Structural, functional and mechanical tissue characterisation in atrial fibrillation by image processing

E Invers-Rubio[1], S Hussain[2], C Corsi[2], MS Guillem[3], AM Climent[3], L Mont[1,4,5]

[1]Institut d'Investigacions Biomèdiques August Pi i Sunyer (IDIBAPS), Barcelona, Catalonia, Spain
[2]Department of Electrical, Electronic and Information Engineering "Guglielmo Marconi", University of Bologna, Cesena, Italy
[3]ITACA Institute, Universitat Politècnica de València, València, Spain
[4]Department of Cardiology, Unitat de Fibril·lació Auricular (UFA), Hospital Clínic, Universitat de Barcelona, Barcelona, Catalonia, Spain
[5]CIBER de Enfermedades Cardiovasculares, Barcelona, Catalonia, Spain

Introduction Atrial fibrillation (AF) is a complex arrhythmia. Its current treatments are antiarrhythmic drugs and catheter ablation, but they still need to improve their success rate. For a higher efficacy, patient stratification is key in order to give each patient a personalised therapy. Usage of non-invasive imaging techniques can help on this stratification.

Methods We are making use of late gadolinium enhancement MRI (LGE-MRI), electrocardiographic imaging (ECGi) and Real-Time 3D Echocardiography (RT-3DE) to characterise structurally, functionally and mechanically the atrial tissue, respectively. The combination of this information allows for findings of regionally diseased atrial tissue and identifies them as possible targets for catheter ablation therapy. With that objective, we will divide the atria in 19 regions and describe which region is more prone to have beating, conduction and structural defects as seen with the aforementioned techniques.

Results We will show that combination of different non-invasive imaging techniques allows for a better characterisation of atrial tissue. Mechanical, structural and functional depiction will give a clearer diagnose of how diseased the atria are, suggesting a personalised treatment for each patient and helping on the stratification. The description of damage, identifying slow conduction, fibrotic and low-beating regions, will allow for catheter ablation targeting and an improvement in arrhythmia recurrence after ablation.

Conclusion Joint efforts on image processing and combination of several non-invasive tissue characterisation techniques allow for an improved characterisation of damage in atrial tissue and suggest ablation targets prior to the ablation procedure. The obtention of this information before the ablation procedure in a non-invasive manner allows for a better treatment stratification.