Original Article

Renal Cell Carcinoma of 4 cm or Less: An Appraisal of Its Clinical Presentation and Contemporary Surgical Management

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OBJECTIVE: Greater availability and utilization of modern radiological imaging modalities have resulted in an increase in the incidental discovery of renal cell carcinoma. Such tumours tend to be smaller than their symptomatic counterparts and may potentially be adequately treated using nephron-sparing surgery.

METHODS: A retrospective review of all patients who were diagnosed with renal cell carcinoma of 4 cm or less between January 1990 and December 2001 was conducted to review clinical presentation, surgical management and survival.

RESULTS: The cohort comprised 102 patients who underwent surgery, of 402 patients diagnosed with renal cell carcinoma over the study period. Sixty-eight patients (67%) had tumours detected incidentally. Thirty patients (29%) were managed with partial nephrectomy and 72 (71%) with radical nephrectomy. The median tumour size was 3.0 cm (range, 1.5–4.0 cm). Overall, median follow-up was 60 months (range, 1–148 months). Overall 5-year survival for patients who underwent partial nephrectomy and radical nephrectomy was 96.6% and 85.8%, respectively. Cancer-specific 5-year survival was 100%.

CONCLUSION: A significant proportion of patients had incidental diagnosis of small renal cell carcinoma. Local control may be achieved with either radical or partial nephrectomy, with excellent survival expected. [*Asian J Surg* 2006;29(1):40–3]

Key Words: partial nephrectomy, radical nephrectomy, renal cell carcinoma

Introduction

The greater availability and utilization of modern imaging modalities has brought about an increase in the incidental discovery of small renal cell carcinoma.[1] These lesions are often discovered when patients present for health screening or undergo evaluation for other unrelated problems. The utility of radical nephrectomy, as described by Robson,[2] for the management of such small renal tumours has been challenged.[3–5] Conventionally, imperative indications for partial nephrectomy include bilateral tumours, occurrence of cancer in a solitary kidney and situations where the contralateral kidney is threatened by renal parenchymal disease. Partial nephrectomy in patients with normal contralateral kidneys is usually regarded as an elective indication. Early reports of nephron-sparing surgery provide recurrence and survival results for patients with tumours ≤ 4 cm that are comparable to those for patients undergoing radical nephrectomy.[3–5]

We have previously shown that partial nephrectomy is feasible for small renal cell carcinomas.[6] In this study, we reviewed our institutional experience with patients diagnosed with renal cell carcinoma ≤ 4 cm, focusing on the clinical presentation and surgical management, comparing partial nephrectomy with radical nephrectomy.

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Patients and methods

The records of consecutive patients diagnosed with renal cell carcinoma at the Department of Urology, Singapore General Hospital, from January 1990 to December 2001 were retrieved from the database maintained in our department. A total of 402 patients were diagnosed with renal cell carcinoma during the study period. The resultant cohort was subsequently narrowed to focus on patients with renal cell carcinoma ≤ 4 cm. Patient parameters such as age, gender and clinical presentation were tabulated. The definitive diagnostic radiographic modality prior to surgical intervention was documented. Following surgical extirpation, all nephrectomy specimens were submitted for full pathological examination. The tumours were classified histologically as clear cell, papillary, chromophobe, collecting duct or oncocytic. Surgical outcomes such as postoperative complications and survival were analysed.

Postoperatively, patients were followed-up at 6-monthly intervals for the first 2 years and yearly thereafter. They were monitored with physical examination, chest X-ray, urinalysis and ultrasonography or abdominal computed tomography (CT), where indicated. Patient outcomes were assessed by tumour recurrence and survival analysis. We defined recurrence as reappearance of local or distant disease in a patient with a disease-free interval of at least 6 months after nephrectomy. The follow-up status was obtained from clinical notes as well as a hospital-based electronic medical system, which captured all clinical visits and investigations in the hospital network.

