

Right ventricular electrical activation in patients with repaired tetralogy of Fallot : insights from electro-anatomic mapping and MRI

Fournier E. (1), Jalal Z. (1,2), Sacher F. (1,2), Bordachar P. (2,3), Derval N. (2,3), Cochet H. (2), Teijeira Fernandez E. (2,3), Haissaguerre M. (2,3), Iriart X. (1), Thambo JB. (1,2)
 University Hospital of Bordeaux, Paediatric and congenital heart defects unit, Pessac, France (1); IHU Liryc, Electrophysiology and Heart Modeling Institute, fondation Bordeaux Université, F-33600 Pessac-Bordeaux, France (2); University Hospital of Bordeaux, Electrophysiology and Ablation Unit, Pessac, France (3).

Background : Presence of prolonged QRS duration in patients with repaired tetralogy of Fallot (TOF) is considered as a risk factor for sudden death and associated with altered hemodynamics. It has been suggested that QRS duration mainly reflects abnormalities of the RV outflow tract (RVOT) rather than the RV body itself. We aimed to better understand the RV electrical activation pattern in these patients using activation mapping and MRI.

Methods 61 adults (36 yo [25-48], median QRS duration 159 ms [140-171]) referred for either catheter ablation or pulmonary valve replacement late after TOF repair underwent an ECG, MRI with fibrosis analysis and an invasive RV activation mapping (Carto 3- Biosense Webster). RV activation delay and RV activation time (RVAT) were studied and respectively defined as the delay between the reference surface ECG and the first RV electrogram (EGM) and, the duration between the first and the last RV EGM. RV electrical pattern was also analysed.

Results RVAT was prolonged in all patients with median duration of 135 ms [120-156]). The delay between QRS onset and earliest RV activation was lengthened at 20 ms [7-34] reflecting the absence of RV purkinje activation and the left to RV activation. For most patients, the electrical activation pattern was similar, starting from the septum (78.7%), following by the apex (68.3%), the infundibulum (67.8%) and the RV free wall was the latest activated (77.6%). When the infundibulum was the latest region activated, the RVAT was longer (164 ms [120-156]) and the MRI RVOT scar surface area larger (17.7 cm²). RV dilation at MRI (RVEDV \geq 150 ml/m²) was associated with RVAT prolongation reflecting the link between hemodynamic and electrophysiologic properties. QRS duration and fragmentation were weakly correlated with RVAT (r=0.44, p=0.631).

Conclusion RV activation is delayed in patients with repaired TOF and reflects an homogeneous activation pattern that is not only the consequence of an infundibular disease but also reflects a slow conduction in the RV free wall. This results could help to select eligible patients for resynchronization therapies.

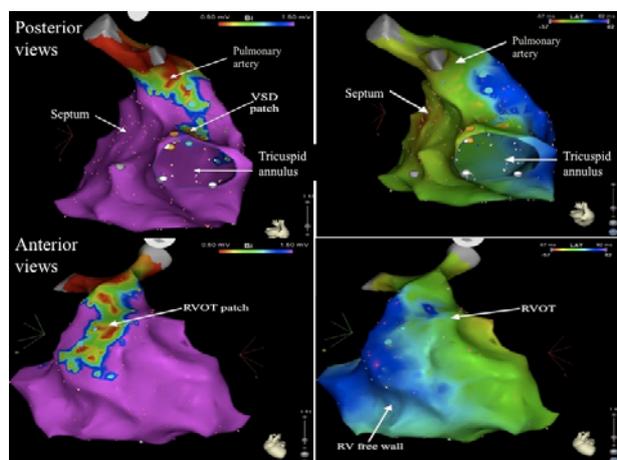


Figure 1 : Anterior and posterior views of RV activation maps (right side) and voltage activation maps (left side) in the same patient. RVOT, right ventricular outflow tract ; VSD, ventricular septal defect ; IVS, interventricular septum ; TA, tricuspid annulus ; PA, pulmonary annulus.