SCIENTIFIC ARTICLE

A prospective study on ablative therapy for small renal masses (SRM) at a tertiary care centre in Sri Lanka

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Abstract

Introduction

Renal cell carcinoma (RCC) is the fourteenth most common malignancy. Improved cross-sectional imaging has increased the identification of small renal masses (SRMs), resulting in a change in care to nephron sparing techniques such as microwave ablation (MWA). This study evaluated the patient characteristics, tumor features, and early outcomes of image-guided MWA for SRMs in a tertiary care environment in Sri Lanka.

Methodology

This prospective observational study was carried out in a tertiary care hospital between April 2023 and May 2024. Consecutive patients with biopsy—proven T1a SRMs (≤4 cm) who underwent curative percutaneous MWA following multidisciplinary team (MDT) evaluation, were included. Clinical, radiological, histological, and renal function data were obtained. The outcomes included technical success, complications, recurrence, and changes in renal function.

Results

Twelve patients (mean age 52.1 ±13.19 years; 83.33% male) underwent MWA with a mean follow-up of 28.63 months until April 2026. Hypertension was the most common comorbidity, and 75% of lesions were incidentally detected. Clear cell RCC was the most common histological subtype (66.67%), followed by oncocytoma (16.67%). Technical success was achieved in all cases, with 83.33% required a single ablation session. Only two minor complications (16.67%) (Clavien-Dindo grades I and II) were recorded. Renal function was preserved, with no evidence of local recurrence or distant metastasis during follow-up.

Conclusion

Image-guided MWA revealed great technical success, acceptable safety, and effective short-term oncological management while maintaining renal function, indicating that it is a potential nephron-sparing alternative for selected SRMs in resource-limited settings.

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Introduction

Renal cell carcinoma (RCC) is the most common form of primary kidney cancer, representing approximately 90% of all renal malignancies and 2-3% of all cancers globally [1,2]. Epidemiological data show that RCC ranks as the fourteenth most common cancer, with a higher incidence in men and a peak diagnosis rate between the ages of 60 and 70 [3,4]. Several risk factors have been identified, including smoking, hypertension, obesity, occupational exposure to carcinogens, alcohol use, and high red meat intake [1,3,5]. The prognosis is strongly depending on the stage of diagnosis, whereas metastatic RCC continues to exhibit poor survival results [1].

The increased use of imaging modalities such as ultrasonography (USS), computed tomography (CT), and magnetic resonance imaging (MRI) has resulted in an increase in incidental identification of small renal masses (SRMs) [6]. SRMs are classified as renal tumors with a diameter of less than 4cm, are frequently detected before symptoms appear [7]. The classic triad of hematuria, flank discomfort, and palpable abdominal mass occurs in less than 10% of individuals [1].

SRMs are now managed with active surveillance, partial nephrectomy, radical nephrectomy and image- guided ablative therapy [3]. Thermal ablative procedures such as radiofrequency ablation (RFA), cryoablation and microwave ablation (MWA) have grown in popularity, particularly among patients who are unsuitable for surgery or have pre-

existing chronic renal disease [8]. Renal function preservation has emerged as a key treatment goal, particularly in patients with single kidneys or baseline renal impairment [9].

MWA is a new minimally invasive thermal ablation technology that produces tumour necrosis by generating electromagnetic energy [8]. MWA has various benefits over other ablative modalities, including greater intratumoral temperatures, bigger ablation zones, faster procedure timeframes, and decreased vulnerability to heat-sink effects [10]. Furthermore, MWA may be conducted percutaneously under imaging guidance, resulting in decreased procedural morbidity, shorter hospital stays, and improved renal functional preservation [9]. Follow-up imaging with CT or MRI is critical in post-ablation monitoring for evaluating treatment effectiveness, residual disease, local recurrence, and consequences [1].

Despite the growing use of ablative treatments internationally, there is no local information on the efficacy and consequences of MWA in the treatment of SRMs in Sri Lanka. As a result, the purpose of this prospective study is to assess patient variables, tumor features, treatment efficacy, and renal functional outcomes in patients with small renal masses who are having microwave ablative therapy at Teaching Hospital Jaffna.

