INTRODUCTION

Left atrial low voltage areas (LVAs) measured with bipolar voltage mapping (BiV) correspond to scar tissue on cardiac MRI with late gadolinium enhancement. LVAs may act as propagation sites of fibrillatory potentials and sustain atrial fibrillation (AF). LVAs may be utilised by the electrophysiologist as a site of additional substrate modification during radiofrequency (RF) or cryoblation. Atrial voltages when mapped in sinus rhythm (SR) typically demonstrate scar tissue if readings are less than 0.5mV and dense scar if below 0.2mV. Previous data suggests that scar distribution while mapped in AF may be a target for substrate modifications. This abstract will discuss the scar distribution and LVA calculations in both SR and AF during radiofrequency ablation using an automated tool for the analysis. This is demonstrated through a case to detail the concept.

METHODS AND MATERIALS

A 59-year-old hypertensive gentleman had symptomatic, refractory persistent AF. He was admitted for pulmonary vein isolation (PVI) by radiofrequency ablation. A 20 pole LASSO, 7-Fr catheter with 4.5mm spacing, D-curve (Biosense-Webster, J & J Medical, Belgium), was used to map the atrium in AF. The patient underwent PVI to restore SR. The atrium was remapped with the same catheter in SR. Over 5000 voltages mapping points were generated in both rhythms. The maps were then analysed using a novel Voltage Histogram Analysis (VHA) tool software.

To use the tool, areas of interference must be removed from the 3D map leaving only the main LA body. The VHA then allows for analysis of the atrium in pre-designated voltage ranges, precisely calculating the total area (in mm²) of the atrium that each voltage range represents. The exact locations of those LVAs are represented in the 3D map via colour coding.

RESULTS

We generated 3D voltage maps, one in AF and one in SR. The VHA tool analysed the maps and assigned myocardial area by its voltage value, into 0.1mV aliquots. These maps and VHA results can be seen in Figure 1.

Out of the sample analysis, the map in AF demonstrates greater area reading >0.2mV, consistent with dense LA scar (1,545.92 mm² from total 11,462.17 mm², 13.49%) when compared to the same map in SR (1,118.43 mm² from total 12,584.51 mm², 8.89%). When analysing voltages of diseased LA tissue, between 0.2mV and 0.5mV, the maps showed an affected area of 2,966.29 mm² in AF (25.88% of total), in comparison to 3,998.09 mm² in SR (31.77%). The maps in AF (39.37%) compared to post-ablation SR (39.5%), 8.89%) were less when analysing voltages of diseased LA tissue, between 0.2mV and 0.5mV, the maps showed an affected area of 2,966.29 mm² in AF (25.88% of total), in comparison to 3,998.09 mm² in SR (31.77%). The maps in AF (39.37%) compared to post-ablation SR (39.5%), 8.89%).

CONCLUSIONS

Automated VHA has demonstrated similar values of total area reading <0.5mV when mapped pre-ablation in AF (30.27%) compared to post-ablation SR (40.5%). However, we have identified greater distribution of this area to the lower voltage aliquots in AF (13.49%) compared to post-ablation SR (8.89%) in comparison to the higher voltage ranges (31.77% vs 25.55% AF). The VHA tool allows for accurate assessment and localisation of myocardial scar and minimises operator variability, giving a clearer voltage breakdown and area. A full comprehensive study is ongoing, examining more patients and anatomically comparing the voltages obtained.