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Clinical image conversion tool implementation for cardiac stereotactic body radiation therapy

Ethan Cohen, OHSU Department of Radiation Medicine, Medical Physics MS Program

Keywords

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Abstract

Cardiac stereotactic body radiation therapy (SBRT) is an emerging interventional technique for patients experiencing ventricular tachycardia (VT). VT is the result of improperly conducted electrical signals resulting from cardiac scarring. Research shows that cardiac SBRT can ablate these scars and return the heart to a normal rhythm when other more common interventions such as medication and catheter ablation fail. In preparation for cardiac SBRT, an electroanatomical map (EAM) is obtained using a system of external and catheter electrodes, which shows the geometric cardiac structure, along with the substrates associated voltage potential. Any tissue below a prespecified voltage potential is deemed unhealthy and is the target in cardiac SBRT. The EAM is not a DICOM image and is instead represented as a 3D mesh of polygons that cannot be imported into a treatment planning system (TPS). Because of this, during the treatment planning stage, contours will be drawn using cognitive fusion techniques between the EAM and CT, which has inherent error. To make this process more accurate, a tool was created to convert the EAM into a DICOM image so that the EAM could be imported into the TPS and directly registered to the patient's CT for treatment planning. The geometric integrity of the DICOM EAM was assessed by calculating a hausdorff and dice coefficient, which showed accuracy within acceptable tolerances. A retrospective analysis of completed treatments will also be performed to determine if any scar tissue was missed during initial treatment planning for past treatments. Upon completion, this project will shed light on the accuracy of current treatments, and suggest possible improvements for future cardiac SBRT treatments, which will likely improve patient outcomes and bring advancements in the field.