Statistical analysis

Statistical analysis was performed using SPSS version 10.0.1 (SPSS Inc, Chicago, IL, USA). Comparison between groups was made using Student's unpaired t test or the Mann-Whitney U test for interval variables when appropriate. Categorical data were compared using chi-square analysis of proportions. Cancer-specific survival and overall survival rates, stratified according to the type of operative procedure, were estimated using Kaplan-Meier analysis. Probabilities equal to or smaller than 0.05 were considered to be significant.

Results

There were 104 patients with tumours ≤ 4 cm during the study period. Two female patients aged 87 and 89 years did not undergo surgery and were excluded from our analysis as no pathological examination was available. The final cohort comprised 102 patients, 70 male patients (69%) and 32 female patients (31%), with a median age of 58 years (range, 28–79 years). Radical and partial nephrectomy was performed in 72 and 30 cases, respectively, and characteristics of patients by type of surgical intervention are shown in Table 1. Demographic analysis revealed no statistical difference in age and gender of patients by type of surgical intervention. Overall, two-thirds of patients (68 patients) had tumours detected incidentally. A higher proportion of patients who underwent partial nephrectomy had the tumour detected incidentally (80%) compared with patients who underwent radical nephrectomy (61%), although this figure was not statistically significant ($p = 0.065$). Most patients in both groups underwent CT as the definitive investigation. There was no difference in the pattern of investigations between the two groups of patients.

Tumour characteristics by type of surgical intervention are shown in Table 2. The median tumour size was 3.0 cm (range, 0.5–4.0 cm). The median size of tumours resected by partial nephrectomy (2.8 cm) was significantly smaller than those resected by radical surgery (3.4 cm; $p = 0.001$). More patients in the radical surgery group had histological upstaging to T3, N1 or M1 disease, but this was not statistically significant. The histology of tumours treated with both types of surgical intervention was heterogeneous, and did not show any difference between groups.

Table 1. Patient characteristics by type of surgical intervention

| | Type of nephrectomy | | |
	Partial ($n = 30$)	Radical ($n = 72$)	p
Median age (range), yr	53 (28–75)	59 (36–79)	0.124
Gender, n (%)			0.259
Male	23 (77)	47 (65)	
Female	7 (23)	25 (35)	
Presentation, n (%)			0.065
Incidental	24 (80)	44 (61)	
Symptomatic	6 (20)	28 (39)	
Definitive investigation, n			0.086
CT	23	66	
US	2	4	
Angiography	3	1	
FNAC	2	1	

CT = computed tomography; US = ultrasonography; FNAC = fine-needle aspiration cytology.

Table 2. Tumour characteristics by type of surgical intervention

	Type of nephrectomy		
	Partial (*n* = 30)	Radical (*n* = 72)	*p*
Median tumour size (range), cm	2.8 (1.5–4.0)	3.4 (0.5–4.0)	0.001
Pathological stage			0.317
T1	29	66	
T3a	1	2	
T3b	–	2	
N1	–	1	
M1	–	1	
Histology			0.360
Conventional	26	57	
Papillary	2	10	
Chromophobe	0	2	
Collecting duct	1	3	
Oncocytic	1	0	

Two patients suffered postoperative bleeding following partial nephrectomy. Bleeding was arrested by embolization in one patient and by completion nephrectomy in the other. There were two cases of superficial wound infection and one case of burst abdomen following radical nephrectomy. There was no difference in postoperative stay following partial nephrectomy (median, 8 days; range, 3–27 days) or radical nephrectomy (median, 8 days; range, 1–40 days; *p* = 0.80).

The overall median follow-up in our cohort was 60 months (range, 1–148 months). There were 13 recorded deaths, including two cancer-related and 11 other disease-related deaths.
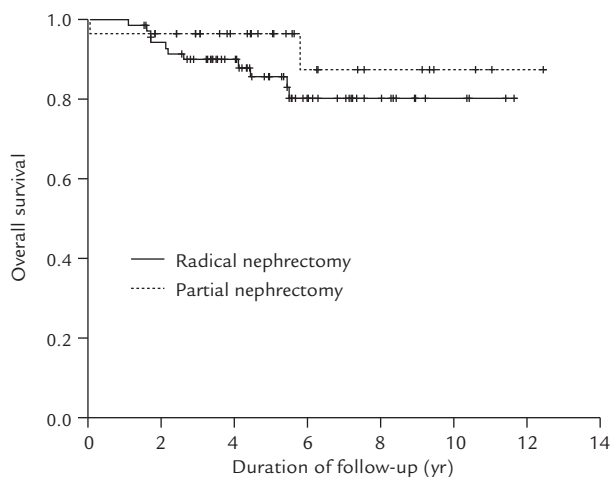

