

Preoperative Transthoracic Echocardiography for Predicting Incomplete Endothelialization of the Watchman Left Atrial Appendage Occluder: A Single-Center Five-Year Study

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Background

Left atrial appendage closure (LAAC) constitutes one of the important means to prevent stroke in patients with atrial fibrillation. However, the incomplete endothelial coverage of the occluder remains a vexing problem in clinical follow-up, which potentially affects long-term stroke prevention efficacy in these patients.

Objective

The present study aimed to investigate the predictive value of transthoracic echocardiography in estimating the endothelialization of the Watchman LAA occluder.

Methods

This was a single-center retrospective study including 437 consecutive nonvalvular atrial fibrillation patients who underwent the LAAC procedure with Boston Scientific™ Watchman 2.5 occluder from January 2017 to December 2022. Cardiac CTA were performed in all patients 3-6 months after procedure. According to contrast infiltration through occluder into LAA cavity (Figure 1), two groups were defined as follows: completely and incompletely endothelialized. The baseline characteristics and the pre-procedural echocardiographical parameters were summarized and analyzed.

Table 1 Baseline characteristics

	All patients (N=437)	Complete endothelial coverage (N=320)	Incomplete endothelial coverage (N=117)	P-value
Female	208(47.6%)	160(50.0%)	48(41.0%)	0.12
Age(years)	70.2±7.6	69.8±7.6	71.4±7.5	0.053†
Hypertension	316(72.3%)	236(73.8%)	80(68.4%)	0.322
Diabetes	119(27.2%)	89(27.8%)	30(25.6%)	0.741
Coronary artery disease	175(40.0%)	124(38.8%)	51(43.6%)	0.421
Smoking	86(19.7%)	61(19.1%)	25(21.4%)	0.689
Alcohol	31(7.1%)	22(6.9%)	9(7.7%)	0.834
Persistent AF	244(55.8%)	168(52.5%)	76(65.0%)	0.027
LVEF%	62.9±6.0	63.0±5.4	62.5±7.5	0.016*
LA diameter(mm)	43.0±6.1	42.7±6.1	44.0±5.9	0.045*

LVEF%: left ventricular ejection fraction; LA: left atrium.

Continuous variables are presented as mean±standard deviation, and categorical variables as percentages.

