Stereotactic body radiotherapy in the treatment of ventricular tachycardia: a case report

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A fifty-five-year-old male patient suffering from dilative cardiomyopathy presented with a five-year history of recurrent episodes of ventricular tachycardia. The patient was admitted to our hospital in May 2019 after receiving several shocks of his implantable cardioverter defibrillator. He received a multidrug antiarrhythmic regimen with a combination of a beta-blocker, amiodarone and mexiletin. Using electroanatomical mapping, the source of the ventricular tachycardia could be located to the posterior wall of the left ventricle, and catheter ablation was performed at and around the site of best pace map. However, the trigger arrhythmia, as well as tachycardia, reoccurred early after the procedure. Since all cardiologic strategies failed to free the patient from recurrence, we decided to perform scar homogenization using stereotactic ablative radiotherapy as reported by Cuculich and colleagues [1, 2] and performed by us previously [3] as a therapy of last resort. A 4D-CT was performed for treatment planning, including a scan in deep inspiration breath hold and a CM-enhanced cardiac CT in treatment position. Patient positioning was performed by WingSTEP™. Target volume definition was performed by the treating electrophysiologist and radiation oncologist based on cardiac MRT and CT, 4 D CT and information of cardiac mapping. Electrophysiological information was correlated to anatomical location using coronary veins as anatomical landmarks. All information added up to a CTV volume of 25 cc and a PTV volume of 59 cc. We prescribed 24 Gy to the 80%-isodose in one single fraction, the maximum dose in the PTV reached 30 Gy and was in parallel with the proposed range of 25–35 Gy, as suggested previously by others. Stereotactic ablative radiotherapy was performed as volumetric modulated arc therapy (3 arcs, 6 MeV, flattening filter free, 7837.2 monitor units, dose rate 500–1400 monitor units/min) using a linear accelerator (Elekta Versa HD, Stockholm, Sweden). Treatment was performed in deep inspiration breath hold using surface guidance with AlignRT in order to reduce the irradiated volume by discarding the internal target margins. Position verification was performed by Cone beam CT and portal imaging. Within the well described blanking period of six weeks the patient suffered from further tachycardia and had to be treated on intensive care unit with multiple and varying intravenous antiarrhythmic medication. During this time the patient was listed for a heart transplantation. After this

period the burden of tachycardia reduced rapidly, the patient was dismissed in a good condition and remained free of tachycardia for eight months until April 2020, when he again developed slow ventricular tachycardia. The patient developed a temporary, mild pericarditis after radiotherapy and on the long term a pericardial effusion, which was diagnostically punctured and showed no signs of infection, and thus might be attributed to radiotherapy. In summary, we performed stereotactic body radiotherapy as a treatment in a case of recurrent, treatment-resistant, cardiac tachycardia. Surface guidance using AlignRT was used to reduce the treatment volumes and thus spare the heart muscle around target volume. The treatment was well tolerated and reduced the burden of tachycardia significantly. The effects were not permanent; however, we were able to delay further treatments as heart transplant for a significant amount of time.

1. Cuculich, P.S., et al., *Noninvasive Cardiac Radiation for Ablation of Ventricular Tachycardia.* New England Journal of Medicine, 2017. **377**(24): p. 2325-2336.
2. Robinson, C.G., et al., *Phase I/II Trial of Electrophysiology-Guided Noninvasive Cardiac Radioablation for Ventricular Tachycardia.* Circulation, 2019. **139**(3): p. 313-321.
3. Scholz, E.P., et al., *Risen from the dead: Cardiac stereotactic ablative radiotherapy as last rescue in a patient with refractory ventricular fibrillation storm.* HeartRhythm Case Rep, 2019. **5**(6): p. 329-332.

