Identification of Left Atrial Appendage Thrombi in Patients With Persistent and Long-Standing Persistent Atrial Fibrillation Using Intra-Cardiac Echocardiography and Cardiac Computed Tomography

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Background: Intracardiac echocardiography (ICE) and cardiac computed tomography (CCT), in addition to standard transesophageal echocardiography (TEE), have been used to identify left atrial (LA) thrombi prior to ablation for atrial fibrillation (AF). The clinical advantages of this, however, remain unclear. This study therefore investigated the advantages of additional pre-procedural LA appendage (LAA) thrombus evaluation using ICE and the clinical value of CCT in persistent and long-standing persistent AF.

Methods and Results: We analyzed data from 108 consecutive patients with persistent and long-standing persistent AF who were scheduled to undergo AF ablation. TEE was performed within 24 h prior to ablation. ICE was performed for 97 patients in whom a thrombus was not detected on TEE. CCT was performed in 95 patients. Thrombus or sludge was detected on TEE in 11 patients (10.3%), for whom ablation was cancelled. Four additional patients were diagnosed with LAA thrombus on ICE. When TEE and ICE were used as the reference for thrombus detection, the sensitivity, specificity, positive predictive value, and negative predictive value of CCT for identifying contrast defects in the LAA were 100%, 81.0%, 40.7%, and 100%, respectively.

Conclusions: ICE combined with TEE increased the detection rate of LAA thrombi in patients with persistent and long-standing persistent AF. Moreover, CCT had high sensitivity and negative predictive value for LAA thrombus detection.

Key Words: Cardiac computed tomography; Intracardiac echocardiography; Left atrial thrombus; Persistent atrial fibrillation; Transesophageal echocardiography

The detection of any thrombus in the left atrial appendage (LAA) is essential prior to ablation therapy for atrial fibrillation (AF) to avoid procedure-related thrombotic events. Although transesophageal echocardiography (TEE) is the clinical standard for the diagnosis of thrombi in the LAA prior to AF ablation, the detection of thrombi is not always accurate because of the inability of some patients to swallow the TEE probe or because of anatomic limitations to clear imaging. Intracardiac echocardiography (ICE) has been used during ablation. ICE of the LAA from the pulmonary artery (PA) provides similar or better-quality images than those obtained with TEE; therefore, ICE could serve as an alternative to TEE for detecting an LAA thrombus prior to AF ablation. Furthermore, cardiac computed tomography (CCT) is reportedly effective for evaluating LAA thrombi. These reports, however, mainly describe cases of paroxysmal AF. The advantages of ICE or CCT in the case of persistent and long-standing persistent AF remain unclear.

In the present study, we investigated the safety and advantages of additional pre-procedural LAA thrombus evaluation using ICE and the clinical value of CCT in the evaluation of LAA thrombi in patients with persistent and long-standing persistent AF before ablation.

Methods

We analyzed data from 108 consecutive patients with persistent or long-standing persistent AF. These patients were scheduled to undergo their first AF ablation session at National Hospital Organization, Tokyo Medical Center between September 2013 and September 2015. This was a non-randomized retrospective study. The definitions of persistent AF and long-standing persistent AF were based...
ICE and CCT Evaluation of LAA Thrombus

Point, the catheter was in close proximity to the LAA, and a slight left and right tilt of the catheter enabled visualization of the LAA (Figure 1).

ICE was carried out and evaluated by an electrophysiologist, along with senior cardiologists, at the catheter laboratory during the procedure. The definition of a thrombus was the same as that used for TEE. ICE was performed to visualize the atrial septum during atrial septal puncture and 3-D mapping of LA, and to detect pericardial effusion after ablation to monitor for complications.

CCT Enhanced CCT was performed for all patients without contraindications for contrast agent use and those on the current clinical guidelines. Persistent AF was defined as recurrent AF that lasts >7 days, whereas long-standing persistent AF was defined as continuous AF that lasts >12 months. This study was approved by the Institutional Review Board of National Hospital Organization, Tokyo Medical Center. All patients provided written informed consent.

Study Protocol

TEE TEE was performed within 24 h prior to ablation. If a thrombus was detected on TEE, then ablation was cancelled and the anticoagulation regimen was modified. If patients could not swallow the TEE probe, then the thrombus was evaluated using ICE alone in a catheter laboratory.

