Automatic identification of fossa ovalis in computed tomography imaging

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Access to the left atrium (LA) of the heart is required for several minimally invasive cardiac interventions of the left heart. Hereto, the atrial septum is punctured through its thin region, termed fossa ovalis (FO), using a catheter inserted in the right atrium via the venous system under fluoroscopic guidance. However, the correct identification of the exact location of FO region is widely dependent of the physician's experience, resulting frequently in sub-optimal puncture locations. As a consequence, repeated punctures or procedural complications are common [1].

In this work, we developed a strategy to automatically identify the FO in computed tomography (CT) datasets. It starts with an automatic approach to accurately segment the left and right atria, the atrial wall and the aorta. The contours are initialized using an atlas-based approach, being posteriorly refined through a competitive segmentation technique based on B-spline Explicit Active Surfaces. Finally, the thickness of the atrial wall is computed and the thinner region (*i.e.* FO) estimated through a cluster-based technique.

A total of 7 CTs were acquired from 7 patients with suspicion of left atrial disease. All the datasets were analyzed by one expert, being each FO segmented using Medical Imaging Interaction Toolkit Software. Specifically, a set of 2D slices were manually delineated, being finally interpolated for a 3D surface. Each resulting region was compared with the correspondent automatic one, and the difference between the center of mass of each contour computed. An error of 3.73 ± 1.52 mm was found for the centroid analysis. Furthermore, a surfaces' overlap higher than ~70% was achieved.

The proposed approach presented potential for the identification of the FO region. Nevertheless, further analysis is required to estimate its real accuracy using a large database.

References:

[1] - Morais P, Vilaça J, Ector J, Dhooge J, Tavares J. Novel solutions applied in transseptal puncture: a systematic review. Journal of Medical Devices, DOI: 10.1115/1.4035374 (in press).

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