Methodology

This institution-based prospective observational study was conducted at the Interventional Radiology Unit, Teaching Hospital Jaffna, in collaboration with the Department of Surgery, Faculty of Medicine, University of Jaffna, from April 2023 to May 2024. Ethical clearance was obtained from the Ethics Review Committee, Teaching Hospital Jaffna. The study aims to assess patient variables, tumour features, and treatment outcomes in patients with SRM treated with MWA.

Patients with biopsy-proven solid renal masses who underwent curative-intent ultrasound (USS)-guided percutaneous MWA were consecutively recruited after providing informed written consent. All patients were discussed at a multidisciplinary team (MDT) meeting, informed about the available therapeutic options for the management of their renal masses and elected to undergo MWA. A renal mass biopsy was performed during the ablation according to the MDT protocol.

Data were collected using a structured data extraction form. Baseline patient factors included age, gender, comorbidities, smoking history, family history, and recurrence status. Tumour size, anatomical location and histological subtype were all considered. Treatment-related factors and procedural details were also documented.

Serum creatinine and estimated glomerular filtration rate (eGFR) were monitored pre- and post-ablation to determine renal functional outcomes. Post-procedural outcomes included procedure-related complications, local recurrence, and distant metastases. Follow-up imaging with contrast-enhanced computed tomography (CT) was conducted at 6 months and then annually after that, with any indication of residual or recurrent disease reported.

Data were analysed with SPSS version 26. Continuous variables were summarised as mean ±SD or median, while categorical variables were represented as frequencies and percentages. Tables and figures were used to summarise patient characteristics, tumour features, treatment outcomes, and follow-up results.

Results

A total of 12 patients with SRM underwent MWA at the Interventional Radiology Unit, Teaching Hospital Jaffna, between April 2023 and May 2024.

The study population had a mean age of 52.1 years (range: 28 to 70, median= 54.5 years). There were ten men (83.33%) and two women (16.67%). The majority of patients (75%) presented with incidentally identified renal abnormalities, while some reported loin pain (25%).

Table 1: baseline demographic and clinical characteristics of patients

Variable		**n (%) / Mean ±SD**
Age (years)		52.1±13.19 (28-70) (median= 54.5)
Sex	Male	10 (83.33%)
	Female	2 (16.67%)
Presenting Complaint	Incidental detection	9 (75%)
	Loin Pain	3 (25%)
Comorbidities	Hypertension	8 (66.67%)
	Diabetes mellitus	5 (41.67%)
	Dyslipidemia	5 (41.67%)
	Bronchial asthma	1 (8.33%)
	Ischemic heart disease	1 (8.33%)
	Sick sinus syndrome	1 (8.33%)
Smoking	Yes	4 (33.33%)
	No	8 (66.67%)
Alcohol	Yes	3 (25%)
	No	9 (75%)

Hypertension was the most prevalent comorbidity (66.67%), either alone or in conjunction with diabetes, bronchial asthma, dyslipidemia, or ischemic heart disease. 41.67% of the patients had diabetic mellitus, 8.33% had bronchial asthma, 41.67% had dyslipidemia, 8.33% had sick sinus syndrome, and 8.33% had ischemic heart disease. One patient's history was suggestive of von Hippel-Lindau syndrome. The majority of patients were nonsmokers (66.67%) and did not use alcohol (75%).

Table 2: Tumor characteristics

Variable		n (%)
Size	Mean tumor size (cm)	3.04±0.6 (2-4)
	< 4 cm	10 (83.33%)
	= 4cm	2 (16.67%)
Laterality	Left kidney	8 (66.67%)
	Right kidney	4 (33.33%)
Histopathological diagnosis	Clear cell RCC	8 (66.67%)
	Oncocytoma	2 (16.67%)
	Papillary RCC	1 (8.33%)
	Chromophobe RCC	1 (8.33%)
TNM Staging*	T1aN0M0	10 (83.33%)
	Not applicable (benign)	2 (16.67%)
WHO/ISUP grading	Grade 1	5 (41.67%)
	Grade 2	2 (16.67%)
	Grade 3	0
	Grade 4	0
	Cannot be graded	2 (16.67%)
	Not applicable	3 (25%)

