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How Could Pre-Procedural Imaging Guide Successful Left Atrial Appendage Closure?

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REFER TO THE PAGE 211-218

Atrial fibrillation (AF) is the most common sustained arrhythmia and strongly associated with ischemic stroke.[1] In patients with AF, the main site of thrombus formation is the left atrial appendage (LAA).[2] Autopsy and surgical data have suggested that about 90% of atrial thrombi in AF patients originate from the LAA.[3]

There are two reasonable ways to prevent ischemic stroke events in patients with AF. The first is maintenance of anticoagulation. The second is to isolate the LAA as a major embolic source from the systemic circulation. Multiple randomized, controlled trials have suggested that oral anticoagulation (OAC) decrease the risk of stroke in patients with AF.[4] However, long-term OAC is contraindicated in 14% to 44% of AF patients with risk of stroke.[5] Because there are various barriers against maintenance of long-term OAC such as the risk of bleeding, inconvenience of dose adjustments, drug interactions, and restrictions on diet.[6] Other novel anticoagulants are also limited by the side effects, and the risk of bleeding from systemic administration of these agents.[7] Because the LAA is a separate anatomic structure, it may be relatively easily isolated from systemic circulation by excision or ligation. Recently, less invasive technique using percutaneous transcatheter have been introduced for LAA isolation by occlusion of this anatomical structure with implantable devices.[8] The PROTECT AF (Watchman Left Atrial Appendage System for Embolic Protection in Patients with Atrial Fibrillation) trial was planned to determine whether systemic anticoagulation with warfarin, the most commonly used anticoagulant, could be replaced by LAA closure with a percutaneously positioned device. This final results of the PROTECT AF trial followed up for an accumulated exposure of 1588 patient-years revealed LAA closure with the Watchman device to be non-inferior to systemic anticoagulation with warfarin regarding prevention of stroke, systemic embolism, and cardiovascular death.[9] On the basis of these data, LAA closure has been decided a class IIb recommendation in the 2014 ACC/ASA guideline as an alternative strategy to prevent stroke.

For this procedure to be accepted as an alternative, there must be a high success rate. Although success rate of the LAA closure is generally high, peri-device leakage of LAA persists due to incomplete closure.[9][10] During percutaneous LAA closure for stroke prophylaxis, the geometric variability of the LAA ostium may result in an incomplete seal of the LAA. To understand the technical limitations of LAA closure, it is important to consider the anatomical variations of the LA and LAA geometry. The geometry of LA and LAA, a detailed knowledge of its anatomical characteristics and relationship might be very useful when planning the procedure. As LA and LAA geometry is complex, there are limited available data about the predictors of successful procedure. The anatomical relationship of LAA and interatrial septum (IAS) may affects the success rate of device implantation.[11] In this issue, Chung et al.[12] introduced 3-dimensional anatomical relation of IAS and LAA orifice as a predictor of peri-device leakage after LAA closure.

One of the novel and interesting aspects of this study is that they use new novel analysis program for accurate measurement of 3-dimensional relationship between IAS and LAA orifice and found that 3-dimensional angulation between IAS and LAA significantly associated with development of peri-device leakage after LAA occlusion. In this study, the angle between the IAS plane and the line linking the LAA orifice midline and foramen ovale was measured using 3-dimensional geometric cardiac CT analysis. Measurement of this new parameter can provide more detail geometric information and predict success

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of the procedure. In addition, it might be helpful to select catheter and to decide the direction of IAS puncture site. This study is the first study that anatomical relationship of IAS and LAA orifice might affect peri-device leakage.

However, clinical implication of peri-device leakage after LAA occlusion is unclear. Despite some previous studies suggested that the incomplete LAA occlusion was not associated with cardioembolic stroke event,[10] understanding the clinical impact of peri-device leakage would be critical. As the authors commented in the limitation, larger sample size, prospective and long-term follow up data are needed to determine the clinical implication of peri-device leak after LAA occlusion. Despite some limitations, this study results suggested that novel anatomical parameter could be measured by their new software and this parameter is useful to predict peri-device leakage after LAA device closure.

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