HSC Public Health Agency
Research and Development

Evidence Brief:

Treating Primary Aldosteronism-Induced Hypertension via Microwave Thermal Therapy

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Why did we start? (The need for the research and/or why the work was commissioned)	The project was initiated in response to a clear clinical need: primary aldosteronism (PA) is a common but underdiagnosed cause of hypertension, accounting for 5–12% of all cases. Existing treatment options are limited, surgical adrenalectomy is only feasible for unilateral disease, and medical therapy is often poorly tolerated due to side effects. As a result, a significant proportion of patients remain without a definitive or effective treatment. The research was commissioned to develop a minimally invasive, image-guided microwave thermal therapy (MWT) system that could safely and effectively treat both unilateral and bilateral aldosterone-producing adenomas (APAs), thereby broadening access to definitive care and reducing long-term cardiovascular risks for patients with PA.
What did we do? (The Methods)	Ulster University (UU) contributed to the project by leading the development of the computational and control algorithms for the image-guided microwave thermal therapy (MWT) system. UU introduced a novel pipeline that significantly improved the segmentation of left and right adrenal glands by integrating advanced pre-processing techniques and a robust post-processing framework. Utilising the 2D UNet architecture with various backbones (VGG16, ResNet34, InceptionV3), the pipeline leverages test-time augmentation (TTA) and targeted removal of unconnected regions to enhance accuracy and robustness.
What answer did we get? (The Findings)	Published results demonstrated a substantial improvement, with a 38% increase in the Dice similarity coefficient for the left adrenal gland and an 11% increase for the right adrenal gland on the AMOS dataset, achieved by the proposed processing pipeline. Additionally, the pipeline significantly reduces false positives, underscoring its potential for clinical applications and its superiority over existing methods. These advancements make our approach a crucial contribution to the field of medical image segmentation.
What should be done now? (The Practice/Policy Implications and/or Recommendations)	It was agreed by the consortium that based on a positive output from the project that the next step would be that the image-guided sub-ablative MWT will be positioned for pilot evaluation in human clinical trials. If successful, the proposed approach may also be adapted for minimally-invasive treatment of other functioning benign endocrine, such as parathyroid adenomas, which are often retrosternally located in the mediastinum. It was also noted a more generic open dataset should be created with labelled CT images for future algorithm developments.