

Recent advances in the interventional planning stage of the transseptal puncture

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Abstract

Access to the left atrium (LA) is required for several minimally invasive cardiac interventions. Hereto, the atrial septum is punctured using a catheter inserted via the venous system using a technique termed transseptal puncture (TSP). Although the TSP has been commonly used, complications are still common. Besides, the exact puncture location is defined based on experience, being sub-optimal in specific situations.

In this project, multiple contributions have been made to improve the state-of-the-art of the TSP. We initiated with a review [1] concerning the technique in terms of guidance technologies, pre-procedural planning and used surgical tools. Although multiple advances can be found regarding the medical tools and guidance technologies, few studies focused on the planning exist. Then, we proposed strategies to automate the planning of the TSP, namely: 1) an atrial region segmentation methodology [2]; 2) a strategy to identify the optimal puncture region, which is usually known as fossa ovalis (FO), and 3) a personalized atrial phantom model [3].

Both segmentation methods were validated on 41 computed tomographic images. The automated segmentations were compared against manual delineations, and an error lower than 1.7 mm was found as to the atrial region [1]. Regarding the identification of the FO, a performance comparable to the inter-observer variability was achieved. Moreover, both methods proved to be much faster than the traditional practice. Regarding the phantom model, it led to a highly accurate production and a highly realistic model in terms of intra-procedural imaging [3].

The developed strategies have shown high feasibility and accuracy, corroborating their potential for the automated planning of TSP.

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