*TNM staging is omitted for benign histopathology

The pre-ablation tumor size ranged from 2cm to 4.0cm, with the majority of lesions measuring less than 4cm (83.33%). The mean tumor size was 3.04cm. The majority of the tumor was found in the left kidney (66.67%). Upper pole lesions were the most common tumor site. The histopathological investigation revealed: Clear cell renal cell carcinoma in 8 patients (66.67%), oncocytoma in 2 patients (16.67%), Papillary renal cell carcinoma in 1 patient (8.33%) and Chromophobe renal cell carcinoma in 1 patient (8.33%).

WHO/ISUP grading was available in selected cases, with grade 1 lesions being the most frequent (41.67%). Tumour staging demonstrated predominantly localised disease, with most patients classified as T1aN0M0(83.33%).

Renal function was evaluated using serum creatinine and estimated glomerular filtration rate(eGFR). Serum creatinine levels in the patients ranged from 57 to 157 µmol/L, with a median of 107.5 µmol/L. The eGFR values varied from 45 to 127 mL/min/1.73m^2 with a median of 70 mL/min/1.73m^2. Three patients (25%) had pre-existing chronic kidney disease (CKD) stage 3a at the time of presentation.

Table 3: Procedural characteristics

Variable			Value
Technical success			12 (100%)
Single session ablation			10 (83.33%)
Repeat ablation			2 (16.67%)
Ablation duration	Mean		8.86 min
	Range		4 -12 min
Power	Mean		55.71 W
	Range		50 – 70 W
Clavien-Dindo complications		Grade I	1 (8.33%)
		Grade II	1 (8.33%)
		Grade III	0
		Grade IV	0
Mean follow-up duration			28.63 months
Recurrence during follow-up			0
Development of metastasis during follow-up			0
Mortality during follow-up			0

All procedures were conducted under general anesthesia with USS-guided percutaneous microwave ablation using the 14G × 15cm antenna of the MWA system. Technical success was obtained in 12 out of 12 patients (100%). Single-session ablation was sufficient in 10 patients (83.33%), however 2(16.67%) individuals required additional ablation sessions due to residual disease. The duration of ablation ranges from 4 to 12 minutes, with a mean of 8.86 minutes. The power used for ablation ranged from 50W to 70W, with a mean of 55.7 W. The majority of treatments were performed with 50W power.

No major immediate procedural complications were documented. Two patients experienced minor complications. One of them developed a perinephric hematoma that was managed conservatively (Clavien-Dindo Grade I), while another developed a small perinephric abscess that was successfully treated with antibiotics (Clavien-Dindo Grade II). The mean follow-up duration was 28.63 months (range, 24-35 months). Renal function remained essentially intact after MWA. In individuals with available follow-up renal function data, serum creatinine levels remained steady after treatment.

During the available follow-up period, no significant local recurrences, newly diagnosed distant metastases or mortality were recorded among successfully treated patients. In the vast majority of cases, nephrons were preserved.