TEE was performed using a 2-D multiplane system (Philips, the Netherlands) according to the standard practice guidelines. We observed LAA at approximately 45–90° and at 90–135° to obtain long-axis and short-axis views, respectively. TEE was first evaluated by a cardiologist and subsequently reviewed by at least 2 other senior cardiologists who were blinded to the results of the first TEE and CCT on the same day. A thrombus was defined as a well-defined mass with defined margins that were distinct from the endocardium and that was visible throughout the cardiac cycle. Sludge was defined as a dynamic, gelatinous, precipitous echo density without a discrete mass that was observed throughout the cardiac cycle.

ICE A Soundstar diagnostic ultrasound catheter (4–10 MHz; 10 Fr; Biosense Webster, CA, USA) was introduced through a 10-Fr sheath positioned in the left femoral vein. This was moved under fluoroscopic guidance to the right atrium (RA) after a multipolar diagnostic catheter was positioned at the His right ventricular (RV) portion. Thereafter, RA angiography was performed until the contrast agent reached the aorta. The ICE catheter was tilted anteriorly so that it could be advanced through the tricuspid valve into the right ventricular outflow tract (RVOT). The tilt was then released, and the catheter was rotated clockwise until the pulmonary valve was observed. The catheter was again tilted anteriorly and gently advanced through the pulmonary valve into the main PA. At that point, the catheter was in close proximity to the LAA, and a slight left and right tilt of the catheter enabled visualization of the LAA (Figure 1).

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Figure 1. Intra-cardiac echocardiography (ICE) probe position and image of the left atrial appendage (LAA) from the pulmonary artery. (A) Antero-posterior fluoroscopic view during catheter ablation. An ICE probe (white arrow) is located in close proximity to the pulmonary artery, where the LAA can be clearly visualized. A circular mapping catheter (PV) and ablation catheter (ABL) are located in the left superior pulmonary vein (LSPV). (B) ICE of the LAA. CS, coronary sinus; ET, esophageal thermometer; PA, pulmonary artery; RA, right atrium; RV, right ventricle.

Figure 2. Cardiac computed tomography (CCT) of the left atrial appendage (LAA): (A) coronal and (B) left oblique view (the LAA is filled with contrast agent). (C, D) Contrast defects in the LAA (white arrow). LV, left ventricle; RVOT, right ventricular outflow tract. Other abbreviations as in Figure 1.
power injector (with a maximum rate of 5 mL/s). The total amount of contrast agent required was calculated by multiplying the body weight × 0.7 mL/s by the estimated required imaging time of the LA. The ascending aorta was set as the region of interest (ROI), and CCT was acquired when the ROI reached a preset threshold of 100 HU; delayed imaging was not used. On CCT, contrast defects in the LAA were evaluated along the transverse plane and in the left oblique view, and the study parameters were set accordingly (Figure 2).

Data Collection
Patients included in this study were divided into 2 groups based on the detection of an LAA thrombus via TEE or ICE. Parameters, such as age, sex, body mass index, CHADS2 score, type of AF, type of anticoagulant, D-dimer, brain natriuretic peptide (BNP), echocardiographic findings (such as the LA antero-posterior diameter in the parasternal long-axis view, left ventricular ejection fraction [LVEF], LAA flow, and presence of spontaneous echo contrast [SEC]), CT findings, and contrast defects in the LAA, were examined.

Ablation and Anticoagulation Protocol
Circumferential pulmonary vein isolation or box isolation was performed at the operator’s discretion during the first session for persistent or long-standing persistent AF. Ablation was scheduled when the prothrombin time international normalized ratio (PT-INR) remained within the therapeutic range for >4 weeks in patients receiving warfarin or for >4 weeks after the initiation of direct oral anticoagulants (DOAC). Warfarin was withdrawn if PT-INR was >2.5, and was resumed on the day after ablation. Only a single dose of DOAC, either once or twice daily, was withdrawn prior to ablation. A heparin bridge was not adopted.

Statistical Analysis
The results are expressed as median (IQR) or n (%). AF, atrial fibrillation; BMI, body mass index; EF, ejection fraction; LA, left atrial; LAD, left atrial diameter; LVEDD, left ventricular end-diastolic diameter; LVESD, left ventricular end-systolic diameter; PCI, percutaneous coronary intervention.

