Impact of electrical cardioversion on cavotricuspid dynamicity: a machine-learning approach to ablation of typical atrial flutter within an interventional MRI

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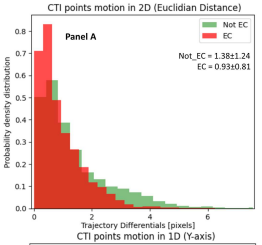
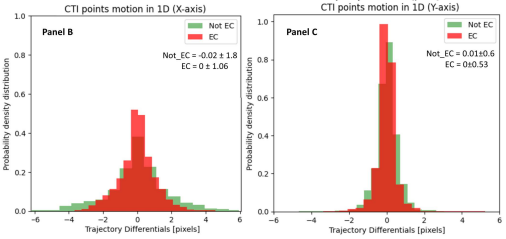
Aims: We sought to investigate whether patients with typical right atrial (RA) flutter in whom electrical cardioversion (EC) was performed prior to ablation display different contraction patterns of the cavotricuspid isthmus (CTI) than that of patients without EC.

Methods: 32 patients (66±10y, 29 males) with typical RA flutter were divided in two groups: Group1 comprised 15 patients who underwent EC less than 12h before ablation, and Group2 included 17 patients without EC. All patients were in sinus rhythm during CTI ablation performed within an interventional MRI environment which provided 25 temporal frames of a predetermined slice optimized for CTI visualization. Tomtec (Philips) software was employed to delineate the contours of the CTI wall across these 2D DICOM images, providing trajectories of CTI points throughout the cardiac cycle. Trajectory differentials between consecutive time positions (e.g., x{t2}-x{t1}) were computed for individual 1D axes and the 2D trajectory vector amplitude (Euclidean distance). A logistic regression algorithm was applied to evaluate correlation between CTI dynamicity and prior EC.

Results: The probability density distributions of the trajectory differentials of CTI points on Euclidean distances (Panel A) show that Group1 displays lower variability than that of Group2. The same result can be observed for the distribution of horizontal movements (Panel B), while Y-axis movement seems to be less impacted by cardioversion (Panel C). The logistic regression algorithm showed an accuracy of 86.6% along the X-axis, 86.6% along the Y-axis and 87.6% in the 2D direction CTI motion for distinguishing both groups of patients.





Conclusion: Reduced CTI dynamicity was observed in patients with EC performed less than 12h prior to ablation. The greater effect of dynamicity loss in X-axis direction confirms previous results showing that antero-posterior motion is prevalent in CTI contraction.