical nephrectomy in patients with unanticipated benign renal tumours. Eur Urol 2010;58:293-8. [CrossRef]
25. Woldrich J, Mehrazin R, Bazzi WM, Bagrodia A, Kopp RP, Malcolm JB, et al. Comparison of rates and risk factors for development of anaemia and erythropoiesis-stimulating agent utilization after radical or partial nephrectomy. BJU Int 2012;109:1019-25. [CrossRef]
26. MacLennan S, Imamura M, Lapitan MC, Omar MI, Lam TB, Hilvano-Cabungcal AM, et al. Systematic review of oncological outcomes following surgical management of localised renal cancer. Eur Urol 2012;61:972-93. [CrossRef]
27. Liss MA, Wang S, Palazzi K, Jabaji R, Patel N, Lee HJ, et al. Evaluation of national trends in the utilization of partial nephrectomy in relation to the publication of the American Urologic Association guidelines for the management of clinical T1 renal masses. BMC Urol 2014;14:101. [CrossRef]
28. Yang G, Villalta JD, Meng MV, Whitson JM. Evolving practice patterns for the management of small renal masses in the USA. BJU Int 2012;110:1156-61. [CrossRef]
29. Woldrich JM, Palazzi K, Stroup SP, Sur RL, Parsons JK, Chang D, et al. Trends in the surgical management of localized renal masses: thermal ablation, partial and radical nephrectomy in the USA, 1998-2008. BJU Int 2013;111:1261-8. [CrossRef]
30. Kim SP, Shah ND, Weight CJ, Thompson RH, Moriarty JP, Shippee ND, et al. Contemporary trends in nephrectomy for renal cell carcinoma in the United States: results from a population based cohort. J Urol 2011;186:1779-85. [CrossRef]
31. Sun M, Bianchi M, Trinh QD, Abdollah F, Schmitges J, Jeldres C, et al. Hospital volume is a determinant of postoperative complications, blood transfusion and length of stay after radical or partial nephrectomy. J Urol 2012;187:405-10. [CrossRef]
32. Bianchi M, Becker A, Abdollah F, Trinh QD, Hansen J, Tian Z, et al. Rates of open versus laparoscopic and partial versus radical nephrectomy for T1a renal cell carcinoma: a population-based evaluation. Int J Urol 2013;20:1064-71. [CrossRef]
33. Al Saidi IK, Alqasem KS, Gharaibeh ST, Qamhia NZ, Abukhiran I, Al-Daghmin AA. Trends of partial and radical nephrectomy in managing small renal masses. Turk J Urol 2017;43:42-7. [CrossRef]
34. Ljungberg B, Gudmundsson E, Christensen S, Lundstam S. Practice patterns for the surgical treatment of T1 renal cell carcinoma: a nationwide population-based register study. Scand J Urol 2014;48:445-52. [CrossRef]
35. Aben KK, Osanto S, Hulsbergen-van de Kaa CA, Soetekouw PM, Stemkens D, Bex A. Adherence to guideline recommendations for management of clinical T1 renal cancers in the Netherlands: a population-based study. World J Urol 2016;34:1053-60. [CrossRef]
36. Lane BR, Campbell SC, Gill IS. 10-year oncologic outcomes after laparoscopic and open partial nephrectomy. J Urol 2013;190:44-9. [CrossRef]
37. Crispen PL, Boorjian SA, Lohse CM, Sebo TS, Cheville JC, Blute ML, et al. Outcomes following partial nephrectomy by tumor size. J Urol 2008;180:1912-7. [CrossRef]
38. Klatte T, Patard JJ, de Martino M, Bensalah K, Verhoest G, de la Taille A, et al. Tumor size does not predict risk of metastatic disease or prognosis of small renal cell carcinomas. J Urol 2008;179:1719-26. [CrossRef]
39. Decastro GJ, McKiernan JM. Epidemiology, clinical staging, and presentation of renal cell carcinoma. Urol Clin North Am 2008;35:581-92. [CrossRef]
40. Lopez-Beltran A, Scarpelli M, Montironi R, Kirkali Z. 2004 WHO classification of the renal tumors of the adults. Eur Urol 2006;49:798-805. [CrossRef]