



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-

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: T₁N₀M₀) 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.^[11] 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).

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).

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