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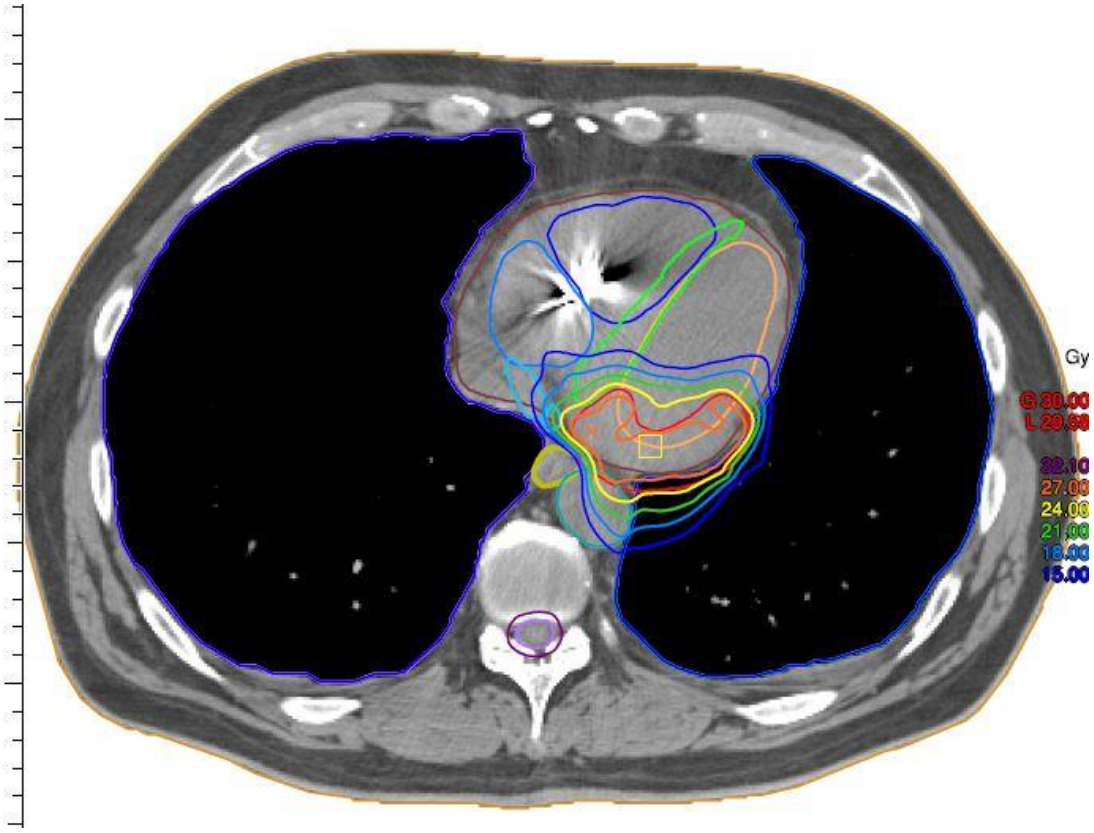
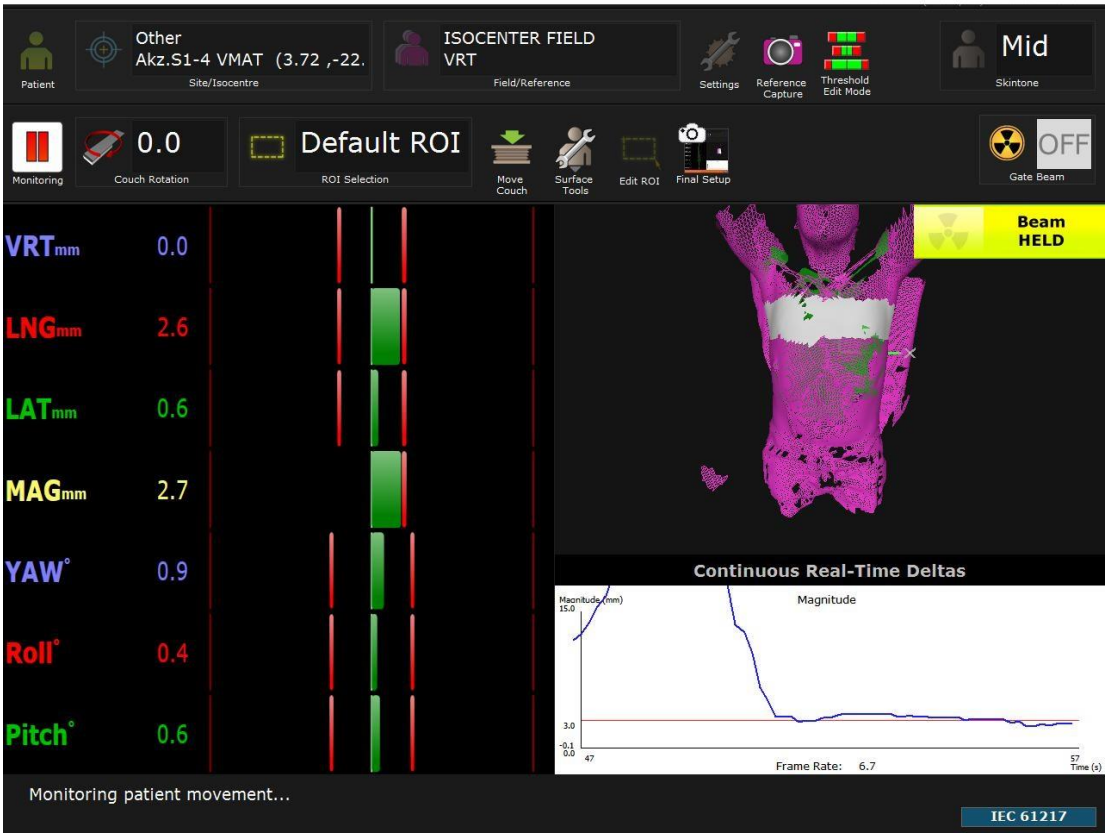


Initial Patient Setup



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