

# Radiofrequency Ablation for Renal Tumours: A Retrospective Cohort From a Tertiary Hospital in Australia

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## Research Article

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# Radiofrequency Ablation for renal tumours: A retrospective cohort from a tertiary hospital in Australia

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## Abstract

**Purpose:** This cohort aimed to evaluate the safety and efficacy outcomes of percutaneous radiofrequency ablation (RFA) for localised renal cell carcinoma (RCC) in a Western Australia tertiary hospital, Royal Perth Hospital (RPH), and potential associations between age, gender, tumour size, location, chronic kidney disease, comorbidities and local recurrence against existing benchmarks.

**Methods:** We retrospectively analysed survival outcomes for patients with biopsy proven RCC treated by RFA at Royal Perth Hospital between 2009 and 2018. Complication data were gathered for all patients that underwent renal RFA along with 2- and 5-year recurrence-free (RFS) and compared the outcomes with data from previous studies.

**Results:** A total of 69 patients (73 procedures) were eligible for the study with biopsy-proven RCC had minimum 2-year follow-up. The RPH complication rate was 8.2 % (6/73) and local recurrence rate 10.9 % (8/73). Two-year RFS is 95.6% and Five-year RFS is 78.78% on a median 3.82-year follow-up (IQR 1.9-5.75).

**Conclusion:** Radiofrequency ablation performed at our centre was found to be safe and effective with low complication rates and durable RFS in line with expectations from existing research. Our study demonstrated that radiofrequency ablation is an alternative modality of treatment for small renal tumours in patients unfit for surgical approach.

**Key Words:** Radiofrequency ablation, Small renal tumours, hydrodissection.

**Abbreviation:** Radiofrequency ablation (RFA), Renal cell carcinoma (RCC), Small renal tumours (SRM)

## INTRODUCTION

Small renal masses are being detected more regularly, owing partly to increased use of CT scanning as well as lifestyle associated factors such as obesity(1). The management of these has been an evolving field of contemporary medicine, including surveillance, surgical resection and thermal ablation.

Renal cancer was the seventh most commonly diagnosed cancer in Australia in 2016(2) with an age-standardised incidence rate of 13 cases per 100,000 persons(2). In 2018 the age-standardised mortality rate was 2.9 deaths per 100,000 persons, however from 2012 to 2016 5-year survival increased from 51% to 79%(2) owing to advance in detection and management. For many years, radical nephrectomy was considered the "gold standard" of treatment for localized renal cell carcinoma. However, it has been reported that a significant number of patients who are rendered with a single kidney after RN, are under increased risk of developing chronic kidney disease (3, 4). Recent advances in surgical techniques have brought the use of nephron-sparing (NS) surgery such as an open, laparoscopic, and robot-assisted laparoscopic partial nephrectomy as radical nephrectomy was considered as overtreating SRM. However, NS surgery is a technically challenging procedure that has been correlated with increased perioperative complications and patient morbidity (5). Therefore, advancement into ablative modalities in treating small renal tumours have expanded considerably with the use of cryoablation (CA), radiofrequency ablation (RFA), high-intensity focused ultrasound, and microwave thermotherapy.

Percutaneous radiofrequency ablation (RFA) is a novel minimally invasive treatment approach to the management of small renal tumours. International studies have shown that RFA is a safe (6,7,8,9), nephron sparing treatment(7) for small <4cm(10) renal cell carcinomas. Due to lack of long term follow up there has been some hesitancy to use RFA as first line management. However, more recent comparative studies have identified that in appropriately selected populations RFA has comparable recurrence rates during interval follow up compared to partial nephrectomy(8), this is of

particular interest for patients who may not be a suitable candidate to undergo surgical management. There has been a lack of data regarding RFA within Australian populations and certain age and comorbid subgroups.

This cohort aimed to compare safety and efficacy outcomes of percutaneous radiofrequency ablation (RFA) for localised renal cell carcinoma (RCC) performed at Royal Perth Hospital with available data, examining the potential associations between age, gender, tumour size, location, chronic kidney disease, comorbidities on complications and local recurrence.

Herein, we report our centre's experience with RFAs of SRMs in the management of 69 patients over a follow up time of at least 24 months.

