3D target definition and initial results from the electroanatomic substrate-guided stereotactic ablative radiotherapy for refractory ventricular tachycardia (ELSTAR-VT)

Y.S. Kaya[1], J. Stoks[1], C. Hazelaar[2], W. Elmpt[2], S. Gommers[3], M.J.M. Cluitmans[1], D. Dilling-Boer[4], D.K.M. De Ruysscher[2], K. Verhoeven[2], P.G.A. Volders[3], R.M.A. Ter Bekke[3]

[1]Cardiovascular Research Institute Maastricht (CARIM), School for Cardiovascular Diseases, Maastricht, Netherlands (The)
[2]Maastro Clinic, Maastricht, Netherlands (The)
[3]Maastricht University Medical Centre (MUMC), Maastricht, Netherlands (The)
[4]Virga Jesse Hospital, Hasselt, Belgium
On behalf of STOPSTORM

Funding Acknowledgements: Type of funding sources: Public grant(s) – EU funding. Main funding source(s): EU Horizon

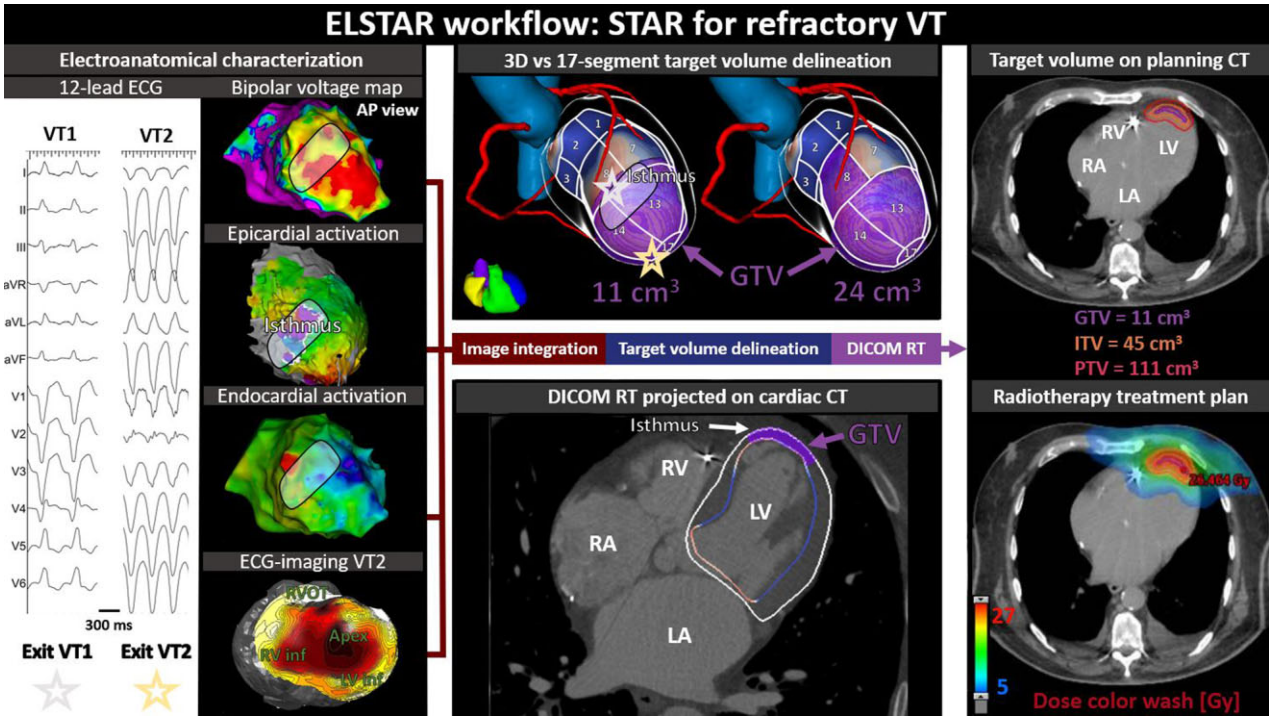
Background/introduction: Noninvasive stereotactic radiotherapy (STAR) is an emerging transmural ablative therapy for refractory ventricular tachycardia (VT). Delineation of the arrhythmogenic gross target volume (GTV) relies on electrical (exit and isthmus) VT characteristics and anatomical scar detailing. 17-AHA segmental approaches or eyeballing techniques are adopted to transfer the GTV to the treatment planning CT. An individualized 3D GTV delineated with ADAS3D based on the areas of interest of each modality could lead to a smaller GTV compared to 17-AHA segmental approaches.

Purpose: We investigated whether our workflow using ADAS3D for the delineating of the GTV renders smaller GTV compared to 17-AHA segmental approaches whilst remaining effective for VT treatment during follow-up.

Methods: We targeted 3D-personalized GTV with STAR in patients with refractory VT in structural heart disease. Electroanatomical detailing was achieved by combining high-resolution invasive and noninvasive (ECG imaging during noninvasive programmed stimulation) mapping, combined with wall thickness analyses by cardiac CT. After coregistration in ADAS3D, a 3D DICOM-radiation therapy file including the delineated target volume was generated and transferred into the free-breathing and respiration-corrected 4D CT scan. Standard STAR using a single-fraction of 20-25 Gy was applied. We compared conventional (17-AHA segmental approaches) versus 3D-based GTV demarcation, and assessed VT burden and procedural safety.

Results: From January 2023 to February 2024 STAR was successfully performed in three patients (all male, mean age 73±1 years, two ischemic cardiomyopathy, one laminopathy) with persistent VT despite ≥2 catheter-based (endocardial/epicardial) ablation procedures. The 3D-derived GTVs showed a statistical trend towards smaller volumes compared to conventional segmental delineation (11±4 versus 21±3 cm3, p=0.07). VT burden and ICD therapy was reduced by 100% over 9 patients-months (8-week blanking period). No acute or subacute adverse events occurred. One patient died of progressive heart failure.

Conclusion: 3D-individualized target volume annotation may hold promise for effective and safe STAR employment.



ELSTAR workflow