



Percutaneous Microwave Ablation of Small Renal Cancers: A Novel Treatment Modality

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Short Communication

The diagnosis of renal cancer (RCC) is on the rise, with a clear stage shift towards an earlier detection. Mortality rates, however, have not increased and have actually fallen in certain parts of the world [1].

The main reason is the increase in radiological imaging, with more than 50% of RCC being incidentally diagnosed with a resultant parallel decrease in clinical stage (70% T1) [2-4].

The current gold standard in treating early stage RCC is nephron sparing surgery as it achieves comparable oncological outcomes to radical nephrectomy and preserves post-operative renal function [2,5].

Focal ablative therapies constitute a viable alternative for those who are high risk surgical candidates and those who are not keen on major operations. Most of the ablative techniques can be performed percutaneously under local anaesthetic and are associated with a shorter length of stay. Moreover, they have been shown to have minimal impact on post-operative renal function with acceptable oncological outcomes [6,7].

Microwave ablation (MWA)

This novel technique in the management of small renal masses was first developed to treat liver lesions with promising results [8]. Microwave energy causes water ion oscillation and frictional heat much like radiofrequency ablation (RFA). However, in vivo and ex vivo models have shown consistently higher intra-lesional temperatures attained over less time than RFA. It is less susceptible to rising tissue impedance and the active heating may limit heat sink phenomenon [9]. This achieves larger ablation zones and may improve the rate of treatment success.

A meta-analysis reported no significant difference between cancer specific survivals of RFA and partial nephrectomy however selection bias and short follow up make interpretation difficult [10].

There is an increasing evidence of the efficacy and safety of the MWA for renal masses, with reports of its superiority over RFA for energy delivery into the targeted areas, with a potential higher rate of peri-operative complications, especially with tumours of higher complexity [11].

In an unpublished series, we compared the treatment response, oncological outcomes and the safety profile of RFA and MWA. Of 185 patients represented in this study who underwent 215 procedures; 136 RFA and 79 MWA procedures were examined. Eight patients received MWA following a failed treatment or local recurrence from RFA. No patients received RFA after MWA. 15 patients had repeat RFA. A further 2 patients required 3 RFA procedures. The indications for these were 13 failed treatments, 3 local recurrences and 3 synchronous small renal masses at presentation. 3 patients received repeat MWA for treatment failure. 6 patients within the RFA cohort had 2 lesions treated simultaneously and a single patient had 3 masses ablated in a single sitting. All MWA were performed on single lesions.

Tumour response was observed after 73 (92%) MWA and 113 (83%) RFA procedures, however this did not reach statistical significance ($p=0.09$).

Multivariate analysis showed no statistically significance between tumour characteristics and the chance of treatment failure in the RFA group; however a lesion location between the polar lines made a unique contribution to a similar model ran for the MWA group ($p=0.03$).

At a median follow up was 19 months for MWA (IQR 9-26.5) and 57 months for RFA (IQR 39-78), local recurrence-free survival was 83% and 95% in successful RFA and MWA procedures respectively, which was not statistically different ($p=0.85$). Overall survival was 76.1% in RFA and

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99% in MWA (p=0.16). Cancer specific survival was 97% for RFA and 100% in MWA (p=0.8).

Complication rate was significantly higher in MWA (p=0.04). Multivariate analysis of tumour characteristics did not reveal any variable that significantly contributed to the complication rate of RFA or MWA.

MWA, however, is still regarded as investigational but it utilises electromagnetic energy with thermal properties that may make it superior to RFA. As a relatively new technique there is a lack of data but some small short term studies have shown high treatment success and local recurrence-free survival [11,12]. To our knowledge no study has previously compared these treatment modalities.

Our results show a higher complication rate within the MWA group. This could be possibly due to the intrinsic thermal properties of the MWA. Its resistance to the heat sink phenomenon and rising tissue impedance may provide treatment advantage but also makes spreading to affect an adjacent structure more likely if imperfectly targeted. As this new technology develops improvements to guidance of the probe and monitoring of the sphere expansion could reduce the rate of complication. The operator's awareness of this more aggressive heating source may also help explain the relationship found between a lesion local between the polar lines and treatment failure in MWA. It may be that treatments were cut short due to a fear of causing renal unit failure with a prolonged treatment in a central location.

In conclusion, MWA constitutes a viable treatment option for small renal cancers. Our study showed high rates of local control for both modalities, but with higher peri-operative complications in MWA. This may improve with increasing experience and improvements to the technology. Longer follow is required to validate the existing results.

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