## METHODS

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This cohort has been approved by the ethics and governance committee (approval number QA35804) to retrospectively study sixty-nine patients (73 procedures) treated with percutaneous RFA from September 2009 to May 2018 at Royal Perth Hospital. Patients included in the study had met the inclusion criteria (Table 1), as pathologic confirmation will provide an accurate treatment and follow-up plan, reduce over-estimation of the treatment effectiveness, and minimize unnecessary follow-up (11). All the patients were followed for at least two years following the RFA procedures and all had pre-procedural imaging and biopsy to confirm renal cell carcinoma. (Table 2,3) demonstrates patients' demographics and tumour details. Clinical indications for RFA for patients included in this audit includes coexisting comorbidities, high anaesthetic or surgical risks, solitary kidney, multiple tumours in the same kidney and patient preference (Table 4). Each patient was reviewed by a Urologist.

All the procedures were performed under general anaesthesia in either prone position (mostly), supine or left lateral/right lateral positions based on tumour site. The procedures were CT-guided with a percutaneous approach with occasional use of hydrodissection with dextrose 5% in water to displace bowel or adjacent structures to approach the tumour precisely. Mean duration of the procedure was 14 minutes (4 – 24 minutes). The centre's recommended follow up was at four-months post procedure then yearly for at least 2 years.

## RESULTS

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Radiofrequency ablation was performed at 73 sessions targeting 69 tumours in 69 patients, with a procedural success in 67 out of 73 (91.8%) and nil immediate complications. Mean age of patients at the time of RFA procedure was 68-year-old (range 47-89 years old). Males account for 59.4% (41 patients) and female of 40.6% (28 patients). Mean tumour size, which was ablated, was 3.2cm (range 1.2 to 5.2cm), with majority of tumours (n=69) were less than 4cm, only four tumours of more than 4cm in diameter were ablated.

Tumour location was classified as upper, interpolar or lower pole in either left or right side. One patient had the tumour in his solitary pelvic tumour. Left kidney tumours accounted for 56.1% (n=41) and right kidney tumours for 42.4% (n=31) of cases. Upper, interpolar and lower tumours

were 17.8, 45.2 and 37% of cases, respectively. Mean ablation time was 14 minutes and majority of ablations were done by either single burn (n=37) or two burns (n=29).

Complications associated with RFA procedures occurred in 6 out of 73 RFA procedures (8.2%), included bleeding, perirenal/retroperitoneal hematoma, contrast extravasation and pneumothorax (Table 5).

All 69 patients underwent pre-RFA renal tumour biopsy to confirm renal cell carcinoma (RCC) prior as part of the inclusion criteria. RCC subtypes were mainly Clear Cell RCC (79.7%), while papillary RCC comprised (19%) and chromophobe RCC (1.3%).

Across the 69 patients, local tumour recurrence was noted in 8 patients only (10.9%) over the follow-up periods (up to 5 years follow up). Four patients underwent re-do RFA for the same tumour (1 male and 3 females) and another four patients underwent radical/partial nephrectomy. Only one patient developed distant metastasis at 4 months follow up CT scan who was referred to medical oncology.

Mean follow up time was 6 years (range between 2 to 10 years). 2-year-RFS (recurrence free survival) was in 66 patients (95.6%). While 5-year-RFS was in 26 patients out of 33 who reached the 5 year follow up year (78.78%). Only one patient has finished the tenth year follow up, who has no recurrence.

## DISCUSSION

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Prior to the advancement of radiological interventions for a long list of indications, radical nephrectomy was considered to be the gold standard treatment for RCC confined to the kidney and it was considered to be the only curative option. As there is a reasonable proportion of patients who are unfit for surgery due to coexisting medical conditions, extensive surgical background or patients who refuses to have surgeries, there should be a modality of treatment which can be offered to those patients to improve outcome and achieve an alternative curable measure or at least offer the best nephron sparing approach in patient with renal insufficiency. Since Zlotta et al. (12) initially described the clinical application of RFA in human RCC in 1997, many authors have been reporting favourable experiences on RFA for SRMs.

