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Short communication

Computed tomography detection and quantification of left atrial appendage residual patency as collateral finding after percutaneous closure☆

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ABSTRACT

Background: Peridevice leaks after left atrial appendage closure (LAAC) may increase the risk of embolic stroke. This study appraises the value of a clinically indicated angio-computed tomography (CT) to assess the presence and size of LAA patency after percutaneous closure.
Methods: We retrospectively analysed patients who underwent LAAC in our centre for a clinically indicated angio-CT to quantify Hounsfield units (HU) in LAA and in the left atrium (LA) and correlated them with the presence and size of LAA leaks at TEE.
Results: CT scan was available in 56 patients of whom 40 also underwent TEE assessment. Any LAA leak at TEE was present in 9/40 (22.5%) patients of whom all had HU >100 in the LAA. However, HU measured in the LAA was >100 HU in 8 additional patients with no leak at TEE, leading to a sensitivity of 100% (9/9), specificity of 74.1% (23/31) and diagnostic accuracy of 80% (32/40). LAA HU or LAA/LA HU ratio did not discriminate LAA leak size at angio-CT. However, a coaptation gap >3 mm at angio-CT between device and LAA ostium was present in all cases with leak size >3 mm at TEE.
Conclusions: HU > 100 in the LAA and a coaptation gap >3 mm between device and LAA ostium at angio-CT identified all LAA leaks and those >3 mm at TEE, respectively.

1. Introduction

Percutaneous left atrial appendage closure (LAAC) is a preventive treatment modality to reduce stroke risk in patients at high bleeding risk with non-valvular atrial fibrillation [1]. The appraisal of residual leaks after LAAC remains key in the decision-making with respect to post-procedural management [2].

The gold standard for LAA patency assessment after closure is the transesophageal echocardiography (TEE). TEE is however invasive and operator-dependent. Two series of 19 and 23 patients who underwent TEE and angio-CT after LAAC [3,4] suggest that cardiac angio-CT might also ascertain LAA patency after intervention.

We analysed patients who underwent a clinically indicated angio-CT within the Bern LAAC registry to assess frequency, putative causes, and clinical implications of LAA patency rates after LAAC.

2. Methods

2.1. Patient population

Patients recruited in the Bern LAAC registry from January 2009 to August 2016 were retrospectively assessed for the availability of a thoracic angio-CT with adequate visualization of cardiac chambers. LAAC procedures were performed according to institutional guidelines [5]. Antithrombotic regimen post LAAC consisted of dual antiplatelet therapy (DAPT) with aspirin and clopidogrel for 1–3 months, followed by aspirin alone, whereas concomitant OAC use was implemented on patient-by-patient decision. The assessment of device success and complication rates was in accordance with the Munich consensus document [6]. Patients were followed clinically shortly after the procedure [i.e., after 1–3 month(s)] and then annually. TEE was to be performed 1–3 month(s) after index procedure according to institutional guidelines.

A single observer (M.A.) who was blinded to angio-CT images assessed the presence and size of residual LAA shunts at TEE images. TEE evaluation was performed scanning LAA device in all 4 suggested projections (0°, 45°, 90°, 135°). Flow-velocity range was set between 50 and 65 cm/s for all acquisitions. To have a higher frame-rate, we reduced

☆ All the authors take responsibility for all aspects of the reliability and freedom from bias of the data presented and their discussed interpretation.

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Table 1
Baseline and procedural characteristics and follow-up of the study cohort.

