

# Development of New Left Atrial Anatomical Models for the Study of the Left Atrial Appendage Implications in Atrial Fibrillation

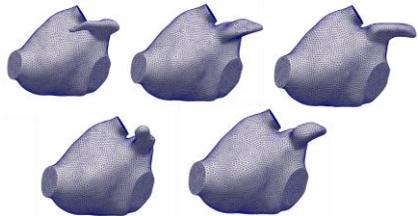
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**Introduction.** Atrial fibrillation is associated with a five-fold increase of the stroke risk. Left atrial appendage (LAA) is the atrial site with the highest blood stasis risk. Recent studies have been focused on the association between the LAA anatomical features and the stroke risk. However, conflicting results have been published. In this context, clinical studies suggested the stroke risk stratification could be improved by using haemodynamic information on the left atrium (LA) and mainly on the LAA. The aim of this study was the design and development of a method, which enabled to reconstruct and generate several LA anatomical models, characterized by the same LA chamber model and different LAA morphology and investigate the fluid dynamic properties within the LAA in order to correlate LAA morphological characteristics and the thrombogenic risk.

**Methods.** Patient specific anatomical models were derived from CT and MRI data applying specifically image segmentation algorithms, previously described. A semantic segmentation of these models was obtained by applying the shape diameter function and the LA chamber was disconnected by the LAA in each model.



The shape of each LAA was characterized by computing several geometrical parameters. One LA model was selected and, by applying the iterative closest point algorithm and the Poisson surface reconstruction approach, the LAAs were connected to the LA model template. CFD simulations were run in five-models with the most different LAAs (see Figure).

**Results and Conclusions.** Results showed that not only LAAs with complex morphologies are characterized by low velocities, few vortex structures and consequently a higher thrombogenic risk. Depending on the flow velocity at the ostium and on the length of the auricula, even a simple morphology may be associated to a high thrombogenic risk. The evaluation of geometric characteristics seems to have a key role in defining thromboembolic risk.