Method for Tracking Respiratory Motion for Cardiac Radioablation

[2020-034]

Digital Imaging - Oncology

> TRL 2-3
> Preclinical

Problem

Cardiac arrhythmias, including atrial fibrillation (AF) and ventricular tachycardia (VT), afflict millions globally, with increasing mortality rates and significant health burdens. It is currently estimated to affect 2-3% of the world's population. Standard treatments like catheter ablation are invasive, complex, and not universally effective, often demanding high operator skill. Elderly patients, who are most at risk, may be precluded from such procedures due to comorbidities.

Recent advances in non-invasive radiotherapy have emerged as an alternative to catheter ablation but raise concerns about long-term effects due to collateral damage to surrounding tissue from the necessary expanded target volumes to accommodate cardiac and respiratory motion. Current image-guided and robotic-assisted methods for precise targeting are clinically unproven and require specialized, unavailable systems in most settings. The invasiveness of existing tracking methods, such as transponder beacons, diminishes the non-invasive appeal of radiotherapy. There is a pressing need for effective and accessible therapies for the treatment of cardiac arrhythmias.

Solution

This innovation provides a method of x-ray guided cardiac radioablation as a non-invasive, precise treatment utilizing a standard linear accelerator, making it widely accessible. It employs advanced diaphragm tracking algorithms to adjust for respiratory motion, ensuring accurate targeting of cardiac substructures while safeguarding healthy tissues.

Pre-treatment involves segmenting medical images to create a respiratory motion model. During treatment, the diaphragm is tracked in real-time via X-ray imaging, allowing for dynamic estimation and adjustment of target position.

This approach negates the need for invasive implantation of transponders, reducing both risk and cost. It promises to revolutionize cardiac arrhythmia treatment, merging the benefits of non-invasiveness, precision, and accessibility while mitigating long-term side effects by minimizing exposure to surrounding anatomy.

Intellectual Property Status

PCT/AU2021/050729 has been filed, published as WO2022006633A1.

Potential Commercial Applications

- Integration with standard linear accelerators in clinical settings
- Treatment of atrial fibrillation and ventricular tachycardia
- Cardiac radiotherapy for patients ineligible for invasive procedures

Inventors

Professor Paul Keall, Nicholas Hindley, Suzanne Lydiard, Dr Chun-Chien Shieh

Contact Commercialisation Office
Name: Emma-Louise Hunsley
Position: Commercialisation Manager – Sydney Biomedical Accelerator
Email: emma-louise.hunsley@sydney,edu.au | Phone: 0437468275
sydney.edu.au/innovation-and-enterprise