Results
Patient Characteristics and Echocardiography
A total of 108 consecutive patients who were scheduled to undergo AF ablation during the study period were assessed. The patient characteristics are summarized in Table 1. In particular, persistent AF was observed in 69 patients (63.9%), and long-standing persistent AF in 39 (36.1%). The mean age was 69 years (range, 61–72 years), and 17 patients (19.4%) were women. A total of 13 patients had a history of stroke or transient ischemic attack. In addition, 64.8%, 29.6%, and 5.6% of the patients had CHADS2 score 0–1, 2–3, and ≥4, respectively. Warfarin and DOAC were prescribed for 33 (30.6%) and for 75 (69.4%), respectively.

A total of 107 patients underwent TEE for LAA thrombus evaluation. One patient could not swallow the TEE probe and therefore underwent thrombus evaluation with ICE, which showed absence of thrombus. Thrombus or without renal insufficiency within the 10 days prior to catheter ablation. CCT was performed with a 64-channel cardiac CT angiography system (Toshiba, Japan). In brief, patients were scanned using contrast-enhanced electrocardiogram non-gated CT with a slice thickness of 0.5 mm. A non-ionic iodinated contrast agent (Iopamidol; FujiPharma, Japan) was injected at a rate of body weight × 0.7 mL/s using a power injector (with a maximum rate of 5 mL/s). The total amount of contrast agent required was calculated by multiplying the body weight × 0.7 mL/s by the estimated required imaging time of the LA. The ascending aorta was set as the region of interest (ROI), and CCT was acquired when the ROI reached a preset threshold of 100 HU; delayed imaging was not used. On CCT, contrast defects in the LAA were evaluated along the transverse plane and in the left oblique view, and the study parameters were set accordingly (Figure 2).

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A total of 107 patients underwent TEE for LAA thrombus evaluation. One patient could not swallow the TEE probe and therefore underwent thrombus evaluation with ICE, which showed absence of thrombus. Thrombus or
sludge was diagnosed on TEE (Figure 3) in 11 patients (10.3%; 6 with thrombus and 5 with sludge); ablation was then cancelled for those patients. The other 97 patients were scheduled to undergo thrombus evaluation via ICE prior to ablation in the catheter laboratory. A thrombus in the LAA was newly diagnosed via ICE in 4 patients (Figure 4); ablation was then cancelled for those patients. One patient could not undergo ICE because of difficulty in advancing the ICE probe into the RVOT. In that patient, TEE did not indicate the presence of a thrombus in the LAA, and ablation was subsequently performed (Figure 5).

Patient characteristics according to LAA thrombus detection are summarized in Table 2. Significantly more patients who presented with advanced age, CHADS2 score ≥2, and long-standing persistent AF were in the thrombus-detected group. D-dimer was also significantly higher in the thrombus-detected group. Moreover, LVEF, LAA emptying velocity (LAAEV), and LAA filling velocity (LAAFV) were significantly lower in the thrombus-detected group. SEC on TEE and contrast defects in the LAA on CCT were noted in all patients in the thrombus-detected group.

Feasibility and Safety of LAA Observation From the PA on ICE
Four patients who were initially thrombus free on TEE were subsequently found to have a thrombus in the LAA on ICE. There was no significant difference in the anticoagulants used; 1 patient was prescribed warfarin; 1 patient, dabigatran (300 mg); 1 patient, rivaroxaban (15 mg); and 1 patient, apixaban (10 mg). TEE enables clear visualization of the ostium and mid-body of the LAA (Figure 3). The apex of the LAA, however, could not be clearly visualized in some patients because of its distance from the TEE probe and the presence of the pectinate muscles. In contrast, the ICE probe was in close proximity to the LAA in the PA and could visualize the entire LAA, including each pectinate muscle (Figure 4). In most of the aforementioned cases, the newly diagnosed thrombus was located between the pectinate muscles and the tip of the LAA – an area that could not be clearly visualized on TEE. There were no adverse events related to ICE from the PA.