A successful RFA outcome has been associated with multiple factors including tumour size, location, impedance of tissue and ablation time as well as the amount of energy delivered and surface area of the electrodes (11). Mylona et al. (13) reported a complete response of 85.7% for tumours less than 3 cm after the first RFA session but reported a noticeably lower response rate with tumours greater than 5 cm in size. Tumours greater than 3 cm were technically challenging to completely ablate on the initial attempt and required multiple overlapping ablation techniques. Therefore, smaller renal tumours are ideal candidates to obtain complete responses for the first RFA session.

Tumour location is another factor that may influence ablative outcome. It is reported that tumours adjacent to large vessels will suffer a 'heat sink', in which a regional vascular flow reduces the extent of the thermally induced coagulation (14, 15). By contrast, the ablative effect of exophytic tumours are higher, as they are easy to target with an RFA probe and because the insulating effect of surrounding perirenal fat allows for higher temperatures during RFA (14, 15). At our centre, we use hydrodissection with 5% dextrose in water to dissect the colon away from the kidney to protect it prior to targeting the tumours.

This retrospective cohort demonstrated that technical success was achieved in 67 of 73 procedures (91.7%) which is within the range of previously reported technical success rate of initial RFA (90-100%) (16). Similarly, the local recurrence rate (9.58%) is comparable with existing data (0% to 11.1%) (14, 17, 18). We had 7 local recurrences during surveillance, 4 patients of them had local

recurrences during the surveillance period of 4, 6, 24 and 48 months, respectively which were treated with re-RFA of the same lesion with no further recurrences. Other 3 patients with local recurrences at 6, 12 and 36 months were treated with partial/radical nephrectomy. All recurrences, in our study, diagnosed radiologically without repeating biopsy as the lesion increased in size or enhancement suggestive of residual tumour or recurrence. Re-biopsy post RFA is not recommended as early post-ablative biopsy is not reliable in the absence of radiological evidence of recurrence (19).

We had a low complication profile (6 of 73 procedures, 8.2%) (18,20). 4 patients developed bleeding/haematoma, one patient developed contrast extravasation, and one patient had pneumothorax. All patients treated conservatively (Clavien-Dindo Grade I or II only) (21, 22).

By comparison with existing literature, we can confirm that RFA for T1 renal tumours performed at Royal Perth Hospital over the past decade has been a safe and well tolerated procedure with curative outcome and a complication rate that is expected when compared to benchmark outcome data.

The data is limited by the available follow-up data and variable follow-up intervals. Only 33 of 69 patients completed the 5-year follow which contributes to 47.8% of patients. However, 66 of 69 patients (95.6%) completed the 2-year surveillance.

Despite this limitation, the RFA has shown its therapeutic potentiality for T1 renal tumours at Royal Perth Hospital as a treatment option for patients who have comorbidities with high risk for surgery/anaesthesia or for patients who prefer non-surgical approach.

## **Conclusion**

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There is evidence from the literature that RFA of renal tumours is a valuable option for treatment of renal cancers especially for patients who are unfit for surgery or those who refuses to have a radical surgical intervention. This audit of local practice at Royal Perth Hospital demonstrates that RFA has a low recurrence rate and low complication rate which is consistent with expectations based on available data. This indicates that, as offered at Royal Perth Hospital, the procedure is a safe and effective treatment measure for small renal tumours and should be considered as an option upon discussion with patients.

## **Declarations:**

I confirm that methods that all methods have been carried out in accordance with relevant guidelines and regulations.

## **Funding**

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The study has not received any funding.

## **Conflict of interest**

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The study has no conflict of interest.

## **Ethical approval**

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The study has been approved by Western Australia Health Governance, Evidence, Knowledge and Outcome (GEKO) committee (QA35804).

## **Consent to participate and consent for publication:**

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Ethical approval approved data collection and publishing. Informed Consent obtained from individuals and from the committee.

Research involving human participants.

## **Availability of data and material**

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All Data and material is available upon request.

## **Author's Contribution**

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M Al-Zubaidi: Protocol/Project development, Data collection, Data analysis, Manuscript writing.

K Lotter: Data analysis, Manuscript writing.

M Marshall: Manuscript editing, Supervision

M Lozinskiy: Manuscript editing, Supervision.

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## Tables:

- Table 1:** Inclusion/Exclusion criteria
- Table 2:** Patient demographics
- Table 3:** Tumour characteristics
- Table 4:** Indications for choosing RFA
- Table 5:** Complications