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VENTRICULAR ARRHYTHMIAS IN TETRALOGY OF FALLOT BEFORE PULMONARY VALVE REPLACEMENT: COMPARISON BETWEEN PRE-EMPTIVE SLOW-CONDUCTING ANATOMICAL ISTHMUS EVALUATION/ABLATION AND TRADITIONAL APPROACH

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Introduction: Slowly conducting anatomical isthmuses (SCAI) represent the substrate of spontaneous re-entrant monomorphic ventricular tachycardia (VT) in tetralogy of Fallot (ToF). Pre-emptive evaluation of SCAI with electrophysiological study (EPS) in patients without history of VT undergoing pulmonary valve replacement late in adulthood has been recently suggested to reduce arrhythmic burden. Comparison between traditional (without EPS) and contemporary (with EPS) approaches are lacking.

Methods: A retrospective evaluation of consecutive ToF patients undergoing PVR without clinical history of VT or EPS evaluation was conducted, and data regarding adverse arrhythmic outcomes were collected. A prospective evaluation of consecutive ToF patients undergoing PVR with pre-emptive EPS and SCAI evaluation was conducted. Electroanatomical mapping was performed with systematic evaluation of all possible anatomical isthmuses (AI; pacemapping, activation mapping in sinus/paced rhythm and bipolar voltage mapping) was performed (AI1: anterior scar/patch to tricuspid annulus; AI2: anterior scar to pulmonary annulus; AI3: pulmonary annulus to ventricular septal defect – VSD- patch; AI4: VSD to tricuspid annulus). Conduction velocity (CV) across all documented AI was calculated (ratio between the distance among the nearest point with bipolar voltage >1.5 mV and their difference inactivation timing). Ventricular programmed stimulation was performed at 2 sites with three extrastimuli until refractoriness or induction, during baseline and isoproterenol infusion. Radiofrequency catheter ablation (RFCA) was performed in all patients with inducible VT and/or SCAI, aiming at conduction block across the SCAI validated with differential pacing. All patients receiving RFCA underwent loop-recording implantation.

Results: The retrospective cohort consisted of 139 prevalently male (70.5%) patients (median age at surgical correction 32, iqr 14-60 months) enrolled until 2023. The contemporary cohort, enrolled between January 2023 and december 2024, consisted of 18 patients, median age at correction 35 months (iqr 23-47), 73% males, age at enrollment 46 ± 10 years; 54% with a previous shunt, 46% with a previous transannular patch, 27% pulmonary valvotomy and infundibular boring. AI1 was present in all patients, AI2 in 11, AI3 in 14 (already blocked in 4 patients), AI 4 in 4. There were no SCAI1; there were 3 SCAI 2 (mean CV 0.43 m/s), 9 SCAI 3 (mean CV 0.3 m/s), 2 SCAI 4 (CV 0.4 m/s). RFCA was performed on all SCAI; acute success was achieved in all but 1 patient, achieving bidirectional conduction block across treated SCAI and non-inducibility of VT.

On follow-up, no adverse events were recorded in the EPS cohort (median follow-up 17 months, iqr 8-21 months) while 11 ventricular arrhythmic events were recorded in the retrospective cohort on a median follow-up duration of 66 months (iqr 1.2-145 months).

Conclusions: A pre-emptive EPS strategy in tetralogy of Fallot patients undergoing PVR, in comparison to those performing PVR without EPS, shows a numerical difference of late ventricular events favoring patients undergoing SCAI evaluation and treatment. EPS and SCAI evaluation and treatment is safe and effective over a relatively long systematic follow-up. A longer follow-up is however needed to further enforce systematic EPS in rToF candidate to PVR.