CCT
A total of 95 patients underwent CCT prior to ablation; 13 patients did not undergo CCT because of renal insufficiency or lack of time (the CCT could not be scheduled before the ablation procedure). The patients who underwent CCT were assessed according to the detection of LAA thrombus (Tables S1, S2). The frequencies of long-standing persistent AF and warfarin prescription were significantly higher in the thrombus-detected group. Moreover, the following parameters that significantly differed on analysis of all 108 consecutive patients – D-dimer, LVEF, LAAEV, LAAFV, and SEC on TEE and contrast defects in the LAA on CCT – were also significantly different in the patients who underwent CCT. When TEE and ICE were considered the gold standard methods for thrombus detection, the sensitivity, specificity, positive predictive value, and negative predictive value (NPV) for identifying contrast defects in the LAA on CCT were 100%, 81.0%, 40.7%, and 100%, respectively.

Patient characteristics based on CT defects in the LAA are summarized in Table 3. The LAAAV and LAAEV were significantly lower in the CT defect group. All 11 patients with CT defects had LAAAV <21 cm/s. SEC was detected significantly more frequently in the CT defect group. Moreover, the CT defect group had trends toward more frequent warfarin prescription, larger LA diameter, and lower LVEF. CHADS2 score, D-dimer, and BNP, however, did not differ between the 2 groups.

Discussion
There are 3 main findings of this study: (1) ICE was able to detect LAA thrombi that could not be clearly visualized on TEE; (2) the prevalence of LAA thrombi was high in
patients with persistent and long-standing persistent AF who were scheduled to undergo ablation, despite well-controlled anticoagulation therapy; and (3) CCT had both a sensitivity and an NPV of 100% for detecting LAA thrombi in patients with persistent and long-standing persistent AF.

Table 2. Baseline Characteristics vs. Presence of LAA Thrombus

<table>
<thead>
<tr>
<th></th>
<th>Thrombus (−) (n=93)</th>
<th>Thrombus (+) (n=15)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>68 (60–72)</td>
<td>72 (71–76)</td>
<td>0.003</td>
</tr>
<tr>
<td>Female</td>
<td>17 (18.3)</td>
<td>4 (26.7)</td>
<td>0.446</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>23.8 (21.5–26.2)</td>
<td>22.1 (20.2–24.5)</td>
<td>0.128</td>
</tr>
<tr>
<td>CHADS² score</td>
<td></td>
<td></td>
<td>0.072</td>
</tr>
<tr>
<td>0–1</td>
<td>64 (68.9)</td>
<td>6 (40.0)</td>
<td></td>
</tr>
<tr>
<td>2–3</td>
<td>25 (26.8)</td>
<td>7 (46.6)</td>
<td></td>
</tr>
<tr>
<td>≥4</td>
<td>4 (4.3)</td>
<td>2 (13.4)</td>
<td></td>
</tr>
<tr>
<td>Persistent AF</td>
<td>65 (69.9)</td>
<td>4 (26.7)</td>
<td>0.001</td>
</tr>
<tr>
<td>Longstanding Persistent AF</td>
<td>28 (30.1)</td>
<td>11 (73.3)</td>
<td>0.001</td>
</tr>
<tr>
<td>Warfarin</td>
<td>23 (24.7)</td>
<td>9 (60.0)</td>
<td>0.039</td>
</tr>
</tbody>
</table>

DOAC
- Dabigatran    19 (20.4) 2 (13.3) 0.519
- Rivaroxaban   30 (32.3) 2 (13.3) 0.119
- Apixaban      21 (22.6) 2 (13.3) 0.417

PT-INR (on warfarin) 2.20 (1.83–2.68) 2.33 (1.80–2.83) 0.690

D-dimer (μg/mL) 0.50 (0.40–0.60) 1.00 (0.60–5.10) 0.012

BNP (pg/mL) 156 (102–292) 206 (79–313) 0.562

LAD (mm) 42 (37–46) 44 (41–53) 0.100

LVEF (%) 60 (57–63) 50 (44–60) 0.002

LAAFV (cm/s) 28.1 (20.6–37.7) 17.3 (13.2–22.4) 0.002

LAAEV (cm/s) 24.9 (19.4–38.1) 17.5 (13.7–24.0) 0.010

SEC 38 (41.8) 15 (100) <0.001

Enhanced CT defect in LAA 16 (19.3) 11 (100)* <0.001

Data given as median (IQR) or n (%). Abbreviations as in Tables 1, 2.

