Comparison of Morphologic Features and Flow Velocity of the Left Atrial Appendage Among Patients With Atrial Fibrillation Alone, Transient Ischemic Attack, and Cardioembolic Stroke

Yonggu Lee, MD, PhD[a], Hwan-Cheol Park, MD, PhD[a,*], Youkyung Lee, MD, PhD[b], and Soon-Gil Kim, MD, PhD[a]

The left atrial appendage (LAA) is a major source of emboli responsible for cardioembolic stroke (CES). We hypothesized that there could be differences in the morphologic and functional features of LAAs among patients with atrial fibrillation (AF) alone, patients with cardioembolic transient ischemic attack (CETIA), and patients with CES. Patients with AF and CETIA/CES were included in either a CETIA group or a CES group. Patients with AF without past histories of stroke were included in an AF/non-CVA (cerebrovascular accident) group. Cardiac computerized tomography and transesophageal echocardiography were employed for morphologic and functional assessments of LAAs. Cauliflower LAA morphology increased and chicken wing LAA morphology decreased in frequency in the following order: AF/non-CVA, CETIA, and CES group. LAA orifice diameters were larger in the CETIA and CES groups than in the AF/non-CVA group. LAA flow velocity was higher in the CES group than in the other groups. Multiple multinominal regression analyses showed that the cauliflower morphology was associated with CETIA and CES; however, after LAA orifice diameters and flow velocity were adjusted, LAA morphology was associated with neither of them. Receiver operating characteristic curve analysis showed that LAA orifice diameter and flow velocity accurately predicted CETIA (c-statistic 0.839) and CES (c-statistic 0.896), respectively. In conclusion, cauliflower LAA morphology is associated with an increased risk of CETIA and CES through its large LAA orifice diameters and low LAA flow velocity. There are clear differences in LAA orifice diameters and flow velocity among patients with AF alone, CES, and CETIA. **(Am J Cardiol 2017;119:1596−1604)**

The left atrial appendage (LAA) is a major source of the emboli responsible for cardioembolic stroke (CES) and transient ischemic attack (TIA) in patients with atrial fibrillation (AF).[1] Recently, studies have shown that certain morphologic and functional features of LAAs were associated with an increased risk of ischemic stroke in patients with AF.[2−4] TIA, as known as mini-stroke, is an episode of neurologic deficit caused by cerebral ischemia that resolves within 24 hours without tissue infarction.[5] Because anteceding episodes of TIA are frequently found in patients with ischemic stroke, experiencing TIA may allow for secondary prevention from ischemic stroke, including anticoagulation therapy and transcatheter LAA occlusion.[5] Given that the thrombus residing in LAAs is a major cause of CES/TIA, we hypothesized that there may be morphologic or functional features of LAAs that distinguish patients who experience cardioembolic TIA (CETIA) as their first cerebrovascular accident (CVA) episode from those who develop CES without an anteceding episode of TIA. Therefore, we investigated the morphologic and functional features of LAAs in patients who experienced their first episode of CETIA or CES and compared them with patients with AF who had no past histories of CVA.

Methods

From January 2011 to October 2015, patients with nonvalvular AF who visited the emergency department with acute CES or CETIA were enrolled consecutively in either the CETIA group or the CES group. Patients with nonvalvular AF who visited the Health Promotion Center for routine cardiologic evaluations without any symptoms or signs of CVA were enrolled in the AF/non-CVA group. Patients with past histories of stroke or TIA, patients with valvular heart disease, and patients with prosthetic valves were excluded. All patients in the CETIA group and the CES group underwent cardiac multidetector computerized tomography (MDCT) to evaluate the morphologic features of LAA and transesophageal echocardiography (TEE) to evaluate LA volume, LAA volume, and LAA flow velocity. In the AF/non-CVA group, cardiac MDCT was obtained in all patients, but TEE was obtained when the patient

[a]Division of Cardiology, Department of Internal Medicine and [b]Department of Radiology, Hanyang University Guri Hospital, Guri City, Gyeonggi-do, Republic of Korea. Manuscript received November 8, 2016; revised manuscript received and accepted February 8, 2017.

See page 1603 for disclosure information.

*Corresponding author: Tel: +(82) 31-560-2248; fax: +(82) 31-553-7369.

E-mail address: hjpooh74@hanyang.ac.kr (H.-C. Park).

