Heart segmentation and evaluation of fibrosis

Mots clés :
- Directeur de thèse : Thierry GERAUD
- Co-encadrant(s) :
- Unité de recherche : Laboratoire de Recherches et Développement de l'EPITA
- Ecole doctorale : École Doctorale Informatique, Télécommunications, Électronique de Paris
- Domaine scientifique principal : Sciences pour l’ingénieur

Résumé du projet de recherche (Langue 1)

Atrial fibrillation (AF) is the most common heart rhythm disease, corresponding with the activation of an electrical substrate within the atrial myocardium. AF is already an endemic disease, and its prevalence is soaring, due to both an increasing incidence of the arrhythmia and an age-related increase in its prevalence. Indeed, 1-2% of the population suffer from AF at present, and the number of affected individuals is expected to double or triple within the next two to three decades both in Europe and in the USA. Due to the limited effects of anti-arrhythmic drugs, AF can only be cured by percutaneous radiofrequency catheter ablation (CA) targeting triggers and critical areas responsible for AF perpetuation in left atrium (LA). Identification and quantification of AF electrical substrate prior to AF ablation remains an unsolved issue as the number of targets remains unpredictable using clinical criteria. AF CA is still a challenging intervention requiring a perioperative 3D mapping to identify AF substrate to select the best ablation strategy. Over the last years, several groups tested the ability of LGE-CMR to detect preexisting fibrosis. Although these reports suggested that the extent of fibrosis may predict recurrences after ablation procedures, the lack of 3D automated LA reconstruction, the lack of reference values for normality has prompted the publication of several image acquisition and post-processing protocols and thresholds to identify fibrosis, eventually limiting the external validation and reproducibility of this technique. Because of these technical limits, the assessment of LA fibrosis has not yet been widely adopted in the clinical practice. The aims of this project involving EPITA and the Institut Cardiovasculaire Paris Sud (ICPS) are to provide a normalized, systematic, consistent, reproducible and automatically 3D LA LGE-CMR reconstruction to identify LA fibrotic tissue prior to AF ablation, using prospective and retrospective CA cases coming from a 900 patient cohort, ablated and MRIed at ICPS between 2009 and 2017.