Table 3. Baseline Characteristics vs. Presence of CT Defect

<table>
<thead>
<tr>
<th></th>
<th>CT defect (−) (n=68)</th>
<th>CT defect (+) (n=27)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>68 (60–72)</td>
<td>72 (65–74)</td>
<td>0.025</td>
</tr>
<tr>
<td>Female</td>
<td>9 (13.2)</td>
<td>9 (33.3)</td>
<td>0.024</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>23.3 (21.2–26.1)</td>
<td>23.8 (21.9–24.6)</td>
<td>0.677</td>
</tr>
<tr>
<td>CHADS² score</td>
<td></td>
<td></td>
<td>0.273</td>
</tr>
<tr>
<td>0–1</td>
<td>46 (67.6)</td>
<td>17 (63.0)</td>
<td></td>
</tr>
<tr>
<td>2–3</td>
<td>20 (29.4)</td>
<td>7 (25.9)</td>
<td></td>
</tr>
<tr>
<td>≥4</td>
<td>2 (3.0)</td>
<td>3 (11.1)</td>
<td></td>
</tr>
<tr>
<td>Persistent AF</td>
<td>48 (70.6)</td>
<td>12 (44.4)</td>
<td>0.017</td>
</tr>
<tr>
<td>Longstanding Persistent AF</td>
<td>20 (29.4)</td>
<td>15 (55.6)</td>
<td>0.017</td>
</tr>
<tr>
<td>Warfarin</td>
<td>16 (23.5)</td>
<td>14 (51.9)</td>
<td>0.007</td>
</tr>
</tbody>
</table>
| PT-INR (on warfarin) 2.08 (1.80–2.51) 2.19 (1.69–2.84) 0.031

D-dimer (μg/mL) 0.50 (0.40–0.68) 0.80 (0.60–1.45) 0.264

BNP (pg/mL) 146 (88–235) 197 (73–304) 0.213

LAD (mm) 41 (36–46) 45 (41–54) 0.007

LVEF (%) 60 (57–63) 55 (44–60) 0.007

LAAFV (cm/s) 31.1 (22.6–42.9) 16.4 (12.4–21.8) <0.001

LAAEV (cm/s) 28.9 (22.6–40.9) 17.3 (13.7–23.9) <0.001

SEC 24 (36.4) 23 (85.2) <0.001

Data given as median (IQR) or n (%). Abbreviations as in Tables 1, 2.
ICE of the LAA from the PA is similar or better than TEE,\textsuperscript{2,4} which is consistent with the present study involving persistent and long-standing persistent AF. The prevalence of LAA thrombi also differs with type of AF; in fact, the prevalence of LAA thrombi\textsuperscript{4} and stroke\textsuperscript{13,15} was higher in persistent AF than in paroxysmal AF. In the present study, we observed a high prevalence of LAA thrombi in patients with persistent and long-standing persistent AF, despite well-controlled oral anticoagulants or DOAC, which is consistent with previous studies. In the present study the anticoagulation regimen could have influenced the high prevalence of LAA thrombi seen. The use of anticoagulation regimen is slightly lower in Japan than in Western countries. PT-INR 1.6–2.5 is recommended for patients >75 years old. Rivaroxaban (15 mg daily) is prescribed in Japan because of the higher risk of intracranial hemorrhage in Asian compared with Caucasian subjects.\textsuperscript{16} The current guidelines recommend the use of risk stratification of thromboembolisms with the CHADS2 scoring system, regardless of the type of AF.\textsuperscript{19} Patients undergoing cardioversion for AF that has persisted >48 h must undergo appropriate anticoagulation for >3 weeks, regardless of the CHADS2 score status,\textsuperscript{16,17,18} which is also true of patients with persistent and long-standing persistent AF undergoing catheter ablation. Moreover, catheter manipulation in the LA could dislodge the intra-atrial thrombi, which could lead to an embolic event. Pre-procedural thrombus evaluation via TEE is therefore vital for avoiding complications.

Four patients were newly diagnosed as having a thrombus in the LAA on ICE in the catheter laboratory. Therefore, we were able to potentially avoid procedure-related thrombotic events. One patient could not undergo ICE due to difficulty in advancing the probe into the RVOT to the PA. This, however, was 1 of the 5 initial cases; ICE was performed in the remaining 100 consecutive cases without any complications.