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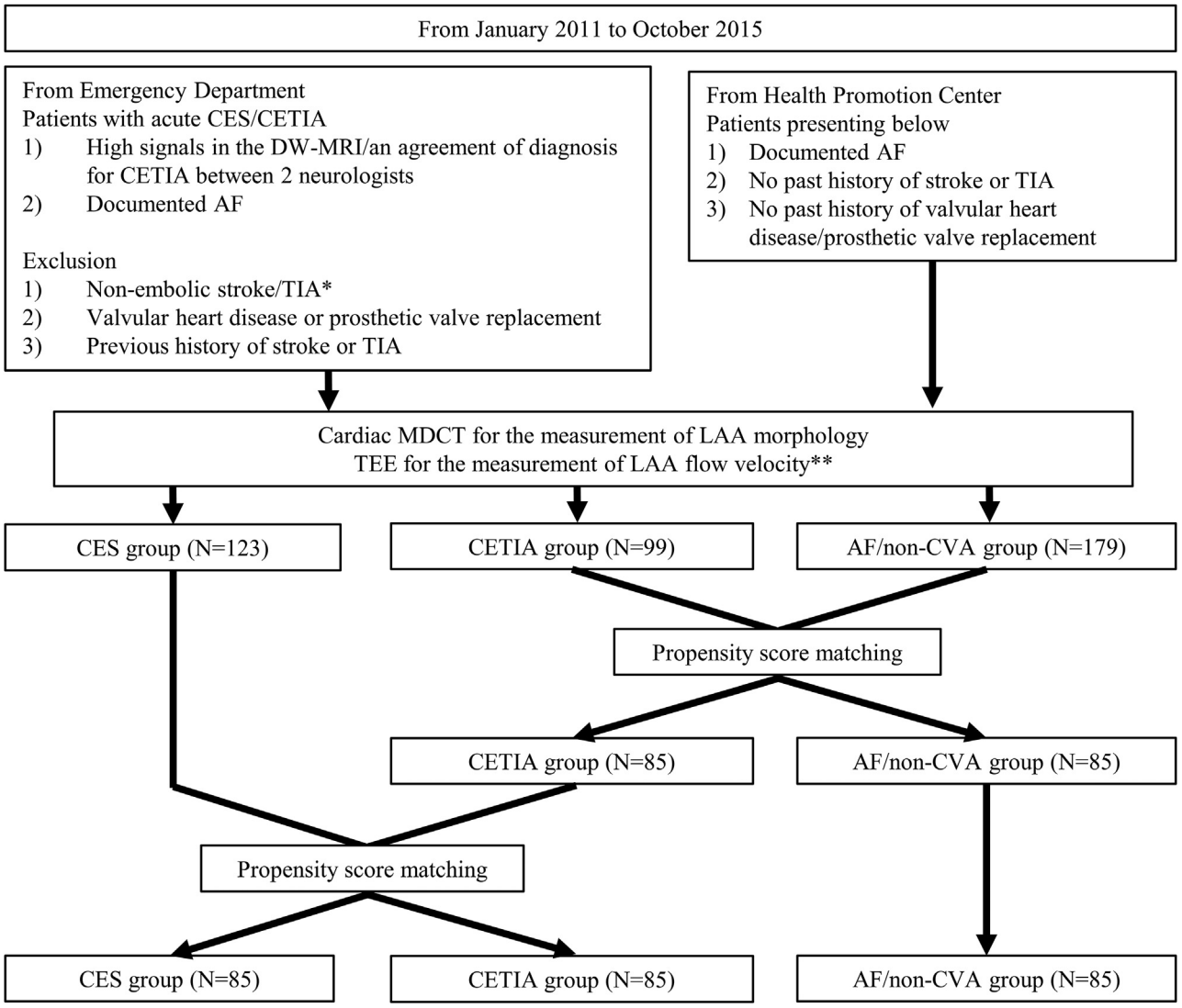

Figure 1. Schematic description of the study design. Between January 2011 and October 2015, patients with AF who had visited the emergency department with the first episode of CETIA or CES were enrolled in either the CETIA or CES group. Patients with AF who had visited for routine health examinations without past histories of CVA were enrolled in the AF/non-CVA group. All patients underwent cardiac MDCT and TEE to evaluate LAA morphology and LAA flow velocity. Baseline characteristics of the patients in the CETIA group were evenly matched to those in the other groups through 2-step propensity score matching processes. DW-MRI = diffusion weighted magnetic resolution imaging. *Trial of Org 10172 in Acute Stroke Treatment criteria were used to classify the type of stroke/TIA. **In the AF/non-CVA group, TEE was performed in 32 patients. Among them, 23 patients were included in the final dataset for the analysis after propensity score matching.

requested the examination (Figure 1). Demographic characteristics, past medical histories, and social histories were obtained, and body weight and height were determined in all patients when the patients visited either the emergency department or the Health Promotion Center. Transthoracic echocardiography, electrocardiography, and Holter monitoring were also performed in all patients for cardiac evaluations. Written informed consent was obtained from all patients before they enrolled in the study. The study protocol was reviewed and approved by the Institutional Review Board of Hanyang University Hospital.

AF was identified from either electrocardiography or Holter monitoring. Paroxysmal AF was defined as recurrent AF (≥2 episodes) that terminated spontaneously within 7 days; persistent AF was defined as recurrent AF that was sustained for ≥7 days; and permanent AF was defined as continuous AF for ≥1 year.[6] The diagnosis of either CETIA or CES was made when 2 neurologists agreed with each other's diagnosis. Ischemic stroke was defined as acute neurologic deficits lasting ≥24 hours with corresponding positive findings in diffusion-weighted magnetic resonance imaging.[5] TIA was defined as a brief episode of neurologic deficits of ischemic origin that completely disappeared within 24 hours without any corresponding imaging evidence of brain tissue infarction.[5] CES and CETIA were defined as previously described.[7] The patient was excluded when non-CES or non-CETIA was suggested or there was a disagreement between 2 neurologists' diagnoses.

Cardiac MDCT was performed using a 128-slice dual source system (SOMATOM Definition Flash; Siemens