AB052. SOH23ABS_030. Treatment planning approaches for the management of functioning adrenal nodules

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Background: Primary aldosteronism is the most common cause of secondary hypertension worldwide. Thermal ablation, via a minimally invasive interventional radiological approach or laparoscopic surgical approach, offers an option for the targeted destruction of aldosterone producing adrenal lesions which have been located in one or both adrenal glands. Accurate treatment planning is needed to ensure optimal ablation with minimal associated collateral damage to normally functioning adrenal cortex. The objective of this study was to evaluate the use of simulated treatment planning system to inform the dose and duration of microwave ablation (MWA) thermal ablation in patients with primary aldosteronism (PA).

Methods: COMSOL Multiphysics software was used to create 3D electromagnetic-bioheat transfer models for simulating thermal profiles created by a 2.45 GHz water-cooled omni-directional microwave ablation applicator. The models simulated microwave ablation for up to 3 min with applied power levels of 40 and 70 W. Real patient 11C-Metomidate positron emission tomography/computed tomography (PET/CT) scans were used as the basis of segmented models to assess the simulations. Images were segmented using 3D Slicer version 4.11.

Results: Simulated ablation profiles were created for 40 and 70 W at various time points up to 180 s. These profiles were used to inform ablation dose and duration for real life patient adrenal nodules, which were segmented with 3D Slicer. A power setting of 70 W required shorter ablation times than that of 40 W. However, 40 W provided a better option for the application of microwave thermal ablation in a more targeted and precise way and within a more controlled environment.

Conclusions: The current study proposes a feasible treatment planning system to inform both thermal ablation of adrenal nodules in the context of PA and the design of optimised thermal ablation systems which will facilitate precision ablation specifically in the context of the adrenal gland. This is necessary in the context of the desired therapeutic outcomes of adrenal ablation, in which preservation of normal tissue is as important as destruction of abnormal tissue, which contrasts with thermal ablation in the context of malignancy.

Keywords: Adenoma; adrenal; simulation; treatment planning; thermal ablation

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Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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