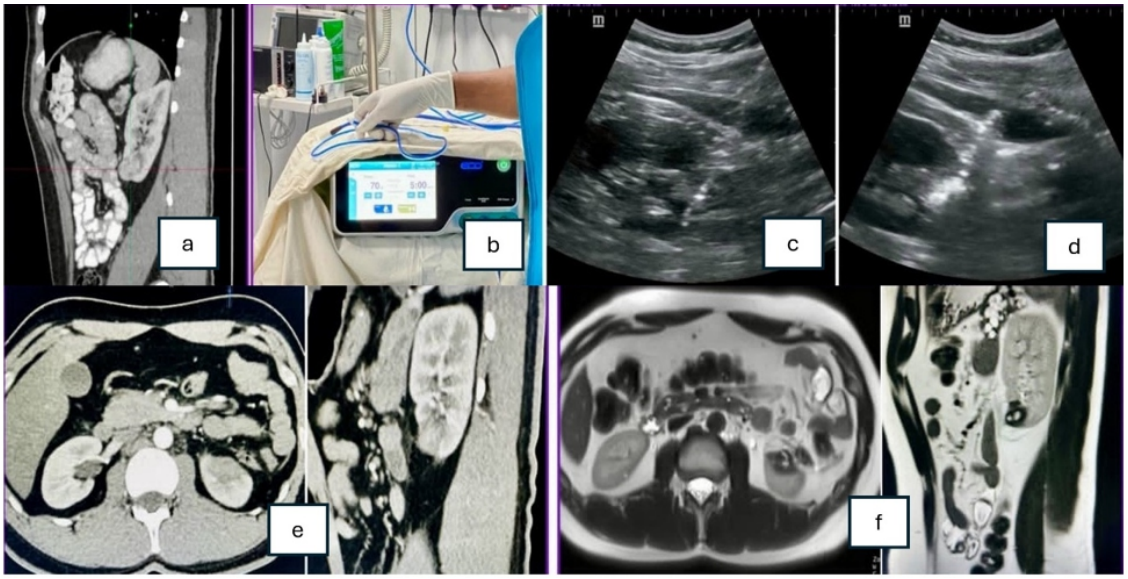

Figure 1a: Left renal lower pole tumour
Figure1b: ECO MWA genrator
Figure1c: MWA antenna within the lesion
Figure1d: Monitoring the ablation with USS
Figure1e: Immediate post ablation CECT
Figure1f: Follow up MRI in 3 months

Discussion

This study looked at the early clinical, functional, and oncological results of MWA in patients with SRMs treated at the Interventional Radiology Unit at Teaching Hospital Jaffna. The results showed high technical success, minimal complications, excellent renal function preservation, and positive short-term oncological management, confirming thermal ablation's expanding significance as a minimally invasive nephron-sparing therapy for some renal malignancies.

The mean age of the study population was 52.1 years, with a significant male predominance. This demographic profile is consistent with the documented epidemiology of renal cell carcinoma (RCC), which frequently affects middle-aged to elderly males. Several recent studies have shown a similar male predominance [1,2,11]. The majority of presentations in the current study were due to incidentally detected renal lesions, which reflects the increasing use of cross-sectional imaging and the rising detection of asymptomatic SRMs worldwide. This tendency has been regularly reported in current renal tumour literature, and it has had a substantial impact on the transition to minimally invasive nephron-sparing therapy [3].

The majority of tumours in this research were categorised as T1a lesions measuring ≤ 4cm, which is consistent with current worldwide recommendations for thermal ablation [2,3,11,12]. According to the current evidence, thermal ablation is regarded an effective therapeutic option for adequately chosen T1a renal tumours, particularly in patients unsuitable for surgery or needing nephron preservation [3,11,12]. The major histological subtype in our group was clear cell RCC, which is consistent with the known worldwide histo pathological distribution of renal malignancies [1–3].

Almost all treatments were technically successful in our study, which is consistent with previous findings reporting high technical success rates for microwave ablation in the management of SRMs, frequently exceeding 90% [11]. Single session of ablation was sufficient in 83.33% of the study population, which is comparable to previously published studies indicating primary effectiveness rates ranging from 73.5% to 89.3% after percutaneous thermal ablation of small renal tumours [12,13].

The current trial also had a satisfactory safety profile, with no serious acute procedural problems reported. Only two individuals (16.67%) suffered mild adverse reactions. A conservatively handled perinephric hematoma was classed as a Grade I complication, whereas a tiny perinephric abscess that was effectively treated with antibiotics was rated as Grade II. This validates prior findings indicating that

percutaneous MWA is linked with reduced morbidity and faster recovery than surgical methods[2,13,14]. Another study reported an overall complication rate of 7.4% after CT-guided MWA, with serious complications occurring in just 3.7% of patients, underlining the good safety profile of this procedure[15]. Similarly, a comprehensive review of thermal ablation for small renal masses noted that Clavien-Dindo Grade I and Grade II events, including hematoma and infectious complications, are the most frequently encountered adverse outcomes, whereas major complications requiring surgical, endoscopic, or radiological intervention remain uncommon[11]. The lack of severe complications in our cohort may be attributed to cautious patient selection, rigorous procedural planning, and the minimally invasive nature of MWA. These data taken together, provide additional evidence for MWA's position as a safe nephron-sparing therapy option for suitably chosen individuals with SRMs.

