

Interatrial Septum and Appendage Ostium in Atrial Fibrillation Patients: A Population Study

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Motivation: Left atrial appendage (LAA) closure is performed in atrial fibrillation (AF) patients to help prevent stroke. LAA closure using an occlusion implant is conducted using imaging guidance. Population analysis of the angle of entry at the interatrial septum relative to the appendage can assist in both catheter design and implant choice for a particular patient. **Methods:** LAA and septum segmentations from MRI scans were obtained for 127 AF subjects. For each subject, we used Corview (Marrek Inc.) to manually mark LAA ostium landmarks that were then reviewed by a clinical expert. The ostium landmarks were used to identify the ostium plane. The septum segmentation was used to find the surface normal from the septum. The angle between the ostium plane and septum normal was computed for all the patients. The inherent number of clusters for these angles was identified using the elbow method. To analyze the spread of LAA types within the clusters of the angles, the LAA shapes (i.e. segmentations) were clustered and classified as cauliflower, chicken wing, wind sock, and cactus with the matching characteristics from the literature (table below). We further computed the normal of the ostium plane and found that this normal was not intersecting the septum segmentation for all the subjects under analysis.

Results: Four angle clusters were found to explain $\sim 90\%$ of the underlying variability. Angles range from 40 and 160 degrees with the majority of the angles belonging to the range between 90 and 150 degrees. **Conclusion:** Population analysis of the septum normal angle relative to the ostia plane can assist the clinicians in making objective decisions for where and at what angle to puncture the septum. This study may also provide insights for the implant and catheter design for appendage closure while accounting of LAA shape variability in AF patients.

