Left atrial appendage angiography is associated with the incidence and number of magnetic resonance imaging–detected brain lesions after percutaneous catheter-based left atrial appendage closure

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BACKGROUND Percutaneous catheter-based left atrial appendage closure (LAAC) is a procedure being increasingly performed in patients with atrial fibrillation and high bleeding risk.

OBJECTIVE The purpose of this study was to evaluate the incidence of magnetic resonance imaging (MRI)-detected acute brain lesions (ABLs) as well as potential changes in neurocognitive function after percutaneous LAAC in patients with atrial fibrillation.

METHODS Brain MRI at 3 T was performed within 24 hours before and after LAAC along with neurologic (National Institutes of Health Stroke Scale [NIHSS] score) and cognitive (Montreal Cognitive Assessment [MoCA] test) assessment. Acquired MRI sequences included high-resolution diffusion-weighted imaging as well as fluid-attenuated inversion recovery.

RESULTS Successful device implantation was achieved in all 23 patients (age 74.1 ± 10.5 years; 16 male) using the Amulet (n = 18), Occlutech (n = 3), or LAmbre (n = 2) device. Thirty-seven ABLs were detected by MRI in 12 of 23 patients (52%) after LAAC. The number of periprocedural LAA angiographies was significantly higher in patients with ABL than in those without ABL (1.67 ± 0.65 vs 1.18 ± 0.41; $P = .048$) and was associated with a higher number of ABL ($\rho = 0.615$; $P = .033$). Compared to pre-LAAC assessment, post-LAAC MoCA and NIHSS scores revealed similar results. After LAAC, MoCA test (mean 24.1 ± 4.6 vs 23.2 ± 4.6; $P = .09$) and

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NIHSS score (mean 1.0 ± 1.7 vs 1.2 ± 1.8; $P = .1$) were similar between patients with and those without ABL, respectively.

CONCLUSION MRI-detected ABLs are commonly observed after percutaneous LAAC. The number of LAA angiographies is significantly associated with the number of ABLs; however, the clinical implications of ABL have yet to be determined.

KEYWORDS Bleeding; Brain lesion; Brain magnetic resonance imaging; Left atrial appendage closure; Oral anticoagulation; Silent cerebral lesion

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Introduction

Percutaneous catheter-based left atrial appendage closure (LAAC) is a procedure being performed more frequently, particularly in patients with atrial fibrillation (AF) who have bleeding complications or who are considered at high risk for bleeding while receiving long-term anticoagulation.[1–7] LAAC also is used after electrical left atrial appendage isolation.[8] Beyond the initial learning curve, recent studies have reported a low incidence of device-related complications, including neurologic events.[1,3,9].Although LAAC aims to reduce the risk of AF-related ischemic stroke and systemic embolization, the incidence of periprocedural acute brain lesions (ABLs) after percutaneous LAAC needs to be fully determined. Magnetic resonance imaging (MRI)–detected ABLs have been reported after various cardiac interventional procedures, including coronary interventions and electrophysiologic procedures.[10–14] Although the clinical implications of MRI-detected ABLs on cognitive function are not fully understood, it seems appropriate to examine the frequency and size of such lesions in this more frequently performed cardiac catheter-based procedure. Whereas a reduction in verbal memory function after pulmonary vein isolation was observed in a very small prospective study,[15] the current study included serial neurologic and neurocognitive assessment.

This prospective pilot study aimed to evaluate the incidence of ABLs using high-resolution diffusion-weighted brain MRI at 3 T as well as the potential clinical implications using standardized neurologic and neurocognitive assessment after catheter-based LAAC.

Methods

Twenty-three consecutive patients (age 74.1 ± 10.5 years; 16 male) with paroxysmal (n = 9), persistent (n = 9), or permanent AF (n = 5) were included in this study. All patients were treated with percutaneous LAAC using either the Amulet (St. Jude Medical, Minneapolis, MN), Occlutech (Occlutech, Jena, Germany), or LAmbre (Lifetech Scientific Corp., Shenzhen, China) LAA occlusion device. All patients underwent LAAC because they were considered to have at least 1 relative or absolute contraindication to long-term oral anticoagulation (OAC), such as a history of previous significant bleeding.

This study conformed to the Guiding Principles of the Declaration of Helsinki of 2014. It was approved by the Charité Ethics Committee (EA/084/15) and was registered at the German Clinical Trials Register (No. DRKS00010300).

Pre-, peri-, and postprocedural management

Transesophageal echocardiography (TEE) was performed in all patients before the intervention to assess for intracardiac thrombi. OAC with phenprocoumon was discontinued before the procedure, targeting an international normalize ratio <2. In patients being treated with a novel OAC, the medication was stopped at least 24 hours before the procedure.

LAAC were performed with the patient under conscious sedation using propofol. An arterial line (5Fr) was inserted to provide continuous invasive hemodynamic monitoring. All patients received a single 1.5-g dose of cefuroxime intravenously before the procedure. After femoral venous access was obtained, a transseptal puncture was performed using a nonsteerable SL1 sheath (St. Jude Medical) in conjunction with a BRK-1 needle or the steerable Occlutech sheath under fluoroscopic and TEE guidance. After transseptal puncture, repeated boluses of unfractionated heparin were administered to achieve a target activated clotting time (ACT) >250 seconds. Angiography of the LAA was performed in all patients (right anterior oblique 30°, caudal 20°) using either a pigtail catheter within the LAA or indirect angiography via a steerable sheath, which was positioned at the LAA entrance. For optimal device selection, LAA dimensions were calculated using both fluoroscopy and TEE. For fluoroscopic calculation of LAA dimensions, the angiographic position of right anterior oblique 30°/caudal 20° was used. After the procedure, arterial access was sealed using an arterial vascular closure device in all patients.

OAC was discontinued in all patients after device implantation, and combined treatment with acetylsalicylic acid and clopidogrel was recommended for all patients for a period of 3 months.

Brain MRI

Brain MRI was performed in all study patients within 24 hours before as well as after the LAAC procedure using 3-T MRI (Tim Trio, Siemens AG, Erlangen, Germany). Acquired sequences were high-resolution diffusion-weighted imaging (DWI) (TE = 93 ms; TR = 8,900 ms; matrix size = 192 × 192; field of view = 230 mm; slice thickness = 2.5 mm, 50 slice; b0 = 0 s/mm^2, b1 = 1,000 s/mm^2; gap = 0 mm), 3-dimensional fluid-attenuated inversion recovery (TE = 364 ms; TR = 5,000 ms; TI = 1,800 ms; matrix size = 256 × 256; field of view = 280 mm; slice thickness 1.1 mm, 144 slices), and T2* (TE = 20 ms; TR = 669 ms; matrix size = 320 × 320; field of view = 220 mm; slice thickness = 5 mm, 25 slices; gap = 0.5 mm). All examination results were read by 2 independent