Compared with TEE, ICE can visualize the LAA more clearly, even though it is a 2-D monoplane echocardiography, because the short distance to the LAA allows for the visualization of the entire LAA and each pectinate muscle, along with a thrombus that could be hidden between them. Based on its varied and complex morphology, LAA can be categorized into 4 types: cactus, chicken wing, windsock, and cauliflower, consisting of a central lobe, multiple secondary lobes, or tertiary lobes.\textsuperscript{19,20} The central lobe could be visualized using TEE, but it can be difficult to clearly visualize the secondary or tertiary lobes because the resolution of TEE decreases as tissue depth increases. Moreover, the presence of non-target tissue between the tertiary lobes and the TEE probe may lead to artifacts. Hence, the use of ICE in addition to TEE for LAA thrombus evaluation prior to AF ablation may be more efficacious. Recently, several studies have shown the non-inferiority of 3-D TEE to evaluate LAA morphology compared with CT or magnetic resonance imaging.\textsuperscript{21} Thus, 3-D TEE can be used to detect LAA thrombus in the near future. Two of the 4 patients with LAA thrombi newly detected on ICE, underwent CCT prior to ablation. Both of these patients had a cauliflower-type LAA morphology (Figure S1), but there were no statistically significant differences between the types of LAA morphology and LAA thrombus.

According to the present study, defects in the CCT were exclusively observed in patients with LAAVF <21 cm/s. The defects in the LAA were not thrombi, but they were speculated to have slow flow velocity. The sensitivity and NPV of CCT for LAA thrombus detection were 100%; the absence of contrast agent defects in the LAA on CCT was indicative of the absence of thrombi in the LAA. This is consistent with previous studies, which also showed that the delayed phase of CCT is effective for thrombus detection,\textsuperscript{5,22,24} and suggests the possibility of decreasing the need for pre-procedural TEE.\textsuperscript{28} We did not use CCT during the delayed phase in the present study, however, because CCT was performed to evaluate the LA anatomy but not to detect thrombi. To simplify the CCT protocol, we performed CCT prior to AF ablation during the same coronary CT phase. Even though only the early phase of enhanced CCT was performed, the sensitivity and NPV were both 100% in the present patients. Based on these findings, TEE and ICE may not be necessary for patients with persistent AF who do not have any contrast defects in the LAA on CCT. This protocol could reduce the overall procedure duration and cost.

The present study has several limitations. First, because this study was an observational and non-randomized retrospective study, variables that were not measured and remain unaccounted for may have confounded the observed associations. Second, the subject group was limited; therefore, further study is needed to confirm whether the absence of contrast defects in the LAA on CCT may be sufficient to exclude the evaluation of LAA thrombus with TEE or ICE prior to ablation. In addition, the subject group size could affect the results, indicating a high prevalence of LAA thrombi. Third, patients who were positive for thrombus or sludge were not evaluated using ICE due to the retrospective nature of the analysis. Therefore, we did not intend to conclude that ICE was superior to TEE; we used ICE in addition to TEE prior to AF ablation. Fourth, the results of TEE and ICE are dependent on operator subjectivity. Fifth, CT, TEE, and ICE were not performed at the same time; there was a time lag of up to 10 days, during which time a thrombus could form or disappear. Finally, because a single dose of DOAC was withdrawn prior to ablation and a heparin bridge was not adopted, the anticoagulability may have been weaker, which could have affected the results of ICE for patients with DOAC.

**Conclusions**

ICE, in addition to standard TEE, increases the detection rate of LAA thrombi in patients undergoing catheter ablation with persistent and long-standing persistent AF. When TEE and ICE were used as a reference, CCT was found to have both a sensitivity and an NPV of 100% for LAA thrombi detection in patients with persistent and long-standing persistent AF.

**Conflicts of Interest**

None.

**Financial Support and Disclosures**

The authors have nothing to declare.

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exclusion into the care of patients undergoing ablation of atrial


Supplementary Files

Supplementary File 1

Figure S1. Representative 3-D cardiac computed tomography of

left atrial appendage (LAA) thrombus newly detected on intra-

cardiac echocardiography.

Table S1. Patient characteristics (n=95)

Table S2. Baseline characteristics vs. presence of LAA thrombus

Please find supplementary file(s);