Figure. Survival after radical nephrectomy or partial nephrectomy for renal cell carcinoma ≤ 4 cm (*n* = 102).

Cancer-related deaths resulted from metastatic disease in the absence of local recurrence in both patients. These deaths occurred at 70 months after partial nephrectomy and at 66 months after radical nephrectomy. There was no local recurrence in either operative group. There were more non-cancer deaths among radical nephrectomy patients, including six who had significant preoperative renal impairment or who were in renal replacement therapy for end-stage renal failure. Overall 5-year survival for patients who underwent partial nephrectomy and radical nephrectomy was 96.6% (95% confidence interval, 90–100%) and 85.8% (95% confidence interval, 77–95%), respectively (Figure). Cancer-specific 5-year survival was 100% for patients who underwent partial nephrectomy or radical nephrectomy.

Discussion

In our study, 25% of patients treated surgically for renal cell carcinoma during a 12-year period had renal tumours ≤ 4 cm, and there was a high rate of incidental detection (67%) for these small tumours. Traditionally, radical nephrectomy has been the treatment of choice for renal cell carcinoma of all sizes, with a 5-year cancer-specific survival of 69%.[7] This rate approaches 93% for incidental, low-stage disease.[8] However, recent reports suggest that partial nephrectomy may safely achieve a survival rate comparable to that of radical nephrectomy in selected patients.[9–13] Partial nephrectomy was performed in 29% of patients in our case series. Overall survival and cancer-free survival following partial nephrectomy were comparable to those following radical nephrectomy.

Multicentricity rather than inadequate excision contributes to local recurrence after nephron-sparing surgery. The overall rate of tumour multiplicity may range from 7% to 16%.[14,15] However, the likelihood of tumour multiplicity decreases to 3.7% in patients with tumours ≤ 3 cm.[16]

Our finding that tumours of smaller size are likely to be treated using partial nephrectomy could well be a reflection of some degree of selection bias for smaller lesions.[6] Obviously, there would also be technical considerations not explicitly mentioned in each case, including location especially in relation to the hilar structure, possible involvement of the pelvicalyceal system (thus the need for repair of the system) as well as the availability of surgical expertise. Premorbid conditions, including end-stage renal disease, would render radical nephrectomy more appropriate, but in contemporary practice, a substantial number of patients are suitable candi-

dates for partial nephrectomy, where equal survival can be expected. It is in this group of patients that long-term functional outcome and survival results need to be carefully weighed. While minimally invasive surgery is commonplace,[17] the current gold standard for partial nephrectomy remains that using an open technique. An open partial nephrectomy may appear slightly more invasive than a laparoscopic partial nephrectomy, but in the long run, it is the preservation of renal function that counts.[18,19]

The 2002 TNM classification of malignant renal tumours is further modified to stratify pT1 renal cell carcinoma into pT1a (≤ 4 cm) and pT1b (> 4 cm to ≤ 7 cm).[20] T1a lesions represent a unique group where technical and oncological factors need to be considered, in addition to the fact that many of them are asymptomatic. In an extended study where the current 30 patients formed part of the cohort of all partial nephrectomies performed for renal cancer in this department (*n* = 50), two recurrences were detected over a mean follow-up period of 49 months.[21] Both lesions measured > 4 cm, once again highlighting the importance of restricting nephron-sparing surgery to lesions ≤ 4 cm.

In summary, there is a trend towards smaller-sized, incidentally detected renal cell carcinoma. Local control may be achieved with either radical or partial nephrectomy, with excellent survival results.

Acknowledgements

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