The current study's key finding was the preservation of renal function after MWA. During follow-up, the majority of patients had stable serum creatinine and estimated glomerular filtration rate (eGFR) values. Recent studies have similarly demonstrated that MWA has modest degradation in renal function, underlining its nephron-sparing benefits[8,15].

During the available follow-up period, no significant local recurrences or newly diagnosed distant metastases were found among successfully treated patients. These data indicate positive short-term oncological outcomes and are consistent with previously reported local tumour control rates after MWA. Local recurrence rates in contemporary systematic reviews and cohort studies usually range between 0 and 23.5%, with most modern series showing rates below 5%, particularly with microwave ablation methods. Similarly, distant metastatic progression remains uncommon, being documented in less than 5% of patients at mid-term follow-up in ablation groups[16,17]. However, the current study's relatively short follow-up period limits the ability to analyse long-term recurrence-free and cancer-specific survival rates. Longer surveillance is required to fully assess long-term oncological effects.

This study has various strengths. It provides preliminary institutional experience with image-guided renal MWA from a tertiary care centre in Northern Sri Lanka and indicates the viability of implementing advanced minimally invasive oncological therapies in a resource-constrained setting. Furthermore, the study adds regional data to the rising worldwide evidence supporting the ablation of SRMs.

Nevertheless, several limitations must be addressed. The study was restricted by its small sample size, single-centre design, and short follow-up period. Long-term renal functional outcomes and survival analysis could not be fully evaluated. Furthermore, the lack of a comparative surgical arm prevents direct comparison with partial nephrectomy or other ablative modalities like cryoablation.

Future multicenter trials with bigger patient populations and longer follow-up periods are needed to back up these findings. Comparative trials of MWA vs surgical and other ablative procedures would also provide useful information about long-term oncological efficacy, kidney preservation, cost-effectiveness, and quality of life outcomes.

Conclusion

In conclusion, image-guided percutaneous microwave ablation appears to be a safe, effective, and nephron-sparing therapy option for certain patients with SRMs. In the current group, the surgery was technically successful, had few complications, preserved renal function, and showed encouraging short-term oncological control. MWA may therefore an important minimally invasive therapeutic alternative for SRMs, particularly in individuals who require nephron preservation or have a high surgical risk.

Ethical approval

Ethical clearance was obtained from the Ethics Review Committee of the Teaching Hospital Jaffna (Approval No.: S03/02/2023)

Conflict of interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

Institution where study was performed

Teaching Hospital Jaffna, Sri Lanka

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References

1.Padala SA, Barsouk A, Thandra KC, Saginala K, Mohammed A, Vakiti A, et al. Epidemiology of Renal Cell Carcinoma. World J Oncol 2020;11:79. https://doi.org/10.14740/WJON1279.

2.Panhelleux M, Balssa L, David A, Thiery-Vuillemin A, Kleinclauss F, Frontczak A. Evaluation of local control after percutaneous microwave ablation versus partial nephrectomy: A propensity score matched study. The French Journal of Urology

