Device Sizing Guided by Echocardiography-Based Three-Dimensional Printing Is Associated with Superior Outcome after Percutaneous Left Atrial Appendage Occlusion

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Background: Left atrial appendage (LAA) occlusion is an alternative to anticoagulation for stroke prevention in patients with atrial fibrillation. Accurate device sizing is crucial for optimal outcome. Patient-specific LAA models can be created using three-dimensional (3D) printing from 3D transesophageal echocardiographic (TEE) images, allowing in vitro model testing for device selection. The aims of this study were to assess the association of model-based device selection with procedural safety and efficacy and to determine if preprocedural model testing leads to superior outcomes.

Methods: In 72 patients who underwent imaging-guided LAA occlusion, 3D models of the LAA were created from 3D TEE data sets retrospectively (retrospective cohort). The optimal device determined by in vitro model testing was compared with the actual device used. Associations of model-match and model-mismatch device sizing with outcomes were analyzed. In another 32 patients, device selection was prospectively guided by 3D models in adjunct to imaging (prospective cohort). The impact of model-based sizing on outcomes was assessed by comparing the two cohorts.

Results: Patients in the retrospective cohort with model-mismatch sizing had longer procedure times, more implantation failures, more devices used per procedure, more procedural complications, more peridevice leak, more device thrombus, and higher cumulative incidence rates of ischemic stroke and cardiovascular or unexplained death (P < .05 for all) over 3.0 ± 2.3 years after LAA occlusion. Compared with the retrospective imaging-guided cohort, the prospective model-guided patients achieved higher implantation success and shorter procedural times (P < .05) without complications. Clinical device compression (r = 0.92) and protrusion (r = 0.95) agreed highly with model testing (P < .0001). Predictors for sizing mismatch were nonwindsock morphology (odds ratio, 4.7) and prominent LAA trabeculations (odds ratio, 7.1).

Conclusions: In patients undergoing LAA occlusion, device size selection in agreement with 3D-printed model-based sizing is associated with improved safety and efficacy. Preprocedural device sizing with 3D models in adjunct to imaging guidance may lead to superior outcomes. (J Am Soc Echocardiogr 2019; ■: ■ - ■.)

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