P-value: complete vs incomplete endothelial coverage. † p<0.1, * p<0.05

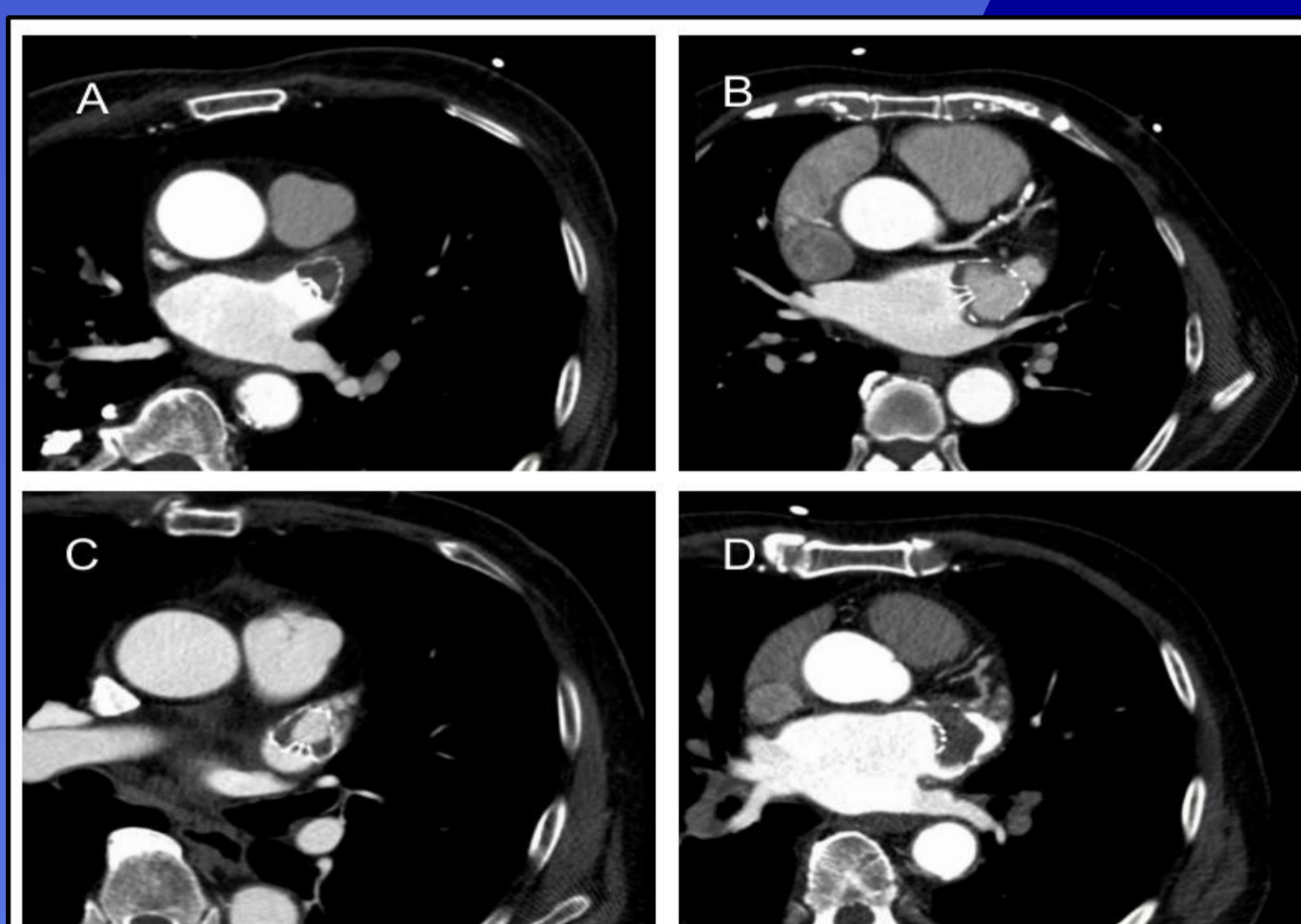


Figure 1 Neo-endothelialization of Watchman occluder evaluated by cardiac CTA. (A) complete coverage, (B-C) incomplete coverage, (D) complete coverage with peri-occluder leak.

Results

Baseline characteristic data (Table 1) showed that the average age of patients was 70.2 and there were 208 females (47.6%). The incompletely endothelialized group had older age (71.4 ± 7.5 vs 69.8 ± 7.6 , $p=0.053$), higher left atrial (LA) diameter (44.0 ± 5.9 vs 42.7 ± 6.1 mm, $p=0.045$), and lower left ventricular ejection fraction (LVEF%) (62.5 ± 7.5 vs $63.0 \pm 5.4\%$, $p=0.016$) than the completely endothelialized group. There were no difference in terms of gender and comorbidities. The univariate logistic regression analysis showed that incomplete endothelialization was associated with persistent atrial fibrillation (OR:1.68; 95% CI:1.08-2.10; $P=0.021$), higher left atrial diameter (OR:1.04; 95% CI:1.00-1.07; $P=0.046$), higher left ventricular diastolic diameter (LVDD) (OR:1.05; 95% CI:1.00-1.10; $P=0.032$), and existence of mild mitral stenosis (Mean pressure gradient <5 mmHg and mitral valve area >1.5 cm², OR:11.29; 95% CI:1.25-102.10; $P=0.031$), while negatively correlated with mild left ventricular diastolic dysfunction (ie. Grade I and II) (OR:0.49; 95% CI:0.26-0.94; $P=0.033$). The multivariate analysis showed that mild mitral stenosis (OR:13.79; 95% CI:1.37-139.13; $P=0.026$) was an independent predictor for incomplete endothelialization (Table 2).

Table 2 Univariate and multivariate analysis of baseline and echocardiographical factors associated with incomplete endothelial coverage

	Summary	Univariate Models		Multivariate Models		
		OR(95% CI)	P-value	OR(95% CI)	P-value	
Baseline Medical History	Female	47.6%	0.70(0.45-1.07)	0.097†	0.63(0.37-1.06)	0.084†
	Age(years)	70.2±7.6	1.03(1.00-1.06)	0.054†	1.03(0.99-1.06)	0.105
	Persistent AF	55.8%	1.68(1.08-2.60)	0.021*	1.36(0.70-2.67)	0.368
	LVEF%	62.9±6.0	0.23(0.01-7.24)	0.402		
	LA diameter(mm)	43.0±6.1	1.04(1.00-1.07)	0.046*	1.01(0.96-1.06)	0.698
	LVDD(mm)	49.7±4.6	1.05(1.00-1.10)	0.032*	1.02(0.92-1.14)	0.667
	LVDS(mm)	32.4±4.2	1.05(1.00-1.10)	0.053†	0.97(0.87-1.09)	0.655
	Mitral reflux(moderate or severe)	12.1%	1.78(0.97-3.25)	0.061†	1.57(0.76-3.26)	0.227
	Tricuspid reflux(moderate or severe)	22.9%	1.47(0.91-2.39)	0.119	1.07(0.59-1.96)	0.816
	Aortic reflux(moderate or severe)	4.1%	1.05(0.36-3.00)	0.934		
Echocardiography	Pulmonary reflux(moderate or severe)	1.1%	1.82(0.30-11.05)	0.514		
	Diastolic dysfunction	39.4%	0.9(0.75-1.09)	0.287		
	Grade I & II	16.7%	0.49(0.26-0.94)	0.033*	0.65(0.29-1.44)	0.285
	Grade III	22.7%	0.83(0.49-1.41)	0.493		
	sPAP(mmHg)	33.6±6.9	1.03(0.99-1.06)	0.113		
	Dilated cardiomyopathy	3.7%	2.2(0.80-6.05)	0.127		
	Hypertrophic cardiomyopathy	1.4%	1.37(0.25-7.60)	0.716		
	Aortic stenosis	0.0%	0(0.00-∞)	0.981		
	Mitral stenosis	1.2%	11.29(1.25-102.10)	0.031*	13.79(1.37-139.13)	0.026*

AF: atrial fibrillation; LVEF%: left ventricular ejection fraction; LA: left atrium; LVDD: left ventricular end-diastolic dimension; LVDS: left ventricular end-systolic dimension; sPAP: systolic pulmonary artery pressure.

Continuous variables are presented as mean±standard deviation, and categorical variables as percentages.

P-value: complete vs incomplete endothelial coverage. † p<0.1, * p<0.05

Conclusion

Preoperative transthoracic echocardiography may predict the outcomes of endothelialization after left atrial appendage occlusion. Certain manifestations such as mild mitral stenosis can predict poor endothelial coverage after procedure, which suggests that further measures are probably required to prevent atrial fibrillation-related stroke.

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