2024;34:102534. https://doi.org/10.1016/J.PUROL.2023.09.021.
3.Ljungberg B, Albiges L, Abu-Ghanem Y, Bedke J, Capitanio U, Dabestani S, et al. European Association of Urology Guidelines on Renal Cell Carcinoma: The 2022 Update. Eur Urol 2022;82:399–410. https://doi.org/10.1016/ J.EURURO.2022.03.006.
4.Bray F, Laversanne M, Sung H, Ferlay J, Siegel RL, Soerjomataram I, et al. Global cancer statistics 2022: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA Cancer J Clin 2024;74:229–63. https://doi.org/10.3322/CAAC.21834;REQUESTEDJOURNAL:JOURNAL:15424863;WGROUP:STRING:PUBLICATION.
5.Balagobi B, Indika K, Samaraweera WMCK, Wijayarathna KSN, Maddumage HP, Sutharshan KK, et al. Risk factors of renal cell carcinoma in a cohort of Sri Lankan patients: A case-control study. J Cancer Res Ther 2019;15:S91–6. https://doi.org/10.4103/0973-1482.206867.
6.Kim WY, Rose TL. Renal Cell Carcinoma. JAMA 2024;332:1001. https://doi.org/10.1001/JAMA.2024.12848.
7.Gholami M, Kaouk J, Zargar H. Small Renal Masses. Urol Sci 2023;34:117–23. https://doi.org/10.4103/UROS.UROS_31_23.
8.Uhlig J, Strauss A, Rücker G, Seif Amir Hosseini A, Lotz J, Trojan L, et al. Partial nephrectomy versus ablative techniques for small renal masses: a systematic review and network meta-analysis. Eur Radiol 2019;29:1293–307. https://doi.org/10.1007/S00330-018-5660-3.
9.Campbell SC, Clark PE, Chang SS, Karam JA, Souter L, Uzzo RG. Renal Mass and Localized Renal Cancer: Evaluation, Management, and Follow-Up: AUA Guideline: Part I. J Urol 2021;206:199–208. https://doi.org/10.1097/JU.0000000000001911.
10.Choi SH, Kim JW, Kim JH, Kim KW. Efficacy and Safety of Microwave Ablation for Malignant Renal Tumors: An Updated Systematic Review and Meta-Analysis of the Literature Since 2012. Korean J Radiol 2018;19:938. https://doi.org/10.3348/KJR.2018.19.5.938.
11.Sun G, Eisenbrey JR, Smolock AR, Lallas CD, Anton KF, Adamo RD, et al. Percutaneous Microwave Ablation versus Cryoablation for Small Renal Masses (≤4 cm): 12-Year Experience at a Single Center. J Vasc Interv Radiol 2024;35:865. https://doi.org/10.1016/J.JVIR.2024.02.005.
12.Grbanović L, Alduk AM, Knežević N, Kaštelan Ž, Hudolin T, Prutki M. SHORT-TERM OUTCOMES OF PERCUTANEOUS RADIOFREQUENCY AND MICROWAVE ABLATION IN THE TREATMENT OF SMALL RENAL MASSES. Acta Clin Croat 2023;62:37–45. https://doi.org/10.20471/ACC.2023.62.S2.6.
13.Dvorak P, Hoffmann P, Brodak M, Kosina J, Pacovsky J, Raupach J, et al. Percutaneous radiofrequency and microwave ablation in the treatment of renal tumors – 10 years of experience. Videosurgery and Other Miniinvasive Techniques 2017;12:394. https://doi.org/10.5114/WIITM.2017.72322.
14.Guo J, Arellano RS, Guo J, Arellano RS. Percutaneous Microwave Ablation of Category T1a Renal Cell Carcinoma: Intermediate Results on Safety, Technical Feasibility, and Clinical Outcomes of 119 Tumors. Https://WwwAjronlineOrg/ 2020;216:117–24. https://doi.org/10.2214/AJR.20.22818.
15.Foret A, Haaga CB, Jain S, Baumgartner CO, Escott M, Henderson BR, et al. Clinical safety and efficacy of microwave ablation for small renal masses. International Brazilian Journal of Urology Official Journal of the Brazilian Society of Urology 2024;50:277. https://doi.org/10.1590/S1677-5538.IBJU.2024.0017.
16.Cazalas G, Jambon E, Coussy A, Le Bras Y, Petitpierre F, Berhnard JC, et al. Local recurrence and other oncologic outcomes after percutaneous image-guided tumor ablations on stageT1b renal cell carcinoma: a systematic review and network meta-analysis. International Journal of Hyperthermia 2021;38:1295–303. https://doi.org/10.1080/02656736.2021.1970826.
17.Aveta A, Iossa V, Spena G, Conforti P, Pagano G, Dinacci F, et al. Ablative Treatments for Small Renal Masses and Management of Recurrences: A Comprehensive Review 2024;14:450. https://doi.org/10.3390/LIFE14040450.