Mechanical-electrical interaction of the right ventricle in patients with repaired tetralogy of fallot: the next step towards resynchronization in congenital heart disease

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Introduction: Patients with repaired tetralogy of Fallot (rTF) and severe pulmonary regurgitation frequently progress to dilation and dysfunction of the right ventricle (RV). It has been documented in the literature that there is a correlation between the duration of the QRS in the surface electrocardiogram and the hemodynamic parameters of the RV of these patients, suggesting the presence of a mechanical-electrical interaction.

Purpose: To determine if there is an association between the contraction delay in certain areas of the RV measured in M-mode echocardiography and the delay in electrical activation measured in the electroanatomic map (EAM) of RV in patients with rTF.

Methods: Unicentric and observational study of all patients with rTF undergoing EAM, echocardiography with study of RV asynchrony and cardiac magnetic resonance imaging (MRI). Activation delay in the antero-basal area and in the RV outflow tract (RVOT) in the EAM were both analysed (Figure 1A). The shortening delay in the same areas in M-mode echocardiography was also evaluated (Figure 1B, C). MRI data regarding volume and ejection fraction was also collected.

Results: 64 patients were included (36.7±10.6 years, 65% men). The mean total activation time of the RV (RV-TAT) was 127.3±42.4 ms. Activation mapping showed a recurrent pattern with beginning in the interventricular septum and ending in RV antero-basal region and/or RVOT. A linear positive correlation was observed between RV-TAT and the activation delay in both regions analysed (ρ=0.60 and ρ=0.52, respectively; $p<0.001$) and also between the electrical and mechanical delay in the anterior wall (ρ=0.41; p=0.001). On the other hand, it was observed a negative correlation between RV ejection fraction (RVEF), measured on MRI, and the RV-TAT (ρ=–0.41, p=0.002) and also between RVEF and the activation delay in the RV antero-basal region and in the RVOT (ρ=–0.32, p=0.016 and ρ=–0.36, p=0.007, respectively).

Conclusions: There is a mechanical-electrical interaction in the RV of patients with rTF, with a negative correlation between the activation delay and RVEF and between mechanical and electrical activation delay in specific anatomical regions (regional mechanical-electrical interaction). These results may guide future studies on resynchronization in this heart disease.

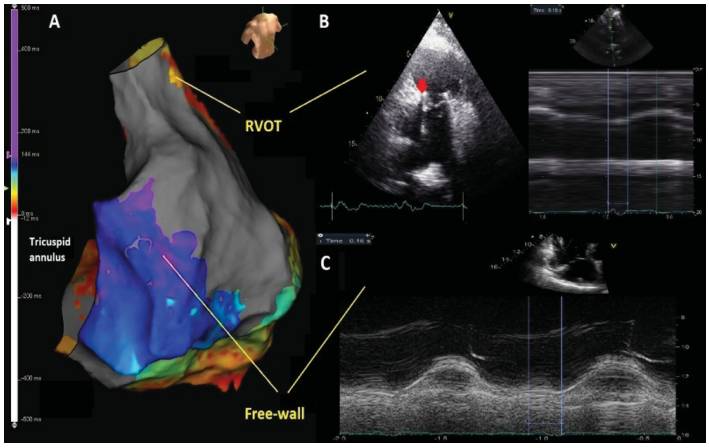

Figure 1. EAM and echocardiographic measures