	All (n = 56)	Patent LAA[a] (n = 24)	Sealed LAA[a] (n = 32)	p value
Age (years)	73.2 ± 8.8	72.8 ± 10.1	73.5 ± 7.9	0.76
Male sex	39 (69.6%)	18 (75%)	21 (65.6%)	0.56
Height (cm)	173.8 ± 8.4	176.4 ± 6.1	171.8 ± 9.5	0.046
Weight (kg)	82.3 ± 13.7	80 ± 12.6	84.2 ± 14.5	0.26
Body-mass index (kg/m^2)	27.3 ± 4.7	25.5 ± 2.9	28.6 ± 5.4	0.009
AF paroxysmal	35 (62.5%)	14 (58.3%)	21 (65.6%)	0.59
AF persistent or permanent	21 (37.5%)	10 (41.7%)	11 (34.4%)	0.59
Prior CAD	33 (58.1%)	14 (58.3%)	19 (59.4%)	0.99
Prior MI	16 (28.6%)	8 (33.3%)	8 (25.0%)	0.55
Prior history stroke/TIA	22 (39.3%)	10 (41.7%)	12 (37.5%)	0.78
Prior ischemic stroke	12 (21.4%)	5 (20.8%)	7 (21.9%)	0.99
Prior hemorrhagic stroke	6 (10.7%)	3 (12.5%)	3 (9.4%)	0.99
Carotid disease	3 (5.4%)	2 (8.3%)	1 (3.1%)	0.57
Prior PTA or TEA	3 (5.4%)	2 (8.3%)	1 (3.1%)	0.57
History of CHF	21 (37.5%)	12 (50%)	9 (28.1%)	0.10
Diabetes mellitus	15 (26.8%)	6 (25.0%)	9 (28.1%)	0.99
Hypertension	52 (92.9%)	23 (90.6%)	29 (95.8%)	0.62
Valvular heart disease	15 (26.8%)	8 (33.3%)	7 (21.9%)	0.37
Prior bioprosthesis	14 (25%)	8 (33.3%)	6 (18.8%)	0.23
Systemic embolism	3 (5.4%)	2 (8.3%)	1 (3.1%)	0.57
eGFR (ml/min/kg)	67.3 ± 31.0	70.0 ± 27.4	65.3 ± 33.8	0.57
LVEF (%)	52 ± 11.5	47.5 ± 12.4	55.5 ± 9.6	0.009
Indications to LAAC				
CHADS2	2.6 ± 1.2	2.9 ± 1.4	2.5 ± 1.0	0.22
CHA_2DS_2-VASc score	4.1 ± 1.5	4.5 ± 1.6	3.9 ± 1.4	0.20
HAS-BLED score	2.9 ± 1.0	3.0 ± 1.2	2.9 ± 0.9	0.70
Previous relevant bleeding	28 (50%)	12 (50.0%)	16 (50.0%)	0.99
• Intracranial bleed	7 (12.5%)	3 (12.5%)	4 (12.5%)	0.99
• Gastrointestinal bleed	13 (23.2%)	6 (25.0%)	7 (21.9%)	0.99
• Others	8 (14.3%)	3 (12.5%)	5 (15.6%)	0.99
High bleeding risk[b]	27 (48.2%)	12 (50.0%)	15 (46.9%)	0.99
Refuse of N (OAC)	7 (12.5%)	4 (16.7%)	3 (9.4%)	0.44
Labile INR	2 (3.6%)	2 (8.3%)	0 (0%)	0.18
Need for Triple therapy	22 (39.3%)	9 (37.5%)	13 (40.6%)	0.99
Baseline antithrombotic regimen				
N (OAC)	30 (53.5%)	9 (37.5%)	21 (65.6%)	0.06
Acetylsalicylic acid	35 (62.5%)	17 (70.8%)	18 (56.2%)	0.40
Clopidogrel	17 (30.4%)	10 (41.7%)	7 (21.9%)	0.14
DAPT	13 (23.5%)	8 (33.3%)	5 (15.6%)	0.20
Triple therapy	8 (14.3%)	4 (16.7%)	4 (12.5%)	0.71
Discharge antithrombotic regimen				
N (OAC)	2 (3.6%)	0 (0%)	2 (6.2%)	0.50
Acetylsalicylic acid	49 (87.5%)	20 (83.3%)	29 (90.6%)	0.44
Other	54 (96.4%)	24 (100%)	30 (93.8%)	0.50
DAPT	48 (85.7%)	20 (41.7%)	28 (58.3%)	0.71
DAPT duration (months)	3 (1−12)	3 (1–6)	3 (1–12)	0.45
Triple therapy	0 (0%)	–	–	–
Angio-CT at follow up				
Median time LAAC-CT	217 (86–401)	228 (106–401)	189 (65–443)	0.62
Median slice thickness	1 (1–5)	1 (1–5)	1 (1–5)	0.66
Mean LAA HU measurement	126.1 ± 86.1	209.0 ± 67.3	63.8 ± 21.8	<0.001
Mean LA HU measurement	330.8 ± 143.3	350.1 ± 141.5	316.4 ± 145.1	0.38
Ratio LAA/LA	0.42 ± 0.3	0.65 ± 0.2	0.25 ± 0.1	<0.001
ACP criteria (referred to 50)		n = 23	n = 27	
Lobe compression (%)	8.3 (0.2–16.7)	4.5 (0–14)	11.4 (3.5–20)	0.64
Lobe compression >10%	24 (48%)	9 (39.1%)	15 (55.6%)	0.27
Axis	36 (72.0%)	15 (65.2%)	21 (77.8%)	0.36
Concave disc	47 (94%)	21 (91.3%)	26 (96.3%)	0.59
Device diameter (mm)	23.1 ± 4.0	23.4 ± 3.7	22.8 ± 4.3	0.59
Lobe width 2/3 LCA	30 (60%)	15 (65.2%)	15 (55.6%)	0.56
Disc lobe separation>2 mm	46 (92.0%)	22 (95.7%)	24 (88.9%)	0.61
Clinical follow up				
Median years of follow up	2.01 (1.3–2.9)	1.8 (1.14–2.)	2.04 (1.64–3.03)	0.49
Stroke	3 (5.4%)	2 (8.3%)	1 (3.1%)	0.57
TIA	1 (1.8%)	1 (4.2%)	0 (0%)	0.42
Systemic embolism	2 (3.6%)	2 (8.3%)	0 (0%)	0.17
Cumulative embolism	4 (7.1%)	3 (12.5%)	1 (3.1%)	0.33
Myocardial infarction	1 (1.8%)	1 (4.2%)	0 (0%)	0.42
Pulmonary embolism	5 (8.9%)	2 (8.3%)	3 (9.4%)	0.99
Any bleeding	7 (12.5%)	4 (16.7%)	3 (9.4%)	0.44
Major or life threatening bleeding	5 (8.9%)	2 (8.3%)	3 (9.4%)	0.99

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